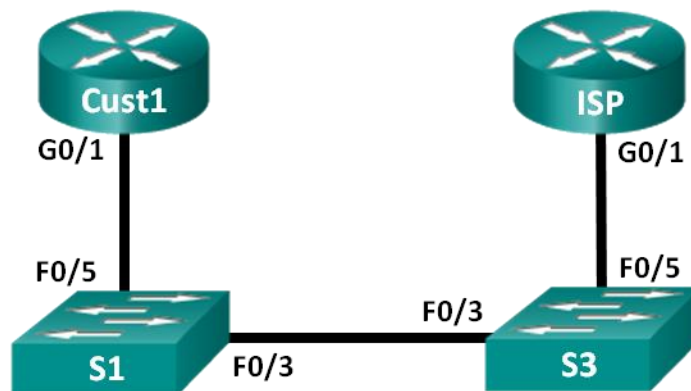


## Lab – Configuring a Router as a PPPoE Client for DSL Connectivity (Instructor Version)

**Instructor Note:** Red font color or Gray highlights indicate text that appears in the instructor copy only.

### Topology



### Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
Cust1	G0/1	Learned via PPP	Learned via PPP	Learned via PPP
ISP	G0/1	N/A	N/A	N/A

### Objectives

**Part 1: Build the Network**

**Part 2: Configure the ISP Router**

**Part 3: Configure the Cust1 Router**

### Background / Scenario

ISPs often use Point-to-Point Protocol over Ethernet (PPPoE) on DSL links to their customers. PPP supports the assignment of IP address information to a device at the remote end of a PPP link. More importantly, PPP supports CHAP authentication. ISPs can check accounting records to see if a customer's bill has been paid, before letting them connect to the Internet.

In this lab, you will configure both the client and ISP side of the connection to set up PPPoE. Typically, you would only configure the client end.

**Note:** The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

**Note:** Ensure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

**Instructor Note:** Refer to the Instructor Lab Manual for the procedures to initialize and reload devices.

### Required Resources

- 2 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology

## Part 1: Build the Network

**Step 1: Cable the network as shown in the topology.**

**Step 2: Initialize and reload the routers and switches.**

**Step 3: Configure basic settings for each router.**

- Disable DNS lookup.
- Configure device name as shown in the topology.
- Encrypt plain text passwords.
- Create a message of the day (MOTD) banner warning users that unauthorized access is prohibited.
- Assign **class** as the encrypted privileged EXEC mode password.
- Assign **cisco** as the console and vty password and enable login.
- Set console logging to synchronous mode.
- Save your configuration.

## Part 2: Configure the ISP Router

In Part 2, you configure the ISP router with PPPoE parameters for connection from the Cust1 router.

**Note:** Many of the ISP router PPPoE configuration commands are beyond the scope of the course; however, they are necessary for completion of the lab. They can be copied and pasted into the ISP router at the global configuration mode prompt.

- Create a local database username **Cust1** with a password of **ciscoppoe**.

```
ISP(config)# username Cust1 password ciscoppoe
```

- Create a pool of addresses that will be assigned to customers.

```
ISP(config)# ip local pool PPPoEPOOL 10.0.0.1 10.0.0.10
```

- Create the Virtual Template and associate the IP address of G0/1 with it. Associate the Virtual Template with the pool of addresses. Configure CHAP to authenticate customers.

```
ISP(config)# interface virtual-template 1
```

```
ISP(config-if)# ip address 10.0.0.254 255.255.255.0
```

```
ISP(config-if)# mtu 1492
```

```
ISP(config-if)# peer default ip address pool PPPoEPOOL
```

```
ISP(config-if)# ppp authentication chap callin
```

```
ISP(config-if)# exit
```

- d. Assign the template to the PPPoE group.

```
ISP(config)# bba-group pppoe global
ISP(config-bba-group)# virtual-template 1
ISP(config-bba-group)# exit
```

- e. Associate the bba-group with the G0/1 physical interface.

```
ISP(config)# interface g0/1
ISP(config-if)# pppoe enable group global
ISP(config-if)# no shutdown
```

### Part 3: Configure the Cust1 Router

In Part 3, you will configure the Cust1 router with PPPoE parameters.

