Network Technology B – PPP

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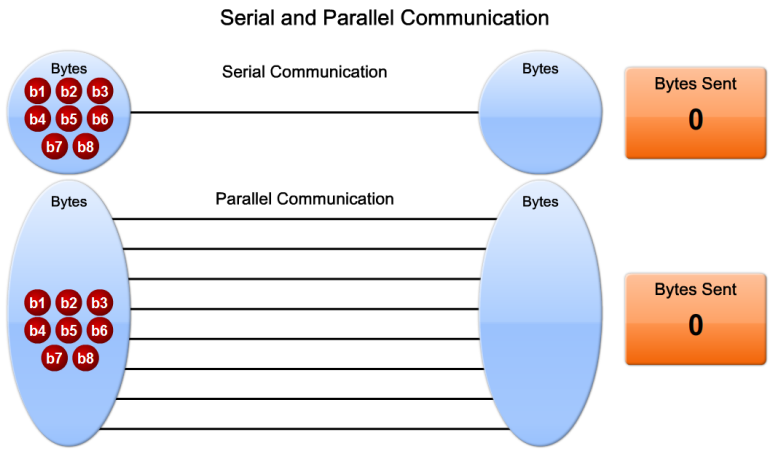
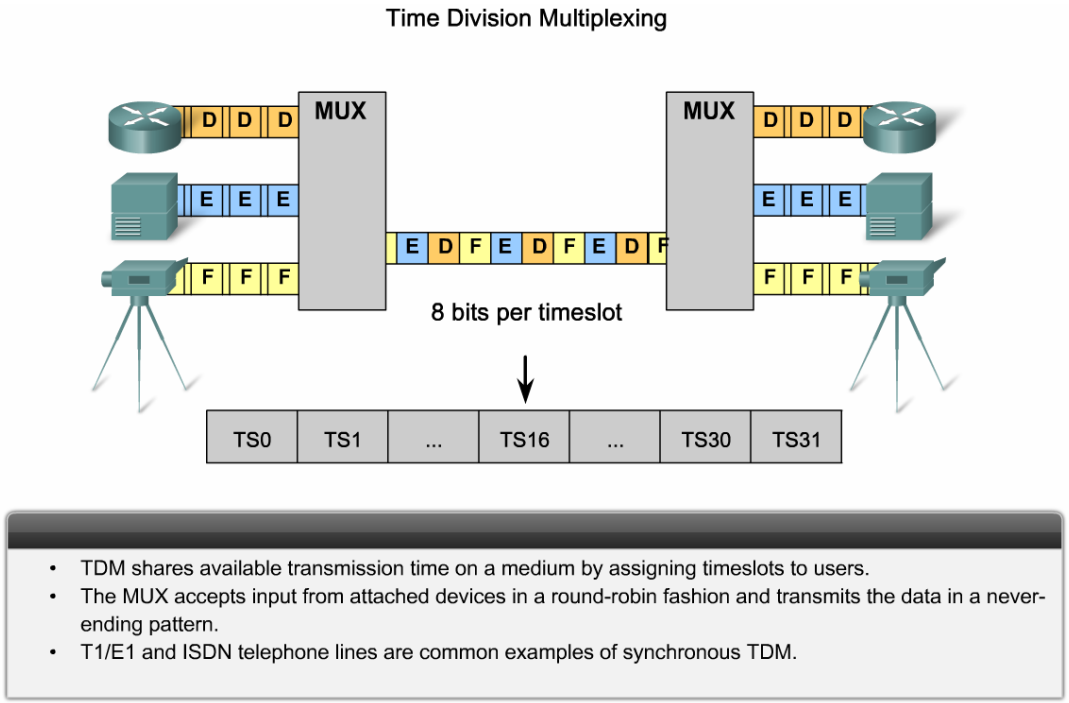
Transmission modes

- Serial sends data using one wire.
- Parallel sends over multiple wires simultaneously.
- Problems with parallel transmission
  - Clock skew
  - Crosstalk
  - Cost.



