

POINT TO POINT DATALINK PROTOCOLS

ETI 2506 – Telecommunication Systems

Monday, 7 November 2016

TELECOMMUNICATION SYLLABUS

ETI 2506 Telecommunication Systems

Prerequisites

ETI 2301 Computer Networks

Purpose

The aim of this course is to enable the student to;

1. understand evolution of telephony
2. understand structure of basic transmission systems and network topologies

Learning Outcomes

At the end of this course, the student should be able to;

1. apply knowledge of telephony in telecommunication systems

Course Description

Evolution of the fixed line telephony, analog to digital, relay switched to stored program controlled switching, manual PBX to private automatic branch exchange (PABX), analog to ISDN and DSL, non-cellular mobile phone systems, cordless phones (DECT). System structure: Basic transmission system. Types of switching: circuit switching, message switching and packet. Network topologies, exclusive and multiparty lines; signaling methods; signaling No. 7 protocol. Call types: local, trunk and international, automatic multi-exchange connection and inter-exchange signaling. Terminal Equipment: Telephone set (receiver and transmitter), telex, facsimile, computer. Traffic modeling and dimensioning: queuing theory, Erlang traffic theory. Use of traffic tables in capacity design of telephone network systems.

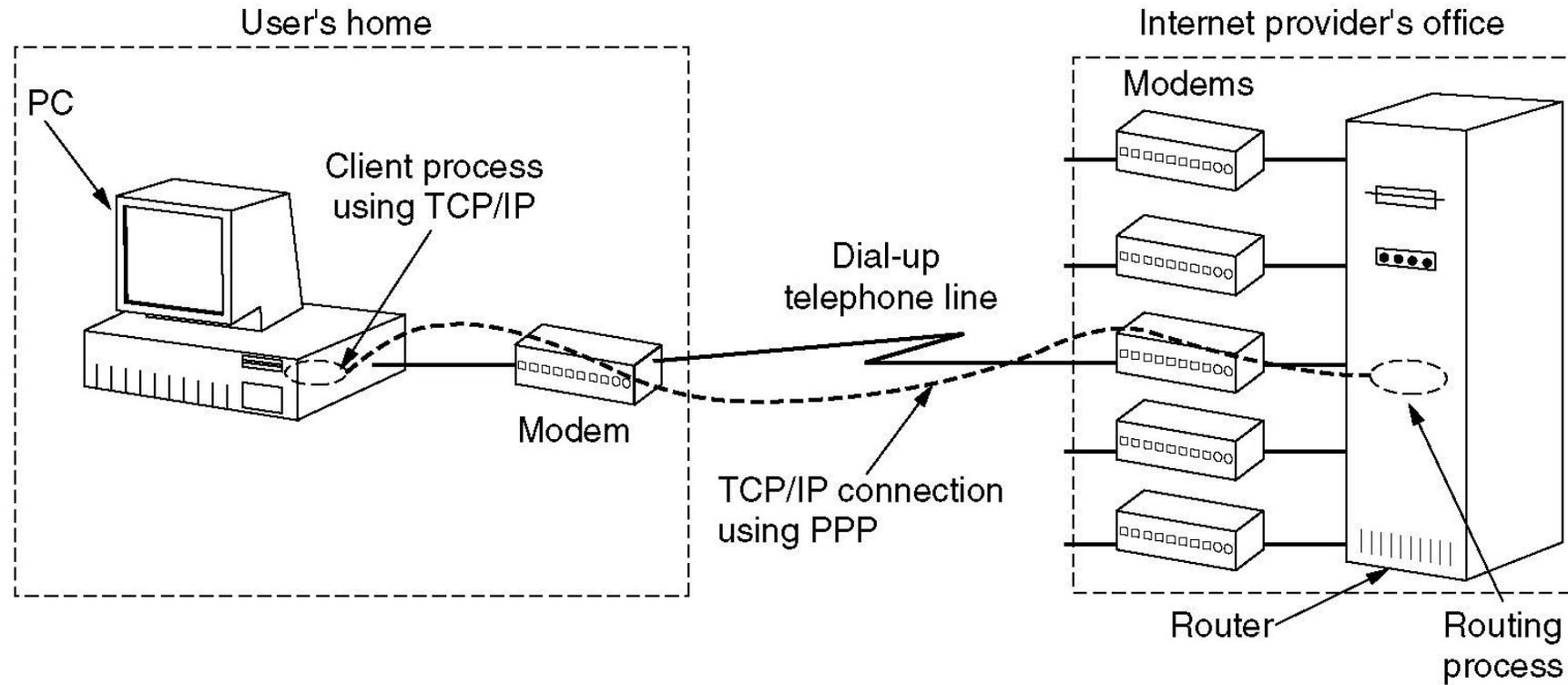
Principles of Telecom (IP Telephony and IP TV) - Key Issues to remember

