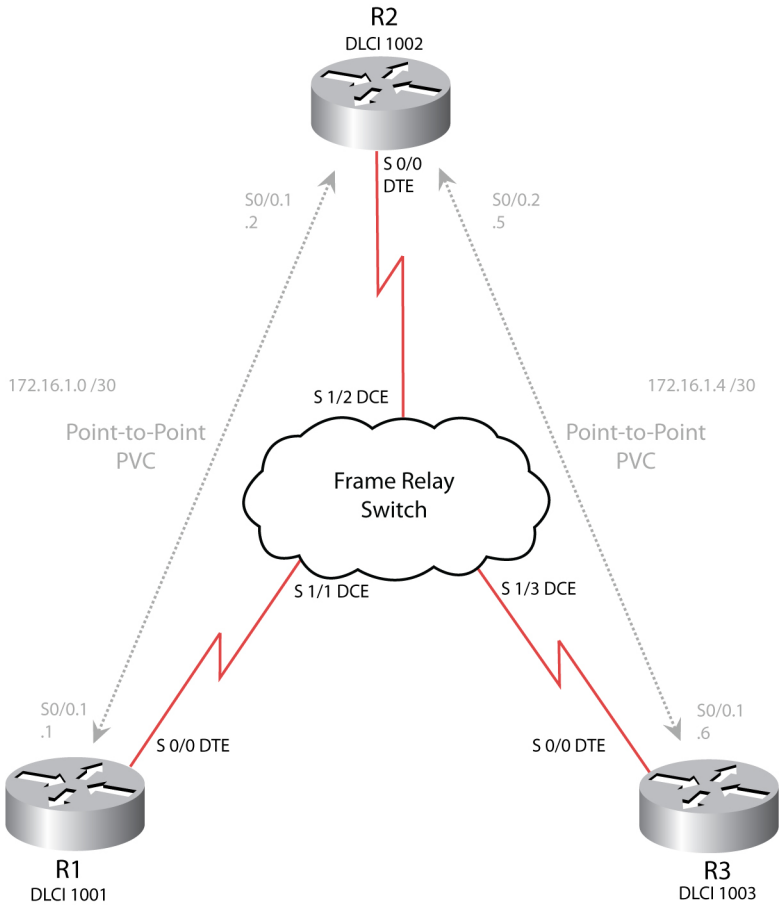
Frame Relay with 2 PVCs in different subnet Tutorial

(By Angel Cool; January 28, 2010)



Topology Layout

Introduction

In part 1 of this tutorial we will configure 3 routers connected in a hub and spoke topology through a Frame Relay network. We will start by configuring the layer 2 settings (Frame Relay) on the Frame Relay switch and the end routers (R1,R2,R3); after the layer 2 configuration is up and running , we can configure the layer 3 (IP) in the 3 end routers.

NOTE: The Frame Relay cloud is just another router, what makes it especial is the fact that it has several serial interfaces and that we will configure it to run Frame Relay switching. A Cisco 2520 or a 2600 with a NM-4T routers will function for this tutorial.

In part 2 we will configure RIPv2, OSPF and EIGRP to route among R1,R2 and R3; interface loopbacks will be set to represent networks to be routed.

PART I.- Layer 2 (Frame Relay) and Layer 3 (IP) configuration

Configuration Steps

1.-We will first have to enable Frame Relay switching (only needs to be done in the Frame Relay switch):

FR-Switch(config)#**frame-relay switching**

2.-We can now configure the serial interfaces in the Frame Relay switch that will connect to the end routers; these interfaces will be the DCEs, so we need to specify the clock rate and the fact that they will be DCEs. Finally, we need to specify the layer 2 switching:

FR-Switch(config)#**interface Serial 1/1**
FR-Switch(config-if)#**no shut**
FR-Switch(config-if)#**clock rate 128000**
FR-Switch(config-if)#**encapsulation frame-relay**
FR-Switch(config-if)# **frame-relay intf-type dce**
FR-Switch(config-if)#**frame-relay route 1002 interface Serial1/2 1001**

FR-Switch(config)#i**nterface Serial 1/2**
FR-Switch(config-if)#**no shut**
FR-Switch(config-if)#**clock rate 128000**
FR-Switch(config-if)#**encapsulation frame-relay**
FR-Switch(config-if)#**frame-relay intf-type dce**
FR-Switch(config-if)#**frame-relay route 1001 interface Serial1/1 1002**
FR-Switch(config-if)#**frame-relay route 1003 interface Serial1/3 1002**

FR-Switch(config)#**interface Serial 1/3**
FR-Switch(config-if)#**no shut**
FR-Switch(config-if)#**clock rate 128000**
FR-Switch(config-if)#**encapsulation frame-relay**
FR-Switch(config-if)#**frame-relay intf-type dce**
FR-Switch(config-if)#**frame-relay route 1002 interface Serial1/2 1003**

The **frame-relay route** command specifies how the router connected to this interface can reach other routers. For example, the last command (*frame-relay route 1002 interface Serial1/2 1003*) tells R3 to reach the router with the DLCI of 1002 through Serial1/2; in turn, the router connected to Serial1/2 will see R3 as having a DLCI of 1003. At this point we can issue the command **show frame-relay route** in the router to see the DLCIs routing settings.

