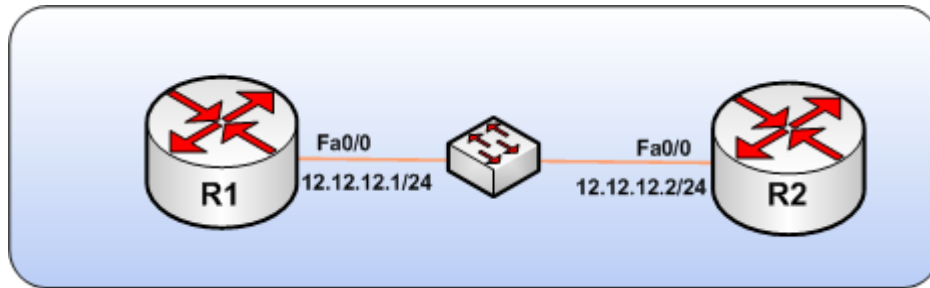


Lab 1 - Basic PPPoE



Task 1: Configure PPPoE on R1 and R2. Use a Dialer on R1 and a BBA-Group called “R2R1” on R2. No authentication is required.

Solution:

Note – There are multiple ways to configure PPPoE, In this scenario we are using Dialers and BBA-Groups, Prior to BBA-Groups the global vpdn profile could be used. The disadvantage of vpdn for pppoe is that one profile could be created. BBA-Groups provide the ability to create multiple PPPoE profiles on the one router.

R1 Configuration:

```
interface FastEthernet0/0
no ip address
speed 100
full-duplex
pppoe enable
pppoe-client dial-pool-number 1
no shut
!
interface Dialer1
ip address 12.12.12.1 255.255.255.0
encapsulation ppp
dialer pool 1
```

R2 Configuration:

```
bba-group pppoe R2R1
virtual-template 1
!
interface FastEthernet0/0
no ip address
speed 100
```

```
full-duplex
pppoe enable group R2R1
no shut
!
interface Virtual-Template1
ip address 12.12.12.2 255.255.255.0
```

Verification on R1:

```
R1#show pppoe session
1 client session
```

Uniq ID	PPPoE SID	RemMAC LocMAC	Port	VT	VA	VA-st	State
N/A	1	cc01.2650.0000	Fa0/0	Di1	Vi1		UP
		cc00.2650.0000					UP

```
R1#ping 12.12.12.2
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 12/21/40 ms

Verification on R2:

```
R2#show pppoe session
1 session in LOCALLY_TERMINATED (PTA) State
1 session total
```

Uniq ID	PPPoE SID	RemMAC LocMAC	Port	VT	VA	VA-st	State
1	1	cc00.2650.0000	Fa0/0	1	Vi1.1	PTA	
		cc01.2650.0000					UP

```
R2#ping 12.12.12.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/11/16 ms

```
R2#debug ppp nego
```

```
PPP protocol negotiation debugging is on
```

```
R2#
```

```
*Mar 1 03:12:26.047: ppp1 PPP: Send Message[Dynamic Bind Response]
```

```
*Mar 1 03:12:26.047: ppp1 PPP: Using default call direction
```

