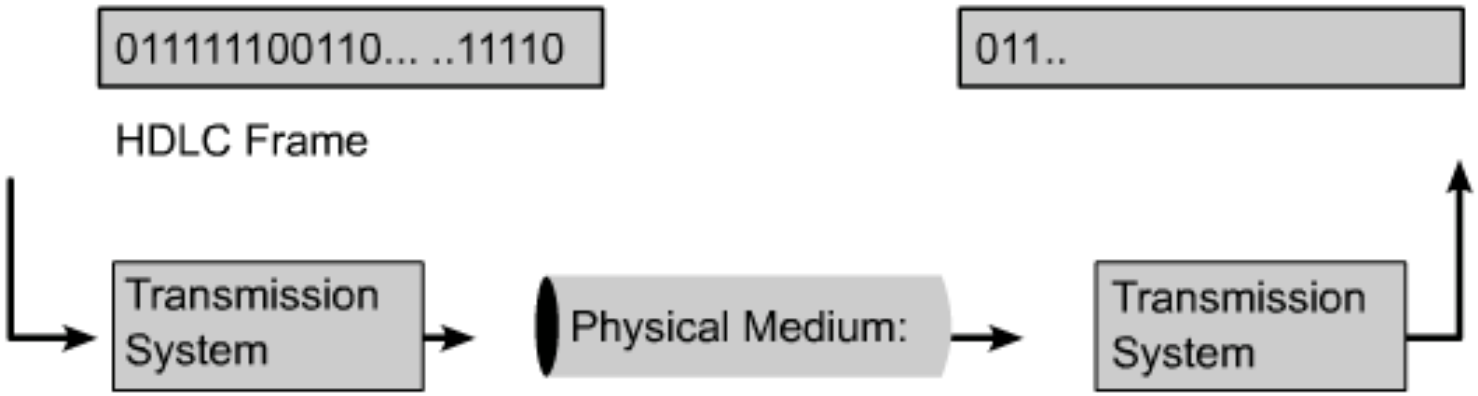
Chapter 5
PPP

Objectives

- Serial point-to-point links
- HDLC
- PPP authentication
- Configuring PPP

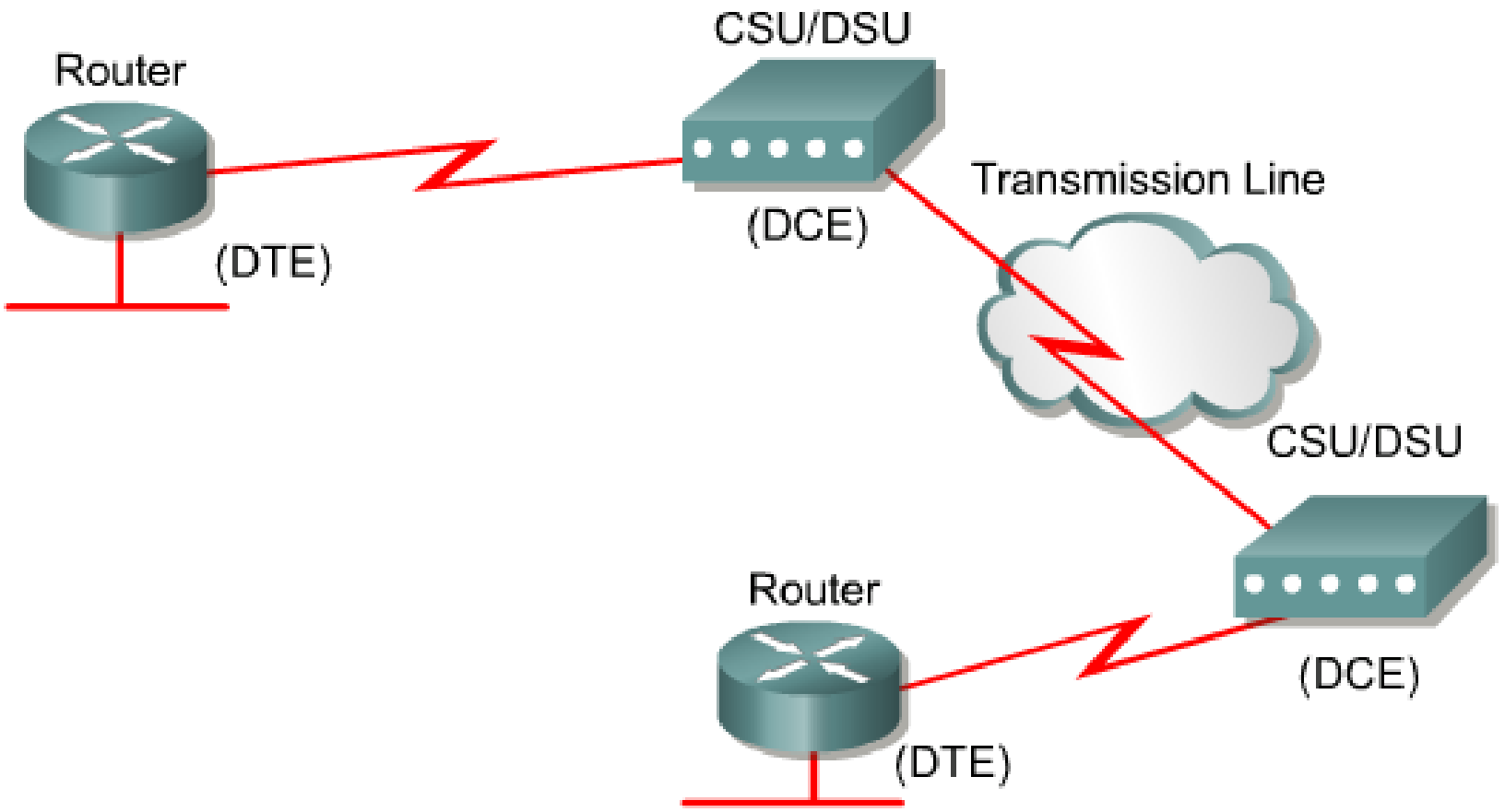
Serial Communications



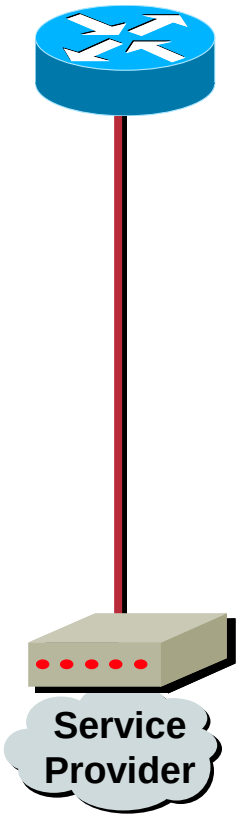
Some of the many serial communications standards include the following:

- RS-232-E
- V.35
- High-Speed Serial Interface (HSSI)

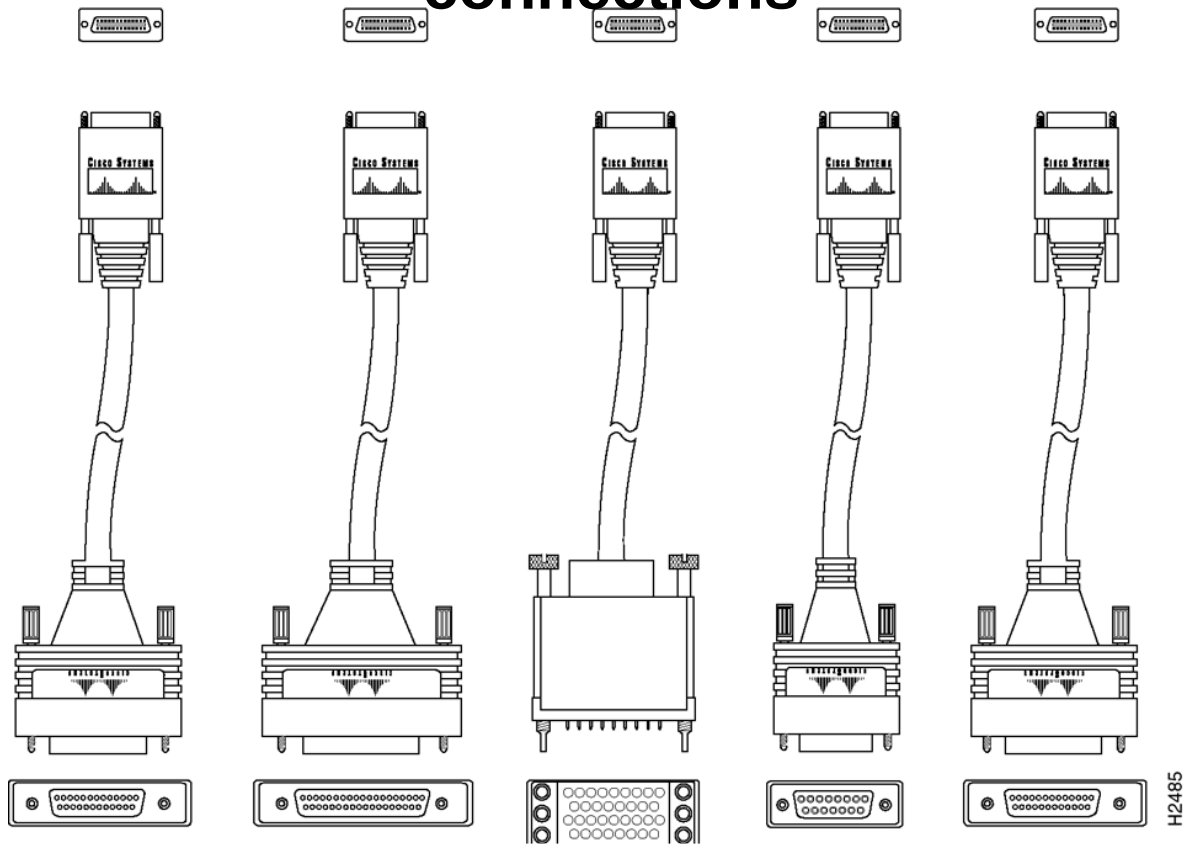
DTE-DCE



Serial Point-to-Point Connections



Router connections



Network connections at the CSU/DSU

Definition of HDLC

- The High-Level Data-Link Control (HDLC) protocol is a popular ISO-standard, bit-oriented Data Link layer protocol.
- It specifies an encapsulation method for data on synchronous serial data links using frame characters and checksums.
- HDLC is a point-to-point protocol used on leased lines. No authentication can be used with HDLC.
- HDLC is the default encapsulation used by Cisco routers over synchronous serial links.

