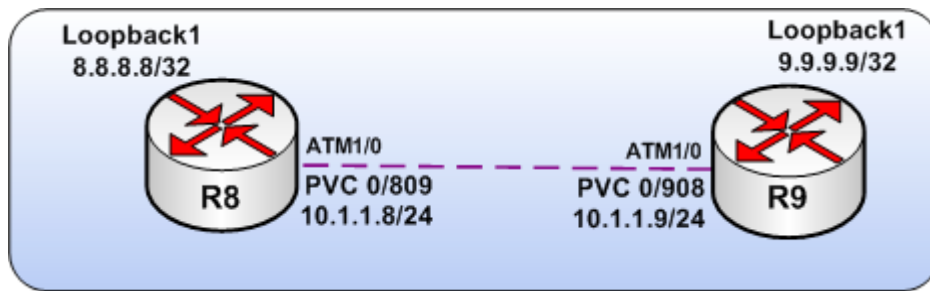


## Lab 1 - ATM PPPOA – Multi-point Sub-interface



**Task 1:** Configure PPPoA on R8 and R9 using Multi-point sub-interfaces. Use the IP addresses / PVC show in the diagram.

Add the loopbacks 8.8.8.8/32 and 9.9.9.9/32 to each respective router.

### Solution:

Note – An alternative to the Virtual-template is a Dialer interface. The configuration for a Dialer requires a bit more work than the Virtual-Template, But allows more options.

### R8 Configuration:

```
interface ATM1/0
no ip address
no atm enable-ilmi-trap
no clns route-cache
!
interface ATM1/0.809 multipoint
no atm enable-ilmi-trap
pvc 0/809
encapsulation aal5snap
protocol ppp Virtual-Template1
!
interface Virtual-Template1
ip address 10.1.1.8 255.255.255.0
```

### R9 Configuration:

```
interface ATM1/0
no ip address
no atm enable-ilmi-trap
no clns route-cache
!
```

```
interface ATM1/0.908 multipoint
no atm enable-ilmi-trap
pvc 0/908
encapsulation aal5snap
protocol ppp Virtual-Template1
!
interface Virtual-Template1
ip address 10.1.1.9 255.255.255.0
```

### Verification on R8:

```
R8#ping 10.1.1.9
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/18/48 ms

```
R8#show ip route
```

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 10.1.1.9/32 is directly connected, Virtual-Access1

C 10.1.1.0/24 is directly connected, Virtual-Access1

```
R8#show atm pvc 0/809
```

ATM1/0.809: VCD: 2, VPI: 0, VCI: 809

UBR, PeakRate: 155000

AAL5-LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0

OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)

OAM up retry count: 3, OAM down retry count: 5

OAM Loopback status: OAM Disabled

OAM VC status: Not Managed

ILMI VC status: Not Managed

InARP frequency: 15 minutes(s)

InPkts: 58, OutPkts: 75, InBytes: 2384, OutBytes: 2160

InPRoc: 39, OutPRoc: 61, Broadcasts: 0

InFast: 19, OutFast: 19, InAS: 0, OutAS: 0

Giants: 0

OAM cells received: 0

F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0

OAM cells sent: 0

F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutAIS: 0, F5 OutRDI: 0

OAM cell drops: 0

Status: UP

**PPP: Virtual-Access1 from Virtual-Template1**

## Verification on R9

```
R9#ping 10.1.1.8
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

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

```
R9#show ip route
```

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 10.1.1.8/32 is directly connected, Virtual-Access1

C 10.1.1.0/24 is directly connected, Virtual-Access1

```
R9#show atm pvc 0/908
```

ATM1/0.908: VCD: 1, VPI: 0, VCI: 908

UBR, PeakRate: 155000

AAL5-LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0

OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)

OAM up retry count: 3, OAM down retry count: 5

OAM Loopback status: OAM Disabled

OAM VC status: Not Managed

ILMI VC status: Not Managed

InARP frequency: 15 minutes(s)

InPkts: 37, OutPkts: 37, InBytes: 1570, OutBytes: 1530

InPRoc: 28, OutPRoc: 24, Broadcasts: 0

InFast: 9, OutFast: 9, InAS: 0, OutAS: 0

Giants: 0

OAM cells received: 0

F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0

OAM cells sent: 0

F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutAIS: 0, F5 OutRDI: 0

OAM cell drops: 0

Status: UP

**PPP: Virtual-Access1 from Virtual-Template1**

**Task 2:** When R8 connects to R9, It needs to provide the username R8 and password cisco. R9 should authenticate R8 using chap.

