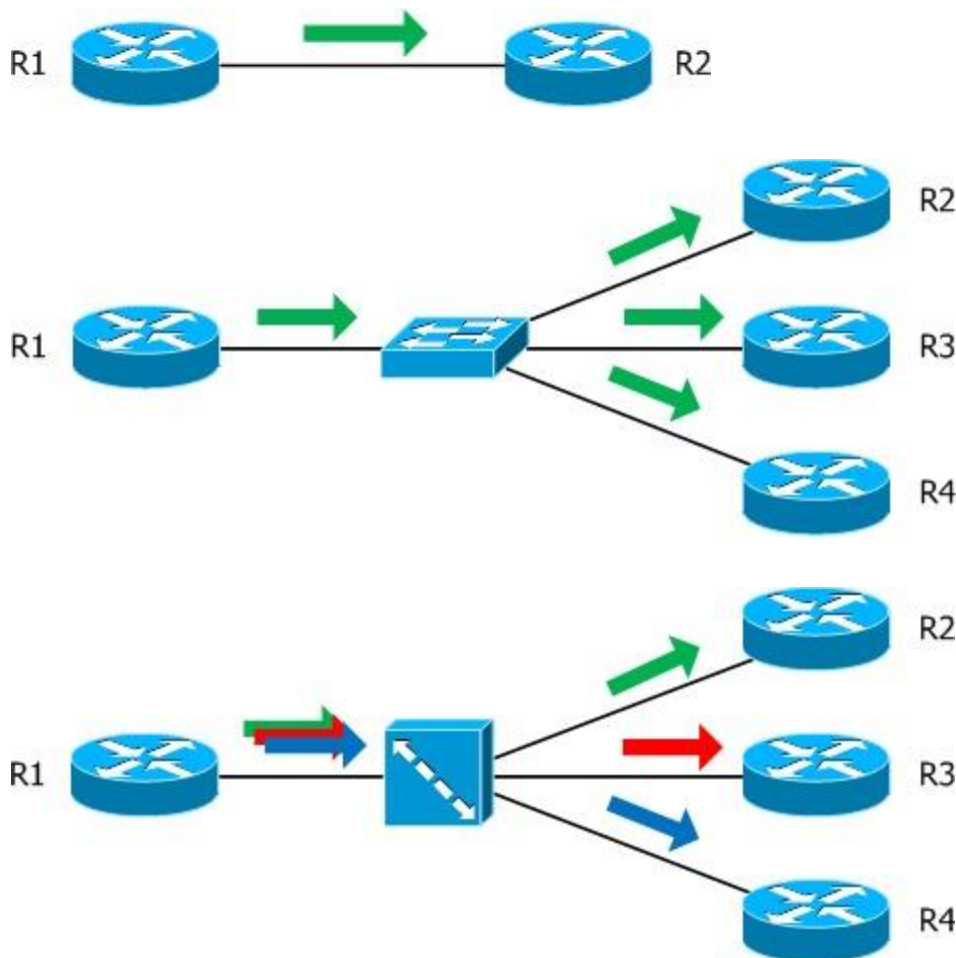


OSPF Network Types:

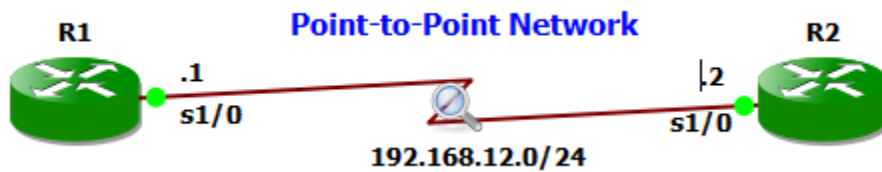
The network type defines how the neighbor relationship will be formed. Behavior of OSPF when operating in these different network types – whether hellos are multicast or unicast, if DR/BDR are elected, and so on. There are five different OSPF network types on a Cisco router point-to-point, broadcast, non-broadcast, point-to-multipoint non-broadcast and point-to-multipoint.