Configuring HDLC Encapsulation


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

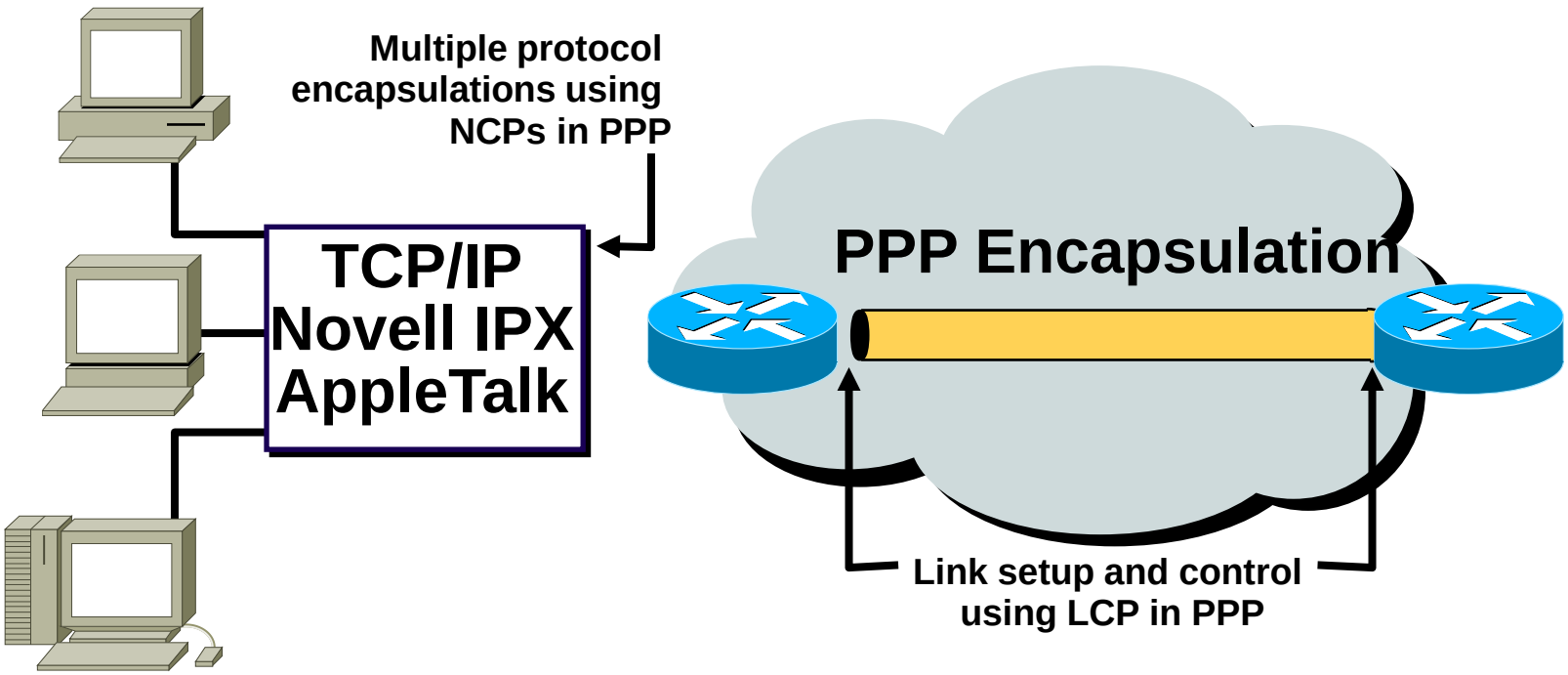
Enables HDLC encapsulation

Uses the default encapsulation on synchronous serial interfaces

Overview of PPP

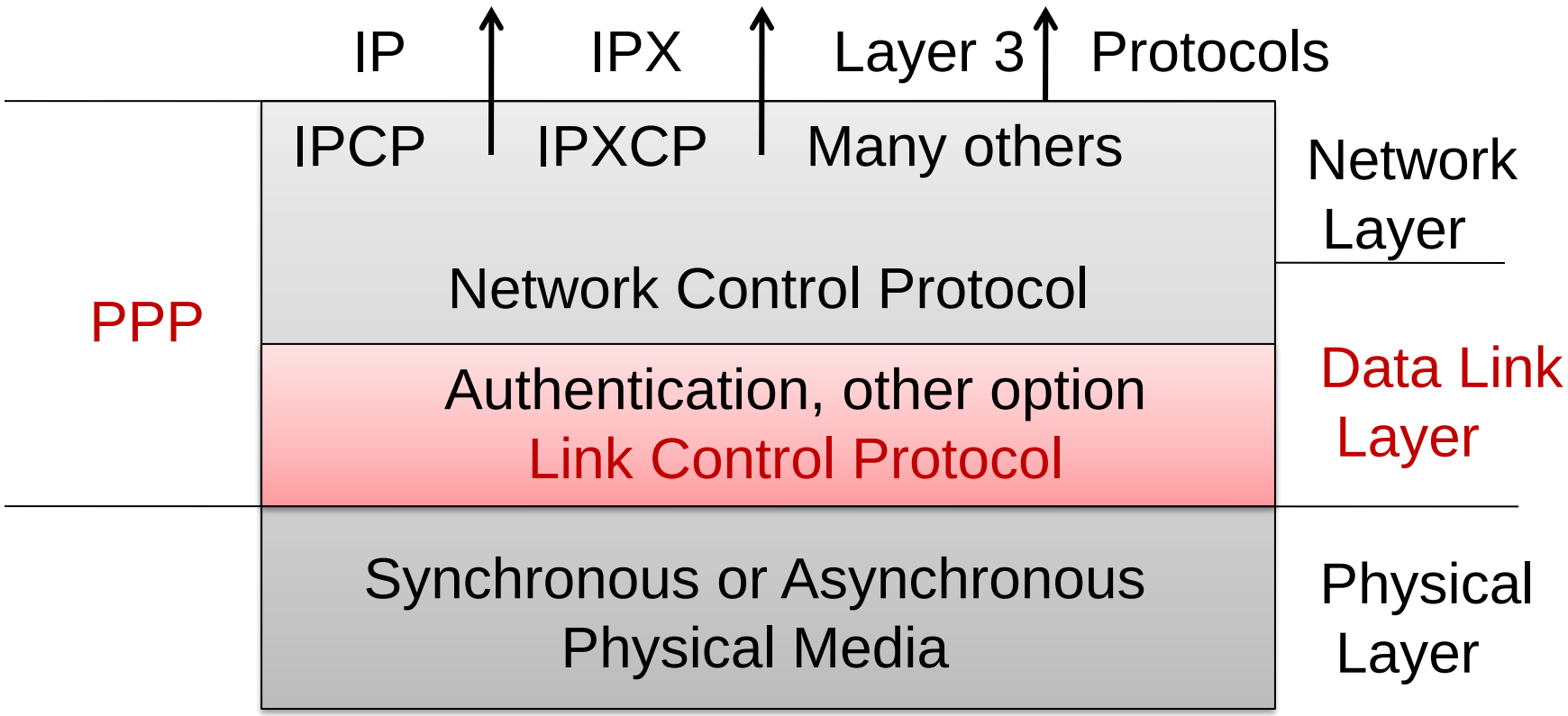
- **Point-to-Point Protocol (PPP) is a Data Link layer protocol that can be used over either asynchronous serial (dial-up) or synchronous serial (ISDN) media.**