**Solution:**

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

### **R8 Configuration:**

```
interface Virtual-Template 1
  ppp chap hostname R8
  ppp chap password cisco
end
```

### **R9 Configuration:**

```
username R8 password cisco
!
interface Virtual-Template1
  ppp authentication chap
!
end
```

### **Verification on R8:**

```
R8# debug ppp authentication
```

```
00:13:00: Vi1 CHAP: I CHALLENGE id 9 len 23 from "R9"
00:13:00: Vi1 CHAP: Using alternate hostname R8
00:13:00: Vi1 CHAP: Using default password
00:13:00: Vi1 CHAP: O RESPONSE id 9 len 23 from "R8"
00:13:00: Vi1 CHAP: I SUCCESS id 9 len 4
00:13:01: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state to
up
```

### **Verification on R9**

```
R9#show ip route
```

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

```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    10.1.1.8/32 is directly connected, Virtual-Access1
C    10.1.1.0/24 is directly connected, Virtual-Access1
R9#ping 10.1.1.8
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/16/40 ms
```

**Task 3:** Configure R8 to authenticate R9 using pap. R9 should send the username CE1 and password PPPoA.

**Solution:**

**R8 Configuration:**

```
interface Virtual-Template 1
  ppp chap hostname R8
  ppp chap password cisco
end
```

**R9 Configuration:**

```
username R8 password cisco
!
interface Virtual-Template1
  ppp authentication chap
!
end
```

**Verification on R8:**

```
R8#show ip route
```

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

```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    10.1.1.9/32 is directly connected, Virtual-Access1
C    10.1.1.0/24 is directly connected, Virtual-Access1
```

```
R8#ping 10.1.1.9
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/9/12 ms
```

```
R8#
```

**Verification on R9**

```
R9# debug ppp authentication
```

```
00:12:37: Vi1 CHAP: O CHALLENGE id 14 len 23 from "R9"
```

```
00:12:37: Vi1 PAP: O AUTH-REQ id 1 len 14 from "CE1"
```

```
00:12:37: Vi1 CHAP: I RESPONSE id 14 len 23 from "R8"  
00:12:37: Vi1 CHAP: O SUCCESS id 14 len 4  
00:12:37: Vi1 PAP: I AUTH-ACK id 1 len 5  
00:12:38: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state to  
up
```

**Task 4:** Remove the ip address from the Virtual-template on R8. R8 should now request an ip address from R9 using ppp. On R9 use the address range 10.1.1.10 – 10.1.1.15

**Solution:**

**R8 Configuration:**

```
interface Virtual-Template 1  
 ip address negotiated  
end
```

**R9 Configuration:**

```
interface Virtual-Template1  
 peer default ip address pool PPPoA  
!  
ip local pool PPPoA 10.1.1.10 10.1.1.20  
!  
end
```

**Verification on R8:**

```
01:18:47: Vi1 IPCP: I CONFACK [ACKsent] id 145 len 10  
01:17:48: Vi1 IPCP: Address 10.1.1.10 (0x03060A01010A)  
01:17:48: Vi1 IPCP: State is Open  
01:17:48: Vi1 IPCP: Install negotiated IP interface address 10.1.1.10  
01:17:48: Vi1 IPCP: Install route to 10.1.1.9  
01:17:49: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state to  
up
```

R8#show ip route

Gateway of last resort is not set

```
10.0.0.0/32 is subnetted, 2 subnets  
C    10.1.1.10 is directly connected, Virtual-Access1  
C    10.1.1.9 is directly connected, Virtual-Access1
```

R8#ping 10.1.1.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/16/40 ms

**Task 5:** Reconfigure R8 so all previous task objectives are met without using a Virtual-Template.

### **Solution:**

Note – If a Virtual-Template cannot be used, the alternative is a dialer.

### **R8 Configuration:**

```
interface ATM1/0.809 multipoint
 pvc 0/809
  protocol ppp dialer
  dialer pool-member 1
 !
interface Dialer1
 ip address negotiated
 encapsulation ppp
 dialer pool 1
 dialer-group 1
 ppp authentication pap
 ppp chap hostname R8
 ppp chap password 0 cisco
 !
dialer-list 1 protocol ip permit
```

