

PPP Concept

What is PPP?

Recall that HDLC is the default serial encapsulation method when you connect two Cisco routers. With an added protocol type field, the Cisco version of HDLC is proprietary. Thus, Cisco HDLC can only work with other Cisco devices. However, when you need to connect to a non-Cisco router, you should use PPP encapsulation.

- PPP encapsulation has been carefully designed to retain compatibility with most commonly used supporting hardware. PPP encapsulates data frames for transmission over Layer 2 physical links. PPP establishes a direct connection using serial cables, phone lines, cellular telephones, specialized radio links, or fiber-optic links. There are many advantages to using PPP, including the fact that it is not proprietary. Moreover, it includes many features not available in HDLC:

- The link quality management feature monitors the quality of the link. If too many errors are detected, PPP takes the link down.
- PPP supports PAP and CHAP authentication.

PPP contains three main components:

- HDLC protocol for encapsulating datagrams over point-to-point links.
- Extensible Link Control Protocol (LCP) to establish, configure, and test the data link connection.
- Network Control Protocols (NCPs) for establishing and configuring different Network layer protocols. PPP allows the simultaneous use of multiple Network layer protocols. Some of the more common NCPs are Internet Protocol Control Protocol, Appletalk Control Protocol, Novell IPX Control Protocol, Cisco Systems Control Protocol, SNA Control Protocol, and Compression Control Protocol.

- Most of the work done by PPP is at the data link and Network layers by the LCP and NCPs. The LCP sets up the PPP connection and its parameters, the NCPs handle higher layer protocol configurations, and the LCP terminates the PPP connection.

Link Control Protocol Layer

The LCP provides automatic configuration of the interfaces at each end, including:

- Handling varying limits on packet size
- Detecting common misconfiguration errors
- Terminating the link
- Determining when a link is functioning properly or when it is failing

- PPP also uses the LCP to agree automatically on encapsulation formats (authentication, compression, error detection) as soon as the link is established.

Network Control Protocol Layer

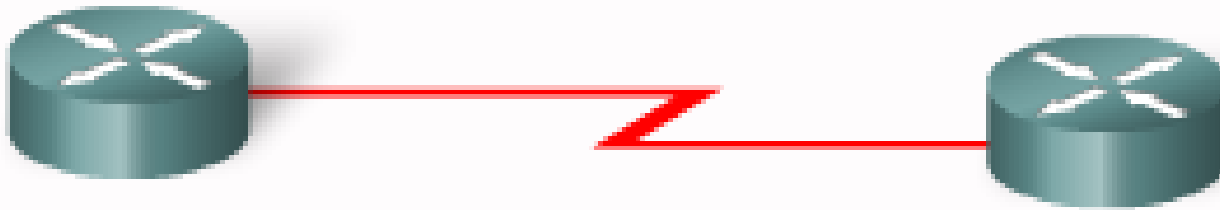
- Point-to-point links tend to worsen many problems with the current family of network protocols. For instance, assignment and management of IP addresses, which is a problem even in LAN environments, is especially difficult over circuit-switched point-to-point links (such as dialup modem servers). PPP addresses these issues using NCPs.

- PPP permits multiple Network layer protocols to operate on the same communications link. For every Network layer protocol used, PPP uses a separate NCP. For example, IP uses the IP Control Protocol (IPCP), and IPX uses the Novell IPX Control Protocol (IPXCP).

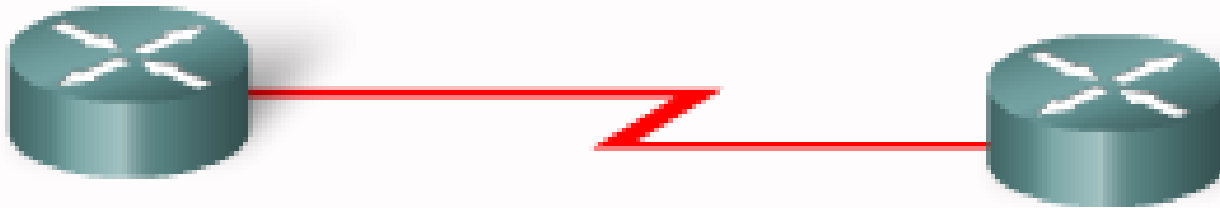
Establishing a PPP Session

- The figure shows the three phases of establishing a PPP session:
 - 1- Phase 1: Link establishment and configuration negotiation
 - 2- Phase 2: Link quality determination (optional)
 - 3- Phase 3: Network layer protocol configuration negotiation

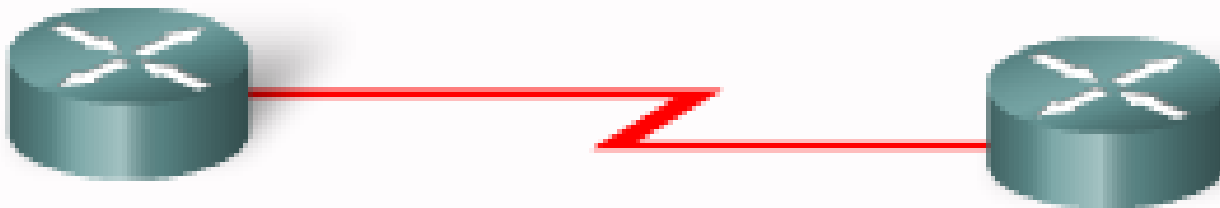
Establishing a PPP Session



Phase 1 - Link Establishment: "Let's negotiate."



Phase 2 - Determine Link Quality: "Maybe we should discuss some details about quality. Or, maybe not ..."



Phase 3 - Network Protocol Negotiation: "OK, I will leave it to the NCPs to discuss higher level details."

The LCP does all the talking.

Phase 1: Link establishment and configuration negotiation

- Before PPP exchanges any Network layer datagrams (for example, IP), the LCP must first open the connection and negotiate configuration options. This phase is complete when the receiving router sends a configuration-acknowledgment frame back to the router initiating the connection.

Phase 2: Link quality determination (optional)

- The LCP tests the link to determine whether the link quality is sufficient to bring up Network layer protocols. The LCP can delay transmission of Network layer protocol information until this phase is complete.

Phase 3: Network layer protocol configuration negotiation

- After the LCP has finished the link quality determination phase, the appropriate NCP can separately configure the Network layer protocols, and bring them up and take them down at any time. If the LCP closes the link, it informs the Network layer protocols so that they can take appropriate action.

- The link remains configured for communications until explicit LCP or NCP frames close the link, or until some external event occurs (for example, an inactivity timer expires or a user intervenes). The LCP can terminate the link at any time. This is usually done when one of the routers requests termination, but can happen because of a physical event, such as the loss of a carrier or the expiration of an idle-period timer.