

Features

- Synchronous or Asynchronous
- Protocol Type field, like Cisco's HDLC—Frame looks the same
- Authentication—PAP or CHAP (below), mostly for dial-up

LCP (Link Control Protocol)—Handles L2 and below. Handles

- Authentication
- Error Detection
- Multi-link load balancing
- Looped link detection

NCP (Network Control Protocol)—Separate Control protocol for each L3 protocol carried, e.g. IP.

Configuring PPP encapsulation on a line is simple and because it's not a default, *does* show up in your running-config.

```
R1(config)# interface s0/2/0
R1(config-if)# encapsulation ppp
```

A U T H E N T I C A T I O N

PAP (Password Authentication Protocol)—In this example, R1 authenticates itself to R2 by sending an unsolicited password in the clear (no encryption).

	R1	R2
1	interface Serial0/2/0	username R_One password myPass
2	encapsulation ppp	<i>This is like an account for the other router</i>
3	ppp pap sent-username R_One password myPass	interface Serial0/2/0
4	<i>Send authentication, required or not</i>	encapsulation ppp
5		ppp authentication pap
6		<i>Require authentication</i>

If you chose to have both routers authenticate to each other, it would look more like this:

	R1	R2
1	username R_Two password 0 p2	username R_One password p1
2	interface Serial0/2/0	interface Serial0/2/0
3	encapsulation ppp	encapsulation ppp
4	ppp authentication pap	ppp authentication pap
5	ppp pap sent-username R_One password p1	ppp pap sent-username R_Two password p2

CHAP (Challenge Handshake Authentication Protocol)—More secure. One side issues a challenge containing a random #. The other side generates an MD5 hash combining that random # and the shared secret password and returns the result. The password is never on the net and the challenge response differs with each different challenge, preventing a replay attack.

	R1—THE SIDE ISSUING THE CHALLENGE	R2
1	hostname R1	hostname R2
2	username R2 password myShared	<i>Hostname (R2) is case-sensitive to match the</i>
3	<i>This is like an account for the other router</i>	<i>username entry on R1</i>
4	interface s0/0	username R1 password myShared
5	encapsulation ppp	<i>Password same both sides and case-sensitive</i>
6	ppp authentication chap	interface s0/0
7	<i>This side issues the challenge</i>	encapsulation ppp

Since the password is a shared secret, the username/password construct [line 2] is used both to tell a router how to respond to a challenge from the named router and what response to expect if it is doing the challenging. The side with authentication configured on the interface issues the challenge—could be both. Authentication failure leaves the link in an up/down state. Notice also that CHAP has no "sent-username," so the username has to be the router's hostname [at least for the now—see PPPoE in Chapter 15 for added complexity].

As long as you stick to the restrictions imposed by CHAP (username = hostname and same password on both routers), You can configure both PAP and CHAP in order of preference (only one will be used).

```
R2(config)# interface s0/2/0
R2(config-if)# ppp authentication chap pap
                If CHAP fails, router will try PAP
```

V E R I F I C A T I O N

The "show interfaces" command separately reports each half of PPP. Line 7 tells you that you're using PPP encapsulation and that the "Link Control Protocol" half is working (open). Line 8 tells you that the "Network Control Protocol" half has two network protocol handlers running, IPCP for IPv4 traffic and CDPCP for the Cisco Discovery Protocol.

```
1 R1# show interfaces s0/2/0
2 Serial0/2/0 is up, line protocol is up
3   Hardware is GT96K Serial
4   Internet address is 10.12.1.1/30
5   MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,
6     reliability 255/255, txload 1/255, rxload 1/255
7   Encapsulation PPP, LCP Open
8   Open: IPCP, CDPCP, loopback not set
9     Rest omitted
```

Authentication happens in LCP, so if it fails, LCP won't be shown as "open" [line 7] and the line protocol will be down [line 2].

Actually, the previous example just tells you that PPP is working, with or without authentication. To see if authentication has been configured, you'll need to use the command "show ppp all." The "+" following "CHAP" corresponds to "open" and "-" means "failed." If you see a ">" on the right edge of the column, that just means that there wasn't enough room in the column.

```

1 R1# show ppp all
2 Interface/ID OPEN+ Nego* Fail-      Stage      Peer Address      Peer Name
3 -----
4 Se0/2/0      LCP+ CHAP+ IPCP+ CDP> LocalT      10.12.1.2         R2

```

If you're only authenticating in one direction, you'll only see PAP+ or CHAP+ on the router that's requiring the other router to authenticate. In other words, the authentication status will show on the router whose configuration contains the *ppp authentication { pap | chap }* interface configuration command (R2 in the PAP example, R1 in the CHAP example).