### **Verification on R8:**

```
01:35:07: Vi1 PPP: Phase is ESTABLISHING [0 sess, 0 load]
01:35:07: Vi1 LCP: O CONFREQ [Open] id 2 len 14
01:35:07: Vi1 LCP:  AuthProto PAP (0x0304C023)
01:35:07: Vi1 LCP:  MagicNumber 0x0C5A885C (0x05060C5A885C)
01:35:07: Vi1 LCP: O CONFACK [Open] id 143 len 15
01:35:07: Vi1 LCP:  AuthProto CHAP (0x0305C22305)
01:35:07: Vi1 LCP:  MagicNumber 0x0D558910 (0x05060D558910)
01:35:07: Di1 IPCP: Remove route to 10.1.1.9
01:35:07: Vi1 LCP: I CONFACK [ACKsent] id 2 len 14
01:35:07: Vi1 LCP:  AuthProto PAP (0x0304C023)
01:35:07: Vi1 LCP:  MagicNumber 0x0C5A885C (0x05060C5A885C)
01:35:07: Vi1 LCP: State is Open
```

```
01:35:07: Vi1 PPP: Phase is AUTHENTICATING, by both [0 sess, 1 load]
01:35:07: Vi1 CHAP: I CHALLENGE id 96 len 23 from "R9"
01:35:07: Vi1 PAP: I AUTH-REQ id 83 len 14 from "CE1"
01:35:07: Vi1 CHAP: Using alternate hostname R8
01:35:07: Vi1 CHAP: Username R9 not found
01:35:07: Vi1 CHAP: Using default password
01:35:07: Vi1 CHAP: O RESPONSE id 96 len 23 from "R8"
01:35:07: Vi1 PAP: Authenticating peer CE1
01:35:07: Vi1 PAP: O AUTH-ACK id 83 len 5
01:35:07: Vi1 CHAP: I SUCCESS id 96 len 4
01:35:07: Vi1 PPP: Phase is UP [0 sess, 1 load]
01:35:07: Vi1 IPCP: O CONFREQ [Closed] id 3 len 10
01:35:07: Vi1 IPCP: Address 0.0.0.0 (0x030600000000)
01:35:07: Vi1 CDPCP: O CONFREQ [Closed] id 2 len 4
01:35:07: Vi1 IPCP: I CONFREQ [REQsent] id 95 len 10
01:35:07: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)
01:35:07: Vi1 IPCP: O CONFACK [REQsent] id 95 len 10
01:35:07: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)
01:35:07: Vi1 IPCP: I CONFNAK [ACKsent] id 3 len 10
01:35:07: Vi1 IPCP: Address 10.1.1.10 (0x03060A01010A)
01:35:07: Vi1 IPCP: O CONFREQ [ACKsent] id 4 len 10
01:35:07: Vi1 IPCP: Address 10.1.1.10 (0x03060A01010A)
01:35:07: Vi1 LCP: I PROTREJ [Open] id 144 len 10 protocol CDPCP (0x820701020004)
01:35:07: Vi1 CDPCP: State is Listen
01:35:07: Vi1 IPCP: I CONFACK [ACKsent] id 4 len 10
01:35:07: Vi1 IPCP: Address 10.1.1.10 (0x03060A01010A)
01:35:07: Vi1 IPCP: State is Open
01:35:07: Di1 IPCP: Install negotiated IP interface address 10.1.1.10
01:35:07: Di1 IPCP: Install route to 10.1.1.9
```

```
R8#show ip route
```

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

```
10.0.0.0/32 is subnetted, 2 subnets
```

```
C 10.1.1.10 is directly connected, Dialer1
```

```
C 10.1.1.9 is directly connected, Dialer1
```

```
R8#ping 10.1.1.9
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/14/24 ms
```

```
R8#ping 10.1.1.10
```

```
Type escape sequence to abort.
```

