

## 实验二十八、OSPF 在 NBMA 网络的配置(点到多点)

### 一、 实验目的

1. 掌握 OSPF 协议在 NBMA (非广播多点可达) 环境下的配置
2. 理解 NBMA 环境的特殊性

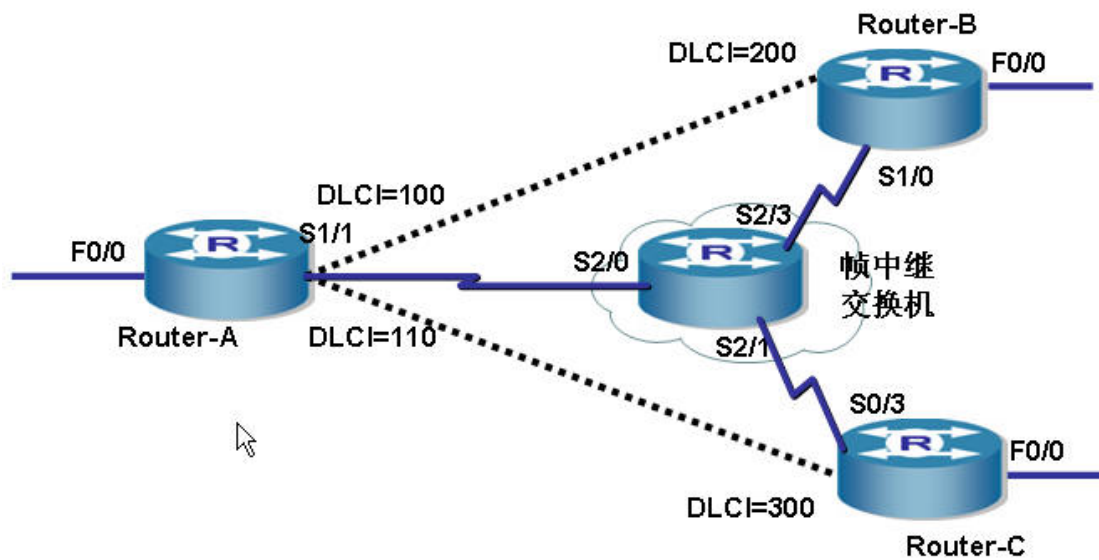
### 二、 应用环境

在帧中继的网络中, 通常一个物理接口对应多条 PVC, DR 的选择非常重要, 如在下图中, 将 OSPF 接口配置为点到多点, 同样能保证 OSPF 路由更新的正确

### 三、 实验设备

- |                                    |    |
|------------------------------------|----|
| 1. DCR-1751                        | 三台 |
| 2. DCR-2630 (安装相应模块满足三个 serial 接口) | 一台 |
| 3. CR-V35FC                        | 三条 |
| 4. CR-V35MT                        | 三条 |

