6DISS

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Router Configuration #2

(continued)

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Laboratory Exercise: *IPv6 Router's configuration #2 (continued)*

Objectives

In this laboratory exercise you will complete the following tasks:

- *Create IPv6 over IPv4 tunnels*

Visual Objective

The following figure shows the configuration of the current laboratory:

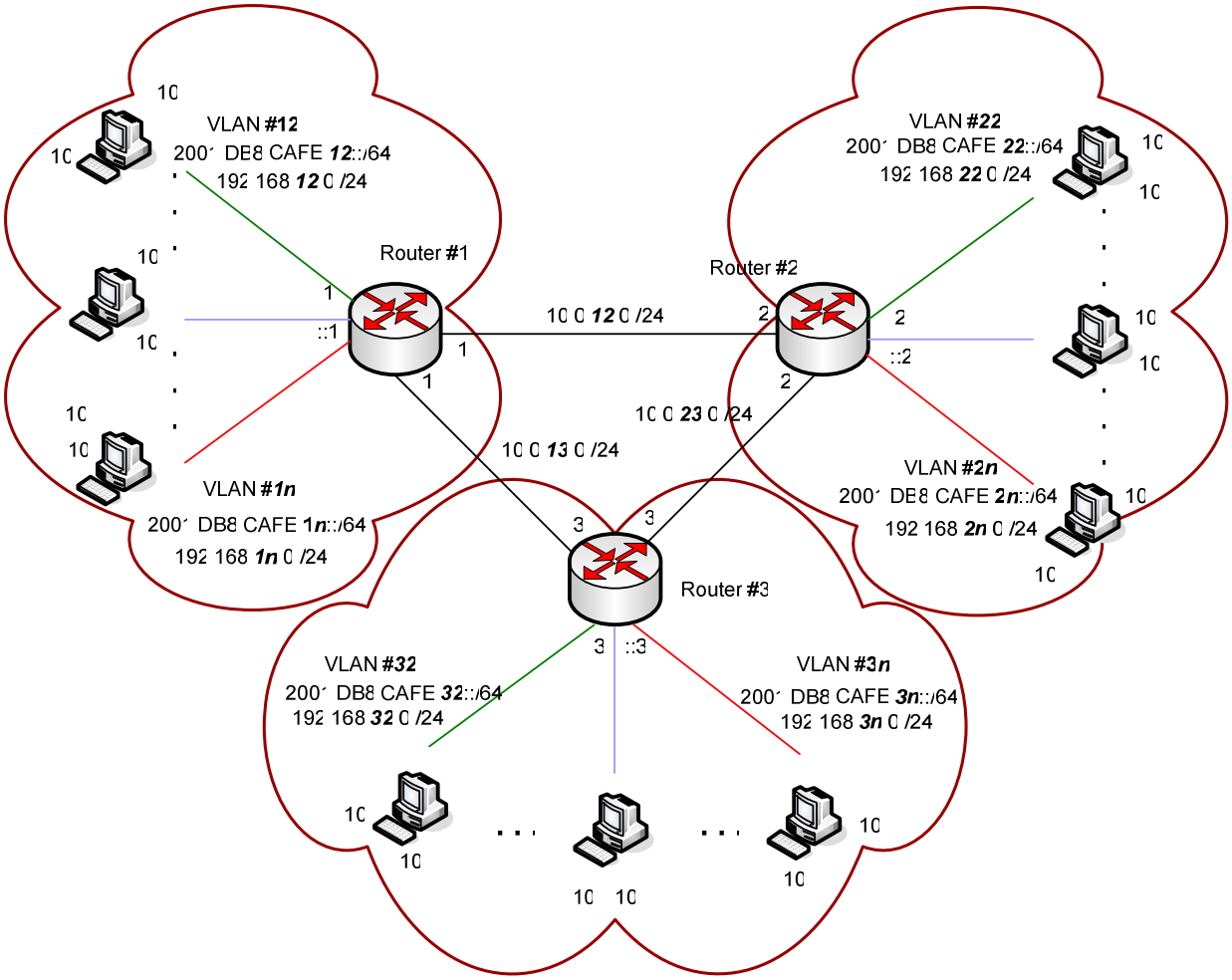

Figure 1: Scenario Topology

Setup/Scenario

*This scenario is very similar to the previous scenario (Router configuration #2). In this case the 3 routers are connected to each other using **ONLY** IPv4 addresses. This means that we have 3 IPv6 islands connected via IPv4, as show in the following tables:*

Router 1:

Interface	Address	Connects to
FastEthernet **0**	10.0.***12***.1 /24	Router 2 (fe 0)
FastEthernet **1**	10.0.***13***.1 /24	Router 3 (fe 0)