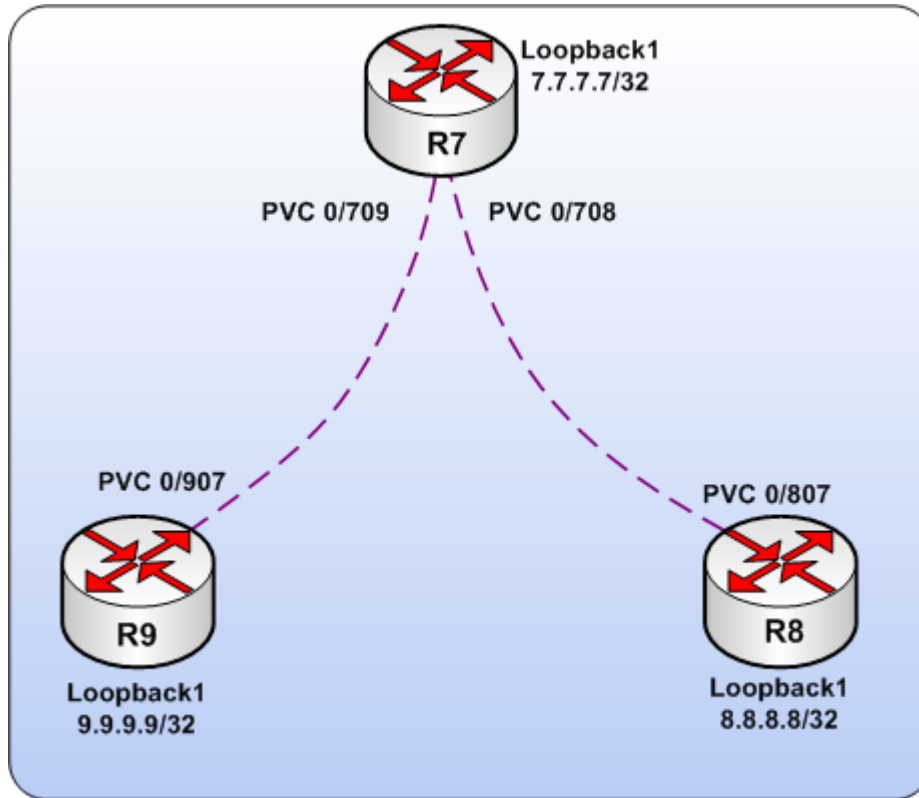
```
Sending 5, 100-byte ICMP Echos to 10.1.1.10, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/22/24 ms  
R8#
```

**Lab completed, Erase config and continue to next lab.**

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## Lab 2 - ATM PPPoA – Hub and Spoke



R7	10.1.1.7/24
R8	10.1.1.8/24
R9	10.1.1.9/24

**Task 1:** Configure R7 as the hub using a single multipoint sub-interface and one ip address. Both R8 and R9 are to be configured as spokes using a point-to-point sub-interface.

### Solution:

Note – The advantage of using Point-to-point interfaces on R8 and R9 is that spoke to spoke communications can occur without additional configuration. This is because R7 has host routes to each spoke and the spokes have the subnet assigned to the point-to-point sub-interface.

### R7 Configuration:

```
interface ATM1/0
no ip address
no atm enable-ilmi-trap
no clns route-cache
no shut
```

```
!  
interface ATM1/0.789 multipoint  
no atm enable-ilmi-trap  
pvc 0/708  
encapsulation aal5snap  
protocol ppp Virtual-Template1  
!  
pvc 0/709  
encapsulation aal5snap  
protocol ppp Virtual-Template1  
!  
interface Virtual-Template1  
ip address 10.1.1.7 255.255.255.0  
no clns route-cache
```

### **R8 Configuration:**

```
interface ATM1/0  
no ip address  
no atm enable-ilmi-trap  
no clns route-cache  
!  
interface ATM1/0.807 point-to-point  
no atm enable-ilmi-trap  
pvc 0/807  
encapsulation aal5snap  
protocol ppp Virtual-Template1  
!  
interface Virtual-Template1  
ip address 10.1.1.8 255.255.255.0  
no clns route-cache
```

### **R9 Configuration:**

```
interface ATM1/0  
no ip address  
no atm enable-ilmi-trap  
no clns route-cache  
!  
interface ATM1/0.907 point-to-point  
no atm enable-ilmi-trap  
pvc 0/907  
encapsulation aal5snap  
protocol ppp Virtual-Template1  
!  
interface Virtual-Template1  
ip address 10.1.1.9 255.255.255.0
```

no clns route-cache

### Verification on R7:

R7#show atm pvc

Interface	Name	VPI	VCI	Type	Encaps	SC	Kbps	Kbps	Cells	Sts
1/0.789	1	0	708	PVC	SNAP	UBR	155000			UP
1/0.789	2	0	709	PVC	SNAP	UBR	155000			UP

R7#show ip route

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks  
C 10.1.1.8/32 is directly connected, Virtual-Access1  
C 10.1.1.9/32 is directly connected, Virtual-Access2  
C 10.1.1.0/24 is directly connected, Virtual-Access2  
is directly connected, Virtual-Access1

R7#ping 10.1.1.8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 12/19/44 ms

R7#ping 10.1.1.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/9/12 ms

R7# debug ppp negotiation

00:26:00: Vi1 PPP: Phase is ESTABLISHING, Passive Open [0 sess, 1 load]

