

Lab 15d. PPPoE Troubleshooting

TOPOLOGY & GOAL

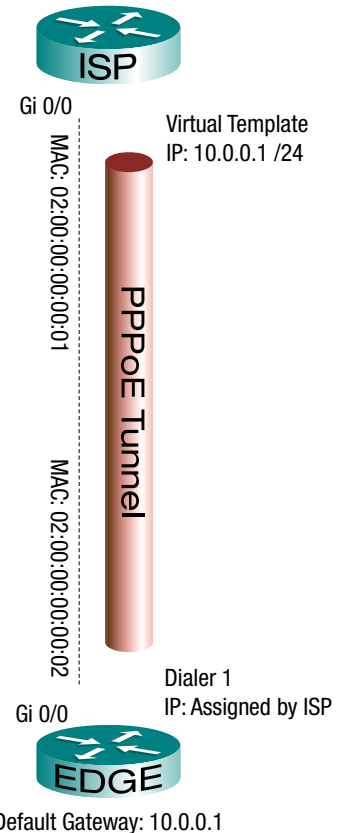
Client Pool: 10.0.0.2 – 10.0.0.254

Create a PPPoE connection from an edge router to an ISP, observing how the output of various "show..." commands changes as you configure each of the OS layers. You'll need two routers of almost any vintage (I'm using a 2821 and a 2851) with an Ethernet crossover cable between their 0/0 ports.

CONFIGURATION AND VERIFICATION

First, configure the ISP router without concern for what it all means.

ISP CONFIGURATION (YOU DON'T NEED TO LEARN THIS)
<code>ip local pool clientPool 10.0.0.2 10.0.0.254</code>
<code>interface Virtual-Template 1</code> <code>ip address 10.0.0.1 255.255.255.0</code> <code>peer default ip address pool clientPool</code> <code>ppp authentication chap callin</code>
<code>bba-group pppoe myBbaGroup</code> <code>virtual-template 1</code>
<code>interface GigabitEthernet0/0</code> <code>mac-address 0200.0000.0001</code> <code>no ip address</code> <code>pppoe enable group myBbaGroup</code> <code>no shutdown</code>
<code>username cisco password class</code>



From now on we'll be working exclusively on the customer's edge router. After giving your router a basic configuration for usability (hostname, no DNS lookup of typos, synchronous logging, and preventing console timeouts), you'll configure it as a PPPoE client. Configure each of the OSI layers 1, 2, and 3 in that order and watch for changes at each stage, using the following three commands:

- "Show Interfaces" on the dialer interface and the virtual-access interface
- "Show IP Interface Brief" on the dialer interface
- "Show pppoe session"

Preparation

To see what things look like without any real configuration,

- Assign a MAC address of 02:00:00:00:00:02 to the Ethernet interface and give it a "no shutdown." This will simply help you read the "show pppoe session" command output.
- Create a dialer interface number 1 with no configuration
- Run the three "show" commands to see what a "no config" starting point looks like

```
show pppoe session
show interfaces dialer 1
show ip interface brief dialer 1
```

What are the line and protocol statuses of the dialer? _____

What does the show pppoe session command show? _____

OSI Layer One

Now associate the dialer interface and the Ethernet interface it will use.

- Configure the Ethernet interface as a PPPoE client and make it a part of dial-pool 1
- Tell the Dialer Interface to use dial-pool 1

Rerun your diagnostics and see what has changed.

OSI Layer Two

Now configure PPP. Working on the dialer interface,

- Set the encapsulation to PPP
- Configure your router to authenticate itself to the ISP using CHAP. The account will be "cisco" and the password will be "class"

Rerun your diagnostics and see what has changed.

OSI Layer Three

Now configure IP. Working on the dialer interface,

- Force the MTU to be smaller to accommodate the extra 8 bytes of PPP and PPPoE headers
- Tell it to obtain an IP address as part of its PPP negotiations with the ISP

If there's any danger of an old IP address remaining on your Ethernet interface, get rid of it.

Rerun your diagnostics and see what has changed.

W A L K T H R O U G H

Starting from a fresh, unconfigured state, give your edge router a basic configuration.