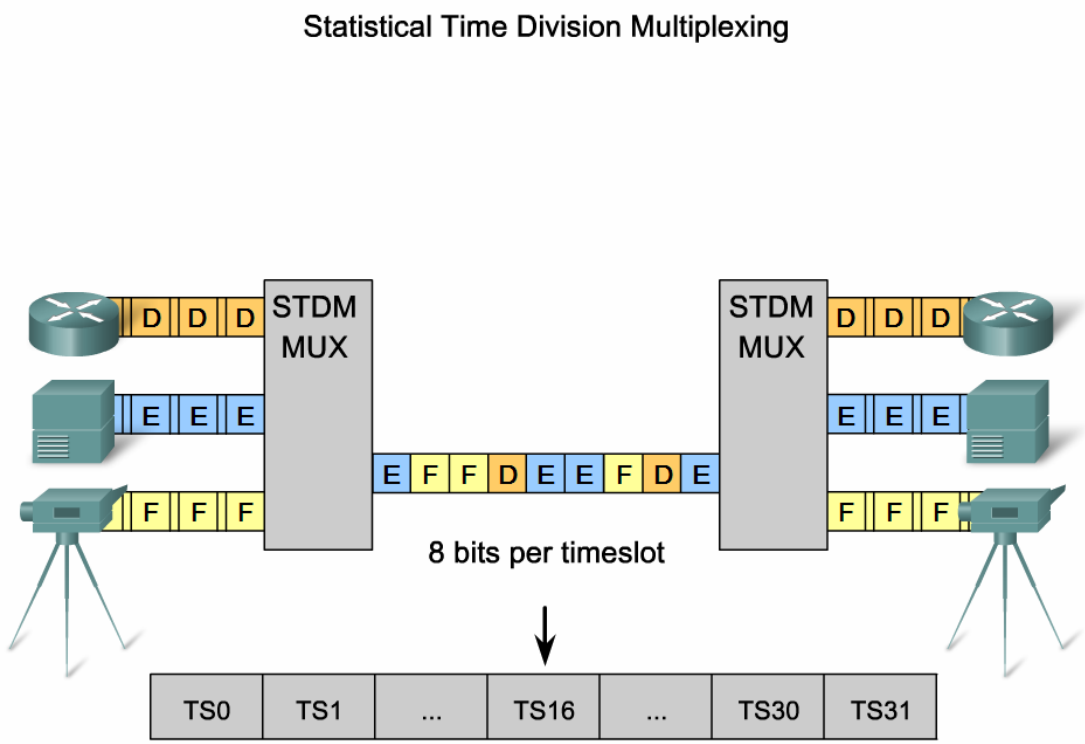
Figur: Serial and Parallel transmissions [2].

Sharing a physical connection



Figur: Time-division Multiplexing [2].

Sharing a physical connection



Figur: Statistical Time-division Multiplexing [2].

Synchronous

Needs an external clock signal to synchronize sender and receiver.

Asynchronous

No external clock is needed, usually timing is encoded within the symbols (Manchester encoding).

Bit-oriented

A communications protocol in which individual bits within a byte are used as control codes. [**2003mdo**]

Byte-oriented

A communications protocol in which full bytes are used as control codes. Also known as character-oriented protocol. [**2003mdo**]

High-level Data Link Control Procotol

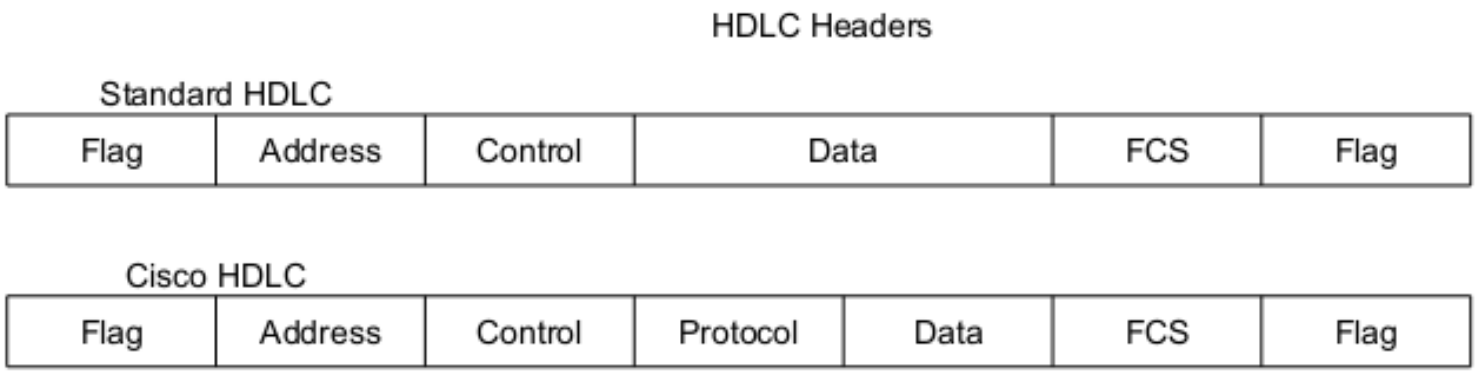
HDLC

HDLC is the default layer two encapsulation type for point-to-point connections on a Cisco router.