00:26:01: Vi1 LCP: I CONFREQ [Listen] id 11 len 10

00:26:01: Vi1 LCP: MagicNumber 0x0C1B3FC9 (0x05060C1B3FC9)

00:26:01: Vi1 LCP: O CONFREQ [Listen] id 5 len 10

00:26:01: Vi1 LCP: MagicNumber 0x0B1B4516 (0x05060B1B4516)

00:26:01: Vi1 LCP: O CONFACK [Listen] id 11 len 10

00:26:01: Vi1 LCP: MagicNumber 0x0C1B3FC9 (0x05060C1B3FC9)

00:26:01: Vi1 LCP: I CONFACK [ACKsent] id 5 len 10

00:26:01: Vi1 LCP: MagicNumber 0x0B1B4516 (0x05060B1B4516)

00:26:01: Vi1 LCP: State is Open

00:26:01: Vi1 PPP: Phase is UP [0 sess, 1 load]

00:26:01: Vi1 IPCP: O CONFREQ [Closed] id 5 len 10

```
00:26:01: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)
00:26:01: Vi1 IPCP: I CONFREQ [REQsent] id 5 len 10
00:26:01: Vi1 IPCP: Address 10.1.1.8 (0x03060A010108)
00:26:01: Vi1 IPCP: O CONFACK [REQsent] id 5 len 10
00:26:01: Vi1 IPCP: Address 10.1.1.8 (0x03060A010108)
00:26:01: Vi1 IPCP: I CONFACK [ACKsent] id 5 len 10
00:26:01: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)
00:26:01: Vi1 IPCP: State is Open
00:26:01: Vi1 IPCP: Install route to 10.1.1.8
00:26:02: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state to up
00:26:30: Vi2 PPP: Phase is ESTABLISHING [0 sess, 1 load]
00:26:30: Vi2 LCP: O CONFREQ [Open] id 6 len 10
00:26:30: Vi2 LCP: MagicNumber 0x0B1BB5EB (0x05060B1BB5EB)
00:26:30: Vi2 LCP: O CONFACK [Open] id 13 len 10
00:26:30: Vi2 LCP: MagicNumber 0x0D1BAFE5 (0x05060D1BAFE5)
00:26:30: Vi2 IPCP: Remove route to 10.1.1.9
00:26:30: Vi2 LCP: I CONFACK [ACKsent] id 6 len 10
00:26:30: Vi2 LCP: MagicNumber 0x0B1BB5EB (0x05060B1BB5EB)
00:26:30: Vi2 LCP: State is Open
00:26:30: Vi2 PPP: Phase is UP [0 sess, 1 load]
00:26:30: Vi2 IPCP: O CONFREQ [Closed] id 6 len 10
00:26:30: Vi2 IPCP: Address 10.1.1.7 (0x03060A010107)
00:26:30: Vi2 IPCP: I CONFREQ [REQsent] id 6 len 10
00:26:30: Vi2 IPCP: Address 10.1.1.9 (0x03060A010109)
00:26:30: Vi2 IPCP: O CONFACK [REQsent] id 6 len 10
00:26:30: Vi2 IPCP: Address 10.1.1.9 (0x03060A010109)
00:26:30: Vi2 IPCP: I CONFACK [ACKsent] id 6 len 10
00:26:30: Vi2 IPCP: Address 10.1.1.7 (0x03060A010107)
00:26:30: Vi2 IPCP: State is Open
00:26:30: Vi2 IPCP: Install route to 10.1.1.9
00:27:23: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access2, changed state to down
```

## Verification on R8

```
R8#show ip route
```

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

```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    10.1.1.0/24 is directly connected, Virtual-Access1
C    10.1.1.7/32 is directly connected, Virtual-Access1
```

```
R8#ping 10.1.1.7
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.7, timeout is 2 seconds:
```

```
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/19/56 ms
R8#ping 10.1.1.9

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/20/52 ms
R8#
```

**Task 2:** Configure R8 and R9 so the host route does not get installed. Verify that the Hub and other spoke are still reachable.

**Solution:**

Note – The host route is not needed on the point-to-point sub-interface.