Preparation

Now, we can create an unconfigured dialer interface (OSI L3), set the MAC address on our Ethernet interface (L2), ...

```
Router> en
Router# conf t
Router(config)# hostname EDGE
EDGE(config)# no ip domain-lookup
EDGE(config)# line console 0
EDGE(config-line)# exec-timeout 0 0
EDGE(config-line)# logging synchronous
```

INTERFACE DIALER 1	INTERFACE GIGABITETHERNET 0/0
1 EDGE(config)# interface Dialer 1	EDGE(config)# interface Gi 0/0
2 <i>No config. We're just creating it.</i>	EDGE(config-if)# mac-address 0200.0000.0002
3 EDGE(config-if)# exit	<i>The '2' in the second digit makes the number "unofficial"</i>
	EDGE(config-if)# no shutdown

...and run our suite of diagnostic "show commands" to see an unconfigured environment. It will be especially interesting to see what our show commands say about a dialer that exists but isn't configured, thanks to our highly artificial choice of stopping at this point.

```

1 EDGE# show pppoe session
2 EDGE#

```

From the session command's lack of output, we immediately see that there is no session. In fact, PPPoE isn't enabled on any Ethernet interface. If it was, we'd at least have headings with no output. Don't worry about that detail. You're unlikely to manually type "pppoe enable" on an Ethernet interface; the router will do it automatically when you assign the interface to a dial pool as a pppoe-client. At that point, the session command will display headers *and* output.

```

1 EDGE# show interfaces dialer 1
2 Dialer1 is up (spoofing), line protocol is up (spoofing)
3 Hardware is Unknown
4 MTU 1500 bytes, BW 56 Kbit/sec, DLY 20000 usec,
5 reliability 255/255, txload 1/255, rxload 1/255
6 Encapsulation HDLC, loopback not set
7 Keepalive set (10 sec)
8 DTR is pulsed for 1 seconds on reset
9 Last input never, output never, output hang never
10 Last clearing of "show interface" counters never
11 Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
12 Queueing strategy: weighted fair
13 Output queue: 0/1000/64/0 (size/max total/threshold/drops)
14 Conversations 0/0/16 (active/max active/max total)
15 Reserved Conversations 0/0 (allocated/max allocated)
16 Available Bandwidth 42 kilobits/sec
17 5 minute input rate 0 bits/sec, 0 packets/sec
18 5 minute output rate 0 bits/sec, 0 packets/sec
19 0 packets input, 0 bytes
20 0 packets output, 0 bytes

```

From the "show interfaces" command we can see our L1 and L2 details. The dialer interface is up from the moment it's created, not requiring a "no shutdown" like a physical interface would. We've seen that before, with loopback interfaces.

Notice that with no config on the dialer, we see some defaults that would be incorrect for PPPoE:

- The MTU is 1500, standard for Ethernet but should be reduced to 1492 for PPPoE—we'll fix this when we configure L3 IP, at the end
- Encapsulation is HDLC, not PPP—we'll fix that when we configure L2

```

1 EDGE# show ip interface brief dialer 1
2 Interface IP-Address OK? Method Status Protocol
3 Dialer1 unassigned YES unset up up

```

Of course, the "show ip interface..." commands confirm that the dialer interface is up/up (omitting the "spoofing" detail), but tell us that we're nowhere near ready for L3 IP traffic.

OSI Layer One

Here's how we associate the dialer interface and the physical Ethernet interface it will use.

INTERFACE DIALER 1	INTERFACE GIGABITETHERNET 0/0
1 EDGE(config)# interface dialer 1	EDGE(config)# interface Gi 0/0
2 EDGE(config-if)# dialer pool 1	EDGE(config-if)# pppoe-client dial-pool-number 1
3	EDGE(config-if)# pppoe enable <i>Automatically added by the router, and technically, part of OSI Layer 2, not 1</i>

So now we've told our physical Ethernet interface to act as a PPPoE client. Also, our dialer interface, which lacks physical form and is more of a theoretical construct, is able use that "real" Ethernet interface thanks to the dialer pool connection. At which point, Cisco would probably prefer that I not compare their methodology to demon possession, so we'll run another round of diagnostics instead.

```

1 EDGE# show pppoe session
2   1 client session
3
4 Uniq ID  PPPoE  RemMAC          Port          VT  VA      State
5          SID  LocMAC
6          0  0000.0000.0000  Gi0/0        Di1  N/A     PADORCVD
7          0000.0000.0000

