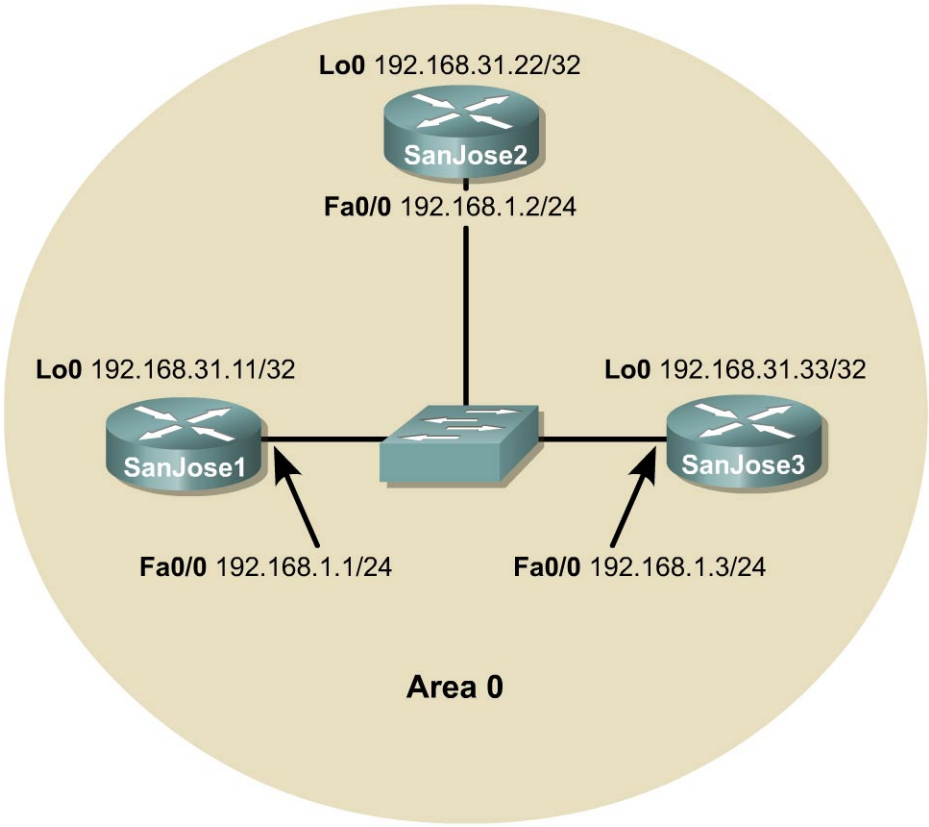
Lab 6.9.2a Examining the DR/BDR Election Process



Objective

In this lab, observe the OSPF DR and BDR election processing using **debug** commands. Then assign each OSPF interface a priority value to force the election of a specific router as a DR.

Scenario

The backbone of International Travel Agency's enterprise network consists of three routers connected using an Ethernet core. SanJose1 has more memory and processing power than the other core routers. Unfortunately, other core routers are continually elected as the DR under the default settings. In the interest of optimization, ensure that SanJose1 is elected the DR, because it is best suited to handle associated extra duties, including management of Link State Advertisements (LSA) for Area 0. Investigate and correct this situation.

Step 1

Build and configure the network according to the diagram. Use the configuration files from the previous lab if available. Configure OSPF on all Ethernet interfaces. A switch or hub is required to connect the three routers through Ethernet. Be sure to configure each router with the loopback interface and IP address shown in the diagram.

Use **ping** to verify the work and test connectivity between the Ethernet interfaces.

Step 2

Use the **show ip ospf neighbor detail** command as follows to verify that the OSPF routers have formed adjacencies:

Note: The routers are still using authentication for the previous lab setup.

```
SanJose3#show ip ospf neighbor detail
 Neighbor 192.168.31.11, interface address 192.168.1.1
    In the area 0 via interface FastEthernet0/0
    Neighbor priority is 1, State is FULL, 12 state changes
    DR is 192.168.1.3 BDR is 192.168.1.2
    Options 2
    Dead timer due in 00:00:17
    Index 2/2, retransmission queue length 0, number of retransmission 1
    First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
    Last retransmission scan length is 1, maximum is 1
    Last retransmission scan time is 0 msec, maximum is 0 msec
 Neighbor 192.168.31.22, interface address 192.168.1.2
    In the area 0 via interface FastEthernet0/0
    Neighbor priority is 1, State is FULL, 6 state changes
    DR is 192.168.1.3 BDR is 192.168.1.2
    Options 2
    Dead timer due in 00:00:15
    Index 1/1, retransmission queue length 0, number of retransmission 5
    First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
    Last retransmission scan length is 1, maximum is 1
    Last retransmission scan time is 0 msec, maximum is 0 msec
```

1. Which router is the DR? Why?

_____

2. Which router is the BDR? Why?

_____

Recall that router IDs determine the DR and BDR.