PPP Frame and Phases

Password Authentication Protocol (PAP)

Challenge Handshake Authentication Protocol (CHAP)

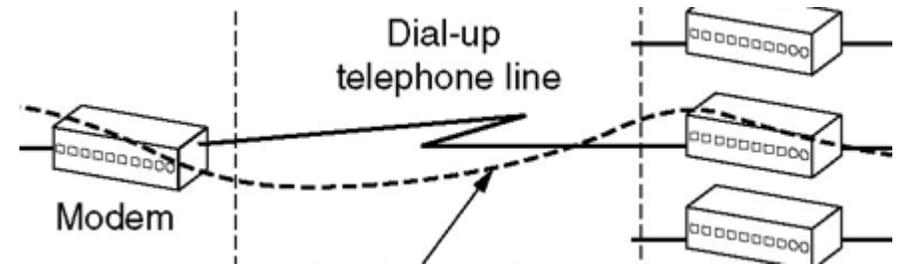
POINT TO POINT LINKS



FEATURES OF PPP DATA LINKS

- **Point to Point Protocol (PPP)** links have one sender, one receiver, one link with the following features:

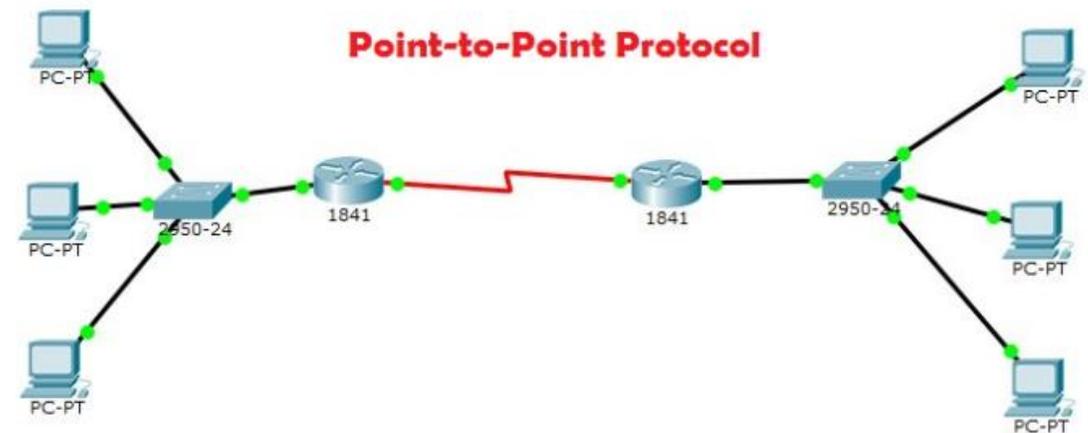
- No Media Access Control
- No need for explicit MAC addressing
- Examples are dialup links, ISDN line



- Popular point-to-point and high-level DLC protocols:
 - PPP (point-to-point protocol)
 - HDLC: High level data link control (Data link used to be considered “high layer” in protocol stack). HDLC is also used in multi-point links (one station many receivers)
- These protocols can operate over other data link technologies providing best of both worlds
 - e.g., PPPoE, HDLC encapsulation by Ethernet

WHAT IS POINT TO POINT PROTOCOL(PPP)?