*Mar 1 03:12:26.047: ppp1 PPP: Treating connection as a dedicated line
*Mar 1 03:12:26.047: ppp1 PPP: Session handle[FC000004] Session id[1]
*Mar 1 03:12:26.047: ppp1 PPP: Phase is ESTABLISHING, Active Open
*Mar 1 03:12:26.047: ppp1 LCP: O CONFREQ [Closed] id 1 len 14
*Mar 1 03:12:26.047: ppp1 LCP: MRU 1492 (0x010405D4)
*Mar 1 03:12:26.047: ppp1 LCP: MagicNumber 0x01D67DE3 (0x050601D67DE3)
*Mar 1 03:12:26.099: ppp1 LCP: I CONFREQ [REQsent] id 1 len 10
*Mar 1 03:12:26.103: ppp1 LCP: MagicNumber 0x00D67EE2 (0x050600D67EE2)
*Mar 1 03:12:26.107: ppp1 LCP: O CONFACK [REQsent] id 1 len 10
*Mar 1 03:12:26.107: ppp1 LCP: MagicNumber 0x00D67EE2 (0x050600D67EE2)
*Mar 1 03:12:28.019: ppp1 LCP: I CONFREQ [ACKsent] id 2 len 10
*Mar 1 03:12:28.023: ppp1 LCP: MagicNumber 0x00D67EE2 (0x050600D67EE2)
*Mar 1 03:12:28.023: ppp1 LCP: O CONFACK [ACKsent] id 2 len 10
*Mar 1 03:12:28.027: ppp1 LCP: MagicNumber 0x00D67EE2 (0x050600D67EE2)
*Mar 1 03:12:28.043: ppp1 LCP: Timeout: State ACKsent
*Mar 1 03:12:28.047: ppp1 LCP: O CONFREQ [ACKsent] id 2 len 14
*Mar 1 03:12:28.047: ppp1 LCP: MRU 1492 (0x010405D4)
*Mar 1 03:12:28.047: ppp1 LCP: MagicNumber 0x01D67DE3 (0x050601D67DE3)
*Mar 1 03:12:28.059: ppp1 LCP: I CONFNAK [ACKsent] id 2 len 8
*Mar 1 03:12:28.059: ppp1 LCP: MRU 1500 (0x010405DC)
*Mar 1 03:12:28.059: ppp1 LCP: O CONFREQ [ACKsent] id 3 len 14
*Mar 1 03:12:28.059: ppp1 LCP: MRU 1500 (0x010405DC)
*Mar 1 03:12:28.059: ppp1 LCP: MagicNumber 0x01D67DE3 (0x050601D67DE3)
*Mar 1 03:12:28.067: ppp1 LCP: I CONFACK [ACKsent] id 3 len 14
*Mar 1 03:12:28.067: ppp1 LCP: MRU 1500 (0x010405DC)
*Mar 1 03:12:28.067: ppp1 LCP: MagicNumber 0x01D67DE3 (0x050601D67DE3)
*Mar 1 03:12:28.067: ppp1 LCP: State is Open
*Mar 1 03:12:28.067: ppp1 PPP: Phase is FORWARDING, Attempting Forward
*Mar 1 03:12:28.067: ppp1 PPP: Send Message[Connect Local]
*Mar 1 03:12:28.103: ppp1 PPP: Queue IPCP code[1] id[1]
*Mar 1 03:12:28.103: ppp1 PPP: Discarded CDPCP code[1] id[1]
*Mar 1 03:12:28.107: ppp1 PPP: Bind to [Virtual-Access1.1]
*Mar 1 03:12:28.107: Vi1.1 PPP: Send Message[Static Bind Response]
*Mar 1 03:12:28.119: Vi1.1 PPP: Phase is ESTABLISHING, Finish LCP
*Mar 1 03:12:28.123: Vi1.1 PPP: Phase is UP
*Mar 1 03:12:28.127: Vi1.1 IPCP: O CONFREQ [Closed] id 1 len 10
*Mar 1 03:12:28.127: Vi1.1 IPCP: Address 12.12.12.2 (0x03060C0C0C02)
*Mar 1 03:12:28.127: Vi1.1 PPP: Process pending ncp packets
*Mar 1 03:12:28.127: Vi1.1 IPCP: Redirect packet to Vi1.1
*Mar 1 03:12:28.127: Vi1.1 IPCP: I CONFREQ [REQsent] id 1 len 10
*Mar 1 03:12:28.127: Vi1.1 IPCP: Address 12.12.12.1 (0x03060C0C0C01)
*Mar 1 03:12:28.127: Vi1.1 IPCP: O CONFACK [REQsent] id 1 len 10
*Mar 1 03:12:28.127: Vi1.1 IPCP: Address 12.12.12.1 (0x03060C0C0C01)
*Mar 1 03:12:28.135: Vi1.1 IPCP: I CONFACK [ACKsent] id 1 len 10
*Mar 1 03:12:28.139: Vi1.1 IPCP: Address 12.12.12.2 (0x03060C0C0C02)
*Mar 1 03:12:28.139: Vi1.1 IPCP: State is Open
*Mar 1 03:12:28.139: Vi1.1 IPCP: Install route to 12.12.12.1
*Mar 1 03:12:30.087: Vi1.1 CDPCP: I CONFREQ [Not negotiated] id 2 len 4

```
*Mar 1 03:12:30.091: Vi1.1 LCP: O PROTREJ [Open] id 4 len 10 protocol CDPCP
(0x820701020004)
```