Network Type	Hello Timer	Dead Timer	Adjacency
Broadcast	10	40	Automatic + DR/BDR
Non-Broadcast	30	120	Manual + DR/BDR
Point-to-Multipoint	30	120	Automatic No DR/BDR
Point-to-Multipoint non-Broadcast	30	120	Manual No DR/BDR
Point-to-Point	10	40	Automatic No DR/BDR



Point-to-Point Network:

This is the simplest form of the network types. Point-to-Point network types are intended to be used between two directly connected routers. An example of a point-to-point link is a serial link connecting just two routers using HDLC or PPP. With point-to-point links, OSPF does not select a DR or BDR. In addition, hello packets are sent to the multicast address 224.0.0.5. The Point-to-Point network type has a 10-second hello and 40-second dead timer. Discovers neighbors dynamically.



R1 Configuration

```
R1(config)#interface s1/0
R1(config-if)#ip address 192.168.12.1 255.255.255.0
R1(config-if)#no shutdown
R1(config)#router ospf 1
R1(config-router)#network 192.168.12.0 0.0.0.255 area 0
R1#show ip ospf interface s1/0
R1#show ip ospf neighbor
```

R2 Configuration

```
R2(config)#interface s1/0
R2(config-if)#ip address 192.168.12.2 255.255.255.0
R2(config-if)#no shutdown
R2(config)#router ospf 1
R2(config-router)#network 192.168.12.0 0.0.0.255 area 0
R2#show ip ospf interface s1/0
R2#show ip ospf neighbor
```

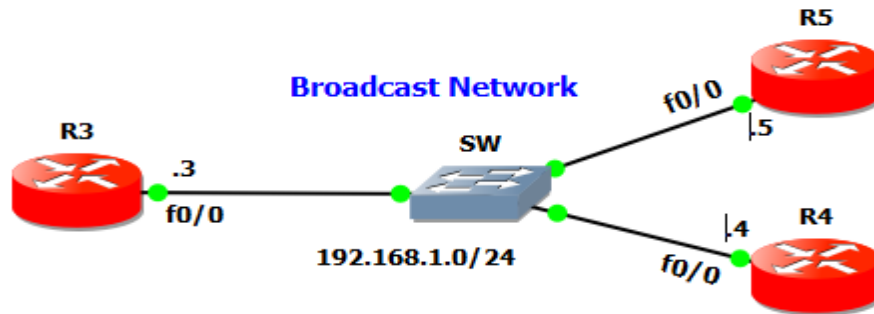
```
R1#show ip ospf interface s1/0
Serial1/0 is up, line protocol is up
Internet Address 192.168.12.1/24, Area 0
Process ID 1, Router ID 192.168.12.1, Network Type POINT_TO_POINT, Cost: 64
Topology-MTID      Cost      Disabled      Shutdown      Topology Name
0                  64        no            no            Base
Transmit Delay is 1 sec, State POINT_TO_POINT
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
oob-resync timeout 40
Hello due in 00:00:01
```

Capture packets of one of the serial interfaces, which will enable to look into the details of the hello packet sent by the routers. The packet is sent to the multicast address of **224.0.0.5**. In addition, notice that the 'Designated Router' and 'Backup Designated Router' fields are set to 0.0.0.0 meaning there is **no DR or BDR. 10-second hello and 40-second dead timer.**

```
> Internet Protocol Version 4, Src: 192.168.12.1, Dst: 224.0.0.5
  Open Shortest Path First
    OSPF Header
      Version: 2
      Message Type: Hello Packet (1)
      Packet Length: 44
      Source OSPF Router: 192.168.12.1
      Area ID: 0.0.0.0 (Backbone)
      Checksum: 0x1ff5 [correct]
      Auth Type: Null (0)
      Auth Data (none): 0000000000000000
    OSPF Hello Packet
      Network Mask: 255.255.255.0
      Hello Interval [sec]: 10
      Options: 0x12, (L) LLS Data block, (E) External Routing
      Router Priority: 1
      Router Dead Interval [sec]: 40
      Designated Router: 0.0.0.0
      Backup Designated Router: 0.0.0.0
    OSPF LLS Data Block
```

Broadcast Networks:

A network type that connects two or more OSPF routers over a broadcast media such as Ethernet. The Broadcast network type requires that a link support Layer 2 Broadcast capabilities. On broadcast networks, neighbors are dynamically discovered by the hellos that sent to the multicast address of 224.0.0.5. In addition, DR and BDR are elected on these networks. The Broadcast network type has a 10 second hello and 40 second dead timer.