**R8 Configuration:**

```
interface Virtual-Template 1
  no peer neighbor-route
!
end
```

**R9 Configuration:**

```
interface Virtual-Template1
  no peer neighbor-route
!
end
```

**Verification on R8:**

```
R8#show ip route
```

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

```
    10.0.0.0/24 is subnetted, 1 subnets
C    10.1.1.0 is directly connected, Virtual-Access1
```

```
R8#ping 10.1.1.7
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.7, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/25/52 ms
R8#ping 10.1.1.9
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 20/26/40 ms

R8#

### Verification on R9:

R9# debug ppp negotiation

00:35:50: %SYS-5-CONFIG\_I: Configured from console by console

00:35:51: %LINK-3-UPDOWN: Interface ATM1/0, changed state to up

00:35:52: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM1/0, changed state to up

00:35:56: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state to up

00:35:56: Vi1 PPP: Using default call direction

00:35:56: Vi1 PPP: Treating connection as a dedicated line

00:35:56: Vi1 PPP: Phase is ESTABLISHING, Active Open [0 sess, 1 load]

00:35:56: Vi1 LCP: O CONFREQ [Closed] id 23 len 10

00:35:56: Vi1 LCP: MagicNumber 0x0D245ACF (0x05060D245ACF)

00:35:56: Vi1 LCP: I CONFREQ [REQsent] id 16 len 10

00:35:56: Vi1 LCP: MagicNumber 0x0B2460F3 (0x05060B2460F3)

00:35:56: Vi1 LCP: O CONFACK [REQsent] id 16 len 10

00:35:56: Vi1 LCP: MagicNumber 0x0B2460F3 (0x05060B2460F3)

00:35:56: Vi1 LCP: I CONFACK [ACKsent] id 23 len 10

00:35:56: Vi1 LCP: MagicNumber 0x0D245ACF (0x05060D245ACF)

00:35:56: Vi1 LCP: State is Open

00:35:56: Vi1 PPP: Phase is UP [0 sess, 1 load]

00:35:56: Vi1 IPCP: O CONFREQ [Closed] id 16 len 10

00:35:56: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)

00:35:56: Vi1 IPCP: I CONFREQ [REQsent] id 16 len 10

00:35:56: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)

00:35:56: Vi1 IPCP: O CONFACK [REQsent] id 16 len 10

00:35:56: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)

00:35:56: Vi1 IPCP: I CONFACK [ACKsent] id 16 len 10

00:35:56: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)

00:35:56: Vi1 IPCP: State is Open

00:35:57: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state to up

R9#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, E - EGP

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

10.0.0.0/24 is subnetted, 1 subnets

**C 10.1.1.0 is directly connected, Virtual-Access1**

R9#ping 10.1.1.7

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.7, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 16/39/48 ms

R9#ping 10.1.1.8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/32/88 ms

R9#

**Task 3:** Configure R7 to provide ip addresses to R8 and R9. Create two pools each with a single address. Change the spoke configuration to request an ip address from R7 and allow the host route to be installed.

### **Solution:**

Note – To complete this task Two virtual-templates are needed, The use of ip unnumbered and an additional loopback interface is needed. Spoke to Spoke communication will now fail as the /24 is no longer assigned to the interface and each spoke is only aware of itself and the hub address

### **R7 Configuration:**

**no interface virtual-template 1**

!

**interface Loopback789**

**ip address 10.1.1.7 255.255.255.0**

no clns route-cache

!

**interface ATM1/0**

no ip address

no atm enable-ilmi-trap

no clns route-cache

!

**interface ATM1/0.789 multipoint**

no atm enable-ilmi-trap

pvc 0/708

encapsulation aal5snap

**protocol ppp Virtual-Template8**

```
!  
pvc 0/709  
encapsulation aal5snap  
protocol ppp Virtual-Template9
```

```
!  
interface Virtual-Template8  
ip unnumbered Loopback789  
peer default ip address pool R8  
!
```

```
interface Virtual-Template9  
ip unnumbered Loopback789  
peer default ip address pool R9  
!
```

```
ip local pool R8 10.1.1.8  
ip local pool R9 10.1.1.9
```

**R8 Configuration:**

```
interface Virtual-Template 1  
ip address negotiated  
peer neighbor-route  
!  
end
```

**R9 Configuration:**

```
interface Virtual-Template 1  
ip address negotiated  
peer neighbor-route  
!  
end
```

**Verification on R7:**

