15d. PPPoE Troubleshooting

PPPoE troubleshooting has been a part of the CCNA longer than certification guide authors have made any serious attempt to cover the topic. Students have been left to "check the config and see if it's right." In life, that may still be the fastest approach, but you should never count on a Cisco exam to respond when you type "show running config."

OSI LAYERS

Mr. Odom breaks the PPPoE configuration and diagnostic "show" commands into the OSI layers they represent, allowing you to focus on 2-3 lines of configuration instead of 7-8. This also opens the possibility of multiple-choice exam questions where the wrong answers are from an irrelevant OSI layer. Since OSI layers 2 and 3 each build on lower layers, Mr. Odom recommends troubleshooting from physical (layer 1) upward.

The associated lab [on ccnacookbook.com] walks through all of this in detail. What follows is the condensed version, showing the configuration's effects on each of the relevant diagnostic "show" commands.

OSI	Dialer Interface
1 2 3	`interface Dialer 1`
1 2 3	`mtu 1492`
N 1 2 3	`ip address negotiated`
O 1 2 3	`encapsulation ppp`
N 1 2 3	`ppp chap hostname myISPaccount`
E 1 2 3	`ppp chap password myPassword`
1 2 3	`dialer pool 42`
	Ethernet Interface
1 2 3	`interface GigabitEthernet0/0`
3 3 3	*`mac-address 0200.0000.0002`*
1 2 3	`pppoe-client dial-pool-number 42`
1 2 3	*`pppoe enable`*
1 2 3	*`no ip address`*
1 2 3	*`no shutdown`*

The configuration above designates the OSI layer of each configuration line with colored highlighting along its left margin. Italicized lines are either optional or automatically created by the router in at least some situations. The "show" commands that follow illustrate a working config. The same OSI colors from the above configuration will denote which layer is diagnosed by various parts of those "show" command outputs. When all the outputs related to a given OSI layer are correct, you know to seek problems in the configuration lines related to a higher OSI layer.

Color Code for OSI Layers:

Color	OSI Layer
Grey	None or optional config
Blue	1
Orange	2
Green	3

PPPOE LIFE CYCLE

It helps to understand what processes are are being started as a PPPoE tunnel is created. First, you've already seen that processes run on interfaces—when you put an IP address on an interface, you're also starting an IP process on that interface to handle packets. PPPoE will actually run on a dynamically created "virtual access" interface and negotiate the creation of a PPP connection through the PPPoE tunnel. Since the virtual access interface doesn't exist while we're typing the configuration, it's config must be cloned from a template; we put PPPoE configs in the dialer.

Show PPPoE Session

```
CLIENT# show pppoe session
     1 client session

Uniq ID  PPPoE  RemMAC           Port                 VT  VA          State
           SID  LocMAC                                   VA-st       Type
    N/A      3  001b.d476.6058   Gi0/0                Di1 Vi1         UP
                0200.0000.0002                            UP
```

This command begins showing output as soon as an Ethernet interface configuration mentions PPPoE. Prior to that, it responds with silence and a new prompt. We'll call this layer 1 because the Ethernet port is treated like nothing more than an I/O device for the layer 2 PPPoE.

To *really* slice things finely, if PPPoE is enabled on an Ethernet interface ("pppoe enable") you'll see column headings and no detail lines. Once you declare the interface to be a PPPoE client ("pppoe-client dial-pool-number #"), you'll see detail lines. Honestly though, that'll never happen because you'll allow the router to automatically enable PPPoE on the Ethernet interface as a result of you declaring it to be a PPPoE client.

Uniq ID—Ignore this. We're only doing the client end, so you're not likely to see a value here.

PPPoE Session ID—Each time PPPoE tries to start a PPP session, the PPPoE session ID will increment. Once everything is running, this number will stay stable. Since the router would have been trying to connect while you were still typing the configuration, a fairly low number other than one is normal.

MAC Addresses—The local and remote MAC addresses will both be "0000.0000.0000" until a PPPoE session starts. Once the PPPoE tunnel is up, you'll see the address of each end, whether or not PPP can start up and operate within the tunnel.

Dialer Interface and Ethernet "Port"—Seeing both the Ethernet port and the Dialer ("Di1" under the header "VT") mentioned tells you that the dial pool you configured in each has successfully linked them for this PPPoE session.

Virtual-Access interface—The "VA" column will be listed as "N/A" with no state until L2 is correct (PPPoE and PPP). You'll be able to see the virtual-access interface that will eventually used by the session when you type "show ip interface brief." It's just not part of the PPPoE session, yet.

Session State [far right]—Once L2 PPPoE is fully configured and working, the state will be up. If PPPoE isn't fully configured, the state may cycle between SHUTDOWN and PADORCVD if the Ethernet interface is up, or display PADISNT if the interface is administratively shut down. For the PADISNT state, I just remember "the Port Allocated by the Doofus (me) ISN'T up" and issue a "no shutdown."

Session State	Circumstances / Causes
(no command output)	No dialer interface configured or one with no dialer pool entry
PADISNT	Dialer and Ethernet interface in a dialer pool, Ethernet admin shutdown.
SHUTDOWN / PADORCVD	Dialer and Ethernet interface in a dialer pool, Ethernet not shutdown

Note: Mr. Odom doesn't mention PADORCVD, he just says that the session state will be SHUTDOWN if the Ethernet is up and in a dialer pool used by a dialer without PPPoE configured.

