实验 12 OSPF 单区域配置

一、实验目标

- 掌握 OSPF 中 Router ID 的配置方法
- 掌握 OSPF 的配置方法掌握通过 display 命令查看 OSPF 运行状态的方法
- 掌握使用 OSPF 收发缺省路由的方法
- 掌握修改 OSPF hello 和 dead 时间的配置方法
- 理解多路访问网络中的 DR 或 BDR 选举
- 掌握 OSPF 路由优先级的修改方法

二、实验场景

您是公司的网络管理员。现在公司网络中需要使用 OSPF 协议来迚行路由信息的传递。规划网络中所有路由器属于 OSPF 的区域 0。实际使用中需要向 OSPF 发布默认路由，此外您也希望通过这次部署了解 DR/BDR 选举的机制。

三、实验拓扑图

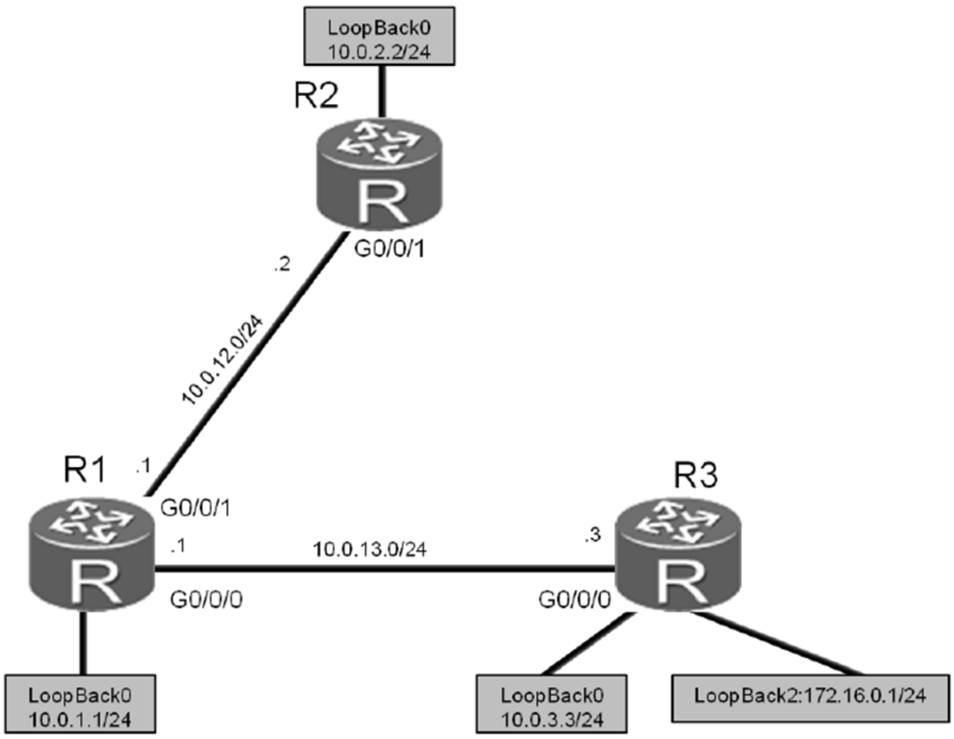

图 12.1 OSPF 单域配置实验拓扑图

五、操作步骤

任务一 实验环境准备

如果本任务中您使用的是空配置设备，需要从任务一开始配置，然后跳过任务二。如果使用

的设备包含上一个实验的配置，请直接从任务二开始配置。

步骤 1　R1 基本配置以及 IP 编址。

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R1
[R1]interface GigabitEthernet 0/0/1
[R1-GigabitEthernet 0/0/1]ip address 10.0.12.1 24
[R1-GigabitEthernet 0/0/1]quit
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]ip address 10.0.13.1 24
[R1-GigabitEthernet0/0/0]quit
[R1]interface LoopBack 0
[R1-LoopBack0]ip address 10.0.1.1 24
```

步骤 2　R2 基本配置以及 IP 编址。

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R2
[R2]interface GigabitEthernet 0/0/1
[R2-GigabitEthernet 0/0/1]ip address 10.0.12.2 24
[R2-GigabitEthernet 0/0/1]quit
[R2]interface LoopBack 0
[R2-LoopBack0]ip address 10.0.2.2 24
```