Task 2: PPPoE introduces an 8 Byte overhead. Only change the mtu on the interfaces required to support this.

Solution:

Note – There are multiple ways to configure PPPoE, In this scenario we are using Dialers and BBA-Groups, Prior to BBA-Groups the global vpdn profile could be used. The disadvantage of vpdn for pppoe is that one profile could be created. BBA-Groups provide the ability to create multiple PPPoE profiles on the one router.

R1 Configuration:

```
interface Dialer1
mtu 1492
```

Verification on R1:

Before the change

```
R1#show int dialer 1
Dialer1 is up, line protocol is up (spoofing)
Hardware is Unknown
Internet address is 12.12.12.1/32
MTU 1500 bytes, BW 56 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Bound to:
Virtual-Access2 is up, line protocol is up
Hardware is Virtual Access interface
MTU 1500 bytes, BW 56 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
```

After the change

```
R1#show int dialer 1
Dialer1 is up, line protocol is up (spoofing)
Hardware is Unknown
Internet address is 12.12.12.1/32
MTU 1492 bytes, BW 56 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Bound to:
Virtual-Access2 is up, line protocol is up
```

Hardware is Virtual Access interface
MTU 1492 bytes, BW 56 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255

Task 3: R1 is the client, Configure it to provide the username CE1 and password Cisco1. R2 should authenticate the client using Chap.

Solution:

Note – This is a one-way authentication using PPP.

R1 Configuration:

```
interface Dialer1
  ppp chap hostname CE1
  ppp chap password Cisco1
```

R2 Configuration:

```
username CE1 password Cisco1
!
interface Virtual-Template1
  ppp authentication chap
```

Verification on R1:

```
R1#show pppoe ses
  1 client session
```

Uniq ID	PPPoE SID	RemMAC LocMAC	Port	VT VA	State
N/A	3	cc01.2650.0000	Fa0/0	Di1 Vi1	UP
		cc00.2650.0000		UP	

Verification on R2:

```
R2#ping 12.12.12.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/22/44 ms

```
*Mar 1 03:30:01.175: ppp4 PPP: Phase is AUTHENTICATING, by this end
*Mar 1 03:30:01.175: ppp4 CHAP: O CHALLENGE id 1 len 23 from "R2"
*Mar 1 03:30:01.187: ppp4 CHAP: I RESPONSE id 1 len 24 from "CE1"
*Mar 1 03:30:01.187: ppp4 PPP: Phase is FORWARDING, Attempting Forward
*Mar 1 03:30:01.187: ppp4 PPP: Phase is AUTHENTICATING, Unauthenticated User
*Mar 1 03:30:01.187: ppp4 PPP: Phase is FORWARDING, Attempting Forward
*Mar 1 03:30:01.187: ppp4 PPP: Send Message[Connect Local]
*Mar 1 03:30:01.227: ppp4 PPP: Bind to [Virtual-Access1.1]
*Mar 1 03:30:01.227: Vi1.1 PPP: Send Message[Static Bind Response]
*Mar 1 03:30:01.239: Vi1.1 PPP: Phase is AUTHENTICATING, Authenticated User
*Mar 1 03:30:01.247: Vi1.1 CHAP: O SUCCESS id 1 len 4
```

Task 4: Change the authentication so that EAP is the only type used. Use the existing username/password combination.

Solution:

R1 Configuration:

