实验 OSPF 基本配置

【实验名称】

OSPF 单区域基本配置。

【实验目的】

掌握在路由器上配置 OSPF 单区域。

【背景描述】

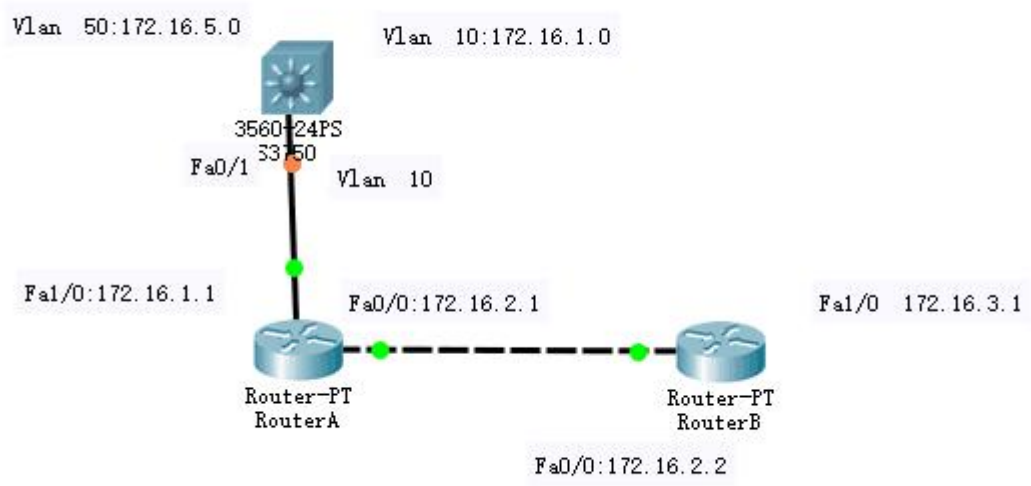
假设校园网通过 1 台三层交换机连到校园网出口路由器，路由器再和校园外的另 1 台 路由器连接，现做适当配置，实现校园网内部主机与校园网外部主机的相互通信。

本实验以两台路由器、1 台三层交换机为例。S3550 上划分有 VLAN10 和 VLAN50， 其中 VLAN10 用于连接 RA，VLAN50 用于连接校园网主机。

【需求分析】

需要在路由器和交换机上配置 OSPF 路 由协议，使全网互通，从而实现信息的共享和传递。

【实验拓扑】



【实验设备】

三层交换机 1 台

路由器 2 台

交叉线或直连线 3 条

【预备知识】 路由器基本配置知识、OSPF

【实验原理】

OSPF（Open Shortest Path First，开放式最短路径优先）协议，是目前网络中应用最广泛的路由协议之一。属于内部网关路由协议，能够适应各种规模的网络环境，是典型的链 路状态（link-state）协议。

OSPF 路由协议通过向全网扩散本设备的链路状态信息，使网络中每台设备最终同步一个具有全网链路状态的数据库（LSDB），然后路由器采用 SPF 算法，以自己为根，计算到达其他网络的最短路径，最终形成全网路由信息。
OSPF 属于无类路由协议，支持 VLSM（变长子网掩码）。OSPF 是以组播的形式进行链路状态的通告的。
在大模型的网络环境中，OSPF 支持区域的划分，将网络进行合理规划。划分区域时必须存在 area0（骨干区域）。其他区域和骨干区域直接相连，或通过虚链路的方式连接。

【实验步骤】

第一步：在路由器和三层交换机配置 IP 地址

```
switch#configure terminal
switch(config)#hostname S3750
S3750(config)#vlan 10
S3750(config-vlan)#exit
S3750(config)#vlan 50
S3750(config-vlan)#exit
S3750(config)#interface f0/1
S3750(config-if)#switchport access vlan 10
S3750(config-if)#exit
S3750(config)#interface f0/2
S3750(config-if)#switchport access vlan 50
S3750(config-if)#exit
S3750(config)#interface vlan 10
S3750(config-if)#ip address 172.16.1.2 255.255.255.0
S3750(config-if)#no shutdown
S3750(config-if)#exit
S3750(config)#interface vlan 50
S3750(config-if)#ip address 172.16.5.1 255.255.255.0
S3750(config-if)#no shutdown
S3750(config-if)#exit
RouterA(config)# interface fastethernet 1/0
RouterA(config-if)# ip address 172.16.1.1 255.255.255.0
RouterA(config-if)# no shutdown
RouterA(config-if)#exit
RouterA(config)# interface fastethernet 0/0
RouterA(config-if)# ip address 172.16.2.1 255.255.255.0 RouterB(config-if)# no shutdown
RouterB(config)# interface fastethernet1/0
RouterB(config-if)# ip address 172.16.3.1 255.255.255.0
RouterB(config-if)# no shutdown
RouterB(config-if)#exit
RouterB(config)# interface fastethernet 0/0
RouterB(config-if)# ip address 172.16.2.2 255.255.255.0
RouterB(config-if)# no shutdown
```