Configuration

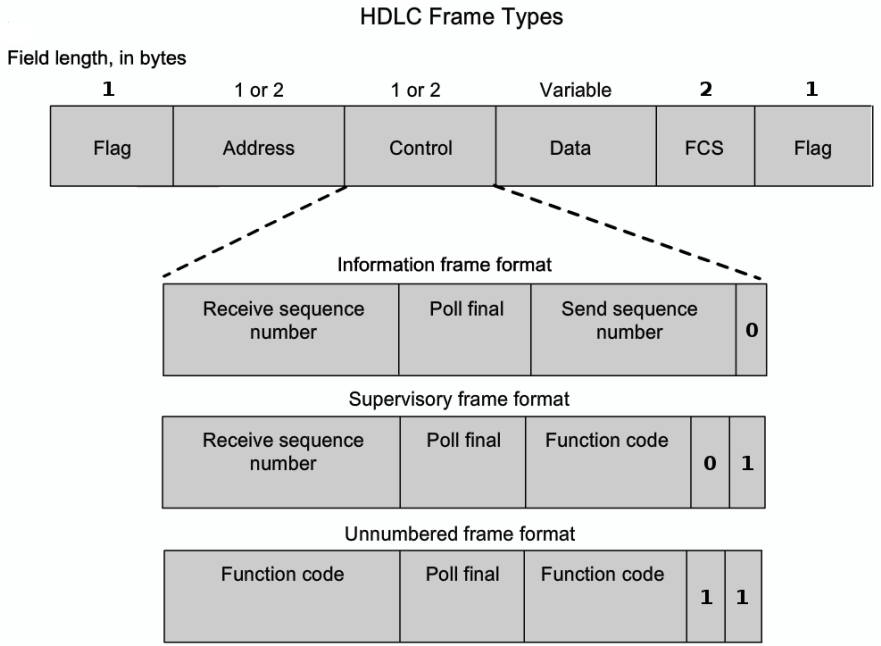
```
Router(config-if)#encapsulation hdlc
```

- Bit-oriented
- Synchronous
- Flag – Initiates and terminates error checking.
  - Bit pattern: *01111110*.
  - Inserts a *0* after every fifth *1* (bit stuffing).



Figur: HDLC Headers [2].

- Control – Three types of HDLC frames
  - Information frames: Carry upper layer information, and used for flow control and error control (piggybacking).
  - Supervisory frames: Provides flow and error control (when we can't piggyback).
  - Unnumbered frames: Used for session management and control information between connected devices (e.g Establish and connection release)



Figur: HDLC Frame types [2].

Point-to-Point Protocol

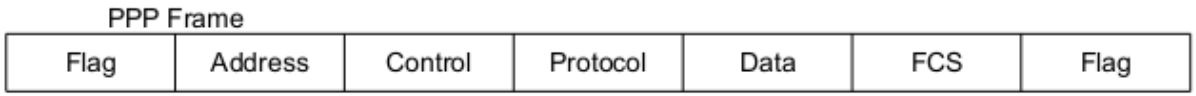
PPP

- PPP is a commonly used layer 2 protocol for connecting two (non-Cisco) routers together.
- Allows two devices to negotiate a link-establishment.
- Provides authentication.
- Provides link quality management features – Shuts down the link if too many errors are detected.
- Works in both the Physical Layer, Data Link Layer and Network Layer.
- Can be used for both point-to-point connections and multi-point connections.
- Byte-oriented.

PPP

- Does not provide flow-control.
- Very basic error-control, depends on higher layer protocol to address missing packets, out-of-order delivery et cetera.

- Flag - Starts and ends with a 1-byte flag *0x7E*
- Byte stuffing – An escape byte is inserted when a flag-byteäppears in the payload, *0x7D*
- Address - *0xFF*, can be omitted.
- Control - Left for backwards compatibility (HDLC), *0xC0* can be omitted.