3.- We can now configure the end routers (R1,R2 and R3) for layer 2 Frame Relay support:

R1(config)#**interface Serial 0/0**
R1(config-if)#**no shut**
R1(config-if)#**encapsulation frame-relay**

R2(config)#**interface Serial 0/0**
R2(config-if)#**no shut**
R2(config-if)#**encapsulation frame-relay**

R3(config)#**interface Serial 0/0**
R3(config-if)#**no shut**
R3(config-if)#**encapsulation frame-relay**

After enabling Frame Relay in all end routers, we should have an up/up state for the interfaces' status/protocol and we should have a PVC table in each end, this information was supplied by the Frame Relay switch (if LMI is present), and can be seeing with the global configuration command: **show frame-relay pvc**.

4.- After being able to receive the DLCIs from the Frame Realay switch, we can configure the R1, R2 and R3 with layer 3 IP addresses; as illustrated by the topology figure, each PVC will be in a different subnet, we will use point to point subinterfaces to accomplish this:

```
R1(config)# interface Serial0/0.1 point-to-point
R1(config-if)# ip address 172.16.1.1 255.255.255.252
R1(config-if)# frame-relay interface-dlci 1002

R2(config)# interface Serial0/0.1 point-to-point
R2(config-if)# ip address 172.16.1.2 255.255.255.252
R2(config-if)# frame-relay interface-dlci 1001

R2(config)# interface Serial0/0.2 point-to-point
R2(config-if)# ip address 172.16.1.5 255.255.255.252
R2(config-if)# frame-relay interface-dlci 1003

R3(config)# interface Serial0.1 point-to-point
R3(config-if)# ip address 172.16.1.6 255.255.255.252
R3(config-if)# frame-relay interface-dlci 1002
```

Once the above configuration has been setup we should be able to ping R1 and R3 from R2:

```
R2#ping 172.16.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/29/32 ms
R2#ping 172.16.1.6

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/29/32 ms
R2#
```

Other show commands of interests that can be executed in R2 are : **show frame-relay map** and **show frame-relay pvc**; upon successfully pinging R1 and R3 from R2 we have completed part 1 of this tutorial.

PART II.- Routing Protocol Configuration Through Frame Relay Cloud

This tutorial will demonstrate how to configure RIPv2, OSPF and EIGRP to route networks using the Frame Relay cloud configured in part 1. We need to setup some loopback interfaces in R1 and R2 to emulate subnets to route.

```
R1(config)# int loopback 1
R1(config-if)# ip address 192.168.100.1 255.255.255.0
R1(config)# int loopback 2
R1(config-if)# ip address 192.168.101.1 255.255.255.0
R1(config)# int loopback 3
R1(config-if)# ip address 192.168.102.1 255.255.255.0

R3(config)# int loopback 1
R3(config-if)# ip address 192.168.10.1 255.255.255.0
R3(config)# int loopback 2
R3(config-if)# ip address 192.168.11.1 255.255.255.0
R3(config)# int loopback 3
R3(config-if)# ip address 192.168.12.1 255.255.255.0
```

RIPv2

The following steps demonstrate how to configure RIPv2 to route the loopback networks and the connected networks. Split horizon does no become an issue due we have our Frame Relay PVCs configured with point-to-point interfaces.

Configuration Steps

1.- Enable routing for the connected and loopback networks:

```
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 192.168.100.0
R1(config-router)#network 192.168.101.0
R1(config-router)#network 192.168.102.0
R1(config-router)#network 172.16.0.0

R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 172.16.0.0

R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#network 192.168.10.0
R3(config-router)#network 192.168.11.0
R3(config-router)#network 192.168.12.0
R3(config-router)#network 172.16.0.0
```

At this point all routers should have all networks present in their respective routing table, upon confirmation the networks exist in the routing tables all should be pingable from any router.

