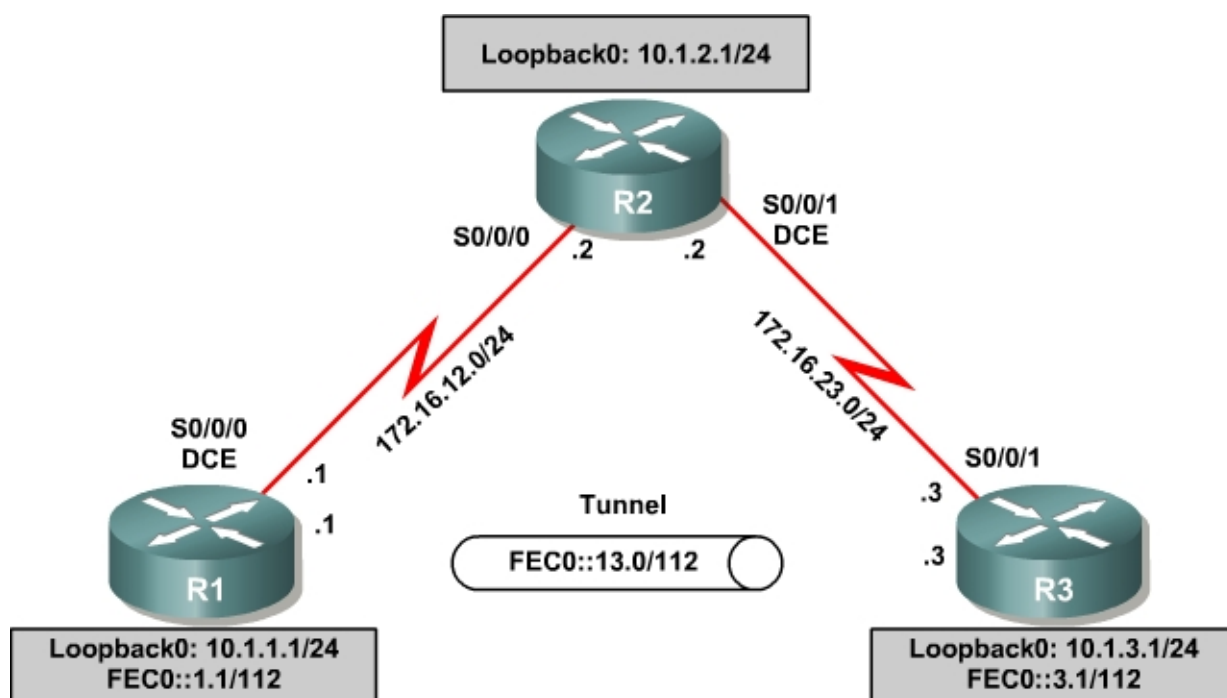


Lab 8-2 Using Manual IPv6 Tunnels

Learning Objectives

- Configure EIGRP for IPv4
- Create a manual IPv6 tunnel
- Configure OSPFv3

Topology Diagram



Scenario

For this lab, you will configure EIGRP for full connectivity between all IPv4 subnets. Then you will create a manual IPv6 tunnel and run OSPFv3 over it.

Step 1: Lab Preparation

Start this lab by clearing out your configurations and reloading your routers. Once your routers are reloaded, set up the appropriate hostnames.

Step 2: Configure Loopbacks and Physical Interfaces

Configure the loopback interfaces with IPv4 addresses and IPv6 addresses where appropriate. Also configure the serial interfaces with the IPv4 addresses

shown in the diagram. Set the clockrates on the appropriate interfaces and issue **no shutdown** on all serial connections. Verify that you have local subnet connectivity with **ping**.

```
R1(config)# interface loopback0
R1(config-if)# ip address 10.1.1.1 255.255.255.0
R1(config-if)# ipv6 address FEC0::1:1/112
R1(config-if)# interface serial0/0/0
R1(config-if)# ip address 172.16.12.1 255.255.255.0
R1(config-if)# clockrate 64000
R1(config-if)# no shutdown

R2(config)# interface loopback0
R2(config-if)# ip address 10.1.2.1 255.255.255.0
R2(config-if)# interface serial0/0/0
R2(config-if)# ip address 172.16.12.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# interface serial0/0/1
R2(config-if)# ip address 172.16.23.2 255.255.255.0
R2(config-if)# clockrate 64000
R2(config-if)# no shutdown

R3(config)# interface loopback0
R3(config-if)# ip address 10.1.3.1 255.255.255.0
R3(config-if)# ipv6 address FEC0::3:1/112
R3(config-if)# interface serial0/0/1
R3(config-if)# ip address 172.16.23.3 255.255.255.0
R3(config-if)# no shutdown
```