1. **Point-to-Point Protocol (PPP)** is a data link (layer 2) protocol used to establish a direct connection between two nodes.
2. **PPP is used over many types of physical networks including serial cable, phone line, trunk line, cellular telephone, specialized radio links, and fiber optic links.**
3. **PPP is also used over Internet access connections.** Internet service providers (ISPs) have used PPP for customer dial-up access to the Internet.



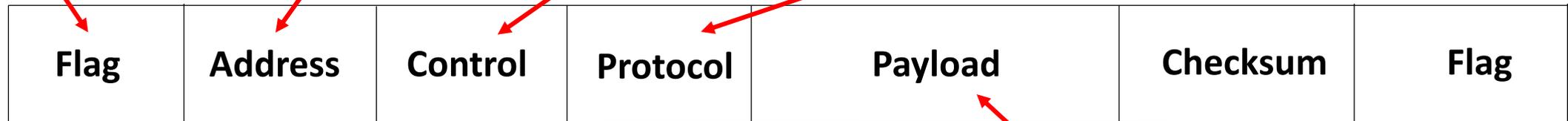
PPP FRAME FORMAT

Flag
1-byte with the bit pattern 01111110

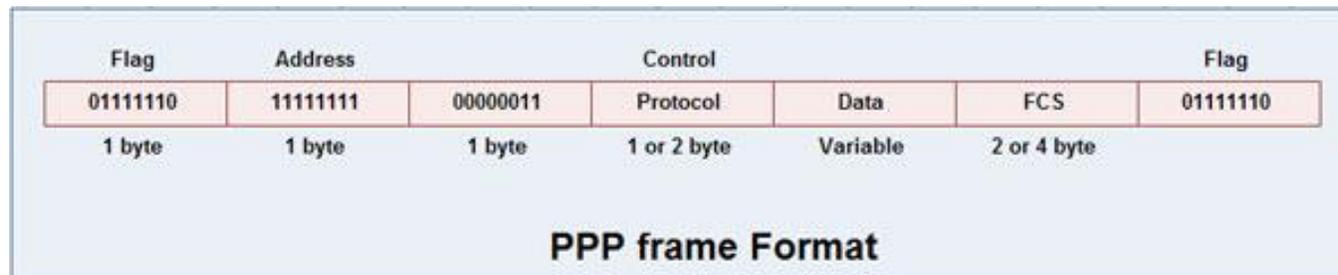
Address
Usually set to 11111111 (broadcast address).

Control
Usually set to the constant value 11000000 (imitating unnumbered frames in HDLC)

Protocol
Defines what is being carried in the data field: either user data or other information.