步骤 3　R3 基本配置以及 IP 编址。

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R3
[R3]interface GigabitEthernet 0/0/0
[R3-GigabitEthernet0/0/0]ip address 10.0.13.3 24
[R3-GigabitEthernet0/0/0]quit
[R3]interface LoopBack 0
[R3-LoopBack0]ip address 10.0.3.3 24
[R3-LoopBack0]quit
[R3]interface LoopBack 2
[R3-LoopBack2]ip address 172.16.0.1 24
```

任务二 清除设备上原有的配置

步骤 1 打开 **R1** 必要的接口，关闭无关接口。

```
[R1]interface GigabitEthernet 0/0/1
[R1-GigabitEthernet0/0/1]undo shutdown
[R1-GigabitEthernet0/0/1]quit
```

步骤 2 打开 **R2** 必要的接口，关闭无关接口。

```
[R2]interface GigabitEthernet 0/0/0
```

```
[R2-GigabitEthernet0/0/0]undo rip summary-address 172.16.0.0 255.255.0.0
[R2-GigabitEthernet0/0/0]shutdown
```

步骤 3 打开 R3 必要的接口，关闭无关接口。

```
[R3]interface GigabitEthernet 0/0/0
[R3-GigabitEthernet0/0/0]undo shutdown
[R3-GigabitEthernet0/0/0]quit
[R3]interface GigabitEthernet 0/0/1
[R3-GigabitEthernet0/0/1]shutdown
[R3-GigabitEthernet0/0/1]quit
[R3]undo interface LoopBack 3
Info: This operation may take a few seconds. Please wait for a moment...succeeded.
[R3]undo interface LoopBack 4
Info: This operation may take a few seconds. Please wait for a moment...succeeded.
[R3]undo interface LoopBack 5
Info: This operation may take a few seconds. Please wait for a moment...succeeded.
```

步骤 4 删除 R1 上的 RIP 认证配置和 RIP 进程 1。

```
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]undo rip authentication-mode
[R1-GigabitEthernet0/0/0]quit
[R1]undo rip 1
Warning: The RIP process will be deleted. Continue?[Y/N]y
```

步骤 5 删除 R2 上的 RIP 认证配置和 RIP 进程 1。

```
[R2]interface GigabitEthernet 0/0/0
[R2-GigabitEthernet0/0/0]undo rip authentication-mode
[R2-GigabitEthernet0/0/0]quit
[R2]interface GigabitEthernet 0/0/1
[R2-GigabitEthernet0/0/1]undo rip authentication-mode
[R2-GigabitEthernet0/0/1]quit
[R2]undo rip 1
Warning: The RIP process will be deleted. Continue?[Y/N]y
```

步骤 6 删除 R3 上的 RIP 认证配置和 RIP 进程 1。

```
[R3]interface GigabitEthernet 0/0/1
[R3-GigabitEthernet0/0/1]undo rip authentication-mode
[R3-GigabitEthernet0/0/1]quit
[R3]undo rip 1
Warning: The RIP process will be deleted. Continue?[Y/N]y
```

任务三 配置 OSPF

步骤 1 将 R1 的 Router ID 配置为 10.0.1.1（逻辑接口 Loopback 0 的地址），开启 OSPF 进程 1（缺省进程），并将网段 10.0.1.0/24、10.0.12.0/24 和 10.0.13.0/24 发布到 OSPF 区域 0。