第二步：配置 OSPF 路由协议

S3750(config)# ip routing　#先启用 routing，才能配置 ospf 1
S3750(config)#router ospf 1
S3750(config-router)#network 172.16.5.0 0.0.0.255 area 0
S3750(config-router)#network 172.16.1.0 0.0.0.255 area 0
S3750(config-router)#end
RouterA(config)# router ospf 1
RouterA(config-router)#network 172.16.1.0 0.0.0.255 area 0
RouterA(config-router)#network 172.16.2.0 0.0.0.255 area 0
RouterA(config-router)#end
RouterB(config)#router ospf 1
RouterB(config-router)#network 172.16.2.0 0.0.0.255 area 0
RouterB(config-router)#network 172.16.3.0 0.0.0.255 area 0
RouterB(config-router)#end

第三步：验证测试

S3750#show vlan

VLAN Name Status Ports

---- -------------------------------- --------- -------------------------------

1 VLAN0001 STATIC Fa0/3, Fa0/4, Fa0/5, Fa0/6
Fa0/7, Fa0/8, Fa0/9, Fa0/10
Fa0/11, Fa0/12, Fa0/13,
Fa0/14 Fa0/15, Fa0/16,
Fa0/17, Fa0/18, Fa0/22
Fa0/19, Fa0/20, Fa0/21,
Fa0/23, Fa0/24, Gi0/25,
Gi0/26 ,Gi0/27, Gi0/28
10 VLAN0010 STATIC Fa0/1
50 VLAN0050 STATIC Fa0/2

S3750#show ip interface brief

Interface IP-Address(Pri) OK? Status VLAN 10 172.16.1.2/24 YES UP
VLAN 50 172.16.5.1/24 YES UP

RA#show ip interface brief

Interface IP-Address(Pri) OK? Status
FastEthernet 0/0 172.16.2.1/24 YES UP
FastEthernet 0/1 172.16.1.1/24 YES UP

RB#show ip interface brief

Interface IP-Address(Pri) OK? Status
FastEthernet 0/0 172.16.2.2/24 YES UP
FastEthernet 0/1 172.16.1.3/24 YES UP
Loopback 0 no address YES DOWN

S3750#show ip route

Codes: C - connected, S - static, R - RIP B - BGP
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
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default
Gateway of last resort is no set
C 172.16.1.0/24 is directly connected, VLAN 10
C 172.16.1.2/32 is local host.
O 172.16.2.0/24 [110/2] via 172.16.1.1, 00:14:09, VLAN 10
O 172.16.3.0/24 [110/3] via 172.16.1.1, 00:04:39, VLAN 10
C 172.16.5.0/24 is directly connected, VLAN 50
C 172.16.5.1/32 is local host.
RA#show ip route
Codes: C - connected, S - static, R - RIP B - BGP
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
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default
Gateway of last resort is no set
C 172.16.1.0/24 is directly connected, FastEthernet 0/1 C 172.16.1.1/32 is local host.
C 172.16.2.0/24 is directly connected, FastEthernet 0/0
C 172.16.2.1/32 is local host.
O 172.16.3.0/24 [110/2] via 172.16.2.2, 00:05:21, FastEthernet 0/0
O 172.16.5.0/24 [110/2] via 172.16.1.2, 00:14:51, FastEthernet 0/1
RB#show ip route
Codes: C - connected, S - static, R - RIP B - BGP
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
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default
Gateway of last resort is no set
O 172.16.1.0/24 [110/2] via 172.16.2.1, 00:05:58, FastEthernet 0/0
C 172.16.2.0/24 is directly connected, FastEthernet 0/0
C 172.16.2.2/32 is local host.
C 172.16.3.0/24 is directly connected, FastEthernet 0/1
C 172.16.3.1/32 is local host.
O 172.16.5.0/24 [110/3] via 172.16.2.1, 00:15:22, FastEthernet 0/0
RA#show ip ospf neighbor
OSPF process 1:
Neighbor ID Pri State Dead Time Address Interface
172.16.5.1 1 Full/DR 00:00:38 172.16.1.2 FastEthernet 0/1
172.16.2.2 1 Full/DR 00:00:36 172.16.2.2 FastEthernet 0/0
RA#show ip ospf interface fastEthernet 0/0
FastEthernet 0/0 is up, line protocol is up