Payload
carries user data or other information



PPP LINE ACTIVATION & PHASES

LINK DEAD PHASE

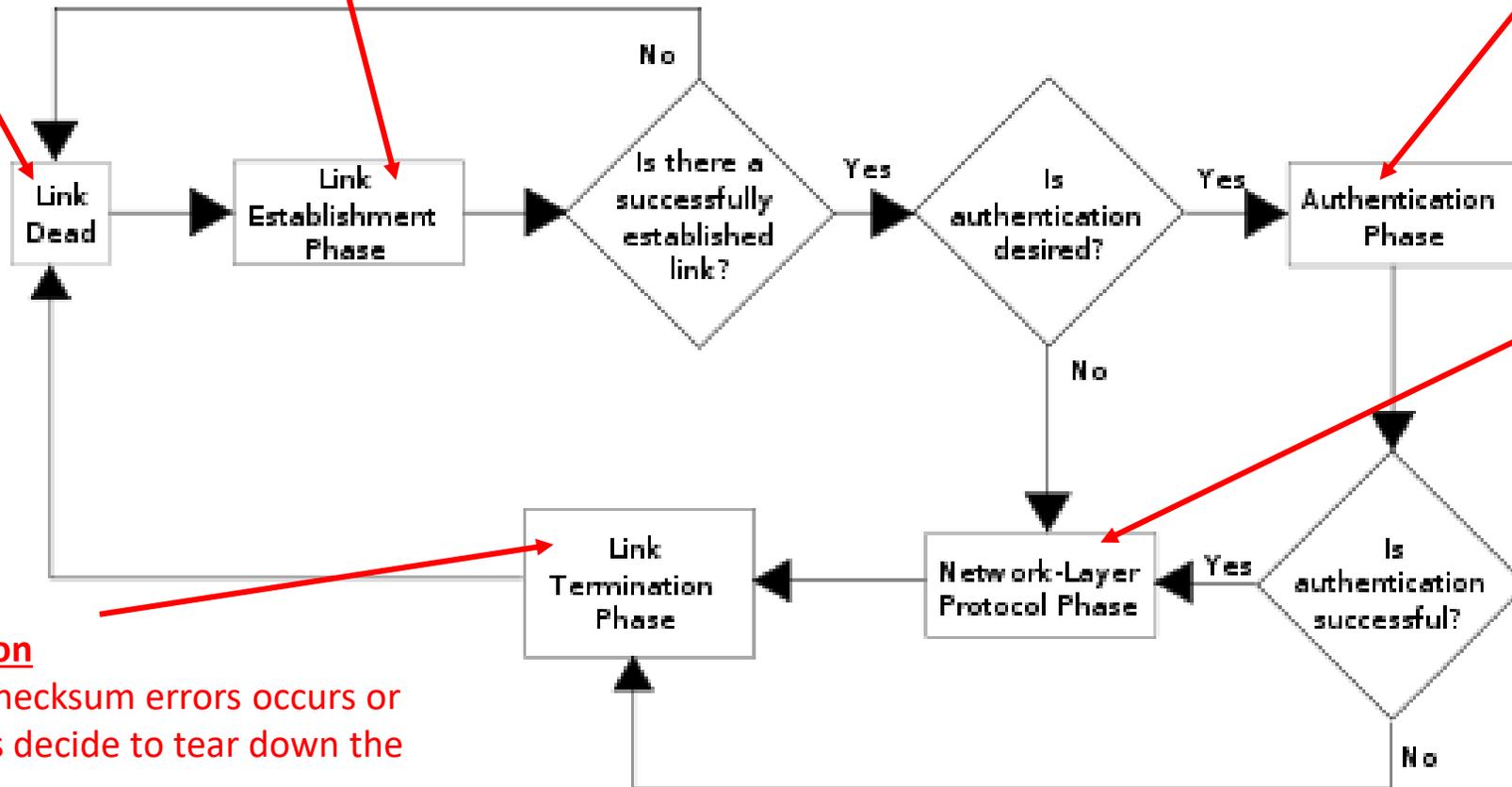
Occurs when the link fails, or one side has been told to disconnect.

LINK ESTABLISHMENT

Link Control Protocol negotiation is attempted

AUTHENTICATION PHASE

Allows both sides to verify each others identity before a connection is established



