**PPP Components**

**Link Control Protocol (LCP)**
Provides for the establishment, configuration, and maintenance of a PPP link. Protocol-independent options are negotiated by LCP.

**Network Control Protocol (NCP)**
A separate NCP is used to negotiate the configuration of each network layer protocol (such as IP) carried by PPP.

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**PPP Header**

<table>
<thead>
<tr>
<th>Address</th>
<th>Control</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>16</td>
<td>24</td>
</tr>
</tbody>
</table>

---

**LCP Header**

<table>
<thead>
<tr>
<th>Code</th>
<th>Identifier</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>16</td>
<td>24</td>
</tr>
</tbody>
</table>

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**Authentication Protocols**

**Plaintext Authentication Protocol (PAP)**
Original, obsolete authentication protocol which relies on the exchange of a plaintext key to authenticate peers (RFC 1334).

**Challenge Handshake Authentication Protocol (CHAP)**
Authenticates peers using the MD5 checksum of a pre-shared secret key (RFC 944).

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**General PPP Configuration**

- Configure a peer account if authentication will be used
  username **peer-hostname** password **password**

- Configure a local IP address pool if needed
  ip pool **name first-IP last-IP**
  interface Serial0/0
  ! Enable PPP encapsulation
  encapsulation ppp

- Enable CHAP and/or PAP for authentication
  ppp authentication { chap | pap } [ chap | pap ]

- Enable compression
  compress { predictor | stac }

- Enable peer IP address assignment (server side)
  peer default ip address { pool **name** | **IP-address** }

- Enable IP address negotiation (client side)
  ip address negotiated

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**Multilink PPP Configuration**

- Create the multilink interface
  interface Multilink1
  ip address **IP-address subnet-mask**
  ppp multilink group **group**

- Assign physical interfaces to the multilink group
  interface Serial0/0
  encapsulation ppp
  ppp multilink group **group**

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**PPP Summary**

**Standard**
RFC 1661

**Interfaces**
Asynchronous serial, synchronous serial, ISDN, HSSI

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**PPP Features**

**Protocol Multiplexing**
- Multiple NCPs

**Optional Authentication**
- PAP/CHAP

**Optional Compression**
- Stacker/predictor

**Loopback Detection**
- Provided by LCP

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**Connection Phase Flowchart**

- **Dead**
  - **Establish**
  - **Authenticate**
    - **Network**
    - **Terminate**
      - Admin Shutdown
      - Failure

---

**PPP Connection Example**

- **LCP Configuration Request**
- **LCP Configuration Ack**
- **CHAP Challenge**
- **CHAP Response**
- **CHAP Success**
- **IP Control Configuration Request**
- **IP Control Configuration Ack**
- **CDP Control Configuration Request**
- **CDP Control Configuration Ack**

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**PPP Compression Algorithms**

**Stacker**
Replaces repetitive data with symbols from a dynamic dictionary (more processor-intensive)

**Predictor**
Attempts to predict sequential data (more memory-intensive)

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**Troubleshooting**

- show ppp multilink
- debug ppp authentication
- debug ppp { negotiation | packet }