```
interface Dialer1
  no ppp chap hostname CE1
  no ppp chap password Cisco1
  ppp eap identy CE1
  ppp eap password Cisco1
```

R2 Configuration:

```
!
interface Virtual-Template1
  ppp authentication eap
  ppp eap local
!
end
```

Verification on R2:

```
R2#ping 12.12.12.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 12/21/44 ms

*Mar 1 03:45:22.019: %LINK-3-UPDOWN: Interface Virtual-Access3, changed state to down

*Mar 1 03:45:23.019: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access3, changed state to down

*Mar 1 03:45:44.079: ppp15 PPP: Using default call direction

*Mar 1 03:45:44.083: ppp15 PPP: Treating connection as a dedicated line

*Mar 1 03:45:44.083: ppp15 PPP: Session handle[39000015] Session id[15]

*Mar 1 03:45:44.083: ppp15 PPP: Authorization required

*Mar 1 03:45:46.135: ppp15 EAP: O REQUEST IDENTITY id 1 len 5

*Mar 1 03:45:46.179: ppp15 EAP: I RESPONSE IDENTITY id 1 len 8 from "CE1"

*Mar 1 03:45:46.183: ppp15 EAP: O REQUEST MD5 id 2 len 24 from "R2"

*Mar 1 03:45:46.191: ppp15 EAP: I RESPONSE MD5 id 2 len 25 from "CE1"

*Mar 1 03:45:46.195: ppp15 PPP: Sent CHAP LOGIN Request

*Mar 1 03:45:46.195: ppp15 PPP: Received LOGIN Response PASS

*Mar 1 03:45:46.271: %LINK-3-UPDOWN: Interface Virtual-Access3, changed state to up

*Mar 1 03:45:46.287: Vi3 PPP: Sent LCP AUTHOR Request

*Mar 1 03:45:46.287: Vi3 PPP: Sent IPCP AUTHOR Request

*Mar 1 03:45:46.291: Vi3 LCP: Received AAA AUTHOR Response PASS

*Mar 1 03:45:46.291: Vi3 IPCP: Received AAA AUTHOR Response PASS

*Mar 1 03:45:46.291: Vi3 EAP: O SUCCESS id 2 len 4

*Mar 1 03:45:46.303: Vi3 PPP: Sent IPCP AUTHOR Request

*Mar 1 03:45:47.271: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access3, changed state to up

Task 5: Configure R1 to request an address from R2. R2 should provide the address 12.12.12.1 from a pool called CE1

Solution:

R1 Configuration:

```
interface Dialer1
 ip address negotiated
```

R2 Configuration:

```
ip local pool CE1 12.12.12.1
```

```
!  
interface Virtual-Template1  
 peer default ip address pool CE1
```

Verification on R2:

```
R2#ping 12.12.12.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/12/20 ms

```
*Mar 1 00:10:29.835: Vi3 AAA/AUTHOR/IPCP: Start. Her address 0.0.0.0, we want 0.0.0.0
```

```
*Mar 1 00:10:29.835: Vi3 AAA/AUTHOR/IPCP: Done. Her address 0.0.0.0, we want 0.0.0.0
```