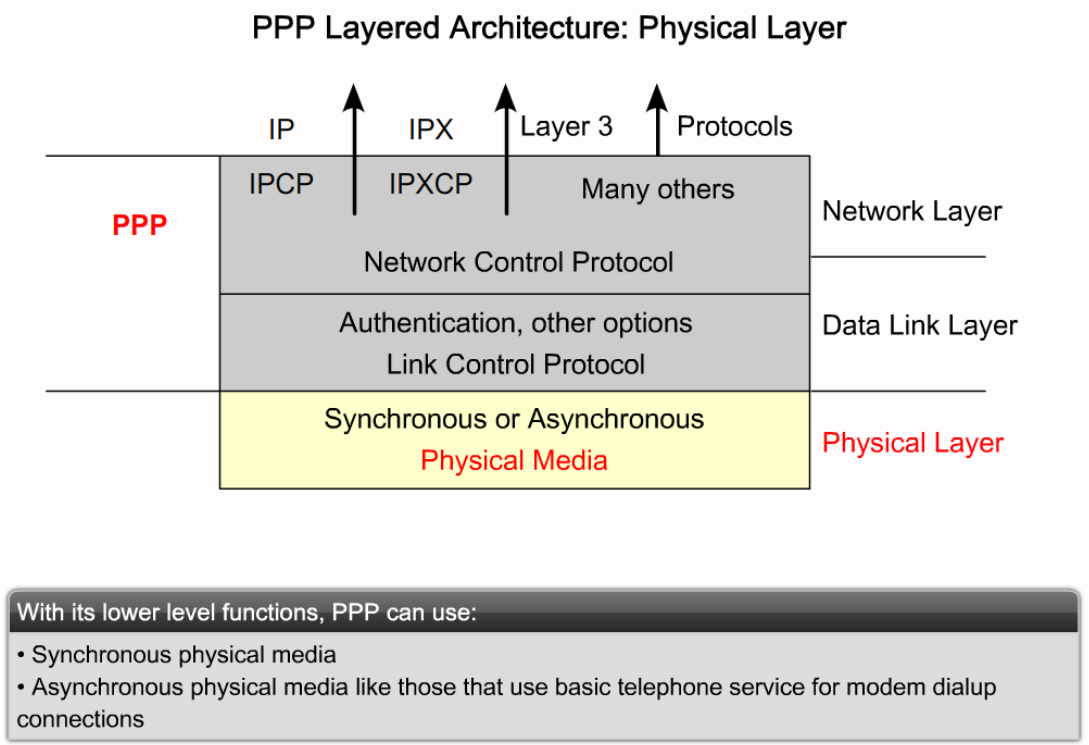


Figur: PPP frame

Layered architecture

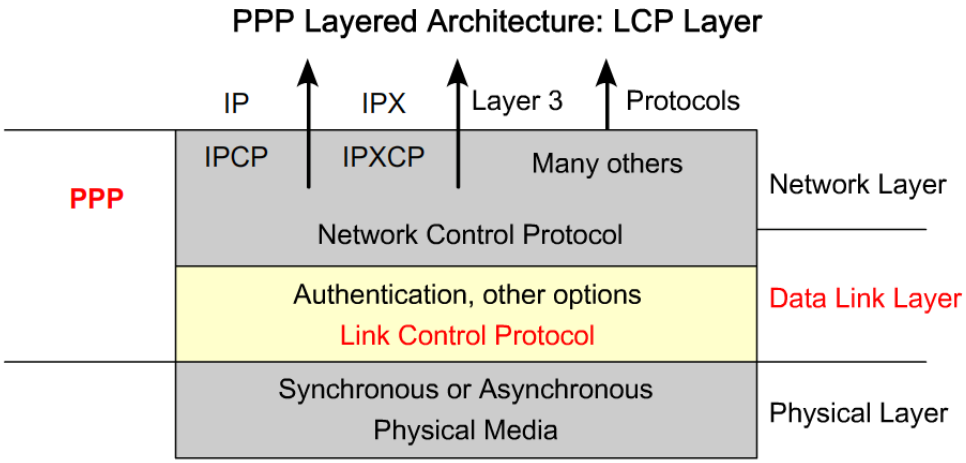
- PPP uses a set of protocols to provide the necessary functions.
- Physical Layer.
- Link Control Protocol.
- Two Authentication protocols.
- Multiple Network Control Protocols.

- Requires a duplex circuit (in comparison to simplex).
- Operates in Synchronous or Asynchronous mode.
- Operates across more or less any media.



Figur: Physical layer [2].

- Negotiate, Establish, Authenticates and Maintains the connection between the devices.
- Can handle variably sized packets.
- Detects common misconfiguration errors, and if the link is working properly.
- Terminates the link.