```
[R1]ospf 1 router-id 10.0.1.1
[R1-ospf-1]area 0
[R1-ospf-1-area-0.0.0.0]network 10.0.1.0 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.13.0 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.12.0 0.0.0.255
```

*** 注意：**同一个路由器可以开启多个 OSPF 进程，默认进程号为 1，由于进程号只具有本地意义，所以同一路由域的不同路由器可以使用相同或不同的 OSPF 进程号。另外 network 命令后面需使用反掩码。

步骤 2 将 R2 的 Router ID 配置为 10.0.2.2，开启 OSPF 进程 1，并将网段 10.0.12.0/24 和 10.0.2.0/24 发布到 OSPF 区域 0。

```
[R2]ospf 1 router-id 10.0.2.2
[R2-ospf-1]area 0
[R2-ospf-1-area-0.0.0.0]network 10.0.2.0 0.0.0.255
[R2-ospf-1-area-0.0.0.0]network 10.0.12.0 0.0.0.255
…output omitted…
Nov 30 2013 09:41:39+00:00 R2 %%01OSPF/4/NBR_CHANGE_E(l)[5]:Neighbor changes event:
neighbor status changed. (ProcessId=1, NeighborAddress=10.0.12.1,
NeighborEvent=LoadingDone, NeighborPreviousState=Loading,
NeighborCurrentState=Full)
```

*当回显信息中包含“NeighborCurrentState=Full”信息时，表明邻接关系已经建立。

步骤 3 将 R3 的 Router ID 配置为 10.0.3.3，开启 OSPF 进程 1，并将网段 10.0.3.0/24 和 10.0.13.0/24 发布到 OSPF 区域 0。

```
[R3]ospf 1 router-id 10.0.3.3
[R3-ospf-1]area 0
[R3-ospf-1-area-0.0.0.0]network 10.0.3.0 0.0.0.255
[R3-ospf-1-area-0.0.0.0]network 10.0.13.0 0.0.0.255
…output omitted…
Nov 30 2013 16:05:34+00:00 R3 %%01OSPF/4/NBR_CHANGE_E(l)[5]:Neighbor changes event:
neighbor status changed. (ProcessId=1, NeighborAddress=10.0.13.1,
NeighborEvent=LoadingDone, NeighborPreviousState=Loading,
NeighborCurrentState=Full)
```

任务四 验证 OSPF 配置

待 OSPF 收敛完成后，查看 R1、R2 和 R3 上的路由表。

步骤 1 查看 R1 的路由表。

```
<R1>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------
Routing Tables: Public
Destinations : 15 Routes : 15
Destination/Mask Proto Pre Cost Flags NextHop Interface
  10.0.1.0/24 Direct 0 0 D 10.0.1.1 LoopBack0
  10.0.1.1/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.1.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.2.2/32 OSPF 10 1 D 10.0.12.2 GigabitEthernet0/0/1
  10.0.3.3/32 OSPF 10 1 D 10.0.13.3 GigabitEthernet0/0/0
  10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/1
  10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
  10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
  10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/0
  10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
  10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
  127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
  127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
  127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
  255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
```

步骤 2 查看 R2 的路由表。

```
<R2>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------
Routing Tables: Public
Destinations : 13 Routes : 13
Destination/Mask Proto Pre Cost Flags NextHop Interface
  10.0.1.1/32 OSPF 10 1 D 10.0.12.1 GigabitEthernet0/0/1
  10.0.2.0/24 Direct 0 0 D 10.0.2.2 LoopBack0
  10.0.2.2/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.2.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.3.3/32 OSPF 10 2 D 10.0.12.1 GigabitEthernet0/0/1
  10.0.12.0/24 Direct 0 0 D 10.0.12.2 GigabitEthernet0/0/1
  10.0.12.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
  10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
  10.0.13.0/24 OSPF 10 2 D 10.0.12.1 GigabitEthernet0/0/1
  127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
  127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
  127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
  255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
```

步骤 3 查看 R3 的路由表。