```

So now, our pppoe session at least exists [line 2], but isn't up [line 6, far right]. The session state may alternate between SHUTDOWN and PADORCVD if the Ethernet interface is up, or show PADISNT if the interface is administratively shut down. We also see that

- The dialer interface is associated with the session [line 6].
- There's no Virtual-Access interface [line 6]. It's listed as "N/A" under the heading "VA." This will also shorten our "show interfaces dialer" output, below, because it doesn't include details about a "bound" (related) virtual access interface
- The MAC addresses of the Ethernet interfaces at both ends of the tunnel [Lines 6-7] are still zeroes

```

8 EDGE# show ip interface brief dialer 1
9 Interface          IP-Address      OK? Method Status      Protocol
10 Dialer1            unassigned     YES unset   up          up
11
12 EDGE# show interfaces dialer 1
13 Dialer1 is up (spoofing), line protocol is up (spoofing)
14 Hardware is Unknown
15 MTU 1500 bytes, BW 56 Kbit/sec, DLY 20000 usec,
16 reliability 255/255, txload 1/255, rxload 1/255
17 Encapsulation HDLC, loopback not set
18 Keepalive set (10 sec)
19 DTR is pulsed for 1 seconds on reset
20 Last input never, output never, output hang never
21 Last clearing of "show interface" counters never
22 Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
23 Queueing strategy: weighted fair
24 Output queue: 0/1000/64/0 (size/max total/threshold/drops)
25 Conversations 0/0/16 (active/max active/max total)
26 Reserved Conversations 0/0 (allocated/max allocated)
27 Available Bandwidth 42 kilobits/sec
28 5 minute input rate 0 bits/sec, 0 packets/sec
29 5 minute output rate 0 bits/sec, 0 packets/sec
30 0 packets input, 0 bytes
31 0 packets output, 0 bytes

```

For the Dialer interface,

- There's still no IP address [Line 10] because that would be set by PPP, which isn't up yet
- The dialer interface is up [lines 10], even though the PPPoE session isn't. In fact, the "show interfaces" command shows both the interface and the protocol as "up (spoofing)" [line 12]. Once PPPoE is working at L2, only the line protocol will show "(spoofing);" the interface will be simply "up."

There actually *is* a dialer configuration available that can cause the dialer's status to follow that of the PPPoE session, but that's out of scope for the CCNA. For the exam, you should assume that the dialer is up from the moment it is created.

OSI Layer Two (PPP)

On the dialer interface, we'll set the L2 encapsulation to PPP and provide the configuration details for that L2 encapsulation. In this case, those details are the authentication settings. Conceptually, this is just like the other time we manually specified a layer 2 encapsulation, 802.1Q on Ethernet subinterfaces.

INTERFACE DIALER 1	INTERFACE GIGABITETHERNET 0/0
<pre> 1 EDGE(config)# interface dialer 1 2 EDGE(config-if)# encapsulation ppp 3 EDGE(config-if)# ppp chap hostname cisco 4 EDGE(config-if)# ppp chap password class </pre>	<p><i>Our only OSI layer 2 command for the Ethernet interface, "pppoe enable," was automatically added by the router when we put this interface in a dial pool as a PPPoE client in the previous step (layer 1).</i></p>

Since PPP is an L2 protocol, we're now completely done configuring it and it, PPP, should be completely working.