- a. Configure G0/1 interface for PPPoE connectivity.

```
Cust1(config)# interface g0/1
Cust1(config-if)# pppoe enable
Cust1(config-if)# pppoe-client dial-pool-number 1
Cust1(config-if)# exit
```

- b. Associate the G0/1 interface with a dialer interface. Use the username **Cust1** and password **ciscoppoep** configured in Part 2.

```
Cust1(config)# interface dialer 1
Cust1(config-if)# mtu 1492
Cust1(config-if)# ip address negotiated
Cust1(config-if)# encapsulation ppp
Cust1(config-if)# dialer pool 1
Cust1(config-if)# ppp authentication chap callin
Cust1(config-if)# ppp chap hostname Cust1
Cust1(config-if)# ppp chap password ciscoppoep
Cust1(config-if)# exit
```

- c. Set up a static default route pointing to the Dialer interface.

```
Cust1(config)# ip route 0.0.0.0 0.0.0.0 dialer 1
```

- d. Set up debugging on the Cust1 router to display PPP and PPPoE negotiation.

```
Cust1# debug ppp authentication
Cust1# debug pppoe events
```

- e. Enable the G0/1 interface on the Cust1 router and observe the debug output as the PPPoE dialer session is established and CHAP authentication takes place.

```
Cust1(config)# interface g0/1
Cust1(config-if)# no shutdown
```

```
*Jul 30 19:28:42.427: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to
down
*Jul 30 19:28:46.175: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to
up
*Jul 30 19:28:47.175: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/1, changed state to up
*Jul 30 19:29:03.839: padi timer expired
```

```
*Jul 30 19:29:03.839: Sending PADI: Interface = GigabitEthernet0/1
*Jul 30 19:29:03.839: PPPoE 0: I PADO R:30f7.0da3.0b01 L:30f7.0da3.0bc1 Gi0/1
*Jul 30 19:29:05.887: PPPOE: we've got our pado and the pado timer went off
*Jul 30 19:29:05.887: OUT PADR from PPPoE Session
*Jul 30 19:29:05.895: PPPoE 1: I PADS R:30f7.0da3.0b01 L:30f7.0da3.0bc1 Gi0/1
*Jul 30 19:29:05.895: IN PADS from PPPoE Session
*Jul 30 19:29:05.899: %DIALER-6-BIND: Interface Vi2 bound to profile Di1
*Jul 30 19:29:05.899: PPPoE: Virtual Access interface obtained.
*Jul 30 19:29:05.899: PPPoE : encaps string prepared
*Jul 30 19:29:05.899: [0]PPPoE 1: data path set to PPPoE Client
*Jul 30 19:29:05.903: %LINK-3-UPDOWN: Interface Virtual-Access2, changed state to up
*Jul 30 19:29:05.911: Vi2 PPP: Using dialer call direction
*Jul 30 19:29:05.911: Vi2 PPP: Treating connection as a callout
*Jul 30 19:29:05.911: Vi2 PPP: Session handle[C6000001] Session id[1]
*Jul 30 19:29:05.919: Vi2 PPP: No authorization without authentication
*Jul 30 19:29:05.939: Vi2 CHAP: I CHALLENGE id 1 len 24 from "ISP"
*Jul 30 19:29:05.939: Vi2 PPP: Sent CHAP SENDAUTH Request
*Jul 30 19:29:05.939: Vi2 PPP: Received SENDAUTH Response FAIL
*Jul 30 19:29:05.939: Vi2 CHAP: Using hostname from interface CHAP
*Jul 30 19:29:05.939: Vi2 CHAP: Using password from interface CHAP
*Jul 30 19:29:05.939: Vi2 CHAP: O RESPONSE id 1 len 26 from "Cust1"
*Jul 30 19:29:05.955: Vi2 CHAP: I SUCCESS id 1 len 4
*Jul 30 19:29:05.955: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access2,
changed state to up
*Jul 30 19:29:05.983: PPPoE : ipfib_encapstr prepared
*Jul 30 19:29:05.983: PPPoE : ipfib_encapstr prepared
```

- f. Issue a **show ip interface brief** command on the Cust1 router to display the IP address assigned by the ISP router. Sample output is shown below. By what method was the IP address obtained?

```
_____ PPP
Cust1# show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
Embedded-Service-Engine0/0 unassigned      YES unset   administratively down down
GigabitEthernet0/0       unassigned      YES unset   administratively down down
GigabitEthernet0/1       unassigned      YES unset   up          up
Serial0/0/0              unassigned      YES unset   administratively down down
Serial0/0/1              unassigned      YES unset   administratively down down
Dialer1                  10.0.0.1        YES IPCP   up          up
Virtual-Access1          unassigned      YES unset   up          up
Virtual-Access2          unassigned      YES unset   up          up
```

- g. Issue a **show ip route** command on the Cust1 router. Sample output is shown below.

```
Cust1# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
```

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+ - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

S\* 0.0.0.0/0 is directly connected, Dialer1

10.0.0.0/32 is subnetted, 2 subnets

C 10.0.0.1 is directly connected, Dialer1

C 10.0.0.254 is directly connected, Dialer1

- h. Issue a **show pppoe session** on Cust1 router. Sample output is shown below.