### 四、 实验拓扑



### 五、 实验要求

#### ROUTER-A

S1/1 192.168.1.1/24

F0/0 192.168.2.1/24

#### ROUTER-B

S1/0 192.168.1.2/24

F0/0 192.168.3.1/24

#### ROUTER-C

S03 192.168.1.3/24

F0/0 192.168.4.1/24

## 六、 实验步骤

**第一步:** 参照实验 15, 将帧中继网络配置好, 并测试连通性

**第二步:** 配置路由器 A、B、C 的 OSPF 协议

Router-A#**conf**

Router-A\_config#**int f0/0**

Router-A\_config\_f0/0#**ip address 192.168.2.1 255.255.255.0**

Router-A\_config\_f0/0#**exit**

Router-A\_config#**router ospf 1**

Router-A\_config\_ospf\_1#**network 192.169.1.0 255.255.255.0 area 0**

Router-A\_config\_ospf\_1#**network 192.169.2.0 255.255.255.0 area 0**

Router-B#**conf**

Router-B\_config#**int f0/0**

Router-B\_config\_f0/0#**ip address 192.168.3.1 255.255.255.0**

Router-B\_config\_f0/0#**exit**

Router-B\_config#**router ospf 1**

Router-B\_config\_ospf\_1#**net 192.168.1.0 255.255.255.0 area 0**

Router-B\_config\_ospf\_1#**net 192.168.3.0 255.255.255.0 area 0**

Router-C#**conf**

Router-C\_config#**int f0/0**

Router-C\_config\_f0/0#**ip address 192.168.4.1 255.255.255.0**

Router-C\_config\_rip#**exit**

Router-C\_config#**router ospf 1**

Router-C\_config\_ospf\_1#**network 192.168.1.0 255.255.255.0 area 0**

Router-C\_config\_ospf\_1#**network 192.168.4.0 255.255.255.0 area 0**

**第三步:** 查看各路由器的路由表

Router-A#**sh ip route**

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected

D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area

ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2

OE1 - OSPF external type 1, OE2 - OSPF external type 2

DHCP - DHCP type

VRF ID: 0

C      192.168.2.0/24      is directly connected, FastEthernet0/0

C      192.168.1.0/24      is directly connected, Serial1/1

Router-B# **sh ip route**

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected

D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area  
ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2  
OE1 - OSPF external type 1, OE2 - OSPF external type 2  
DHCP - DHCP type

VRF ID: 0

C 192.168.1.0/24 is directly connected, Serial1/0  
C 192.168.3.0/24 is directly connected, FastEthernet0/0

Router-C#sh ip route

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected  
D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area  
ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2  
OE1 - OSPF external type 1, OE2 - OSPF external type 2  
DHCP - DHCP type

VRF ID: 0

C 192.168.1.0/24 is directly connected, Serial0/3  
C 192.168.4.0/24 is directly connected, FastEthernet0/0

!都没有得到 OSPF 路由, 说明在 NBMA 环境下的需要做特定的配置

第四步: 查看 OSPF 状态

Router-A#sh ip ospf interface

Serial1/1 is up, line protocol is up

Internet Address: 192.168.1.1/24

**Nettype: Non-Broadcast** ! 网络类型为非广播

OSPF process is 1, AREA: 0, Router ID: 192.168.1.1

Cost: 1600, Transmit Delay is 1 sec, Priority 1

Hello interval is 30, Dead timer is 120, Retransmit is 5

OSPF INTF State is IWAITING

Neighbor Count is 0, Adjacent neighbor count is 0

Router-B#sh ip ospf interface

Serial1/0 is up, line protocol is up

Internet Address: 192.168.1.2/24

**Nettype: Non-Broadcast** ! 网络类型为非广播

OSPF process is 1, AREA: 0, Router ID: 192.168.2.1

Cost: 1600, Transmit Delay is 1 sec, Priority 1

Hello interval is 30, Dead timer is 120, Retransmit is 5

OSPF INTF State is IWAITING

Neighbor Count is 0, Adjacent neighbor count is 0

```
Router-C#sh ip ospf interface
Serial0/3 is up, line protocol is up
  Internet Address: 192.168.1.3/24
  Nettype: Non-Broadcast           ! 网络类型为非广播
  OSPF process is 1, AREA: 0, Router ID: 192.168.4.1
  Cost: 1600, Transmit Delay is 1 sec, Priority 1
  Hello interval is 30, Dead timer is 120, Retransmit is 5
  OSPF INTF State is IDrOTHER
  Neighbor Count is 0, Adjacent neighbor count is 0
```

#### 第五步: NBMA 环境下的配置 (点到多点)

```
Router-A# conf
Router-A_config#int s1/1
Router-A_config_s1/1#ip ospf network point-to-multipoint    ! 指定网络类型

Router-B#conf
Router-B_config#int s1/0
Router-B_config_s1/0#ip ospf network point-to-multipoint    ! 指定网络类型

Router-C#conf
Router-C_config#int s0/3
Router-C_config_s0/3#ip ospf network point-to-multipoint    ! 指定网络类型
```