```
00:49:11: Vi2 PPP: Phase is ESTABLISHING [0 sess, 1 load]  
00:50:00: Vi1 LCP: State is Listen  
00:49:11: Vi2 PPP: Phase is UP [0 sess, 1 load]  
00:49:11: Vi2 IPCP: O CONFREQ [Closed] id 5 len 10  
00:49:11: Vi2 IPCP: Address 10.1.1.7 (0x03060A010107)  
00:49:11: Vi2 IPCP: I CONFREQ [REQsent] id 27 len 10  
00:49:11: Vi2 IPCP: Address 0.0.0.0 (0x030600000000)  
00:49:11: Vi2 IPCP: Pool returned 10.1.1.8  
00:49:11: Vi2 IPCP: O CONFNAK [REQsent] id 27 len 10  
00:49:11: Vi2 IPCP: Address 10.1.1.8 (0x03060A010108)  
00:49:11: Vi2 IPCP: I CONFACK [REQsent] id 5 len 10  
00:49:11: Vi2 IPCP: Address 10.1.1.7 (0x03060A010107)  
00:49:11: Vi2 IPCP: I CONFREQ [ACKrcvd] id 28 len 10
```

```
00:49:11: Vi2 IPCP: Address 10.1.1.8 (0x03060A010108)
00:49:11: Vi2 IPCP: O CONFACK [ACKrcvd] id 28 len 10
00:49:11: Vi2 IPCP: Address 10.1.1.8 (0x03060A010108)
00:49:11: Vi2 IPCP: State is Open
00:49:11: Vi2 IPCP: Install route to 10.1.1.8
00:50:00: Vi1 PPP: Missed 5 keepalives, taking LCP down
00:50:00: Vi1 IPCP: State is Closed
00:50:00: Vi1 PPP: Phase is DOWN [0 sess, 1 load]
00:50:00: Vi1 PPP: Phase is ESTABLISHING, Passive Open [0 sess, 1 load]
00:50:00: Vi1 LCP: State is Listen
00:50:00: Vi1 LCP: I CONFREQ [Listen] id 32 len 10
00:50:00: Vi1 LCP: MagicNumber 0x0D3134CD (0x05060D3134CD)
00:50:00: Vi1 LCP: O CONFREQ [Listen] id 25 len 10
00:50:00: Vi1 LCP: MagicNumber 0x0B313ADC (0x05060B313ADC)
00:50:00: Vi1 LCP: O CONFACK [Listen] id 32 len 10
00:50:00: Vi1 LCP: MagicNumber 0x0D3134CD (0x05060D3134CD)
00:50:00: Vi1 LCP: I CONFACK [ACKsent] id 25 len 10
00:50:00: Vi1 LCP: MagicNumber 0x0B313ADC (0x05060B313ADC)
00:50:00: Vi1 LCP: State is Open
00:50:00: Vi1 PPP: Phase is UP [0 sess, 1 load]
00:50:00: Vi1 IPCP: O CONFREQ [Closed] id 5 len 10
00:50:00: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)
00:50:00: Vi1 IPCP: I CONFREQ [REQsent] id 29 len 10
00:50:00: Vi1 IPCP: Address 0.0.0.0 (0x030600000000)
00:50:00: Vi1 IPCP: Pool returned 10.1.1.9
00:50:00: Vi1 IPCP: O CONFNAK [REQsent] id 29 len 10
00:50:00: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)
00:50:00: Vi1 IPCP: I CONFACK [REQsent] id 5 len 10
00:50:00: Vi1 IPCP: Address 10.1.1.7 (0x03060A010107)
00:50:00: Vi1 IPCP: I CONFREQ [ACKrcvd] id 30 len 10
00:50:00: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)
00:50:00: Vi1 IPCP: O CONFACK [ACKrcvd] id 30 len 10
00:50:00: Vi1 IPCP: Address 10.1.1.9 (0x03060A010109)
00:50:00: Vi1 IPCP: State is Open
00:50:00: Vi1 IPCP: Install route to 10.1.1.9
```

```
R7#show ip route
```

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

```
10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
```

```
C 10.1.1.8/32 is directly connected, Virtual-Access2
```

```
C 10.1.1.9/32 is directly connected, Virtual-Access1
```

```
C 10.1.1.0/24 is directly connected, Loopback789
```

```
R7#ping 10.1.1.8
```

```
Type escape sequence to abort.
```

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

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

R7#ping 10.1.1.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/12 ms

R7#

### Verification on R8

R8#show ip route

Gateway of last resort is not set

10.0.0.0/32 is subnetted, 2 subnets

C 10.1.1.8 is directly connected, Virtual-Access1

C 10.1.1.7 is directly connected, Virtual-Access1

R8#ping 10.1.1.7

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.7, timeout is 2 seconds:

!!!!

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

R8#ping 10.1.1.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

.....

Success rate is 0 percent (0/5)

**Task 4:** One each spoke add a static host route to the other Spokes address.

### Solution:

#### R8 Configuration:

```
ip route 10.1.1.9 255.255.255.255 10.1.1.7
```

#### R9 Configuration:

```
ip route 10.1.1.8 255.255.255.255 10.1.1.7
```

**Verification on R8:**

```
R8(config)#do show ip route
```

Gateway of last resort is not set

10.0.0.0/32 is subnetted, 3 subnets

```
C 10.1.1.8 is directly connected, Virtual-Access1
```

```
S 10.1.1.9 [1/0] via 10.1.1.7
```

```
C 10.1.1.7 is directly connected, Virtual-Access1
```

```
R8(config)#do ping 10.1.1.9
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/24/52 ms

```
R8(config)#
```

**Verification on R9:**

```
R9(config)#do show ip route
```

Gateway of last resort is not set

10.0.0.0/32 is subnetted, 3 subnets

```
S 10.1.1.8 [1/0] via 10.1.1.7
```

```
C 10.1.1.9 is directly connected, Virtual-Access1
```

```
C 10.1.1.7 is directly connected, Virtual-Access1
```

```
R9(config)#do ping 10.1.1.8
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 16/34/56 ms

```
R9(config)#
```

**Task 5:** Reconfigure the R7 so all previous tasks are performed without using a Virtual-Template.

**Solution:**

Note – If a Virtual-Template cannot be used, the alternative is a dialer.

**R7 Configuration:**

```
interface ATM1/0.789 multipoint
no atm enable-ilmi-trap
pvc 0/708
encapsulation aal5snap
protocol ppp dialer
dialer pool-member 8
!
pvc 0/709
encapsulation aal5snap
protocol ppp dialer
dialer pool-member 9
!
interface Dialer8
ip unnumbered Loopback789
encapsulation ppp
dialer pool 8
dialer-group 1
peer default ip address pool R8
no clns route-cache
!
interface Dialer9
ip unnumbered Loopback789
encapsulation ppp
dialer pool 9
dialer-group 1
peer default ip address pool R9
no clns route-cache
!
ip local pool R8 10.1.1.8
ip local pool R9 10.1.1.9
!
dialer-list 1 protocol ip permit
```

### Verification on R7:

```
R7#show ip route
```

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

```
10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C    10.1.1.8/32 is directly connected, Dialer8
C    10.1.1.9/32 is directly connected, Dialer9
C    10.1.1.0/24 is directly connected, Loopback789
```

```
R7#ping 10.1.1.8
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/16/32 ms
R7#ping 10.1.1.9

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/13/20 ms
R7#
```

**Task 6:** R7 should authenticate R8 using pap, and R9 using chap. The spokes should use their hostname for authentication and cisco as the password.

**Solution:**

**R7 Configuration:**

```
username R8 password 0 cisco
username R9 password 0 cisco
!
interface Dialer8
 ip unnumbered Loopback789
 ppp authentication pap
!
interface Dialer9
 ppp authentication chap
!
end
```

**R8 Configuration:**

```
interface Virtual-Template1
 ppp pap sent-username R8 password 0 cisco
!
end
```

**R9 Configuration:**

```
interface Virtual-Template1
 ppp chap hostname R9
 ppp chap password 0 cisco
!
end
```

**Verification on R7:**

**01:21:50: Vi2 PAP: I AUTH-REQ id 1 len 13 from "R8"**

**01:21:50: Vi2 PAP: Authenticating peer R8**

**01:21:50: Vi2 PAP: O AUTH-ACK id 1 len 5**

**01:21:51: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access2, changed state to up**

01:21:51: Vi3 CHAP: O CHALLENGE id 10 len 23 from "R7"

01:21:55: Vi3 CHAP: O CHALLENGE id 11 len 23 from "R7"

01:21:59: Vi3 CHAP: O CHALLENGE id 12 len 23 from "R7"

01:22:02: Vi3 CHAP: O CHALLENGE id 13 len 23 from "R7"

01:22:04: Vi3 CHAP: O CHALLENGE id 14 len 23 from "R7"

01:22:06: Vi3 CHAP: O CHALLENGE id 15 len 23 from "R7"

**01:22:08: Vi3 CHAP: O CHALLENGE id 16 len 23 from "R7"**

**01:22:08: Vi3 CHAP: I RESPONSE id 16 len 23 from "R9"**

**01:22:08: Vi3 CHAP: O SUCCESS id 16 len 4**

**01:22:09: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access3, changed state to up**

R7#ping 10.1.1.8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.8, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/16/32 ms

R7#ping 10.1.1.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/13/20 ms

R7#

**Lab completed, Erase config and continue to next lab.**

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