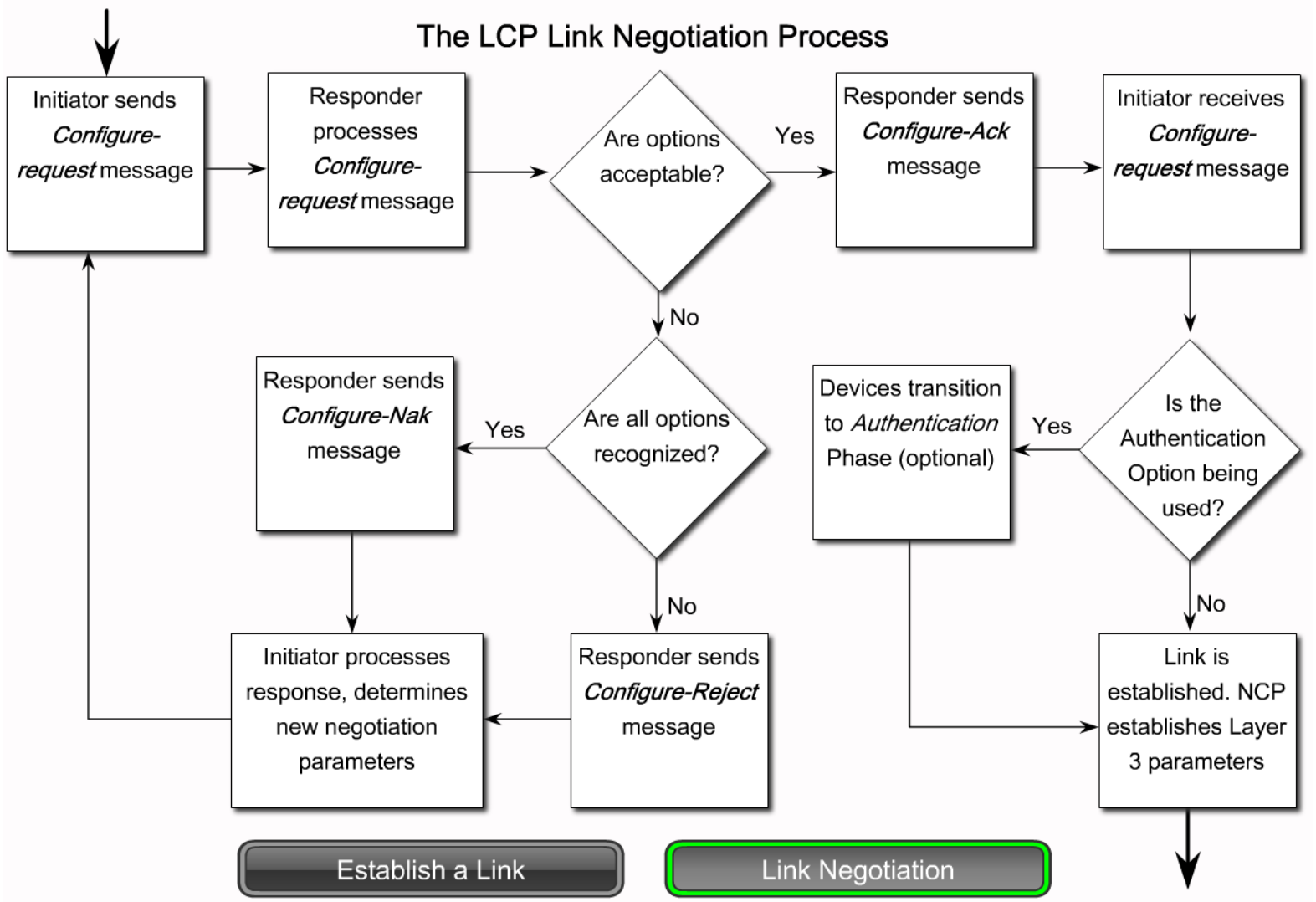


PPP offers service options in LCP and is primarily used for negotiation and frame checking when implementing the point-to-point controls specified by an administrator.

Figur: PPP – Logical Control Protocol [2].

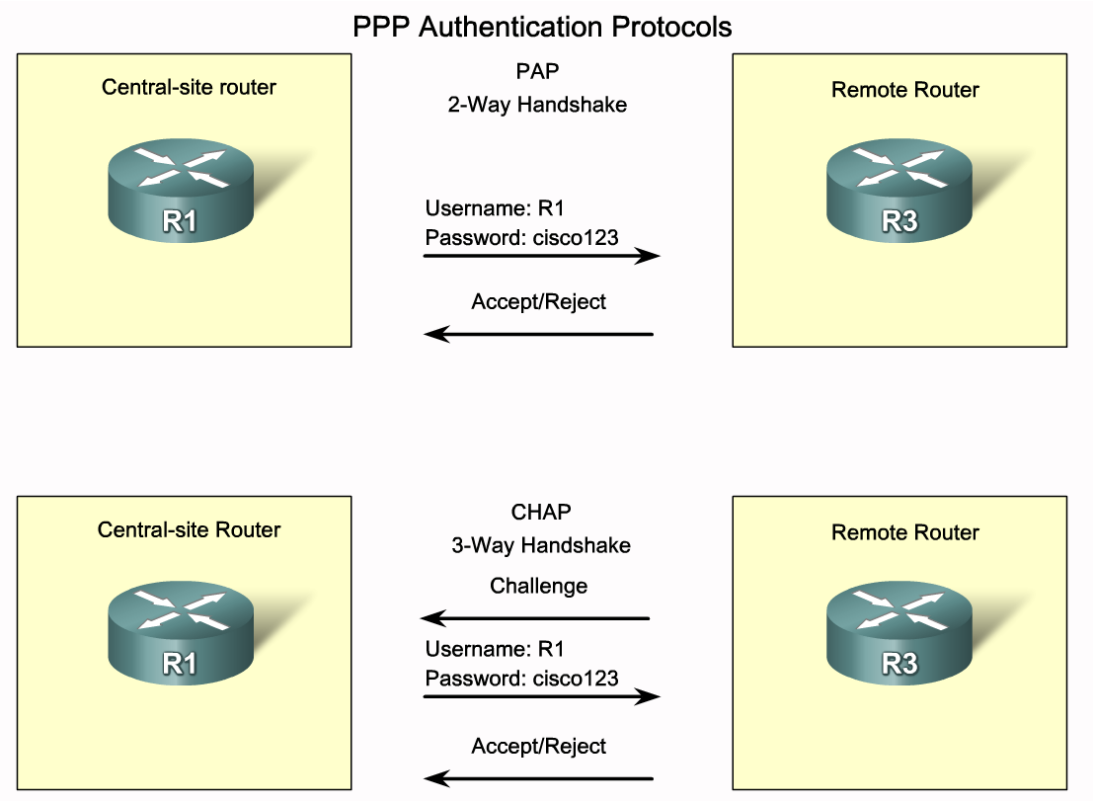
Tabell: LCP packet types [1].