<pre> 1 EDGE# show pppoe session 2 1 client session 3 4 Uniq ID PPPoE RemMAC Port VT VA State 5 SID LocMAC 6 N/A 612 0200.0000.0001 Gi0/0 Di1 Vi1 UP 7 0200.0000.0002 </pre>

Now, our session shows

- An associated virtual-access interface [line 6, "Vi1"]. It's also up [Line 7]; before it existed, that spot was blank. The next command will give lots more detail on the virtual-access interface
- The MAC addresses for both ends of the link are now filled in [lines 6, 7]
- The session state is up [line 6, far right]

If your results don't show the virtual access interface yet, you might need to wait 20 seconds or so, for the router to catch up to your typing.

```

1 EDGE# show interfaces dialer 1
2 Dialer1 is up, line protocol is up (spoofing)
3   Hardware is Unknown
4   MTU 1500 bytes, BW 56 Kbit/sec, DLY 20000 usec,
5     reliability 255/255, txload 1/255, rxload 1/255
6   Encapsulation PPP, LCP Closed, loopback not set
7   Keepalive set (10 sec)
8   DTR is pulsed for 1 seconds on reset
9   Interface is bound to Vil
10  Last input never, output never, output hang never
11  Last clearing of "show interface" counters 00:06:11
12  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
13  Queueing strategy: weighted fair
14  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
15    Conversations 0/0/16 (active/max active/max total)
16    Reserved Conversations 0/0 (allocated/max allocated)
17    Available Bandwidth 42 kilobits/sec
18    5 minute input rate 0 bits/sec, 0 packets/sec
19    5 minute output rate 0 bits/sec, 0 packets/sec
20    0 packets input, 0 bytes
21    0 packets output, 0 bytes
22 Bound to:
23 Virtual-Access1 is up, line protocol is up
24   Hardware is Virtual Access interface
25   MTU 1500 bytes, BW 56 Kbit/sec, DLY 20000 usec,
26     reliability 255/255, txload 1/255, rxload 1/255
27   Encapsulation PPP, LCP Open
28   Stopped: CDPCP
29   PPPoE vaccess, cloned from Dialer1
30   Vaccess status 0x44, loopback not set
31   Keepalive set (10 sec)
32   DTR is pulsed for 5 seconds on reset
33   Interface is bound to Dil (Encapsulation PPP)
34   Last input 00:00:00, output never, output hang never
35   Last clearing of "show interface" counters 00:05:51
36   Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
37   Queueing strategy: fifo
38   Output queue: 0/40 (size/max)
39   5 minute input rate 0 bits/sec, 0 packets/sec
40   5 minute output rate 0 bits/sec, 0 packets/sec
41   77 packets input, 1090 bytes, 0 no buffer
42   Received 0 broadcasts (0 IP multicasts)
43   0 runts, 0 giants, 0 throttles
44   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
45   76 packets output, 1075 bytes, 0 underruns
46   0 output errors, 0 collisions, 0 interface resets
47   0 unknown protocol drops
48   0 output buffer failures, 0 output buffers swapped out
49   0 carrier transitions

```

Our virtual-access interface is bound to our dialer interface [9]. As a result, a "show interfaces" on the dialer also shows information about the virtual access interface. In fact, that output [lines 29-49] is exactly the output we would get from a "show interfaces" on the virtual access interface.

Notice that all of our packet traffic is listed under the virtual-access interface [line 41 and 45 vs. lines 20-21]. Don't let that first pair of lines fool you into thinking you have a layer 1 issue. Also, PPP is listed as the encapsulation on both [lines 6 and 27], but LCP, the part that negotiates opening the link, is only open on the virtual-access interface [line 27].

```

1 EDGE# show ip interface brief dialer 1
2 Interface                IP-Address      OK? Method Status      Protocol
3 Dialer1                  unassigned     YES unset  up          up

```

As expected, we're still seeing nothing at L3. We'll configure that next.

OSI Layer 3 (IP)

On the dialer interface, we'll shrink the MTU (Maximum Transmission Unit) to accommodate an extra 8 bytes of PPP and PPPoE headers. The MTU is the maximum size of an Ethernet frame, not counting the Ethernet headers and trailer. Normally, it's 1500. We'll make it 1492.

We'll also tell the dialer interface to obtain an IP address from the ISP through PPP.