Network Layer Protocol

The desired protocols' Network Control Protocols are invoked

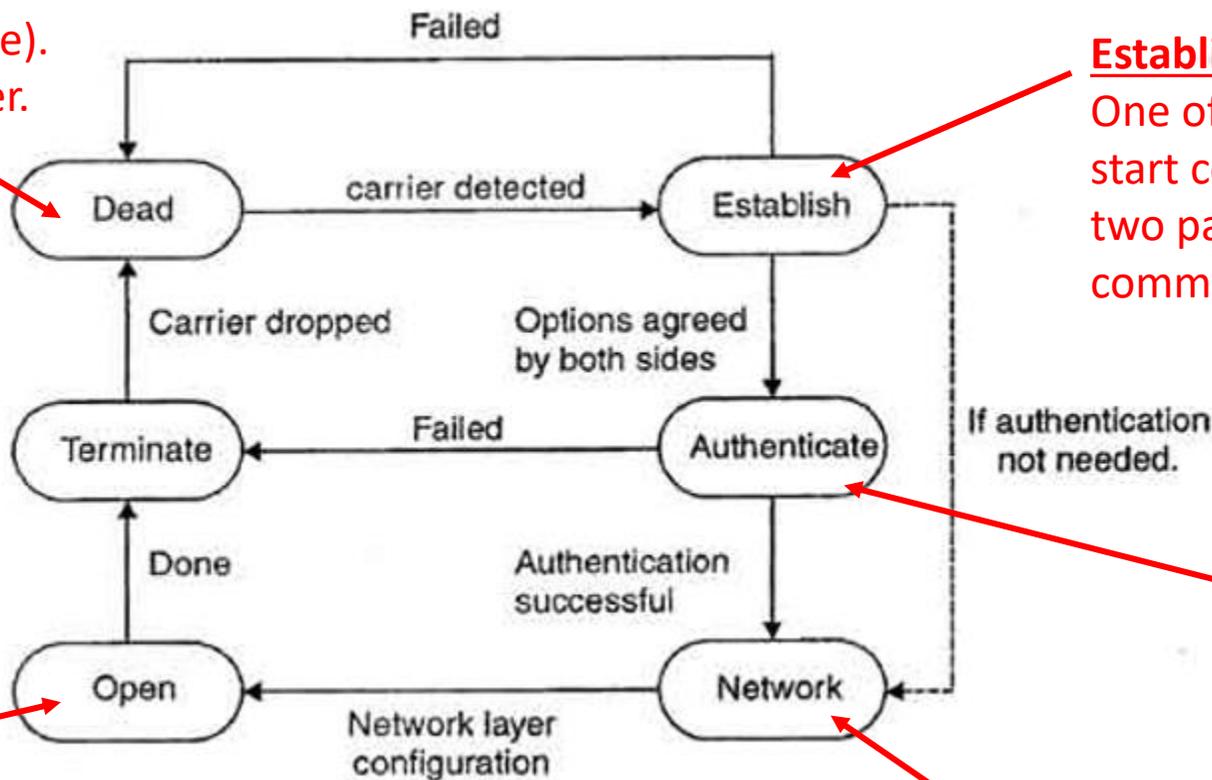
Link Termination

Occurs when checksum errors occurs or the two parties decide to tear down the link.

PPP TRANSITION PHASES

Dead State

Link is not used (or is idle).
There is no active carrier.



Establish Phase

One of the nodes wishes to start communication. The two parties negotiate the communication options

Authentication Phase

The parties send several authentication packets to verify their identities.