Code	Packet Type	Description
0x01	Configure-request	Contains a list of proposed options and their va
0x02	Configure-ack	Accepts all options proposed
0x03	Configure-nak	Announces that some options are not acceptabl
0x04	Configure-reject	Announces that some options are not recognize
0x05	Terminate-request	Requests to shut down the line
0x06	Terminace-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 en
0x0A	Echo-reply	The response to the echo-request message
0x0B	Discard-request	A request to discard the packet



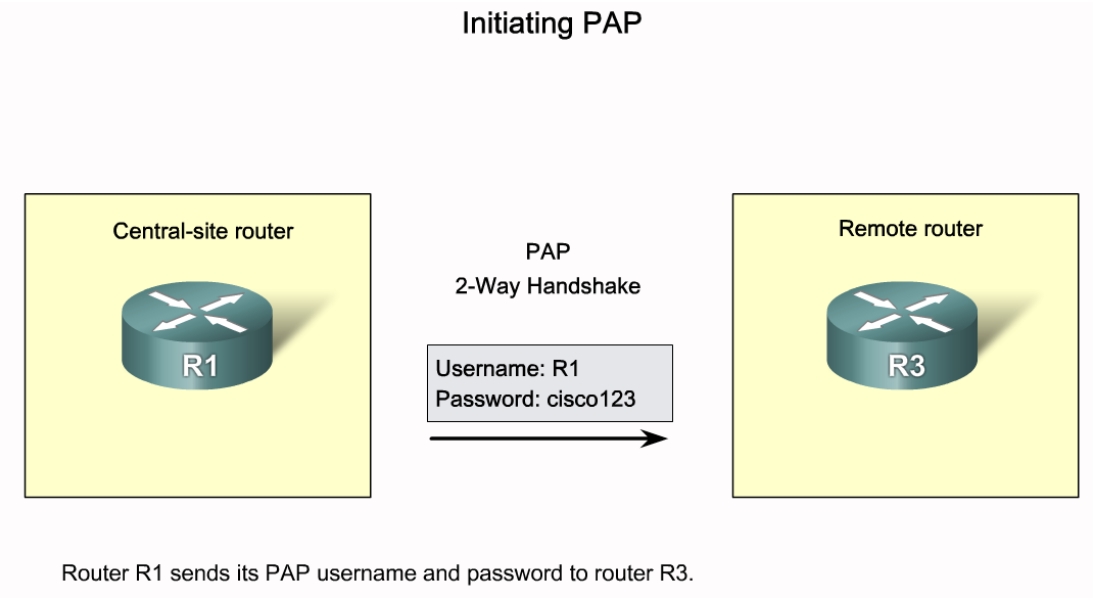
Figur: LCP negotiation process [2].

PPP Authentication



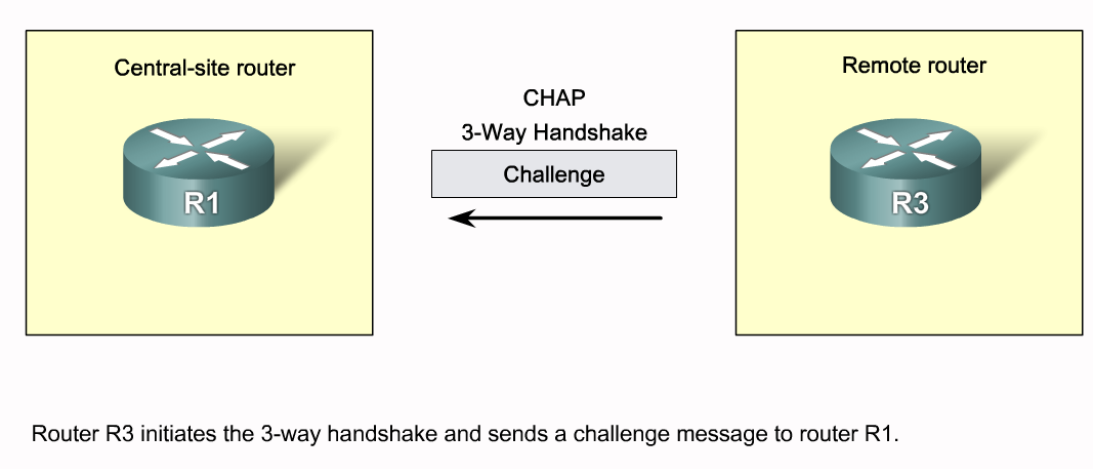
Figur: PPP Authentication types [2]