#### 第六步: 再次查看各路由表

```
Router-A#sh ip route
Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected
       D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area
       ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2
       OE1 - OSPF external type 1, OE2 - OSPF external type 2
       DHCP - DHCP type
```

VRF ID: 0

C	192.168.1.0/24	is directly connected, Serial1/1
O	<b>192.168.1.2/32</b>	<b>[110,1600] via 192.168.1.2(on Serial1/1)</b>
O	<b>192.168.1.3/32</b>	<b>[110,1600] via 192.168.1.3(on Serial1/1)</b>
C	192.168.2.0/24	is directly connected, FastEthernet0/0
O	<b>192.168.3.0/24</b>	<b>[110,1601] via 192.168.1.2(on Serial1/1)</b>
O	<b>192.168.4.0/24</b>	<b>[110,1601] via 192.168.1.3(on Serial1/1)</b>

```
Router-B#sh ip route
Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected
       D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area
```

ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2  
OE1 - OSPF external type 1, OE2 - OSPF external type 2  
DHCP - DHCP type

VRF ID: 0

```
C      192.168.1.0/24      is directly connected, Serial1/0
O      192.168.1.1/32      [110,1600] via 192.168.1.1(on Serial1/0)
O      192.168.1.3/32      [110,3200] via 192.168.1.1(on Serial1/0)
O      192.168.2.0/24      [110,1601] via 192.168.1.1(on Serial1/0)
C      192.168.3.0/24      is directly connected, FastEthernet0/0
O      192.168.4.0/24      [110,3201] via 192.168.1.1(on Serial1/0)
```

Router-C#sh ip route

Codes: C - connected, S - static, R - RIP, B - BGP, BC - BGP connected  
D - DEIGRP, DEX - external DEIGRP, O - OSPF, OIA - OSPF inter area  
ON1 - OSPF NSSA external type 1, ON2 - OSPF NSSA external type 2  
OE1 - OSPF external type 1, OE2 - OSPF external type 2  
DHCP - DHCP type

VRF ID: 0

```
C      192.168.1.0/24      is directly connected, Serial0/3
O      192.168.1.1/32      [110,1600] via 192.168.1.1(on Serial0/3)
O      192.168.1.2/32      [110,3200] via 192.168.1.1(on Serial0/3)
O      192.168.2.0/24      [110,1601] via 192.168.1.1(on Serial0/3)
O      192.168.3.0/24      [110,3201] via 192.168.1.1(on Serial0/3)
C      192.168.4.0/24      is directly connected, FastEthernet0/0
```

第七步: 查看 OSPF 状态

Router-A#sh ip ospf interface

Serial1/1 is up, line protocol is up

Internet Address: 192.168.1.1/24

**Nettype: Point-to-MultiPoint with Broadcast**

! 网络类型为点到多点

OSPF process is 1, AREA: 0, Router ID: 192.168.1.1

Cost: 1600, Transmit Delay is 1 sec, Priority 1

Hello interval is 30, Dead timer is 120, Retransmit is 5

OSPF INTF State is IPOINT\_TO\_MPOINT

Neighbor Count is 2, Adjacent neighbor count is 2

Adjacent with neighbor 192.168.2.1

Adjacent with neighbor 192.168.4.1

FastEthernet0/0 is up, line protocol is up

Internet Address: 192.168.2.1/24

Nettype: Broadcast  
OSPF process is 1, AREA: 0, Router ID: 192.168.1.1  
Cost: 1, Transmit Delay is 1 sec, Priority 1  
Hello interval is 10, Dead timer is 40, Retransmit is 5  
OSPF INTF State is IDr  
Designated Router ID: 192.168.1.1, Interface address 192.168.2.1  
Neighbor Count is 0, Adjacent neighbor count is 0