Network Phase

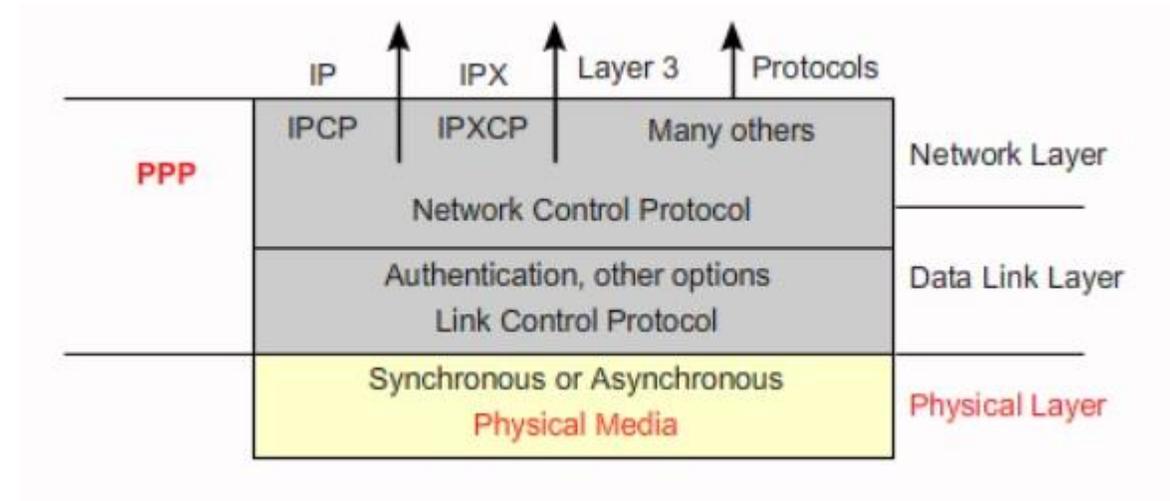
Negotiation for the network layer protocols takes place

Open Phase

Data transfer takes place. The connection remains in this phase until one party requests for termination.

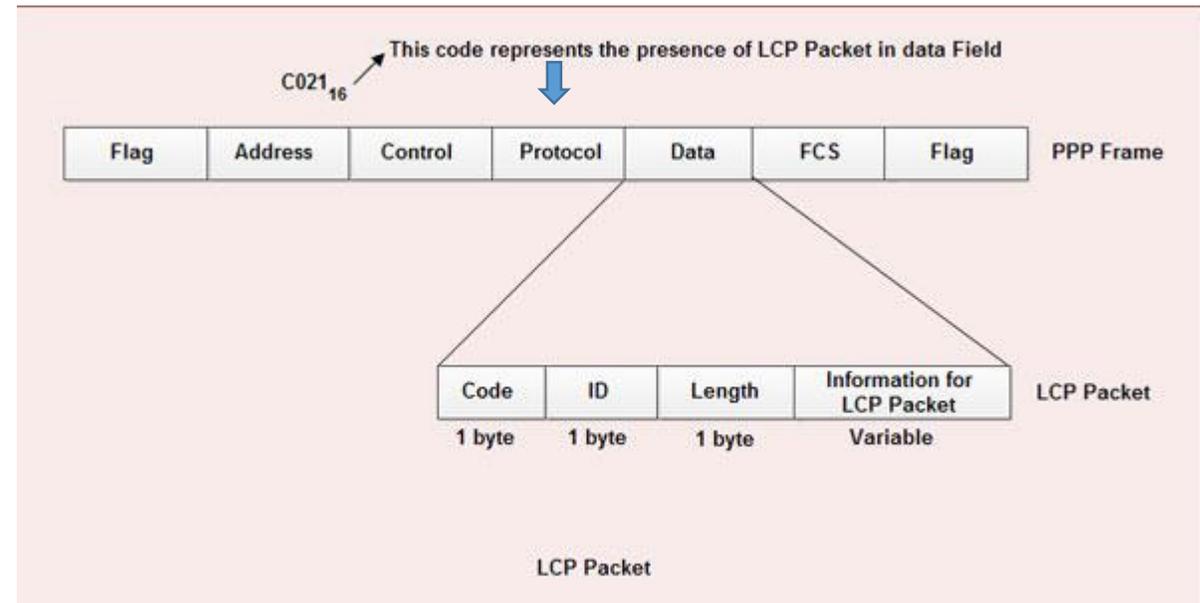
POINT TO POINT PROTOCOL STACK

1. PPP uses several other protocols to establish link, authenticate users and to carry the network layer data.
2. The various protocols used are:
 - a) **Link Control Protocol**
 - b) **Authentication Protocol**
 - c) **Network Control Protocol**



LINK CONTROL PROTOCOL

1. **Link Control Protocol LCP)** is responsible for establishing, maintaining, configuring and terminating the link.
2. LCP provides negotiation mechanism to set options between two endpoints.
3. LCP packets are carried in the data field of the PPP frame.
4. The presence of a value $C021_{hex}$ in the protocol field of PPP frame indicates that LCP packet is present in the data field.