Cust1# **show pppoe session**

1 client session

Uniq ID	PPPoE	RemMAC	Port	VT	VA	State
	SID	LocMAC			VA-st	Type
N/A	1	30f7.0da3.0b01	Gi0/1	Di1	Vi2	UP
		30f7.0da3.0bc1			UP	

- i. Issue a ping to 10.0.0.254 from the Cust1 router. The ping should be successful. If not, troubleshoot until you have connectivity.

Cust1# **ping 10.0.0.254**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.254, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

## Reflection

Why do ISPs who use DSL, primarily use PPPoE with their customers?

---

The PPP protocol supports authentication over an Ethernet link. ISPs can authenticate customers and issue an IP address.

## Router Interface Summary Table

Router Interface Summary				
Router Model	Ethernet Interface #1	Ethernet Interface #2	Serial Interface #1	Serial Interface #2
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

**Note:** To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.

## Device Configs

### Router Cust1

```
Cust1# show run
Building configuration...
Current configuration : 1433 bytes
!
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname Cust1
!
enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2
!
no aaa new-model
!
no ip domain lookup
ip cef
no ipv6 cef
multilink bundle-name authenticated
!
interface Embedded-Service-Engine0/0
no ip address
```

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---

```
shutdown
!
interface GigabitEthernet0/0
  no ip address
  shutdown
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  no ip address
  duplex auto
  speed auto
  pppoe enable group global
  pppoe-client dial-pool-number 1
!
interface Serial0/0/0
  no ip address
  shutdown
  clock rate 2000000
!
interface Serial0/0/1
  no ip address
  shutdown
!
interface Dialer1
  mtu 1492
  ip address negotiated
  encapsulation ppp
  dialer pool 1
  ppp authentication chap callin
  ppp chap hostname Cust1
  ppp chap password 0 ciscoppoe
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
ip route 0.0.0.0 0.0.0.0 Dialer1
!
control-plane
!
banner motd ^C
Unauthorized Access Prohibited.
^C
!
line con 0
  password 7 14141B180F0B
  logging synchronous
```

```
login
line aux 0
line 2
  no activation-character
  no exec
  transport preferred none
  transport input all
  transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
  stopbits 1
line vty 0 4
  password 7 05080F1C2243
  login
  transport input all
!
scheduler allocate 20000 1000
!
end
```

### Router ISP

```
ISP# show run
Building configuration...

Current configuration : 1485 bytes
!
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname ISP
!
boot-start-marker
boot-end-marker
!
enable secret 4 06YFDUHH6lwAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2
!
no aaa new-model
!
no ip domain lookup
ip cef
no ipv6 cef
multilink bundle-name authenticated
!
username Cust1 password 0 ciscoppoe
!
bba-group pppoe global
  virtual-template 1
!
!
```



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---

```
interface Embedded-Service-Engine0/0
  no ip address
  shutdown
!
interface GigabitEthernet0/0
  no ip address
  shutdown
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  no ip address
  duplex auto
  speed auto
  pppoe enable group global
!
interface Serial0/0/0
  no ip address
  shutdown
  clock rate 2000000
!
interface Serial0/0/1
  no ip address
  shutdown
!
interface Virtual-Template1
  ip address 10.0.0.254 255.255.255.0
  mtu 1492
  peer default ip address pool PPPoEPOOL
  ppp authentication chap callin
!
ip local pool PPPoEPOOL 10.0.0.1 10.0.0.10
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
control-plane
!
banner motd ^C
Unauthorized Access Prohibited.
^C
!
line con 0
  password 7 14141B180F0B
  logging synchronous
  login
line aux 0
line 2
```

## Lab – Configuring a Router as a PPPoE Client for DSL Connectivity

---

```
no activation-character
no exec
transport preferred none
transport input all
transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
stopbits 1
line vty 0 4
password 7 05080F1C2243
login
transport input all
!
scheduler allocate 20000 1000
!
end
```