	INTERFACE DIALER 1	INTERFACE GIGABITETHERNET 0/0
1	EDGE(config)# interface dialer 1	EDGE(config)# interface gigabitEthernet 0/0
2	EDGE(config-if)# mtu 1492	EDGE(config-if)# no ip address
3	EDGE(config-if)# ip address negotiated	<i>Not necessary if there was no pre-existing configuration</i>

Notice that our dialer interface will get its ip address through PPP, not DHCP, so our command [line 3] differs from the "ip address dhcp" command we've seen previously.

```

1 EDGE# show pppoe session
2     1 client session
3
4 Uniq ID  PPPoE  RemMAC          Port          VT  VA          State
5          SID  LocMAC          Gi0/0         Di1  V11         UP
6          1   0200.0000.0001
7          0200.0000.0002

```

We've only changed configurations at L3, so our PPPoE diagnostics remain completely unchanged.

```

1 EDGE# show interfaces dialer 1
2 Dialer1 is up, line protocol is up (spoofing)
3   Hardware is Unknown
4   Internet address is 10.0.0.2/32
5   MTU 1492 bytes, BW 56 Kbit/sec, DLY 20000 usec,
6     reliability 255/255, txload 1/255, rxload 1/255
7   Encapsulation PPP, LCP Closed, loopback not set
8   Keepalive set (10 sec)
9   DTR is pulsed for 1 seconds on reset
10  Interface is bound to Vi1
11  Last input never, output never, output hang never
12  Last clearing of "show interface" counters 1d22h
13  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
14  Queueing strategy: weighted fair
15  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
16    Conversations 0/0/16 (active/max active/max total)
17    Reserved Conversations 0/0 (allocated/max allocated)
18    Available Bandwidth 42 kilobits/sec
19    5 minute input rate 0 bits/sec, 0 packets/sec
20    5 minute output rate 0 bits/sec, 0 packets/sec
21    2 packets input, 28 bytes
22    582 packets output, 8148 bytes
23  Bound to:
24  Virtual-Access1 is up, line protocol is up
25    Hardware is Virtual Access interface
26    MTU 1492 bytes, BW 56 Kbit/sec, DLY 20000 usec,
27      reliability 255/255, txload 1/255, rxload 1/255
28    Encapsulation PPP, LCP Open
29    Stopped: CDPCP
30    Open: IPCP
31    PPPoE vaccess, cloned from Dialer1
32    Vaccess status 0x44, loopback not set
33    Keepalive set (10 sec)
34    Interface is bound to Di1 (Encapsulation PPP)
35    Last input 00:00:05, output never, output hang never
36    Last clearing of "show interface" counters 00:50:03
37    Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
38    Queueing strategy: fifo
39    Output queue: 0/40 (size/max)
40    5 minute input rate 0 bits/sec, 0 packets/sec
41    5 minute output rate 0 bits/sec, 0 packets/sec
42    590 packets input, 8265 bytes, 0 no buffer
43    Received 0 broadcasts (0 IP multicasts)
44    0 runts, 0 giants, 0 throttles
45    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
46    589 packets output, 8255 bytes, 0 underruns
47    0 output errors, 0 collisions, 0 interface resets
48    0 unknown protocol drops
49    0 output buffer failures, 0 output buffers swapped out
50    0 carrier transitions

```

Now that we're passing L3 IP packets, we suddenly see traffic on our dialer interface [lines 21-22] in addition to our virtual-access interface [lines 42, 46].


```

1 EDGE# show ip interface brief
2 Interface                IP-Address      OK? Method Status
3 Protocol
4 GigabitEthernet0/0       unassigned      YES unset  up
5 GigabitEthernet0/1       unassigned      YES unset  administratively down down
6 Dialer1                  10.0.0.2        YES IPCP    up
7 Virtual-Access1          unassigned      YES unset  up

```

Finally, we have an IP address on (only) the dialer interface. All three of our related interfaces—dialer, virtual-access, and Ethernet—need to be up/up for this to work, though. Notice that the address was set through IPCP. You'll remember that PPP is very modular, with LCP to handle the underlying link and other processes to handle each protocol that uses the link. IPCP is the process that handles IP traffic.



If everything is up and working, *except* for the IP address assignment, you may need to reload the ISP router or the edge router—it doesn't matter which, but save the configuration first. I really hate giving this advice because I can't imagine it ever being the right answer on an exam, but for the CCNA, we're working within a subset of reality. By experience, it seems that the artificially simplistic configuration that we gave to the ISP router can stop trying to give our edge router an IP address before we've entered all the configurations necessary for the edge router to accept it.