R3 Basic Configuration

```
R3(config)#interface FastEthernet0/0
R3(config-if)#ip address 192.168.1.3 255.255.255.0
R3(config-if)#no shutdown
```

R4 Basic Configuration

```
R4(config)#interface FastEthernet0/0
R4(config-if)#ip add 192.168.1.4 255.255.255.0
R4(config-if)#no shutdown
```

R5 Basic Configuration

```
R5(config)#interface FastEthernet0/0
R5(config-if)#ip add 192.168.1.5 255.255.255.0
R5(config-if)#no shutdown
```

OSPF Configuration

```
R3(config)#router ospf 1
R3(config-router)#network 192.168.1.0 0.0.0.255 area 0
R4(config)#router ospf 1
R4(config-router)# network 192.168.1.0 0.0.0.255 area 0
R5(config)#router ospf 1
R5(config-router)# network 192.168.1.0 0.0.0.255 area 0
R3#show ip ospf interface f0/0
R5#show ip ospf interface f0/0
R4#show ip ospf interface f0/0
R3# show ip ospf neighbor
```

```

R3#show ip ospf interface f0/0
FastEthernet0/0 is up, line protocol is up
Internet Address 192.168.1.3/24, Area 0
Process ID 1, Router ID 192.168.1.3, Network Type BROADCAST, Cost: 1
Topology-MTID      Cost      Disabled      Shutdown      Topology Name
0                  1          no            no            Base
Transmit Delay is 1 sec, State DROTHER, Priority 1
Designated Router (ID) 192.168.1.5, Interface address 192.168.1.5
Backup Designated router (ID) 192.168.1.4, Interface address 192.168.1.4
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

```

A packet capture of the hello packet shown below. Notice that a DR and a BDR have been elected on this network. The packet is sent to the multicast address of 224.0.0.5.

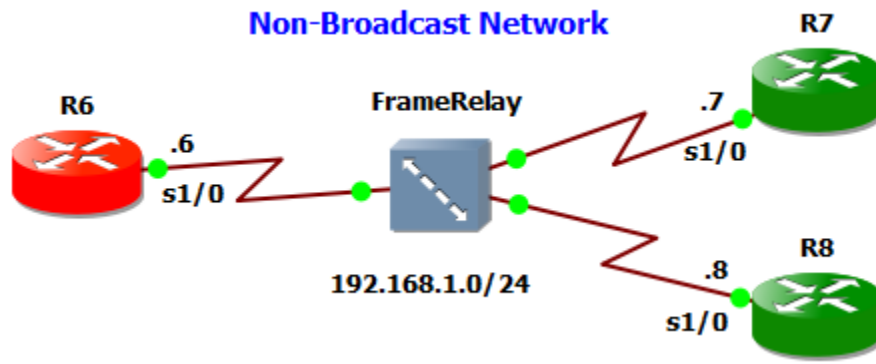
```

> Internet Protocol Version 4, Src: 192.168.1.5, Dst: 224.0.0.5
▼ Open Shortest Path First
  ▼ OSPF Header
    Version: 2
    Message Type: Hello Packet (1)
    Packet Length: 52
    Source OSPF Router: 192.168.1.5
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0x2436 [correct]
    Auth Type: Null (0)
    Auth Data (none): 0000000000000000
  ▼ OSPF Hello Packet
    Network Mask: 255.255.255.0
    Hello Interval [sec]: 10
    > Options: 0x12, (L) LLS Data block, (E) External Routing
    Router Priority: 1
    Router Dead Interval [sec]: 40
    Designated Router: 192.168.1.5
    Backup Designated Router: 192.168.1.4
    Active Neighbor: 192.168.1.3
    Active Neighbor: 192.168.1.4

```

Non-Broadcast Networks:

The Non-Broadcast network type is the default for OSPF enabled frame relay physical interfaces. No dynamic neighbor discovery requires the configuration of static neighbors; hellos are sent via unicast. The Non-Broadcast network type has a 30 second hello and 120 second dead timer. An OSPF Non-Broadcast network type requires the use of a DR/BDR.