PPP – Password Authentication Protocol



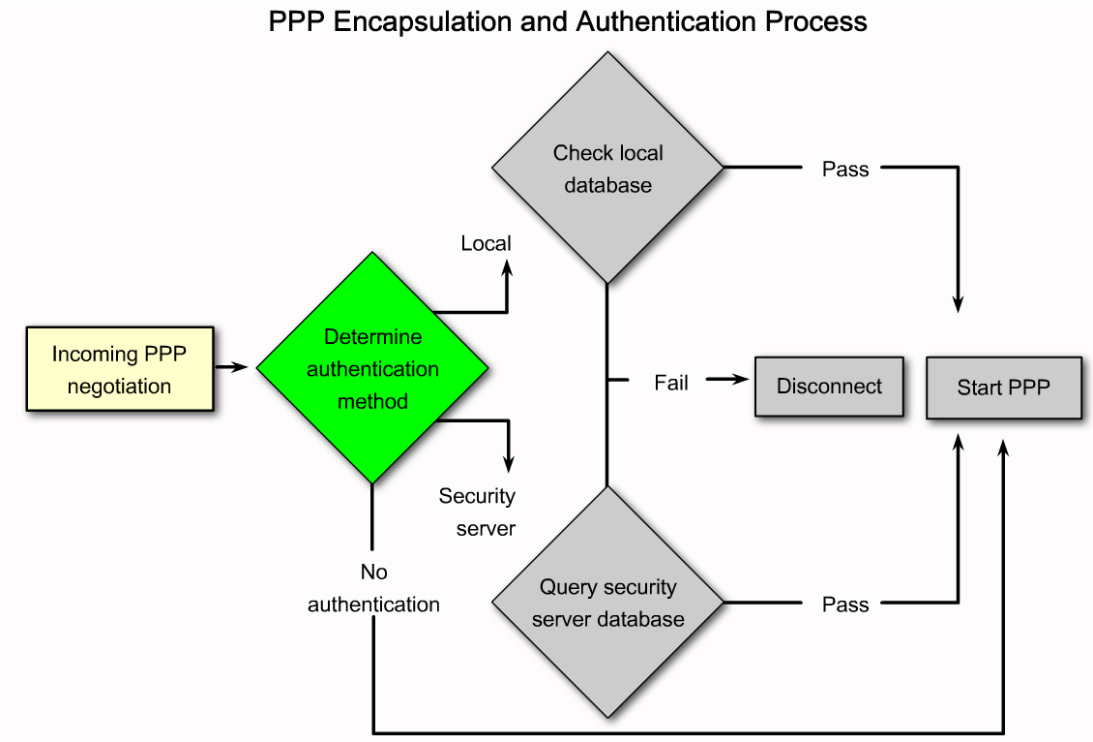
Figur: PPP PAP [2]

PPP – Challenge Handshake Authentication Protocol



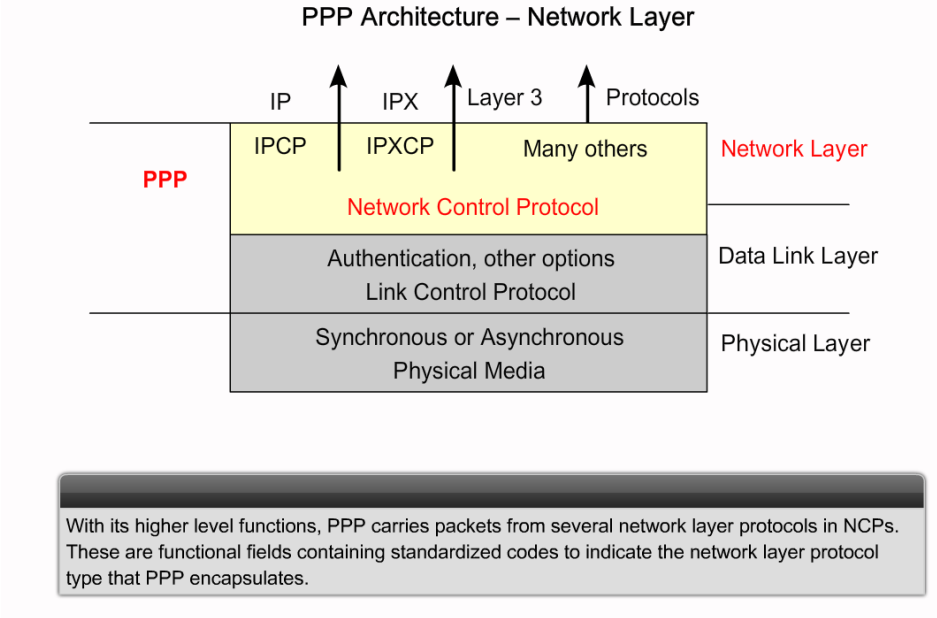
Figur: PPP CHAP [2]