Step 3

If the network is configured according to the diagram, SanJose1 will not be the DR. Temporarily shut down SanJose3, which has the highest router ID, 192.168.31.33, and observe the DR/BDR election process. To observe the election, issue the following **debug** command on SanJose1:

```
SanJose1#debug ip ospf adj
```

Now that OSPF adjacency events will be logged to SanJose1 console, remove SanJose3 from the OSPF network by shutting down its FastEthernet interface as follows:

```
SanJose3(config)#interface fastethernet 0/0
SanJose3(config-if)#shutdown
Watch the debug output on SanJose1:
SanJose1#
00:48:47: OSPF: Rcv hello from 192.168.31.22 area 0 from
FastEthernet0/0 192.168.1.2
00:48:47: OSPF: Neighbor change Event on interface FastEthernet0/0
00:48:47: OSPF: DR/BDR election on FastEthernet0/0
00:48:47: OSPF: Elect BDR 192.168.31.11
00:48:47: OSPF: Elect DR 192.168.31.22
00:48:47: OSPF: Elect BDR 192.168.31.11
00:48:47: OSPF: Elect DR 192.168.31.22
00:48:47:        DR: 192.168.31.22 (Id)   BDR: 192.168.31.11 (Id)
```



```
00:48:47: OSPF: Remember old DR 192.168.31.33 (id)
00:48:47: OSPF: End of hello processing
```

3. Who is elected DR? Why?

The former BDR is promoted to DR.

In the **debug** output, look for a statement about remembering the "old DR". Unless SanJose1 and SanJose2 are powered off, they will remember that SanJose3 was the old DR. When SanJose3 comes back online, these routers will allow SanJose3 to reassume its role as DR.

```
SanJose1#
00:51:32: OSPF: Rcv hello from 192.168.31.22 area 0 from
FastEthernet0/0 192.168.1.2
00:51:32: OSPF: End of hello processing
00:51:33: OSPF: Rcv hello from 192.168.31.33 area 0 from
FastEthernet0/0 192.168.1.3
00:51:33: OSPF: 2 Way Communication to 192.168.31.33 on
FastEthernet0/0, state 2WAY
00:51:33: OSPF: Neighbor change Event on interface FastEthernet0/0
00:51:33: OSPF: DR/BDR election on FastEthernet0/0
00:51:33: OSPF: Elect BDR 192.168.31.11
00:51:33: OSPF: Elect DR 192.168.31.33
00:51:33:        DR: 192.168.31.33 (Id)   BDR: 192.168.31.11 (Id)
00:51:33: OSPF: Send DBD to 192.168.31.33 on FastEthernet0/0 seq
0x21CF opt 0x2 flag 0x7 len 32
00:51:33: OSPF: Send with youngest Key 1
00:51:33: OSPF: Remember old DR 192.168.31.22 (id)
00:51:33: OSPF: End of hello processing
```

Step 4

At this point, SanJose1 should have assumed the role of BDR. Bring SanJose3 back online, and observe the new election process.

4. SanJose3 will assume its former role as DR. Who is elected BDR? Why?

SanJose1 remains the BDR even though SanJose2 has the higher router ID.

Step 5

A router can be manipulated to become the DR by using two methods. The router ID could be changed to a higher number, but that could confuse the loopback addressing system and affect elections on other interfaces. The same router ID is used for every network that a router is a member of. For example, if an OSPF router has an exceptionally high router ID, it could win the election on every multiaccess interface and, as a result, do triple or quadruple duty as a DR.