```
*Mar 1 00:10:29.835: Vi3 IPCP: Pool returned 12.12.12.1
```

```
*Mar 1 00:10:29.835: Vi3 IPCP: O CONFNAK [REQsent] id 1 len 10
```

```
*Mar 1 00:10:29.835: Vi3 IPCP: Address 12.12.12.1 (0x03060C0C0C01)
```

```
*Mar 1 00:10:29.835: Vi3 IPCP: I CONFACK [REQsent] id 1 len 10
```

```
*Mar 1 00:10:29.835: Vi3 IPCP: Address 12.12.12.2 (0x03060C0C0C02)
```

```
*Mar 1 00:10:29.835: Vi3 CDPCP: I CONFREQ [Not negotiated] id 1 len 4
```

```
*Mar 1 00:10:29.835: Vi3 LCP: O PROTREJ [Open] id 3 len 10 protocol CDPCP (0x820701010004)
```

```
*Mar 1 00:10:29.847: Vi3 IPCP: I CONFREQ [ACKrcvd] id 2 len 10
```

```
*Mar 1 00:10:29.851: Vi3 IPCP: Address 12.12.12.1 (0x03060C0C0C01)
```

```
*Mar 1 00:10:29.851: Vi3 IPCP: O CONFACK [ACKrcvd] id 2 len 10
```

```
*Mar 1 00:10:29.851: Vi3 IPCP: Address 12.12.12.1 (0x03060C0C0C01)
```

```
*Mar 1 00:10:29.851: Vi3 IPCP: State is Open
```

```
*Mar 1 00:10:29.855: Vi3 IPCP: Install route to 12.12.12.1
```

```
*Mar 1 00:10:30.763: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-  
Access3, changed state to up
```

Task 6: Reconfigure R1 to request an address using dhcp. R2 should provide the address from a pool called CE1

Solution:

R1 Configuration:

```
interface Dialer1  
 ip address dhcp
```

R2 Configuration:

```
no ip local pool CE1
ip dhcp excluded-address 12.12.12.2
!
ip dhcp pool CE1
 network 12.12.12.0 255.255.255.0
!
interface Virtual-Template1
 no peer default ip address pool CE1
```

Verification on R1:

```
R1#ping 12.12.12.1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 20/30/72 ms

```
R1#ping 12.12.12.2
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/12/20 ms

```
R# debug dhcp
```

```
*Mar 1 01:26:44.875: %LINK-3-UPDOWN: Interface Dialer1, changed state to up
```

```
*Mar 1 01:26:55.147: %DIALER-6-BIND: Interface Vi2 bound to profile Di1
```

```
*Mar 1 01:26:55.171: %LINK-3-UPDOWN: Interface Virtual-Access2, changed state to up
```

```
*Mar 1 01:26:57.223: DHCP: SDiscover attempt # 3 for entry:
```

```
*Mar 1 01:26:57.223: DHCP: SDiscover: sending 289 byte length DHCP packet
```

```
*Mar 1 01:26:57.227: DHCP: SDiscover 289 bytes
```

```
*Mar 1 01:26:57.227: B'cast on Dialer1 interface from 0.0.0.0
```

```
*Mar 1 01:26:58.307: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access2,
changed state to up%Unknown DHCP problem.. No allocation possible
```

```
*Mar 1 01:27:10.743: DHCP: Waiting for 5 seconds on interface Dialer1
```

```
*Mar 1 01:27:15.743: DHCP: Try 2 to acquire address for Dialer1
```

```
*Mar 1 01:27:15.771: DHCP: allocate request
```

```
*Mar 1 01:27:15.771: DHCP: zapping entry in DHC_PURGING state for Di1
```

```
*Mar 1 01:27:15.775: DHCP: deleting entry 64BEEAA0 0.0.0.0 from list
```

```
*Mar 1 01:27:15.775: DHCP: new entry. add to queue, interface Dialer1
```

```
*Mar 1 01:27:15.779: DHCP: SDiscover attempt # 1 for entry:
```

```
*Mar 1 01:27:15.779: DHCP: SDiscover: sending 289 byte length DHCP packet
```