```
<R3>display ip routing-table
Route Flags: R - relay, D - download to fib
```

```
------------------------------------------------------------------------
Routing Tables: Public
Destinations : 16 Routes : 16
Destination/Mask Proto Pre Cost Flags NextHop Interface
  10.0.1.1/32 OSPF 10 1 D 10.0.13.1 GigabitEthernet0/0/0
  10.0.2.2/32 OSPF 10 2 D 10.0.13.1 GigabitEthernet0/0/0
  10.0.3.0/24 Direct 0 0 D 10.0.3.3 LoopBack0
  10.0.3.3/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.3.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
  10.0.12.0/24 OSPF 10 2 D 10.0.13.1 GigabitEthernet0/0/0
  10.0.13.0/24 Direct 0 0 D 10.0.13.3 GigabitEthernet0/0/0
  10.0.13.3/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
  10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
  127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
  127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
  172.16.0.0/24 Direct 0 0 D 172.16.0.1 LoopBack2
  172.16.0.1/32 Direct 0 0 D 127.0.0.1 LoopBack2
  172.16.0.255/32 Direct 0 0 D 127.0.0.1 LoopBack2
255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
```

步骤 4 检测 **R2** 和 **R1**（**10.0.1.1**）以及 **R2** 和 **R3**（**10.0.3.3**）间的连通性。

```
<R2>ping 10.0.1.1
PING 10.0.1.1: 56 data bytes, press CTRL_C to break
Reply from 10.0.1.1: bytes=56 Sequence=1 ttl=255 time=37 ms
Reply from 10.0.1.1: bytes=56 Sequence=2 ttl=255 time=42 ms
Reply from 10.0.1.1: bytes=56 Sequence=3 ttl=255 time=42 ms
Reply from 10.0.1.1: bytes=56 Sequence=4 ttl=255 time=45 ms
Reply from 10.0.1.1: bytes=56 Sequence=5 ttl=255 time=42 ms
--- 10.0.1.1 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 37/41/45 ms

<R2>ping 10.0.3.3
PING 10.0.3.3: 56 data bytes, press CTRL_C to break
Reply from 10.0.3.3: bytes=56 Sequence=1 ttl=254 time=37 ms
Reply from 10.0.3.3: bytes=56 Sequence=2 ttl=254 time=42 ms
Reply from 10.0.3.3: bytes=56 Sequence=3 ttl=254 time=42 ms
Reply from 10.0.3.3: bytes=56 Sequence=4 ttl=254 time=42 ms
Reply from 10.0.3.3: bytes=56 Sequence=5 ttl=254 time=42 ms
--- 10.0.3.3 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
```

```
round-trip min/avg/max = 37/41/42 ms
```

步骤 5 执行 display ospf peer 命令，查看 OSPF 邻居状态。

```
<R1>display ospf peer
OSPF Process 1 with Router ID 10.0.1.1
Neighbors
Area 0.0.0.0 interface 10.0.12.1(GigabitEthernet0/0/1)'s neighbors
Router ID: 10.0.2.2 Address: 10.0.12.2
State: Full Mode:Nbr is Master Priority: 1
DR: 10.0.12.1 BDR: 10.0.12.2 MTU: 0
Dead timer due in 32 sec
Retrans timer interval: 5
Neighbor is up for 00:47:59
Authentication Sequence: [ 0 ]
Neighbors
Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s neighbors
Router ID: 10.0.3.3 Address: 10.0.13.3
State: Full Mode:Nbr is Master Priority: 1
DR: 10.0.13.1 BDR: 10.0.13.3 MTU: 0
Dead timer due in 34 sec
Retrans timer interval: 5
Neighbor is up for 00:41:44
Authentication Sequence: [ 0 ]
```

* **display ospf peer** 命令显示所有 OSPF 邻居的详细信息。本任务中，10.0.13.0 网段上 R1 是 DR。由于 DR 选举是非抢占模式，如果 OSPF 进程不重启，R3 将不会取代 R1 的 DR 角色。

执行 display ospf peer brief 命令，可以查看简要的 OSPF 邻居信息。