- **It uses the LCP (Link Control Protocol) to build and maintain data-link connections.**
- **Network Control Protocol (NCP) is used to allow multiple Network layer protocols (routed protocols) to be used on a point-to-point connection.**
- **The basic purpose of PPP is to transport layer 3 packets across a Data Link layer point-to-point link.**

Overview of PPP



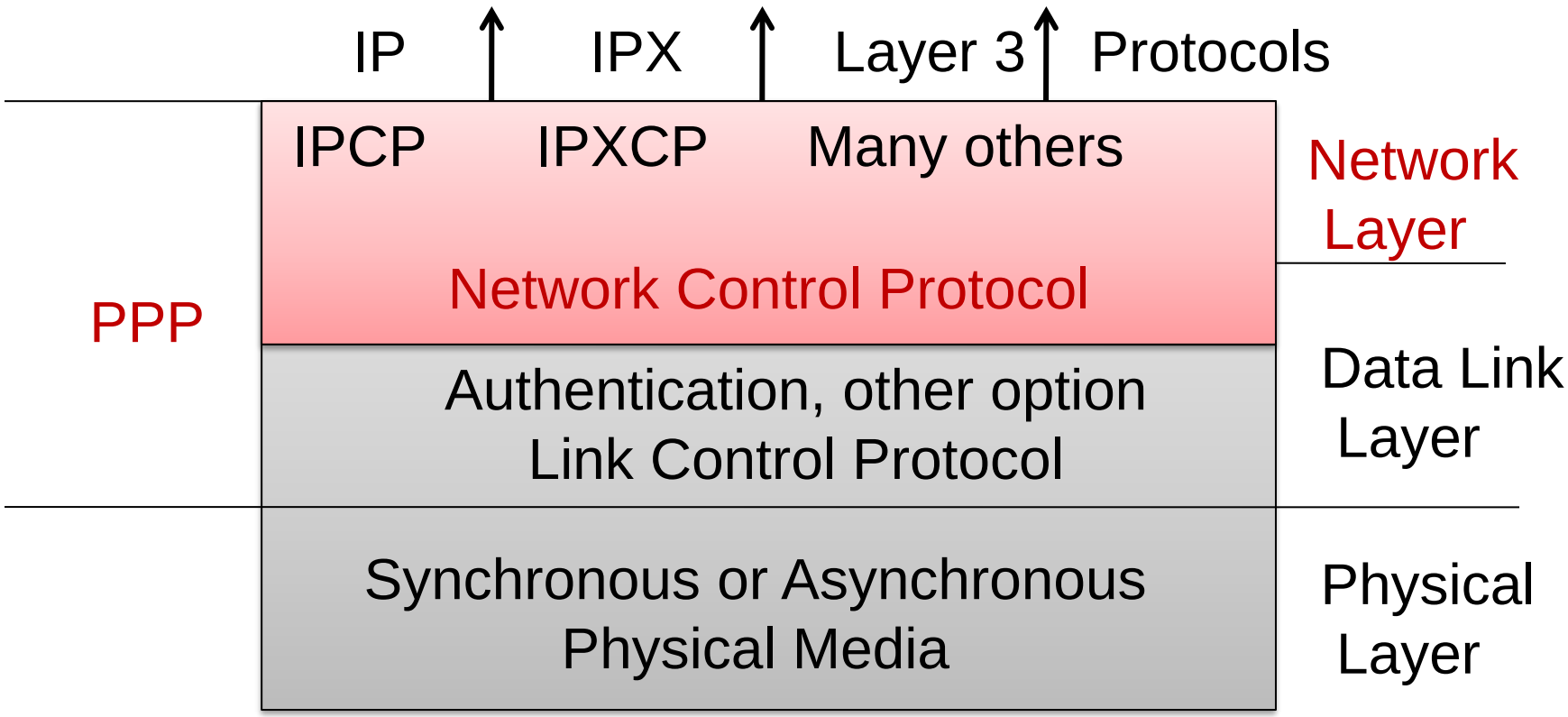
PPP can carry packets from several protocol suites using NCP.
PPP controls the setup of several link options using LCP.

