Single Area OSPF  
  
I created a small topology to play around with Single Area OSPF. I will provide brief explanations of the outputs and what they mean. This will be a high-level overview.  
  
To verify everything is working properly, I ran a #sh ip ospf neighbor on Router3. Below is the output.   
Router3#sh ip ospf neighbor

Neighbor ID Pri State Dead Time Address Interface

2.2.2.2 1 FULL/BDR 00:00:37 10.1.23.1 GigabitEthernet0/5

1.1.1.1 1 FULL/DR 00:00:35 10.1.31.1 GigabitEthernet0/2  
  
With this output we can see the two other OSPF neighbors, currently in a FULL state and their DR/BDR election, along with their interfaces.   
  
We can also see the neighbor ID. The Neighbor ID is the Router ID of the other router. The priority of the Router ID election is listed below:  
1. manually setting the router I.D with the command #router-id <router id> .  
2.highest IP address of any UP loopback interface .  
3.highest IP address of UP physical interface.  
  
Next, I would like to focus on the neighbor State. OSPF States are listed below from start to finish.  
  
1.Down 🡪 2. Innit 🡪3.2-Way 🡪4.Ex-start 🡪5.Ex-change🡪6.Loading🡪7.Full  
  
 brief overview of the states  
1.down – no ospf hello packets have been received  
2.Innit- hello packet has been received but bidirectional communication has not been established.  
3.2-Way – bidirectional communication has been establish and DR/BDR election occurs here.(Not all connection types require DR/BDR, such as point-to-point)  
4.Ex-start- routers identify which router will be primary or secondary for LSDB synchronization   
5. Ex-change – routers exchange link states through DBD packets

6.Loading – more recent LSA are requested   
7. Full – routers are fully adjacent.   
  
DR/BDR election, will be explained next. One of the most important functions of a DR is to reduce OSPF adjacencies on a multi-access network segment. This results in routers only forming a full adjacency with the DR. The DR is then in charge of providing updates to the OSPF routers.

DR/BDR election.  
1. Router with the highest OSPF priority and second highest will become the BDR.

2. In case of a priority tie between the routers, the router with the highest router ID becomes the DR and the second highest router ID becomes the BDR.  
  
  
  
  
  
  
(By default all OSPF interfaces use 1 as their OSPF priority, which can be changed)  
  
Router2#sh ip ospf int bri

Interface PID Area IP Address/Mask Cost State Nbrs F/C

Lo2 1 0 2.2.2.2/32 1 LOOP 0/0

Gi0/6 1 0 10.1.23.1/24 1 BDR 1/1  
  
Router3#sh ip ospf int bri

Interface PID Area IP Address/Mask Cost State Nbrs F/C

Lo3 1 0 3.3.3.3/32 1 LOOP 0/0

Gi0/5 1 0 10.1.23.2/24 1 DR 1/1  
  
From this output, we can see that Router3’s Gi0/5 Interface is the DR, which make sense since the router ID is higher than Router2’s router ID of 2.2.2.2.