Show Interfaces Dialer 1

```
CLIENT# show interfaces dialer 1
Dialer1 is up, line protocol is up (spoofing)
  Hardware is Unknown
  Internet address is 172.16.1.4/32
  MTU 1492 bytes, BW 56 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP Closed, loopback not set
  Keepalive set (10 sec)
  DTR is pulsed for 1 seconds on reset
  Interface is bound to Vi1
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 02:29:44
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/16 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 42 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     2 packets input, 28 bytes
     1776 packets output, 24856 bytes
Bound to:
Virtual-Access1 is up, line protocol is up
  Hardware is Virtual Access interface
  MTU 1492 bytes, BW 56 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP Open
  Stopped: CDPCP
  Open: IPCP
  PPPoE vaccess, cloned from Dialer1
  Vaccess status 0x44, loopback not set
  Keepalive set (10 sec)
  Interface is bound to Di1 (Encapsulation PPP)
  Last input 00:00:08, output never, output hang never
  Last clearing of "show interface" counters 00:14:32
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     176 packets input, 2469 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     175 packets output, 2466 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Line & Protocol Status [Line 2]—Prior to L2 being correct, the dialer interface status will be listed as "up (spoofing)," just like the line protocol status. Once PPPoE is functioning at L2, the interface status will become simply "up," while the protocol status will stay "up (spoofing)." Neither will ever be down unless you explicitly shut the dialer interface down; it's up from the moment it's created, just like a loopback interface.

Encapsulation [Line 7]—The dialer interface encapsulation will default to HDLC, just like a serial line until you configure L2, Specifically, the command "encapsulation ppp" on the dialer interface.

Once L2 PPPoE is running, the virtual access interface will be created using the dialer interface's configuration as a template and bound to the dialer. At that point, lines 23-50 will appear. That's where you'll look for PPPoE diagnostics. For example, notice that the Link Control Protocol (LCP) for PPP is down on the dialer [line 7] but up on the virtual access interface [line 28]. Don't be fooled by the first entry—PPPoE runs on the virtual access interface, not the dialer.

Likewise, the traffic numbers are interesting. Dialer traffic [lines 21-22] indicates that L3 IP is working. When only L2 PPP is present, its traffic is shown on the virtual access interface [lines 42, 46].

Show IP Interface Brief [Dialer 1]

```
1  CLIENT# show ip interface brief
2  Interface                  IP-Address      OK? Method Status
3  Protocol
4  GigabitEthernet0/0         unassigned      YES unset  up                    up
5  GigabitEthernet0/1         unassigned      YES unset  administratively down down
6  Dialer1                    172.16.1.4      YES IPCP   up                    up
7  Virtual-Access1            unassigned      YES unset  up                    up
```

If you see an address on the dialer interface attributed to IPCP, everything's working and you're done.

If you see the virtual access interface, you know that the PPPoE tunnel was created, whether or not a PPP connection was successfully negotiated within it.

BONUS—PPPoE VS. PPP PROBLEMS

Mr. Odom is content to narrow down problems to the nearest OSI level, which combines PPPoE and PPP problems. If your PPP authentication is incorrect, the PPPoE session will start, create the virtual access interface to run on, begin the PPP negotiations through the PPPoE tunnel, fail, wait 22 seconds (on my router, anyway), and try again. The (repeated) syslog messages look like:

```
Jan  3 04:09:27.355: %DIALER-6-BIND: Interface Vi1 bound to profile Di1
Jan  3 04:09:27.359: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state to up
Jan  3 04:09:27.379: %DIALER-6-UNBIND: Interface Vi1 unbound from profile Di1
Jan  3 04:09:27.383: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state to down
```

```
1  CLIENT# show pppoe session
2       1 client session
3
4  Uniq ID  PPPoE  RemMAC          Port                    VT  VA         State
5             SID  LocMAC                                      VA-st      Type
6      N/A     66  001b.d476.6058  Gi0/0                  Di1  N/A        SHUTDOWN
7                  0200.0000.0002
```

The virtual access interface won't be displayed in your "show pppoe session" output, but will be shown in the "show ip interface brief" command, with a status of down/down. The PPPoE session ID [Line 6, highlighted] will steadily increase as the router continually retries. If you're using SSH to configure the router and can't see the syslog messages, that may be your first clue.

R E C A P

Condition	Dialer 1	Virtual-Access 1	IP Address	Dialer Encap.	Virt. Access Encap.	Session State
Working	up / up (spoofing)	up/up	172.16.1.1	PPP, LCP Closed	PPP, LCP Open, IPCP Open	up
Check L3	up / up (spoofing)	up/up	—	PPP, LCP Closed	PPP, LCP Open	up
Check L2	up (spoofing) / up (spoofing)	— or down/down	—	HDLC or PPP, LCP Closed	— or PPP, LCP Closed	PADORCVD or Shutdown
Check L1	up (spoofing) / up (spoofing)	—	—	HDLC	—	—
Check Ethernet Shutdown						PADISNT

Most of the above can be found using "show interfaces Dialer <#>." The session state (far right column) comes from "show pppoe session."

Since osi layers 1-3 are interdependent, Mr. Odom recommends troubleshooting from physical upward.