PPP and Data Link Layer



PPP offers a rich set of services that control setting up a data link. These services are options in LCP and are primarily negotiation and checking frames to implement the point-to-point controls an administrator specifies for the cell.

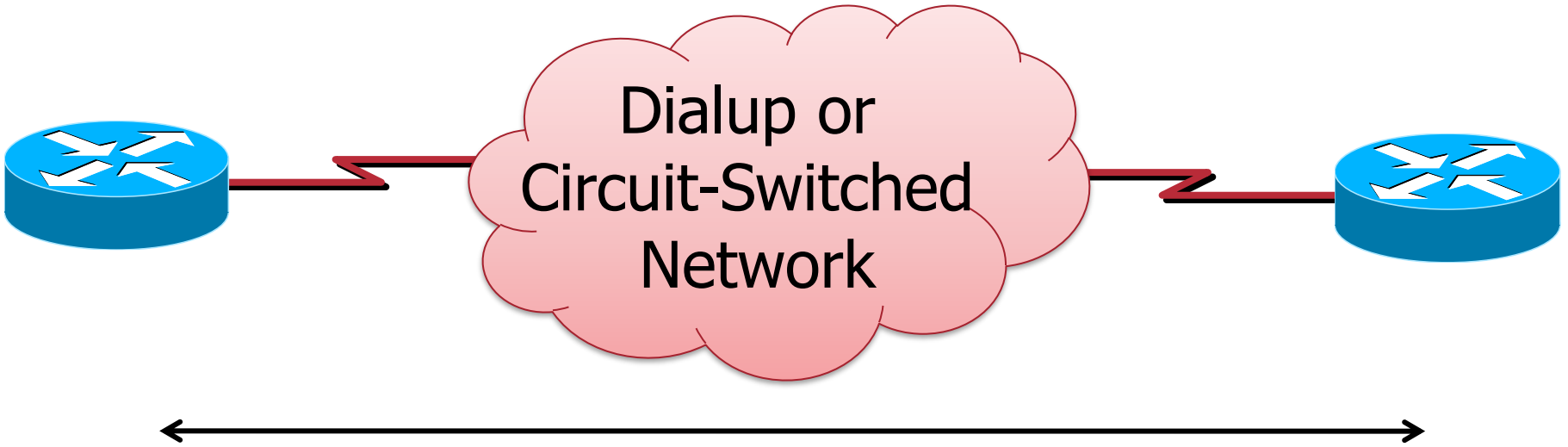
PPP and the Network Layer



With its higher-level function, PPP carries packets from several network-layer protocol in NCPs.

These are functional fields containing standardized codes to indicate the network-layer protocol type that PPP encapsulates.