```
<R1>display ospf peer brief
OSPF Process 1 with Router ID 10.0.1.1
Peer Statistic Information
-------------------------------------------------------------------------
Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/0 10.0.3.3 Full
0.0.0.0 GigabitEthernet0/0/1 10.0.2.2 Full
-------------------------------------------------------------------------
<R2>display ospf peer brief
OSPF Process 1 with Router ID 10.0.2.2
Peer Statistic Information
-------------------------------------------------------------------------
Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/1 10.0.1.1 Full
-------------------------------------------------------------------------
<R3>display ospf peer brief
OSPF Process 1 with Router ID 10.0.3.3
Peer Statistic Information
-------------------------------------------------------------------------
```

```
Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/0 10.0.1.1 Full
-------------------------------------------------------------------------
```

任务五 修改 OSPF hello 和 dead 时间参数

步骤 1 在 **R1** 上执行 **display ospf interface GigabitEthernet 0/0/0** 命令，查看 **OSPF** 默认的 **hello** 和 **dead** 时间。

```
<R1>display ospf interface GigabitEthernet 0/0/0
OSPF Process 1 with Router ID 10.0.1.1
Interfaces
Interface: 10.0.13.1 (GigabitEthernet0/0/0)
Cost: 1 State: DR Type: Broadcast MTU: 1500
Priority: 1
Designated Router: 10.0.13.1
Backup Designated Router: 10.0.13.3
Timers: Hello 10 , Dead 40 , Poll 120 , Retransmit 5 , Transmit Delay 1
```

步骤 2 在 **R1** 的 **GE0/0/0** 接口执行 **ospf timer** 命令，将 **OSPF hello** 和 **dead** 时间分别修改为 **15** 秒和 **60** 秒。

```
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]ospf timer hello 15
[R1-GigabitEthernet0/0/0]ospf timer dead 60
Nov 30 2013 16:58:39+00:00 R1 %%01OSPF/3/NBR_DOWN_REASON(l)[1]:Neighbor state leaves full or changed to Down. (ProcessId=1, NeighborRouterId=10.0.3.3, NeighborAreaId=0, NeighborInterface=GigabitEthernet0/0/0,NeighborDownImmediate reason=Neighbor Down Due to Inactivity, NeighborDownPrimeReason=Interface Parameter Mismatch, NeighborChangeTime=2013-11-30 16:58:39)

<R1>display ospf interface GigabitEthernet 0/0/0
OSPF Process 1 with Router ID 10.0.1.1
Interfaces
Interface: 10.0.13.1 (GigabitEthernet0/0/0)
Cost: 1 State: DR Type: Broadcast MTU: 1500
Priority: 1
Designated Router: 10.0.13.1
Backup Designated Router: 10.0.13.3
Timers: Hello 15 , Dead 60 , Poll 120 , Retransmit 5 , Transmit Delay 1
```

步骤 3 在 **R1** 上查看 **OSPF** 邻居状态。

```
<R1>display ospf peer brief
OSPF Process 1 with Router ID 10.0.1.1
Peer Statistic Information
-------------------------------------------------------------------------
Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/1 10.0.2.2 Full
```

```
----------------------------------------------------------------------
```

上述回显信息表明，R1 只有一个邻居，那就是 R2。因为 R1 和 R3 上的 OSPF hello 和 dead 时间取值不同，所以 R1 无法与 R3 建立 OSPF 邻居关系。

在 R3 的 GE0/0/0 接口执行 **ospf timer** 命令，将 OSPF hello 和 dead 时间分别修改为 15 秒和 60 秒。

```
[R3]interface GigabitEthernet 0/0/0
[R3-GigabitEthernet0/0/0]ospf timer hello 15
[R3-GigabitEthernet0/0/0]ospf timer dead 60
…output omitted…
Nov 30 2013 17:03:33+00:00 R3 %%01OSPF/4/NBR_CHANGE_E(l)[4]:Neighbor changes event:
neighbor status changed. (ProcessId=1, NeighborAddress=10.0.13.1,
NeighborEvent=LoadingDone, NeighborPreviousState=Loading,
NeighborCurrentState=Full)