2.- Verify that all three routers can see all networks:

```
R1#show ip route

R    192.168.12.0/24 [120/1] via 172.16.1.2, 00:00:08, Serial0/0.1
R    192.168.10.0/24 [120/1] via 172.16.1.2, 00:00:08, Serial0/0.1
     172.16.0.0/16 is variably subnetted, 3 subnets, 2 masks
R       172.16.1.4/30 [120/1] via 172.16.1.2, 00:00:08, Serial0/0.1
C       172.16.1.0/30 is directly connected, Serial0/0.1
R    192.168.11.0/24 [120/1] via 172.16.1.2, 00:00:08, Serial0/0.1
C    192.168.102.0/24 is directly connected, Loopback3
C    192.168.100.0/24 is directly connected, Loopback1
C    192.168.101.0/24 is directly connected, Loopback2

R2#show ip route

R    192.168.12.0/24 [120/1] via 172.16.1.6, 00:00:20, Serial1/0.2
R    192.168.10.0/24 [120/1] via 172.16.1.6, 00:00:20, Serial1/0.2
     172.16.0.0/16 is variably subnetted, 3 subnets, 2 masks
C       172.16.1.4/30 is directly connected, Serial1/0.2
C       172.16.1.0/30 is directly connected, Serial1/0.1
R    192.168.11.0/24 [120/1] via 172.16.1.6, 00:00:20, Serial1/0.2
R    192.168.102.0/24 [120/1] via 172.16.1.1, 00:00:16, Serial1/0.1
R    192.168.100.0/24 [120/1] via 172.16.1.1, 00:00:17, Serial1/0.1
R    192.168.101.0/24 [120/1] via 172.16.1.1, 00:00:17, Serial1/0.1
```

R3#s**how ip route**

C 192.168.12.0/24 is directly connected, Loopback3
C 192.168.10.0/24 is directly connected, Loopback1
172.16.0.0/16 is variably subnetted, 3 subnets, 2 masks
C 172.16.1.4/30 is directly connected, Serial1/0.1
R 172.16.1.0/30 [120/1] via 172.16.1.5, 00:00:03, Serial1/0.1
C 192.168.11.0/24 is directly connected, Loopback2
R 192.168.102.0/24 [120/1] via 172.16.1.5, 00:00:03, Serial1/0.1
R 192.168.100.0/24 [120/1] via 172.16.1.5, 00:00:04, Serial1/0.1
R 192.168.101.0/24 [120/1] via 172.16.1.5, 00:00:04, Serial1/0.1

3.- We will disable RIPv2 process to configure OSPF:

R1(config)#**no router rip**
R2(config)#**no router rip**
R3(config)#**no router rip**

OSPF

Once RIPv2 has been disabled we will configure OSPF. Upon completion of the configuration all three routers should have listed all networks in their respective routing table. All networks will be in area 0.

Configuration Steps

1.- Enable routing for the connected and loopback networks:

R1(config)#**router ospf 1**
R1(config-router)#**network 172.16.1.0 0.0.0.3 area 0**
R1(config-router)#**network 192.168.100.0 0.0.0.255 area 0**
R1(config-router)#**network 192.168.101.0 0.0.0.255 area 0**
R1(config-router)#**network 192.168.102.0 0.0.0.255 area 0**

R2(config)#**router ospf 1**
R2(config-router)#**network 172.16.1.0 0.0.0.3 area 0**
R2(config-router)#**network 172.16.1.4 0.0.0.3 area 0**

R3(config)#**router ospf 1**
R3(config-router)#**network 172.16.1.4 0.0.0.3 area 0**
R3(config-router)#**network 192.168.10.0 0.0.0.255 area 0**
R3(config-router)#**network 192.168.11.0 0.0.0.255 area 0**
R3(config-router)#**network 192.168.12.0 0.0.0.255 area 0**

At this point all routers should have all networks present in their respective routing table, upon confirmation the networks exist in the routing tables all should be pingable from any router.

2.- Verify that all three routers can see all networks by issuing **show ip route** in each router.

3.- We will disable OSPF to configure EIGRP.

R1(config)#**no router ospf 1**
R2(config)#**no router ospf 1**
R3(config)**#no router ospf 1**

EIGRP

Finally we will demonstrate how to enable EIRGP.

Configuration Steps

1.- Enable routing for the connected and loopback networks:

```
R1(config)# router eigrp 1
R1(config-router)# network 172.16.1.0 0.0.0.3
R1(config-router)# network 192.168.0.0 0.0.255.255


R2(config)# router eigrp 1
R2(config-router)# network 172.16.1.0 0.0.0.3
R2(config-router)# network 172.16.1.4 0.0.0.3

R3(config)# router eigrp 1
R3(config-router)# network 172.16.1.4 0.0.0.3
R3(config-router)# network 192.168.0.0 0.0.255.255
```

2.- Verify that all three routers can see all networks by issuing **show ip route** in each router.

Conclusion

We configured 3 routers in a Hub and Spoke topology using point-to-point subinterfaces; we used 2 PVCs (one from R2 to R1 and another one from R2 to R3), each PVC was configured in a separate network. In part II of this tutorial we enabled RIP, OSPF and EIGRP (one at the time) to route networks attached to R1 and R3.

Comments and remarks:

http://www.angelcool.net/sphpblog/comments.php?y=12&m=10&entry=entry121030-173800