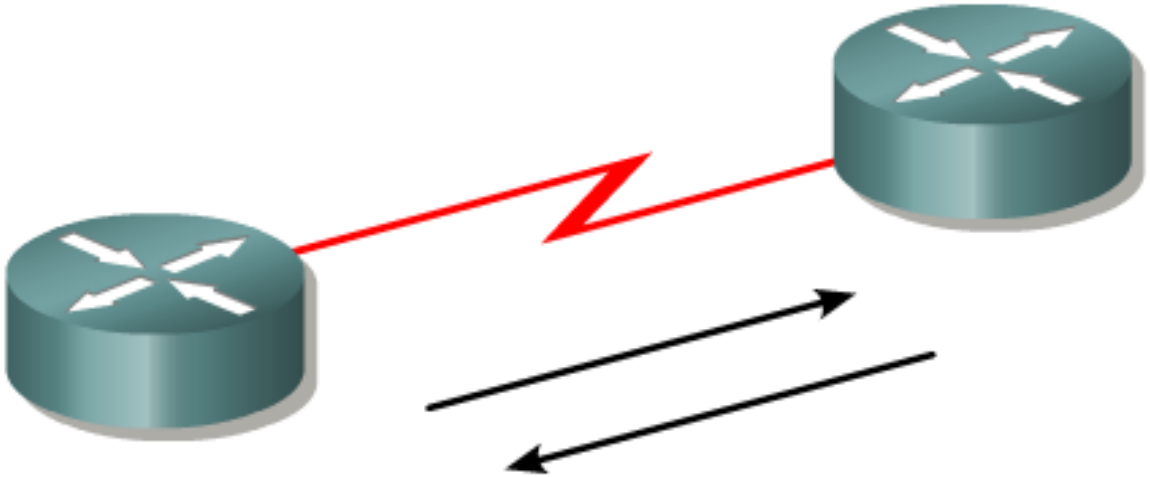
Establishing a PPP Session



PPP Session Establishment

1. Link Establishment Phase
2. Authentication Phase (Optional)
3. Network Layer Protocol Phase

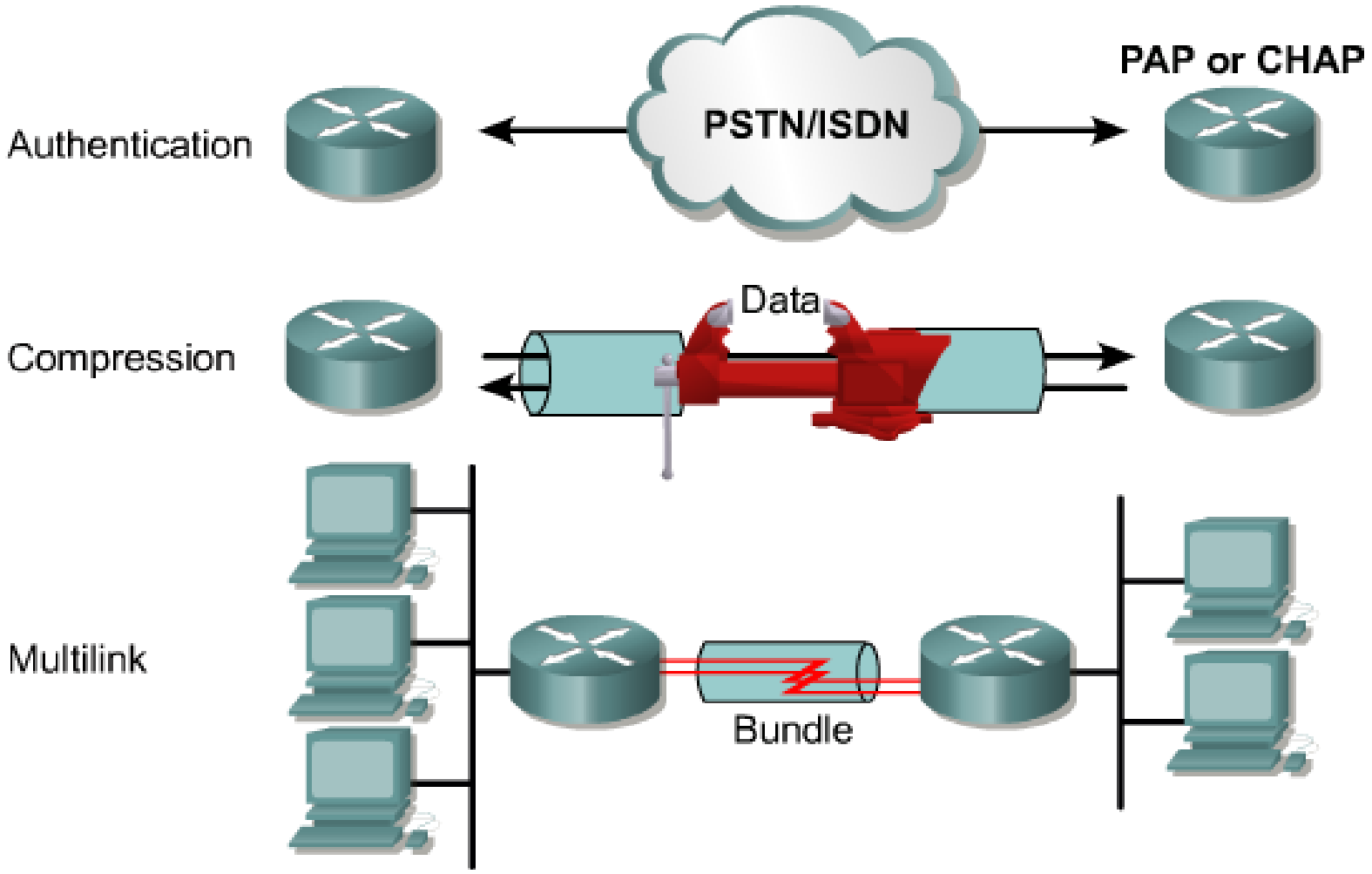
PPP Operation



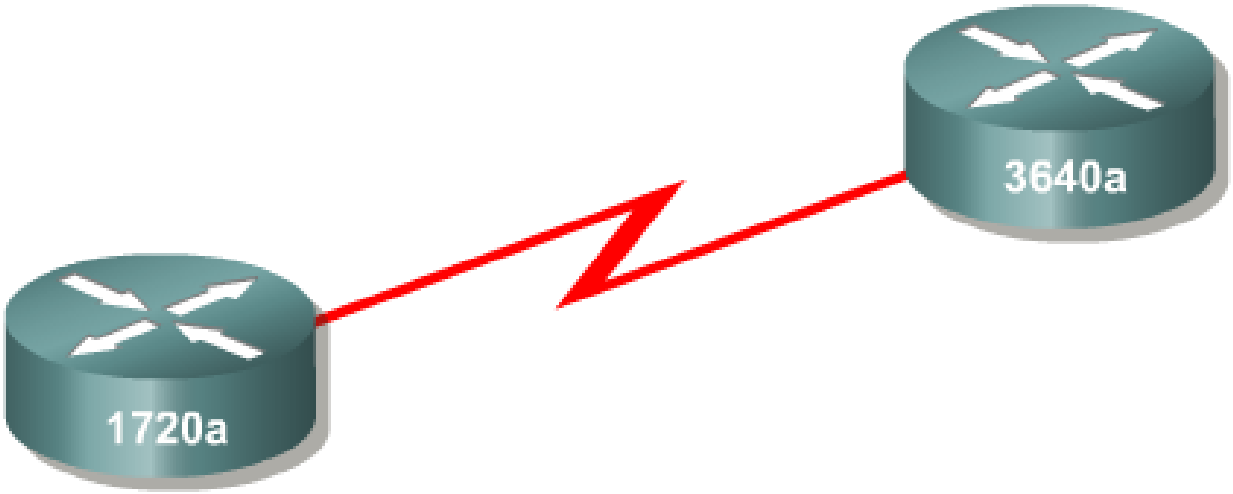