Routers Configurations

```
R6(config)# interface Serial1/0
R6(config-if)# ip address 192.168.1.6 255.255.255.0
R6(config-if)# encapsulation frame-relay
R6(config-if)# no shutdown
```

```
R7(config)# interface Serial1/0
R7(config-if)# ip address 192.168.1.7 255.255.255.0
R7(config-if)# encapsulation frame-relay
R7(config-if)# no shutdown
```

```
R8(config)# interface Serial1/0
R8(config-if)# ip address 192.168.1.8 255.255.255.0
R8(config-if)# encapsulation frame-relay
R8(config-if)# no shutdown
```

```
R6(config)#router ospf 1
R6(config-router)# network 192.168.1.0
0.0.0.255 area 0
R6(config-router)# neighbor 192.168.1.7
R6(config-router)# neighbor 192.168.1.8
```

```
R7(config)#router ospf 1
R7(config-router)# network 192.168.1.0
0.0.0.255 area 0
R7(config-router)# neighbor 192.168.1.6
R7(config-router)# neighbor 192.168.1.8
```

```
R8(config)#router ospf 1
R8(config-router)# network 192.168.1.0 0.0.0.255 area 0
R8(config-router)# neighbor 192.168.1.6
R8(config-router)# neighbor 192.168.1.7
```

```
R6#show ip ospf interface s1/0
```

```
R7#show ip ospf interface s1/0
```

```

R6#show ip ospf interface s1/0
Serial1/0 is up, line protocol is up
Internet Address 192.168.1.6/24, Area 0
Process ID 1, Router ID 192.168.1.6, Network Type NON_BROADCAST, Cost: 64
Topology-MTID      Cost      Disabled      Shutdown      Topology Name
0                  64        no            no            Base
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 192.168.1.6, Interface address 192.168.1.6
Backup Designated router (ID) 192.168.1.8, Interface address 192.168.1.8
Timer intervals configured, Hello 30, Dead 120, wait 120, Retransmit 5

```

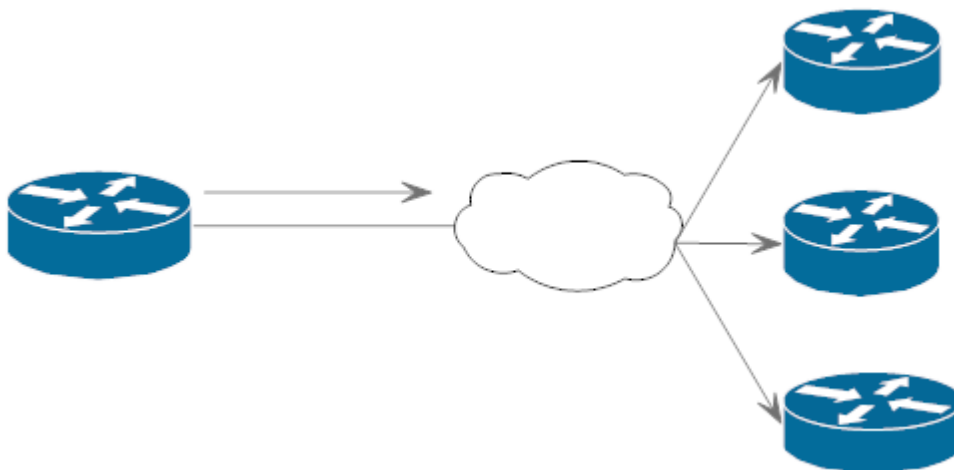
```

> Internet Protocol Version 4, Src: 192.168.1.6, Dst: 192.168.1.8
v Open Shortest Path First
  > OSPF Header
  v OSPF Hello Packet
    Network Mask: 255.255.255.0
    Hello Interval [sec]: 30
  > Options: 0x12, (L) LLS Data block, (E) External Routing
    Router Priority: 1
    Router Dead Interval [sec]: 120
    Designated Router: 192.168.1.6
    Backup Designated Router: 192.168.1.8
    Active Neighbor: 192.168.1.7
    Active Neighbor: 192.168.1.8