Table 1: router 1 interfaces

Router 2:

Interface	Address	Connects to
FastEthernet **0**	10.0.***12***.2 /24	Router 1 (fe 0)
FastEthernet **1**	10.0.***23***.2 /24	Router 3 (fe 1)

Table 2: router 2 interfaces

Router 3:

Interface	Address	Connects to
FastEthernet **0**	10.0.***13***.3 /24	Router 1 (fe 1)
FastEthernet **1**	10.0.***23***.3 /24	Router 2 (fe 1)

Table 3: router 3 interfaces

Check if your router is configured according to the previous tables. If it isn't please call one of the trainers

Through the scenario we are also going to use the term twin hosts. We'll use this term when referring to hosts on an equal PORT number but on a different router. E.g. these 3 hosts are twin hosts:

2001:DB8:CAFE:***12***::10 (Router **1**, PORT **2**- > VLAN ***12***)

2001:DB8:CAFE:***22***::10 (Router **2**, PORT **2**- > VLAN ***22***)

2001:DB8:CAFE:***32***::10 (Router **3**, PORT **2**- > VLAN ***32***)

The IPv4 routes are already configured so you should be able to connect, via IPv4, hosts on the different networks. But you don't have IPv6 connectivity between the different routers.

*Your IPv4 address is assigned by DHCPv4. Verify your PC's IPv6 address. Check if you have one manually configured address on the correct VLAN and with the host part equal to ::10. I.e. with the following format: 2001:DB8:CAFE:**vlan_number**::**10.** If you don't have one, please configure it. This is very IMPORTANT!!!*

Task 1: *Configure IPv6 over IPv4 tunnels*

Complete the following exercise's steps:

Step 1: Check connectivity

Check if you have IPv4 connectivity with your twin hosts. E.g. the host 192.168.***12***.10 should test connectivity with the following hosts: 192.168.***22***.10 and 192.168.***32***.10.

Now verify that you don't have IPv6 connectivity towards your twin hosts. E.g. the host 2001:DB8:CAFE:***12***::10 should test connectivity with the following hosts: 2001:DB8:CAFE:***22***::10 and 2001:DB8:CAFE:***32***::10.

Step 2: Add IPv6 over IPv4 tunnels

Each group should configure two IPv6 over IPv4 tunnels. In order to connect to theirs twin hosts. E.g. the group on the host 2001:DB8:CAFE:***22***::10 should configure a tunnel to the following networks:

- 2001:DB8:CAFE:***12***::/64

- 2001:DB8:CAFE:***32***::/64

On Figure 2 you can visualize a possible tunnel between network 2001:DB8:CAFE:***12***::/64 and network 2001:DB8:CAFE:***22***::/64

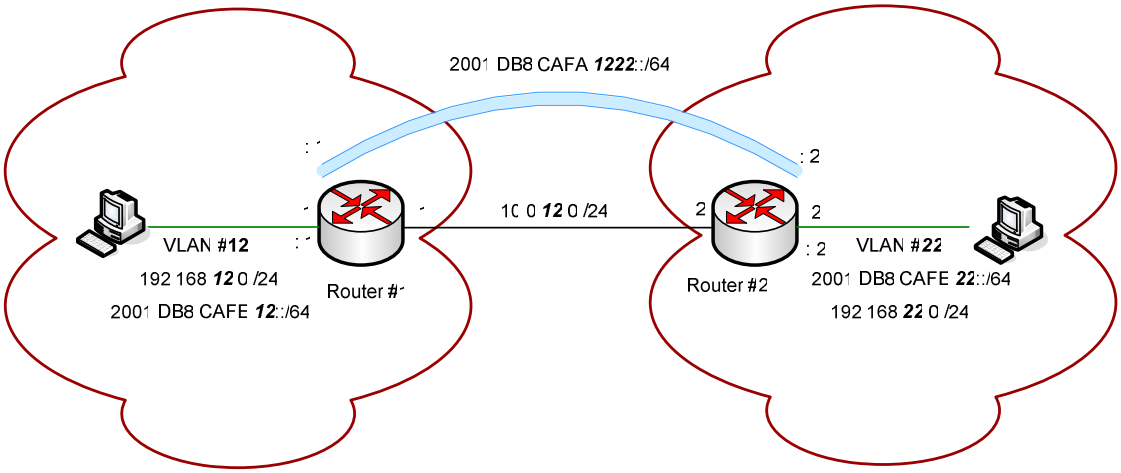

Figure 2: IPv6 over IPv4 tunnel between Router 1 and Router2

Tunnel's creation involves more commands than previous exercises. So, we are going to provide you the commands you need to type on the router in order to configure an IPv6 over IPv4 tunnel:

1. **`enable`**
2. **`configure terminal`**
3. **`interface tunnel`** `tunnel-number`
   (This will initiate the tunnel's creation. You must replace the `tunnel-number`, with your VLAN number concatenated with your twin host VLAN (The lower VLAN's value should go first).
   E.g.1 consider VLAN=***22,*** for your twin host on VLAN=***12***. The tunnel number should be ***1222*** (instead of *2212).*
   E.g.2 consider VLAN=***23***, for your twin host on VLAN=***33***. The tunnel number should be ***2333***)

4. **`tunnel source`** `ipv4-address`
   (You must assign the correct IPv4 address to your side of the tunnel. So, the source address must be the router's interface address on your VLAN (by other words your IPv4 default gateway)

5. **`tunnel destination`** `ipv4-address`
   (Next, you must indicate, as an IPv4 address, where will be the other side of the tunnel. In this case, the destination address must be the router's interface address on your twin host VLAN (by other words the twin host IPv4 default gateway)

6. **`ipv6 address`** `ipv6-prefix/prefix-length`

(Afterwards, you must assign an IPv6 address to your side of the tunnel. For this, use the following format:
2001:DB8:CAFA:**`tunnel_number`**::**`router_number`**/64

For example, you are on network 2001:DB8:CAFE:***12***::/64 and you are configuring a tunnel to 2001:DB8:CAFE:***22***::/64 network. Your tunnel number is **1222** and you are on router **1**. Therefore, the IPv6 address you will assign to your sideof the tunnel will be: 2001:DB8:CAFA:**1222**::**1**/64.

7. **`tunnel mode`** `ipv6ip`
(Finally designate the tunnel mode)

Step 3: Check if the tunnels are correctly configured

Before you proceed, you must check if both tunnels you have just configured (and by your twin hosts) are correctly configured.

From the router and using IPv6 addresses, ping both sides, of each tunnel you have just created. If the ping result was successful then the tunnels are correctly configured.

Step 4: Create the correspondent static routes to the tunnel interface

- Assuming you have the tunnels correctly configure, from your host try to ping your twin hosts. Did you succeed?

- Now, display your router's current IPv6 routing table (**Tip:** `router`***`X`***`#` **`show ipv6 …`**). As you can notice, even if you have a proper tunnel, there's no IPv6 route to your twin host network.

  Add the static routes to your twin hosts' networks. Use the tunnel addresses as the destination, for this purpose.
  (**Tip:** `router`*`X`*`#` **`ipv6 route`** `prefix/prefixlen next_hop`).

  For example**,** you are on VLAN **12** and you configured a tunnel to VLAN **22** (your tunnel number is **1222** and you are on router **1**) you have to configure a static route to 2001:DB8:CAFE:1222::2/64

```
Router1(config)#ipv6 route 2001:db8:cafe:22::/64 2001:db8:cafa:1222::2
```

Step 5: Display IPv6 tunnel information

Check IPv6 tunnel information
(**Tip:** router***X#*** **`show interfaces tunnel …`***)*

Summary

After completing these exercises, you should be able to:

- *Create IPv6 over IPv4 tunnels*

Appendix A

Task 1

Step 2: Add IPv6 over IPv4 tunnels

Example: Let's configure IPv6 over IPv4 tunnels between the following VLANs:

- 2001:DB8:CAFE:***18***::/64
- 2001:DB8:CAFE:***28***::/64
- 2001:DB8:CAFE:***38***::/64

On router 1:

(Tunnel between 2001:DB8:CAFE:***18***::/64 and 2001:DB8:CAFE:***28***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 1828
Router(config-if)# tunnel source 10.0.12.1/24
Router(config-if)# tunnel destination 10.0.12.2/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:1828::1/64
Router(config-if)# tunnel mode ipv6ip
```

(Tunnel between 2001:DB8:CAFE:***18***::/64 and 2001:DB8:CAFE:***38***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 1838
Router(config-if)# tunnel source 10.0.13.1/24
Router(config-if)# tunnel destination 10.0.13.3/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:1838::1/64
Router(config-if)# tunnel mode ipv6ip
```

On router 2:

(Tunnel between 2001:DB8:CAFE:***28***::/64 and 2001:DB8:CAFE:***18***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 1828
Router(config-if)# tunnel source 10.0.12.2/24
Router(config-if)# tunnel destination 10.0.12.1/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:1828::2/64
Router(config-if)# tunnel mode ipv6ip
```

(Tunnel between 2001:DB8:CAFE:***28***::/64 and 2001:DB8:CAFE:***38***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 2838
Router(config-if)# tunnel source 10.0.23.2/24
Router(config-if)# tunnel destination 10.0.23.3/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:2838::2/64
Router(config-if)# tunnel mode ipv6ip
```