Internet Address 172.16.2.1/24, Ifindex 1, Area 0.0.0.0, MTU 1500
Matching network config: 172.16.2.0/24
Process ID 1, Router ID 172.167.1.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State BDR, Priority 1
Designated Router (ID) 172.16.2.2, Interface Address 172.16.2.2
Backup Designated Router (ID) 172.167.1.1, Interface Address 172.16.2.1
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 00:00:05
Neighbor Count is 1, Adjacent neighbor count is 1
Crypt Sequence Number is 82589
Hello received 114 sent 115, DD received 4 sent 5
LS-Req received 1 sent 1, LS-Upd received 5 sent 9 LS-Ack received 6 sent 4, Discarded 0

【注意事项】

1、在申明直连网段时，注意要写该网段的反掩码。

2、在申明直连网段时，必须指明所属的区域。

【参考配置】

S3750#show running-config

```
Building configuration...
Current configuration : 1399 bytes
!
version RGNOS 10.1.00(4), Release(18443)(Tue Jul 17 19:51:54 CST 2007
-ubu6server)
hostname S3750
!
vlan 1
!
vlan 10
!
vlan 50
!
interface FastEthernet 0/1
switchport access vlan 10
!
interface FastEthernet 0/2
switchport access vlan 50
!
interface FastEthernet 0/3
!
interface FastEthernet 0/4
!
interface FastEthernet 0/5
!
interface FastEthernet 0/6
!
```

interface FastEthernet 0/7
!
interface FastEthernet 0/8
!
interface FastEthernet 0/9
!
interface FastEthernet 0/10 !
interface FastEthernet 0/11
!
interface FastEthernet 0/12
!
interface FastEthernet 0/13
!
interface FastEthernet 0/14
!
interface FastEthernet 0/15
!
interface FastEthernet 0/16
!
interface FastEthernet 0/17
!
interface FastEthernet 0/18
!
interface FastEthernet 0/19
!
interface FastEthernet 0/20
!
interface FastEthernet 0/21
!
interface FastEthernet 0/22
!
interface FastEthernet 0/23
!
interface FastEthernet 0/24
!
interface GigabitEthernet 0/25
!
interface GigabitEthernet 0/26
!
interface GigabitEthernet 0/27
!
interface GigabitEthernet 0/28
!
interface VLAN 10

ip address 172.16.1.2 255.255.255.0
!
interface VLAN 50
ip address 172.16.5.1 255.255.255.0
!
router ospf 1 network 172.16.1.0 0.0.0.255 area 0
network 172.16.5.0 0.0.0.255 area 0
!
line con 0
line vty 0 4
login
!
end
RB#show running-config
Building configuration...
Current configuration : 579 bytes
!
version RGNOS 10.1.00(4), Release(18443)(Tue Jul 17 20:50:30 CST 2007
-ubu1server)
hostname RB
!
interface FastEthernet 0/0
ip address 172.16.2.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 0/1
ip address 172.16.3.1 255.255.255.0
duplex auto
speed auto
!
interface Loopback 0
!
router ospf 1
network 172.16.2.0 0.0.0.255 area 0
network 172.16.3.0 0.0.0.255 area 0
!
line con 0
line aux 0
line vty 0 4
login
!
end
RA#show running-config Building configuration...

```
Current configuration : 554 bytes
!
version RGNOS 10.1.00(4), Release(18443)(Tue Jul 17 20:50:30 CST 2007
-ubu1server)
hostname RA
!
interface FastEthernet 0/0
ip address 172.16.2.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 0/1
ip address 172.16.1.1 255.255.255.0
duplex auto
speed auto
!
router ospf 1
network 172.16.1.0 0.0.0.255 area 0
network 172.16.2.0 0.0.0.255 area 0
!
line con 0
line aux 0
line vty 0 4
login
!
end
```