AUTHENTICATION PROTOCOL

Authentication protocols help to validate the identity of a user who needs to access the resources.

There are two authentication protocols:

1. Password Authentication Protocols (PAP)
2. Challenge Handshake Authentication Protocol (CHAP)

PASSWORD AUTHENTICATION PROTOCOL(PAP)

1. **Password Authentication Protocol (PAP)** provides two step authentication procedure as follows:

Step 1: User name and password is provided by the user who wants to access a system.

Step 2: The system checks the validity of user name and password and either accepts or denies the connection.

2. PAP packets are carried in the data field of PPP frames.
3. The presence of PAP packet is identified by the value $C023_{16}$ in the protocol field of PPP frame.
4. There are three PAP packets.

Authenticate-request: used to send user name & password.

Authenticate-ack: used by system to allow the access.

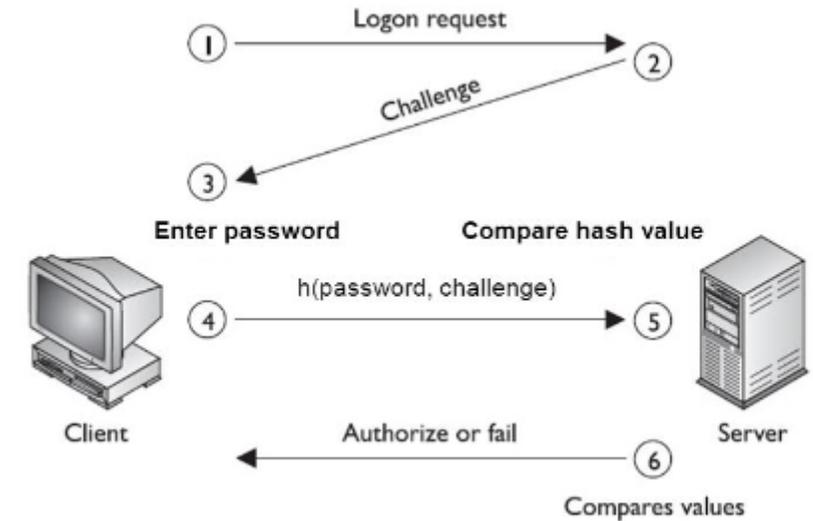
Authenticate-nak: used by system to deny the access.

CHALLENGE HANDSHAKE AUTHENTICATION PROTOCOL(CHAP)

Challenge Handshake Authentication Protocol(CHAP) is a three-way handshaking authentication protocol:

1. User sends to the system a login request.
2. System sends a challenge packet(random) to the user.
3. Using a predefined function, a user combines this challenge value with the user password and sends the resultant packet back to the system.
4. System applies the same function to the password of the user and challenge value and creates a result.

If result is same as the result sent in the response packet, access is granted, otherwise, it is denied.



TYPES OF CHAP PACKETS

There are 4 types of CHAP packets:

1. **Challenge**-used by system to send challenge value.
2. **Response**-used by the user to return the result of the calculation.
3. **Success**-used by system to allow access to the system.
4. **Failure**-used by the system to deny access to the system.

NETWORK CONTROL PROTOCOL (NCP)

1. PPP can carry a network layer data packet from protocols defined by the Internet, DECNET, Apple Talk, Novell, etc.
2. **Network Control Protocol (NCP)** is a set of control protocols that allow the encapsulation of the data coming from network layer.
3. After the network layer configuration is done by one of the NCP protocols, the users can exchange data from the network layer.