Step 3: Configure EIGRP

Configure EIGRP for AS 1 for the major networks 172.16.0.0 and 10.0.0.0 on all three routers. Make sure you disable auto-summarization. You should have full IPv4 connectivity after this.

```
R1(config)# router eigrp 1
R1(config-router)# no auto-summary
R1(config-router)# network 10.0.0.0
R1(config-router)# network 172.16.0.0

R2(config)# router eigrp 1
R2(config-router)# no auto-summary
R2(config-router)# network 10.0.0.0
R2(config-router)# network 172.16.0.0

R3(config)# router eigrp 1
R3(config-router)# no auto-summary
R3(config-router)# network 10.0.0.0
R3(config-router)# network 172.16.0.0
```

Step 4: Configure a Manual IPv6 Tunnel

A tunnel is a logical interface that acts as a logical connection between two endpoints. It is similar to a loopback interface in that there is no corresponding physical interface, but it is different in that there is more than one router involved. An IPv6 manual tunnel is a type of tunnel that has hard-coded source and destination addresses, with an IPv6 address on the tunnel itself. To

configure a manual IPv6 tunnel, first issue the **interface tunnel number** command. For simplicity, use tunnel number 0 on both routers.

Next configure the tunnel mode for a manual tunnel with the **tunnel mode ipv6ip** command. Then configure an IPv6 address with the **ipv6 address address/mask** command. Finally, assign source and destination addresses for the tunnel using the **tunnel source address** and **tunnel destination address** commands. You can also specify the source by interface.

```
R1(config)# int tunnel0
R1(config-if)# tunnel mode ipv6ip
R1(config-if)# tunnel source s0/0/0
R1(config-if)# tunnel destination 172.16.23.3
R1(config-if)# ipv6 add FEC0::13:1/112
```

```
R3(config)# int tunnel0
R3(config-if)# tunnel mode ipv6ip
R3(config-if)# tunnel source s0/0/1
R3(config-if)# tunnel destination 172.16.12.1
R3(config-if)# ipv6 add FEC0::13:3/112
```

Verify that you can ping across the tunnel to the other side.

```
R1#ping FEC0::13:3
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/66/68 ms
```

```
R3#ping FEC0::13:1
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/66/68 ms
```

Step 5: Configure OSPFv3 over a Tunnel

Enable IPv6 routing with the **ipv6 unicast-routing** command on R1 and R3. Configure OSPFv3 on those routers to run over the tunnel and advertise the loopback interfaces into OSPFv3. Verify the configuration using the **show ipv6 ospf neighbor** command and verifying that you can ping the remote loopback interfaces.

```
R1(config)# ipv6 unicast-routing
R1(config)# interface loopback0
R1(config-if)# ipv6 ospf 1 area 0
R1(config-if)# interface tunnel0
R1(config-if)# ipv6 ospf 1 area 0
```

```
R3(config)# ipv6 unicast-routing
R3(config)# interface loopback0
R3(config-if)# ipv6 ospf 1 area 0
R3(config-if)# interface tunnel0
R3(config-if)# ipv6 ospf 1 area 0
```

```
R1#show ipv6 ospf neighbor
```

Neighbor ID	Pri	State		Dead Time	Interface ID	Interface
10.1.3.1	1	FULL/	-	00:00:37	18	Tunnel0

```
R3#show ipv6 ospf neighbor
```

Neighbor ID	Pri	State		Dead Time	Interface ID	Interface
10.1.1.1	1	FULL/	-	00:00:39	21	Tunnel0

```
R1#ping FEC0::3:1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to FEC0::3:1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/64/68 ms

```
R3#ping FEC0::1:1
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to FEC0::1:1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/66/68 ms