Router-A#sh ip ospf neighbor

! 查看邻居

-----  
OSPF process: 1

AREA: 0

Neighbor ID	Pri	State	DeadTime	Neighbor Addr	Interface
192.168.2.1	0	<b>FULL/-</b>	118	192.168.1.2	Serial1/1
192.168.4.1	1	<b>FULL/-</b>	106	192.168.1.3	Serial1/1

-----

! 没有 DR 的选举

Router-B#sh ip ospf interface  
Serial1/0 is up, line protocol is up  
Internet Address: 192.168.1.2/24  
**Nettype: Point-to-MultiPoint with Broadcast**  
OSPF process is 1, AREA: 0, Router ID: 192.168.2.1  
Cost: 1600, Transmit Delay is 1 sec, Priority 1  
Hello interval is 30, Dead timer is 120, Retransmit is 5  
OSPF INTF State is IPOINT\_TO\_MPOINT  
Neighbor Count is 1, Adjacent neighbor count is 1  
Adjacent with neighbor 192.168.1.1

FastEthernet0/0 is up, line protocol is up  
Internet Address: 192.168.3.1/24  
Nettype: Broadcast  
OSPF process is 1, AREA: 0, Router ID: 192.168.2.1  
Cost: 1, Transmit Delay is 1 sec, Priority 1  
Hello interval is 10, Dead timer is 40, Retransmit is 5  
OSPF INTF State is IDr  
Designated Router ID: 192.168.2.1, Interface address 192.168.3.1  
Neighbor Count is 0, Adjacent neighbor count is 0

## 七、 注意事项和排错

1. 在 NBMA 环境下，所有路由更新接口都要设置为点到多点



## 八、 配置序列

```
Router-A#sh run
Building configuration...

Current configuration:
!
!version 1.3.2E
service timestamps log date
service timestamps debug date
no service password-encryption
!
hostname Router-A
!
!
!
!
!
!
!
interface FastEthernet0/0
 ip address 192.168.2.1 255.255.255.0
 no ip directed-broadcast
!
interface Serial1/0
 no ip address
 no ip directed-broadcast
 physical-layer speed 64000
!
interface Serial1/1
 ip address 192.168.1.1 255.255.255.0
 no ip directed-broadcast
 encapsulation frame-relay
 ip ospf network point-to-multipoint broadcast
!
interface Async0/0
 no ip address
 no ip directed-broadcast
!
!
!
router ospf 1
 network 192.168.1.0 255.255.255.0 area 0
 network 192.168.2.0 255.255.255.0 area 0
```

!  
!  
!  
!  
!

## 九、 共同思考

1. 为什么点到多点会产生主机路由？
2. 在哪些接口上配置网络类型？
3. OSPF 有哪些网络类型？

## 十、 课后练习

请将地址改为 10.10.10.0/24 重复以上实验

## 十一、 相关命令详解

### ip ospf network

设置接口的网络类型。no ip ospf network 取消设置。

**ip ospf network { broadcast | nonbroadcast | point\_to\_multipoint | point-to-point }**

**no ip ospf network { broadcast | nonbroadcast | point\_to\_multipoint | point-to-point }**

#### 参数

参数	参数说明
<b>broadcast</b>	设置接口的网络类型为广播类型。
<b>nonbroadcast</b>	设置接口的网络类型为非广播NBMA类型。
<b>point-to-point</b>	设置接口的网络类型为点到点
<b>point-to-multipoint</b>	设置接口的网络类型为点到多点

#### 命令模式

接口配置态

#### 使用说明

在有多址访问能力的广播网上，应该将接口配置成 NBMA 方式。当一个 NBMA 网络中，不能保证任意两台路由器之间都是直接可达的话，应将网络设置为点到多点的方式。



## 示例

配置接口 Serial1/0 为非广播 NBMA 类型。

```
router_config_S1/0#ip ospf network nonbroadcast
```