<R3>display ospf interface GigabitEthernet 0/0/0
OSPF Process 1 with Router ID 10.0.3.3
Interfaces
Interface: 10.0.13.3 (GigabitEthernet0/0/0)
Cost: 1 State: DR Type: Broadcast MTU: 1500
Priority: 1
Designated Router: 10.0.13.3
Backup Designated Router: 10.0.13.1
Timers: Hello 15 , Dead 60 , Poll 120 , Retransmit 5 , Transmit Delay 1
```

步骤 4 再次在 R1 上查看 OSPF 邻居状态。

```
<R1>display ospf peer brief
OSPF Process 1 with Router ID 10.0.1.1
Peer Statistic Information
----------------------------------------------------------------------
Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/0 10.0.3.3 Full
0.0.0.0 GigabitEthernet0/0/1 10.0.2.2 Full
----------------------------------------------------------------------
```

任务六 OSPF 缺省路由发布及验证

步骤 1 在 R3 上配置缺省路由并发布到 OSPF 域内。

```
[R3]ip route-static 0.0.0.0 0.0.0.0 LoopBack 2
[R3]ospf 1
[R3-ospf-1]default-route-advertise
```

步骤 2 查看 R1 和 R2 的路由表。可以看到，R1 和 R2 均已经学习到了 R3 发布的缺省路由。

```
<R1>display ip routing-table
Route Flags: R - relay, D - download to fib
```

```
------------------------------------------------------------------------
Routing Tables: Public
       Destinations : 16 Routes : 16
Destination/Mask Proto Pre Cost Flags NextHop Interface
   0.0.0.0/0 O_ASE 150 1 D 10.0.13.3 GigabitEthernet0/0/0
   10.0.1.0/24 Direct 0 0 D 10.0.1.1 LoopBack0
   10.0.1.1/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.1.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.2.2/32 OSPF 10 1 D 10.0.12.2 GigabitEthernet0/0/1
   10.0.3.3/32 OSPF 10 1 D 10.0.13.3 GigabitEthernet0/0/0
   10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/1
   10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
   10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
   10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/0
   10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
   10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
   127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
   127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0

<R2>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------
Routing Tables: Public
       Destinations : 14 Routes : 14
Destination/Mask Proto Pre Cost Flags NextHop Interface
   0.0.0.0/0 O_ASE 150 1 D 10.0.12.1 GigabitEthernet0/0/1
   10.0.1.1/32 OSPF1 0 1 D 10.0.12.1 GigabitEthernet0/0/1
   10.0.2.0/24 Direct 0 0 D 10.0.2.2 LoopBack0
   10.0.2.2/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.2.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.3.3/32 OSPF 10 2 D 10.0.12.1 GigabitEthernet0/0/1
   10.0.12.0/24 Direct 0 0 D 10.0.12.2 GigabitEthernet0/0/1
   10.0.12.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
   10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1
   10.0.13.0/24 OSPF 10 2 D 10.0.12.1 GigabitEthernet0/0/1
   127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
   127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0

<R3>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------
Routing Tables: Public
```

```
      Destinations : 17 Routes : 17
Destination/Mask Proto Pre Cost Flags NextHop Interface
    0.0.0.0/0 Static 60 0 D 172.16.0.1 LoopBack2
   10.0.1.1/32 OSPF 10 1 D 10.0.13.1 GigabitEthernet0/0/0
   10.0.2.2/32 OSPF 10 2 D 10.0.13.1 GigabitEthernet0/0/0
   10.0.3.0/24 Direct 0 0 D 10.0.3.3 LoopBack0
   10.0.3.3/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.3.255/32 Direct 0 0 D 127.0.0.1 LoopBack0
   10.0.12.0/24 OSPF 10 2 D 10.0.13.1 GigabitEthernet0/0/0
   10.0.13.0/24 Direct 0 0 D 10.0.13.3 GigabitEthernet0/0/0
   10.0.13.3/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
   10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0
   127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
   127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
127.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0
   172.16.0.0/24 Direct 0 0 D 172.16.0.1 LoopBack2
   172.16.0.1/32 Direct 0 0 D 127.0.0.1 LoopBack2
   172.16.0.255/32 Direct0 0 D 127.0.0.1 LoopBack2
255.255.255.255/32 Direct0 0 D 127.0.0.1 InLoopBack0
```

步骤 3 使用 ping 命令，检测 R2 与 172.16.0.1/24 网段之间的连通性。