```

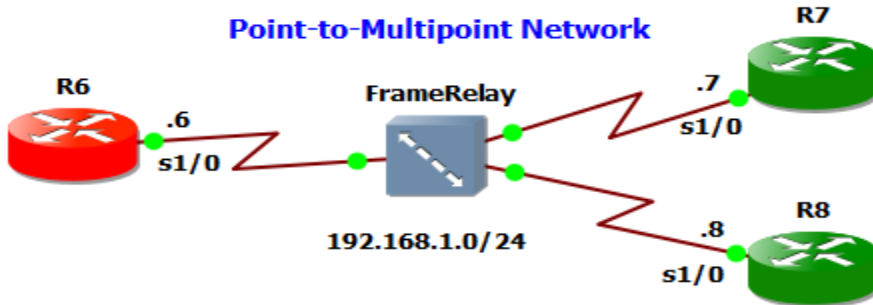
Non-Broadcast Multi-Access:

When OSPF operates in NBMA mode, it mimics a broadcast network (DR/BDR are elected) but, since broadcast is not supported, neighbors may need to be manually configured. One of the limitations of this is that there must be a full mesh between the devices; i.e., neighbors must be able to communicate directly; otherwise, the OSPF network may experience issues. The Non-Broadcast Multi-Access network type has a 30-second hello and 120 second dead timer.



Point-to-Multipoint:

In this mode, OSPF treats the non-broadcast network like a collection of point-to-point links. There is no DR/BDR election, but neighbors may be automatically discovered, depending on how the interface is configured. The interfaces have to be configured with the `ip ospf network point-to-multipoint` command. The Point-to-Multipoint network type has a 30-second hello and 120 second dead timer.



Routers Configurations

```
R6(config)# interface Serial1/0
R6(config-if)# ip address 192.168.1.6 255.255.255.0
R6(config-if)# encapsulation frame-relay
R6(config-if)# no shutdown
R6(config-if)# ip ospf network point-to-multipoint
```

```
R7(config)# interface Serial1/0
R7(config-if)# ip address 192.168.1.7 255.255.255.0
R7(config-if)# encapsulation frame-relay
R7(config-if)# no shutdown
R6(config-if)# ip ospf network point-to-multipoint
```

```
R8(config)# interface Serial1/0
R8(config-if)# ip address 192.168.1.8 255.255.255.0
R8(config-if)# encapsulation frame-relay
R8(config-if)# no shutdown
R6(config-if)# ip ospf network point-to-multipoint
```

```
R6,R7,R8(config)# router ospf 1
R6,R7,R8(config-router)# network 192.168.1.0 0.0.0.255 area 0
```

```
R6#show ip ospf interface s1/0
```

```
R7#show ip ospf interface s1/0
```

```
R8#show ip ospf interface s1/0
```

```
R6# show ip ospf neighbor
```

```
R7# show ip ospf neighbor
```

```
R8# show ip ospf neighbor
```

```

R6#show ip ospf interface serial 1/0
Serial1/0 is up, line protocol is up
Internet Address 192.168.1.6/24, Area 0
Process ID 1, Router ID 192.168.1.6, Network Type POINT_TO_MULTIPOINT, Cost: 64
Topology-MTID      Cost      Disabled      Shutdown      Topology Name
0                 64        no            no            Base
Transmit Delay is 1 sec, State POINT_TO_MULTIPOINT
Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5

```

```
R6#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.1.8	0	FULL/ -	00:01:41	192.168.1.8	Serial1/0
192.168.1.7	0	FULL/ -	00:01:59	192.168.1.7	Serial1/0

```

> Internet Protocol Version 4, Src: 192.168.1.6, Dst: 224.0.0.5
< Open Shortest Path First
  > OSPF Header
  < OSPF Hello Packet
    Network Mask: 255.255.255.0
    Hello Interval [sec]: 30
    > Options: 0x12, (L) LLS Data block, (E) External Routing
    Router Priority: 1
    Router Dead Interval [sec]: 120
    Designated Router: 0.0.0.0
    Backup Designated Router: 0.0.0.0
    Active Neighbor: 192.168.1.8
    Active Neighbor: 192.168.1.7

```