On router 3:

(Tunnel between 2001:DB8:CAFE:***38***::/64 and 2001:DB8:CAFE:***18***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 1838
Router(config-if)# tunnel source 10.0.13.3/24
Router(config-if)# tunnel destination 10.0.13.1/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:1838::3/64
Router(config-if)# tunnel mode ipv6ip
```

(Tunnel between 2001:DB8:CAFE:***28***::/64 and 2001:DB8:CAFE:***38***::/64**)**

```
Router1# configure terminal
Router1(config)# interface tunnel 2838
Router(config-if)# tunnel source 10.0.23.3/24
Router(config-if)# tunnel destination 10.0.23.2/24
Router(config-if)# ipv6 address 2001:DB8:CAFA:2838::3/64
Router(config-if)# tunnel mode ipv6ip
```

Step 3: Check if the tunnels are correctly configured

Example: To check if the tunnel between 2001:DB8:CAFE:***18***::/64 and 2001:DB8:CAFE:***28***::/64 is correctly configured, let's ping both sides of the tunnel.

```
Router1# ping 2001:db8:cafa:1828::1
   Type escape sequence to abort.
   Sending 5, 100-byte ICMP Echos to 2001:DB8:CAFA:1828::1, timeout is 2
   seconds:
   !!!!!
   Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/4 ms


Router1#ping 2001:db8:cafa:1828::2
   Type escape sequence to abort.
   Sending 5, 100-byte ICMP Echos to 2001:DB8:CAFA:1828::2, timeout is 2
   seconds:
   !!!!!
   Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/4 ms
```

Both sides are responding, so, the tunnel is correctly configured.

Step 4: Create the correspondent static routes to the tunnel interface

Output example from router 1 IPv6 routing table:

```
Router1#show ipv6 route
   IPv6 Routing Table - 4 entries
   Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
          U - Per-user Static route
          I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
          O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext
   2
          ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
   C   2001:DB8:CAFE:18::/64 [0/0]
        via ::, Vlan18
   L   2001:DB8:CAFE:18::1/128 [0/0]
        via ::, Vlan18
   L   FE80::/10 [0/0]
        via ::, Null0
   L   FF00::/8 [0/0]
        via ::, Null0
```

As you can see there's no route for your twin hosts VLANs.

Now let's configure the static routes:

On router 1:

(route to 2001:DB8:CAFE:***28***::/64**)**

```
Router1# configure terminal
Router1(config)# ipv6 route 2001:db8:cafe:28::/64 2001:db8:cafa:1828::2
```

(route to 2001:DB8:CAFE:***38***::/64**)**

```
Router1# configure terminal
Router1(config)# ipv6 route 2001:db8:cafe:38::/64 2001:db8:cafa:1838::3
```

On router 2:

(route to 2001:DB8:CAFE:***18***::/64**)**

```
Router2# configure terminal
Router2(config)# ipv6 route 2001:db8:cafe:18::/64 2001:db8:cafa:1828::1
```

(route to 2001:DB8:CAFE:***38***::/64**)**

```
Router2# configure terminal
```

```
Router2(config)# ipv6 route 2001:db8:cafe:38::/64 2001:db8:cafa:2838::3
```

On router 3:

(route to 2001:DB8:CAFE:***18***::/64**)**

```
Router3# configure terminal
Router3(config)# ipv6 route 2001:db8:cafe:18::/64 2001:db8:cafa:1838::1
```

(route to 2001:DB8:CAFE:***28***::/64**)**

```
Router3# configure terminal
Router3(config)# ipv6 route 2001:db8:cafe:28::/64 2001:db8:cafa:2838::2
```

Now that we have the routes let's check the routing table from router 1:

```
Router1#sh ipv6 route
IPv6 Routing Table - 7 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext
2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2001:DB8:CAFA:1828::/64 [0/0]
     via ::, Tunnel1828
L   2001:DB8:CAFA:1828::1/128 [0/0]
     via ::, Tunnel1828
S   2001:DB8:CAFE:28::/64 [1/0]
     via 2001:DB8:CAFA:1828::2
S   2001:DB8:CAFE:38::/64 [1/0]
     via 2001:DB8:CAFA:1838::3
C   2001:DB8:CAFE:12::/64 [0/0]
     via ::, Vlan12
L   2001:DB8:CAFE:12::1/128 [0/0]
     via ::, Vlan12
L   FE80::/10 [0/0]
     via ::, Null0
L   FF00::/8 [0/0]
     via ::, Null0
```