LCP

- LCP listen
- Option negotiation
- Link Quality is determined (optional)
- Network layer configuration begins (IPCP, IPXCP, ATCP)
- Link establishment (LCP Open)
- LCP termination

LCP Options



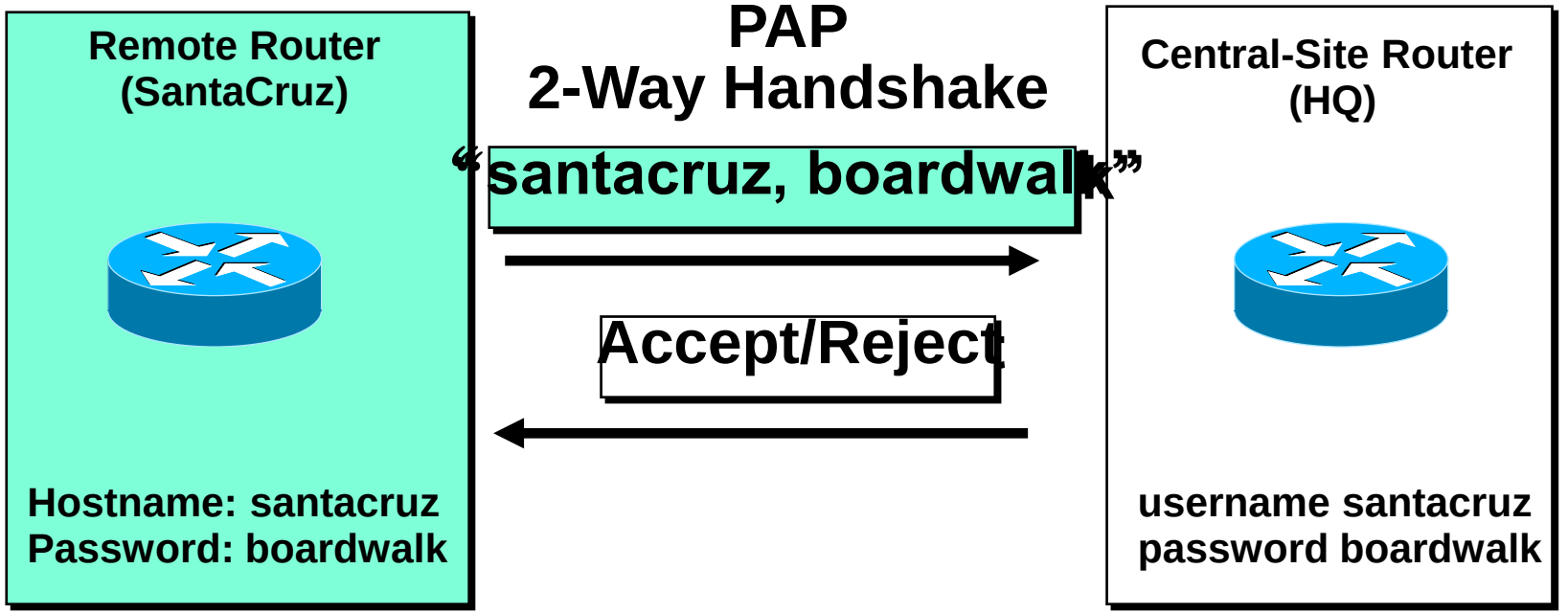
NCP



NCP Characteristics:

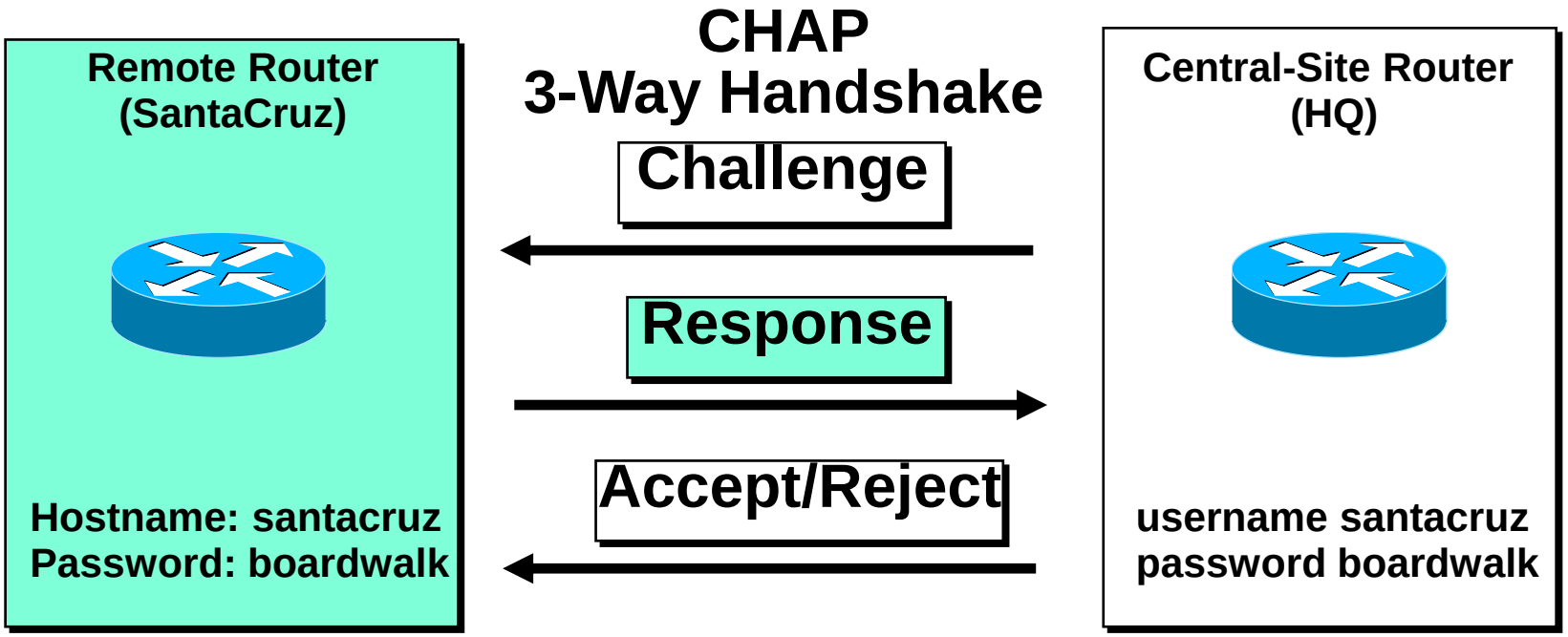
- Responsible for configuring enabling and disabling the L3 protocol.
- Uses L2 protocol field 0x8021 to identify the payload as IPCP
- Address Assignment (DHCP)
- NetBios Name Servers
- Domain Name System

PPP Authentication Protocols



Passwords sent in clear text
Peer in control of attempts

Challenge Handshake Authentication Protocol



Hash values, not actual passwords, are sent across link.
The local router or external server is in control of attempts.

Configuring PPP and Authentication Overview

Authenticating Router
(The Router That Received the Call)

Router to Be Authenticated
(The Router That Initiated the Call)

Enabling PPP

- ☑ ppp encapsulation

Enabling PPP Authentication

- ☑ hostname
- ☑ username / password
- ☑ ppp authentication

Enabling PPP

- ☑ ppp encapsulation

Enabling PPP Authentication

- ☑ hostname
- ☑ username / password
- ☑ ppp authentication

Configuring PPP


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

Enables PPP Encapsulation

Configuring PPP Authentication (1/2)

Router(config)#hostname *name*

Assigns a host name to your router

Router(config)#username *name password password*

Identifies the username and password of remote router

Configuring PPP Authentication (2/2)


```
Router(config-if)#ppp authentication
{chap | chap pap | pap chap | pap}
```

Enables PAP and/or CHAP authentication

PAP Configuration Example


```
hostname left
username right password sameone
!
int serial 0
ip address 10.0.1.1 255.255.255.0
encapsulation ppp
ppp authentication PAP
ppp pap sent-username left
password someone
```

```
hostname right
username left password sameone
!
int serial 0
ip address 10.0.1.2 255.255.255.0
encapsulation ppp
ppp authentication PAP
ppp pap sent-username right
password someone
```

CHAP Configuration Example


```
hostname left
username right password sameone
!
int serial 0
ip address 10.0.1.1 255.255.255.0
encapsulation ppp
ppp authentication CHAP
```

```
hostname right
username left password sameone
!
int serial 0
ip address 10.0.1.2 255.255.255.0
encapsulation ppp
ppp authentication CHAP
```

Verifying the HDLC and PPP Encapsulation Configuration


```
Router#show interface s0
Serial0 is up, line protocol is up
Hardware is HD64570
Internet address is 10.140.1.2/24
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open
Open: IPCP, CDPCP
Last input 00:00:05, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
38021 packets input, 5656110 bytes, 0 no buffer
Received 23488 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
38097 packets output, 2135697 bytes, 0 underruns
0 output errors, 0 collisions, 6045 interface resets
0 output buffer failures, 0 output buffers swapped out
482 carrier transitions
DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```