```
*Mar 1 01:27:15.783: DHCP: SDiscover 289 bytes
```

```
*Mar 1 01:27:15.783: B'cast on Dialer1 interface from 0.0.0.0
```

```
*Mar 1 01:27:17.771: DHCP: Received a BOOTREP pkt
```

```
*Mar 1 01:27:17.775: DHCP: offer received from 12.12.12.2
```

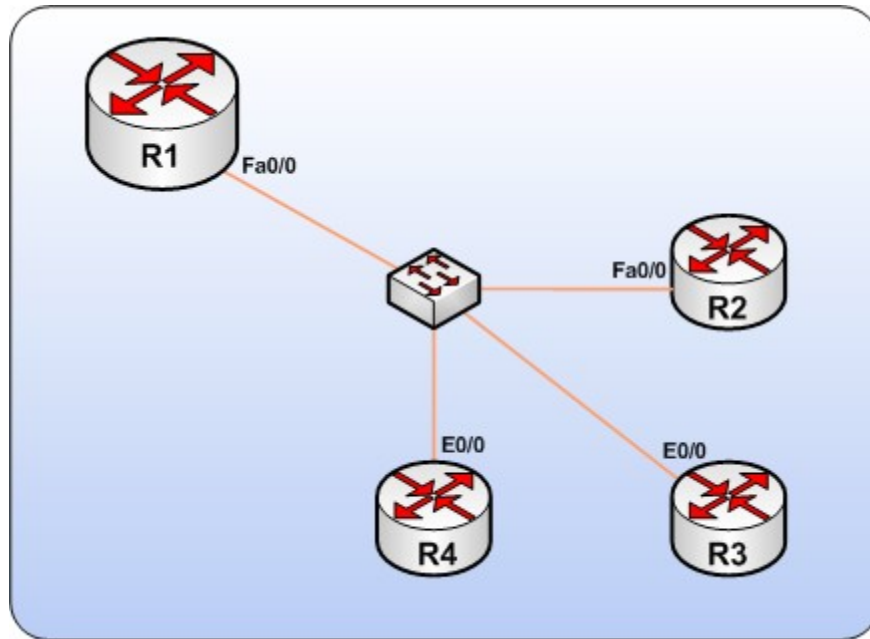
```
*Mar 1 01:27:17.779: DHCP: SRequest attempt # 1 for entry:
```

```
*Mar 1 01:27:17.779: DHCP: SRequest- Server ID option: 12.12.12.2
*Mar 1 01:27:17.783: DHCP: SRequest- Requested IP addr option: 12.12.12.1
*Mar 1 01:27:17.783: DHCP: SRequest placed lease len option: 86400
*Mar 1 01:27:17.787: DHCP: SRequest: 307 bytes
*Mar 1 01:27:17.787: DHCP: SRequest: 307 bytes
*Mar 1 01:27:17.791:      B'cast on Dialer1 interface from 0.0.0.0
*Mar 1 01:27:17.815: DHCP: Received a BOOTREP pkt
*Mar 1 01:27:17.835: DHCP Client Pooling: ***Allocated IP address: 12.12.12.1
*Mar 1 01:27:17.847: Allocated IP address = 12.12.12.1 255.255.255.0

*Mar 1 01:27:17.851: %DHCP-6-ADDRESS_ASSIGN: Interface Dialer1 assigned DHCP
address 12.12.12.1, mask 255.255.255.0, hostname R1
```

Lab completed, Erase config and continue to next lab.

Lab 2 - PPPoE



Task 1: Configure PPPoE on all four routers. R1 should use a BBA-Group, R2, R3 and R4 should use dialer interfaces. R2, R3 and R4 should negotiate addresses with R1 and R1 should only have /32 routes in its table. Make sure there are no MTU issues.

Solution:

Note – To stop the subnet from appearing in R1's routing table the use of a loopback and ip unnumbered is required.

R1 Configuration:

```
bba-group pppoe CE
virtual-template 1
!
interface Loopback1
ip address 12.12.12.1 255.255.255.255
!
interface FastEthernet0/0
no ip address
speed 100
full-duplex
pppoe enable group CE
!
interface Virtual-Template1
```

```
ip unnumbered Loopback1
mtu 1492
peer default ip address pool CE
!
ip local pool CE 12.12.12.2 12.12.12.4
```

R2 Configuration:

```
interface FastEthernet0/0
no ip address
speed 100
full-duplex
pppoe enable
pppoe-client dial-pool-number 1
!
interface Dialer1
ip address negotiated
encapsulation ppp
mtu 1492
dialer pool 1
```

R3 and R4 Configuration:

```
interface Ethernet0/0
no ip address
full-duplex
pppoe enable
pppoe-client dial-pool-number 1
!
interface Dialer1
ip address negotiated
encapsulation ppp
mtu 1492
dialer pool 1
```

Verification on R1:

```
R1#show pppoe ses
 3 sessions in LOCALLY_TERMINATED (PTA) State
 3 sessions total
```

Uniq ID	PPPoE SID	RemMAC LocMAC	Port	VT	VA	State
4	4	cc03.2650.0000 cc00.2650.0000	Fa0/0	1	Vi1.1	PTA UP
5	5	cc01.2650.0000 cc00.2650.0000	Fa0/0	1	Vi1.2	PTA UP

```
6 6 cc02.2650.0000 Fa0/0      1 Vi1.3  PTA
   cc00.2650.0000              UP
```

R1#show ip route

Codes: 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

Gateway of last resort is not set

12.0.0.0/32 is subnetted, 4 subnets

```
C 12.12.12.2 is directly connected, Virtual-Access1.1
C 12.12.12.3 is directly connected, Virtual-Access1.2
C 12.12.12.4 is directly connected, Virtual-Access1.3
C 12.12.12.1 is directly connected, Loopback1
```

R1#ping 12.12.12.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.1, timeout is 2 seconds:

!!!!

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

R1#ping 12.12.12.52

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 20/22/24 ms

R1#ping 12.12.12.63

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.3, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/14/28 ms

R1#ping 12.12.12.4

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.4, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 12/30/92 ms

Verification on R2:

```
R2#show ip route
```

```
Codes: 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
```

```
Gateway of last resort is not set
```

```
    12.0.0.0/32 is subnetted, 2 subnets
```

```
C     12.12.12.2 is directly connected, Dialer1
```

```
C     12.12.12.1 is directly connected, Dialer1
```

```
R2#
```

Task 2: R2, R3 and R4 are unable to communicate with each other, Use an interface level command to add a default route during ppp negotiation.

Solution:

R2.R3 and R4 Configuration:

```
interface Dialer1
 ppp ipcp default route
```

Verification on R2:

```
*Mar 1 01:06:01.243: Vi1 IPCP: State is Open
```

```
*Mar 1 01:06:01.251: Di1 IPCP: Install negotiated IP interface address 12.12.12.2
```

```
*Mar 1 01:06:01.275: Di1 IPCP: Install default route thru 12.12.12.1
```

```
*Mar 1 01:06:01.279: Di1 IPCP: Install route to 12.12.12.1
```

```
*Mar 1 01:06:01.295: Vi1 IPCP: Add link info for cef entry 12.12.12.1
```

```
*Mar 1 01:06:02.159: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1,
changed state to up
```

```
R2#show ip route
```

```
Gateway of last resort is 12.12.12.1 to network 0.0.0.0
```

```
    12.0.0.0/32 is subnetted, 2 subnets
```

```
C     12.12.12.1 is directly connected, Dialer1
```

```
C     12.12.12.3 is directly connected, Dialer1
```

S* 0.0.0.0/0 [1/0] via 12.12.12.1

R2#ping 12.12.12.4

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 12.12.12.4, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/33/76 ms

R2#

Lab completed, Erase config and continue to next lab.

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