Appendix A: TCL Script Output

```
tclsh
```

```
foreach address {  
10.1.1.1  
10.1.2.1  
10.1.3.1  
172.16.12.1  
172.16.12.2  
172.16.23.2  
172.16.23.3  
FEC0::1:1  
FEC0::3:1  
FEC0::13:1  
FEC0::13:3  
} {  
ping $address }
```

```
R1#tclsh
```

```
R1(tcl)#  
R1(tcl)#foreach address {  
+>(tcl)#10.1.1.1  
+>(tcl)#10.1.2.1  
+>(tcl)#10.1.3.1  
+>(tcl)#172.16.12.1  
+>(tcl)#172.16.12.2  
+>(tcl)#172.16.23.2  
+>(tcl)#172.16.23.3  
+>(tcl)#FEC0::1:1  
+>(tcl)#FEC0::3:1  
+>(tcl)#FEC0::13:1  
+>(tcl)#FEC0::13:3  
+>(tcl)#} {  
+>(tcl)#ping $address }
```

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.2.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.3.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/57/64 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::1:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/4 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::3:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/66/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/68/80 ms
R1(tcl)#tcquit

```

```

R2#tcslsh
R2(tcl)#
R2(tcl)#foreach address {
+>(tcl)#10.1.1.1
+>(tcl)#10.1.2.1
+>(tcl)#10.1.3.1
+>(tcl)#172.16.12.1
+>(tcl)#172.16.12.2
+>(tcl)#172.16.23.2
+>(tcl)#172.16.23.3
+>(tcl)#FEC0::1:1
+>(tcl)#FEC0::3:1
+>(tcl)#FEC0::13:1
+>(tcl)#FEC0::13:3
+>(tcl)#} {
+>(tcl)#ping $address }

```

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.2.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.3.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/58/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/57/64 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms%
Unrecognized host or address, or protocol not running.
% Unrecognized host or address, or protocol not running.
% Unrecognized host or address, or protocol not running.
% Unrecognized host or address, or protocol not running.
R2(tcl)#tclquit

R3#tclsh
R3(tcl)#
R3(tcl)#foreach address {
+>(tcl)#10.1.1.1
+>(tcl)#10.1.2.1
+>(tcl)#10.1.3.1
+>(tcl)#172.16.12.1
+>(tcl)#172.16.12.2
+>(tcl)#172.16.23.2
+>(tcl)#172.16.23.3
+>(tcl)#FEC0::1:1
+>(tcl)#FEC0::3:1
+>(tcl)#FEC0::13:1
+>(tcl)#FEC0::13:3
+>(tcl)#} {
+>(tcl)#ping $address }

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.2.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.3.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

```

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.12.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/32/52 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.23.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/57/64 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::1:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/67/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::3:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/67/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FEC0::13:3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
R3(tcl)#tclquit

```

Final Configurations

```

R1#show run
hostname R1
!
ipv6 unicast-routing
!
interface Tunnel0
 no ip address
 ipv6 address FEC0::13:1/112
 ipv6 ospf 1 area 0
 tunnel source Serial0/0/0
 tunnel destination 172.16.23.3
 tunnel mode ipv6ip
!
interface Loopback0
 ip address 10.1.1.1 255.255.255.0
 ipv6 address FEC0::1:1/112
 ipv6 ospf 1 area 0
!
interface Serial0/0/0
 ip address 172.16.12.1 255.255.255.0
 clock rate 64000
 no shutdown
!
router eigrp 1
 network 10.0.0.0
 network 172.16.0.0
 no auto-summary

```

```
!  
ipv6 router ospf 1  
!  
end
```

```
R2#show run  
hostname R2  
!  
interface Loopback0  
 ip address 10.1.2.1 255.255.255.0  
!  
interface Serial0/0/0  
 ip address 172.16.12.2 255.255.255.0  
 no shutdown  
!  
interface Serial0/0/1  
 ip address 172.16.23.2 255.255.255.0  
 clock rate 64000  
 no shutdown  
!  
router eigrp 1  
 network 10.0.0.0  
 network 172.16.0.0  
 no auto-summary  
end
```

```
R3#show run  
hostname R3  
!  
ipv6 unicast-routing  
!  
interface Loopback0  
 ip address 10.1.3.1 255.255.255.0  
 ipv6 address FEC0::3:1/112  
 ipv6 ospf 1 area 0  
!  
interface Tunnel0  
 no ip address  
 ipv6 address FEC0::13:3/112  
 ipv6 ospf 1 area 0  
 tunnel source Serial0/0/1  
 tunnel destination 172.16.12.1  
 tunnel mode ipv6ip  
!  
interface Serial0/0/1  
 ip address 172.16.23.3 255.255.255.0  
 no shutdown  
!  
router eigrp 1  
 network 10.0.0.0  
 network 172.16.0.0  
 no auto-summary  
!  
ipv6 router ospf 1  
!  
end
```