PPP – Authentication process



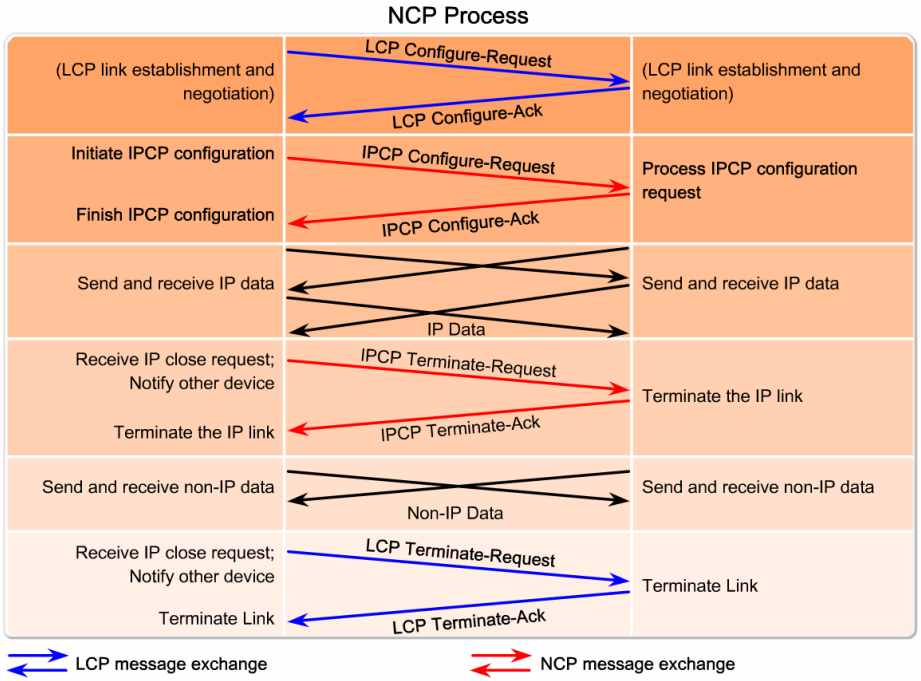
Figur: PPP Authentication types [2]

- Supports multiple network layer protocols (IP, IPX, Apple Talk et cetera.)
- Uses Network Control Protocol to configure the link for carrying a specific type of network layer protocol.
- Configure and assigning addresses.
- Compression.



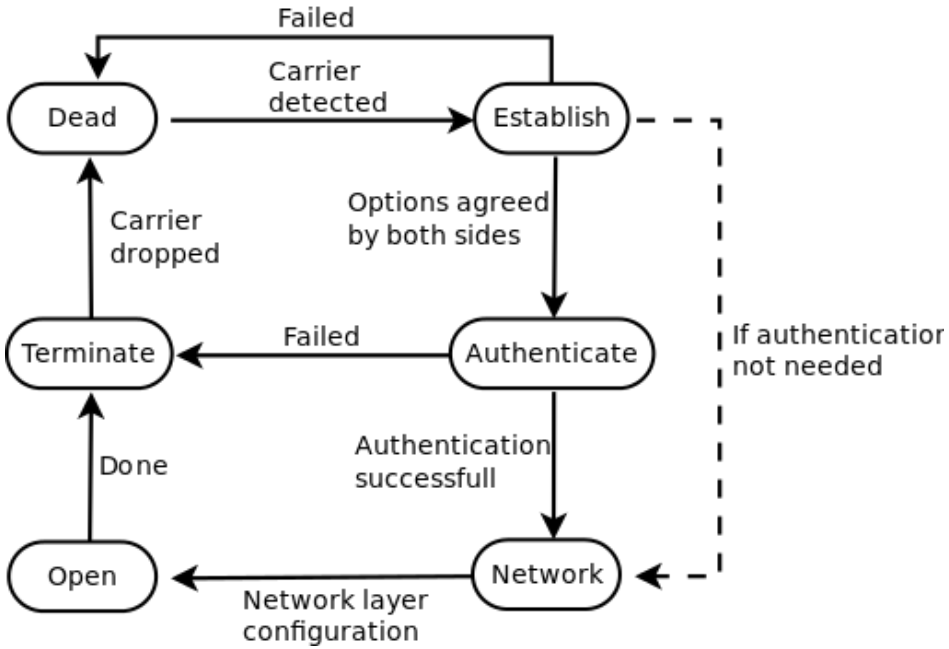
Figur: PPP – Network Control Protocol [2].

PPP Network Control Protocol process



Figur: NCP process [2].

PPP transition phases



Figur: Transition phases in PPP [1].

 Behrouz A. Forouzan och Sophia Chung Fegan. *Data communications and networking*. 4. ed. Boston: McGraw-Hill, 2007. ISBN: 0-07-125442-0 (International ed.)

 Bob Vachon och Rick Graziani. *Accessing the WAN : CCNA exploration companion guide*. Indianapolis, Ind.: Cisco Press, 2008. ISBN: 978-1-58713-205-6 (hardcover w/cd).