Instead of reconfiguring router IDs, manipulate the election by configuring OSPF priority values. Because priorities are an interface-specific value, they provide finer control of the OSPF internetwork by allowing a router to be the DR in one network and a DRother in another. Priority values are the first consideration in the DR election, with the highest priority winning. Values can range from 0 to 255. A value of 0 indicates that the interface will not participate in an election. Use the **show ip ospf interface** command as follows to examine the current priority values of the Ethernet interfaces on the three routers:

```
SanJose1#show ip ospf interface
```



```
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.1/24, Area 0
  Process ID 1, Router ID 192.168.31.11, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 192.168.31.33, Interface address 192.168.1.3
  Backup Designated router (ID) 192.168.31.11, Interface address
192.168.1.1
  Timer intervals configured, Hello 5, Dead 20, Wait 20, Retransmit 5
    Hello due in 00:00:03
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 2
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 192.168.31.33  (Designated Router)
    Adjacent with neighbor 192.168.31.22
  Suppress hello for 0 neighbor(s)
  Message digest authentication enabled
    Youngest key id is 1
```

5. What is the priority value of these interfaces?

The default priority is one (1). Because all have equal priority, router ID is used to determine the DR and BDR.

Modify the priority values so that SanJose1 will become the DR and SanJose2 will become the BDR, regardless of their router ID. Use the following commands:

```
SanJose1(config)#interface fastethernet 0/0
SanJose1(config-if)#ip ospf priority 200

SanJose2(config)#interface fastethernet 0/0
SanJose2(config-if)#ip ospf priority 100
```

In order to reset the election process, write the configuration for each router to NVRAM and reload SanJose1, SanJose2, and SanJose3. Issue the following commands at each router:

```
SanJose1#copy running-config startup-config
SanJose1#reload
```

When the routers finish reloading, try to observe the OSPF election on SanJose1 by using the **debug ip ospf adj** command. Also, verify the configuration by issuing the **show ip ospf interface** command at both SanJose1 and SanJose2.

```
SanJose1#debug ip ospf adj
00:01:20: OSPF: Rcv hello from 192.168.31.22 area 0 from
FastEthernet0/0 192.168.1.2
00:01:20: OSPF: Neighbor change Event on interface FastEthernet0/0
00:01:20: OSPF: DR/BDR election on FastEthernet0/0
00:01:20: OSPF: Elect BDR 192.168.31.22
00:01:20: OSPF: Elect DR 192.168.31.11
00:01:20:       DR: 192.168.31.11 (Id)   BDR: 192.168.31.22 (Id)
00:01:20: OSPF: End of hello processing
```

```
SanJose2#show ip ospf interface
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.2/24, Area 0
  Process ID 1, Router ID 192.168.31.22, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 100
  Designated Router (ID) 192.168.31.11, Interface address 192.168.1.1
```



```
  Backup Designated router (ID) 192.168.31.22, Interface address
192.168.1.2
  Timer intervals configured, Hello 5, Dead 20, Wait 20,
Retransmit 5
    Hello due in 00:00:03
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 192.168.31.33
    Adjacent with neighbor 192.168.31.11  (Designated Router)
  Suppress hello for 0 neighbor(s)
  Message digest authentication enabled
    Youngest key id is 1
```

After the election is complete, verify that SanJose1 and SanJose2 have assumed the correct roles by using the **show ip ospf neighbor detail** command. Troubleshoot, if necessary.

```
SanJose3#show ip ospf neighbor detail
 Neighbor 192.168.31.22, interface address 192.168.1.2
    In the area 0 via interface FastEthernet0/0
    Neighbor priority is 100, State is FULL, 6 state changes
    DR is 192.168.1.1 BDR is 192.168.1.2
    Options 2
    Dead timer due in 00:00:17
    Index 2/2, retransmission queue length 0, number of retransmission 0
    First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
    Last retransmission scan length is 0, maximum is 0
    Last retransmission scan time is 0 msec, maximum is 0 msec
 Neighbor 192.168.31.11, interface address 192.168.1.1
    In the area 0 via interface FastEthernet0/0
    Neighbor priority is 200, State is FULL, 6 state changes
    DR is 192.168.1.1 BDR is 192.168.1.2
    Options 2
    Dead timer due in 00:00:19
    Index 1/1, retransmission queue length 0, number of retransmission 2
    First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
    Last retransmission scan length is 1, maximum is 1
    Last retransmission scan time is 0 msec, maximum is 0 msec
```

Note that the order in which routers join an area can have the most significant effect on which routers are elected as DR and BDR. An election is necessary only when a DR or BDR does not exist in the network. As a router starts its OSPF process, it checks the network for an active DR and BDR. If they exist, the new router becomes a DRother, regardless of its priority or router ID. Remember, the roles of DR and BDR were created for efficiency. New routers in the network should not force an election when adjacencies are already optimized. However, there is an exception. A known bug in some IOS versions allows a 'new' router with higher election credentials to force an election and assume the role of DR.