```
<R2>ping 172.16.0.1
  PING 172.16.0.1: 56 data bytes, press CTRL_C to break
    Reply from 172.16.0.1: bytes=56 Sequence=1 ttl=254 time=47 ms
    Reply from 172.16.0.1: bytes=56 Sequence=2 ttl=254 time=37 ms
    Reply from 172.16.0.1: bytes=56 Sequence=3 ttl=254 time=37 ms
    Reply from 172.16.0.1: bytes=56 Sequence=4 ttl=254 time=37 ms
    Reply from 172.16.0.1: bytes=56 Sequence=5 ttl=254 time=37 ms
--- 172.16.0.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
round-trip min/avg/max = 37/39/47 ms
```

任务七 控制 OSPF DR/BDR 的选举

步骤 1 执行 display ospf peer 命令，查看 R1 和 R3 的 DR/BDR 角色。

```
<R1>display ospf peer 10.0.3.3
      OSPF Process 1 with Router ID 10.0.1.1
          Neighbors
Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s neighbors
Router ID: 10.0.3.3 Address: 10.0.13.3
    State: Full Mode:Nbr is Master Priority: 1
    DR: 10.0.13.3 BDR: 10.0.13.1 MTU: 0
    Dead timer due in 49 sec
    Retrans timer interval: 5
```

```
   Neighbor is up for 00:17:40
   Authentication Sequence: [ 0 ]
```

上述回显信息表明，由于默认路由器优先级（数值为 1）相同，但 R3 的 Router ID 10.0.3.3 大于 R1 的 Router ID 10.0.1.1，所以 R3 为 DR，R1 为 BDR。

步骤 2　执行 ospf dr-priority 命令，修改 R1 和 R3 的 DR 优先级。

```
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]ospf dr-priority 200

[R3]interface GigabitEthernet 0/0/0
[R3-GigabitEthernet0/0/0]ospf dr-priority 100
```

默认情况下，DR/BDR 的选举采用的是非抢占模式。路由器优先级修改后，不会自动重新选举 DR。因此，需要重置 R1 和 R3 间的 OSPF 邻居关系。

步骤 3　先关闭然后再打开 R1 和 R3 上的 Gigabit Ethernet 0/0/0 接口，重置 R1 和 R3 间的 OSPF 邻居关系。

```
[R3]interface GigabitEthernet0/0/0
[R3-GigabitEthernet0/0/0]shutdown

[R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]shutdown
[R1-GigabitEthernet0/0/0]undo shutdown

[R3-GigabitEthernet0/0/0]undo shutdown
```

步骤 4 执行 display ospf peer 命令，查看 R1 和 R3 的 DR/BDR 角色。

```
[R1]display ospf peer 10.0.3.3
      OSPF Process 1 with Router ID 10.0.1.1
Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s neighbors
   Router ID: 10.0.3.3 Address: 10.0.13.3
   State: Full Mode:Nbr is Master Priority: 100
   DR: 10.0.13.1 BDR: 10.0.13.3 MTU: 0
   Dead timer due in 52 sec
   Retrans timer interval: 5
   Neighbor is up for 00:00:25
   Authentication Sequence: [ 0 ]
```

上述信息表明，R1 的 DR 优先级高于 R3，因此 R1 被选举为 DR，而 R3 成为了 BDR。

任务八 查看配置文件

步骤 1 查看 R1 配置文件

```
<R1>display current-configuration
```

（回显省略）

步骤 2 查看 R2 配置文件

```
<R2>display current-configuration
```

（回显省略）

步骤 3 查看 R3 配置文件

```
<R2>display current-configuration
```

（回显省略）