

Initial Configurations for OSPF over Non-Broadcast Links

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Introduction

On non-broadcast media such as Frame Relay, X.25, ATM, and Switched Multimegabit Data Service (SMDS), OSPF can run in two modes:

- NBMA: simulates a broadcast model by electing a designated router (DR) and a backup designated router (BDR). There are two ways to simulate a broadcast model on an NBMA network: define the network type as broadcast with the **ip ospf network broadcast** interface sub-command or configure the neighbor statements using the **router ospf** command.
- Point-to-multipoint: treats non-broadcast network as a collection of point-to-point links by configuring the **ip ospf network point-to-multipoint** command.

You must define the network type on non-broadcast networks to avoid configuring neighbor statements. Below are sample configurations for OSPF over non-broadcast links. Use the **show ip ospf interface** command to check the network type of an interface running OSPF and the command **show ip ospf neighbor** is used to know the status of the neighbor router.

Prerequisites

Requirements

This document requires that you understand basic configuration of the **Open Shortest Path First (OSPF)** routing protocol.

Components Used

The information in this document is based on these software and hardware versions:

- Cisco 2500 routers
- Cisco IOS[®] Software Release 12.2(24a) running on routers

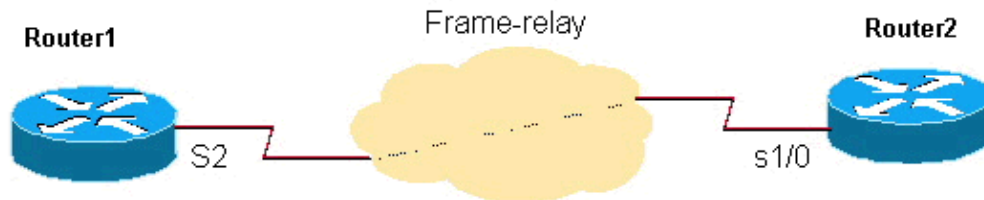
The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

Network Diagram

Below is the network diagram used in the configuration examples in this document.



Configurations for NBMA (Using Network Type Broadcast)

| Router1 |
|--|
| <pre>interface Loopback0 ip address 3.3.3.3 255.255.255.255 ! ! interface Serial2 ip address 1.1.1.2 255.255.255.0 encapsulation frame-relay ip ospf network broadcast no keepalive frame-relay map ip 1.1.1.1 16 broadcast ! ! router ospf 1 network 1.1.1.0 0.0.0.255 area 0</pre> |

| Router2 |
|--|
| <pre>interface Loopback0 ip address 2.2.2.2 255.255.255.255 ! interface Serial1/0 ip address 1.1.1.1 255.255.255.0 encapsulation frame-relay ip ospf network broadcast no keepalive clockrate 2000000 frame-relay map ip 1.1.1.2 16 broadcast ! router ospf 1 network 1.1.1.0 0.0.0.255 area 0 !</pre> |

Verification Tips

Below is the **show** command output for Router1.

```
Router1# show ip ospf neighbor
```

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|----------|-----------|---------|-----------|
| 2.2.2.2 | 1 | FULL/BDR | 00:00:37 | 1.1.1.1 | Serial2 |

```
Router1# show ip ospf interface s2
```

```
Serial2 is up, line protocol is up
  Internet Address 1.1.1.2/24, Area 0
  Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 64
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 3.3.3.3, Interface address 1.1.1.2
  Backup Designated router (ID) 2.2.2.2, Interface address 1.1.1.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:00
  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 4 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 2.2.2.2 (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
```

And the output for Router2 is as follows.

```
Router2# show ip ospf neighbor
```

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|---------|-----------|---------|-----------|
| 3.3.3.3 | 1 | FULL/DR | 00:00:38 | 1.1.1.2 | Serial1/0 |

```
Router2# show ip ospf interface s1/0
```

```
Serial1/0 is up, line protocol is up
  Internet Address 1.1.1.1/24, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 64
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 3.3.3.3, Interface address 1.1.1.2
  Backup Designated router (ID) 2.2.2.2, Interface address 1.1.1.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, 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 4 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 3.3.3.3 (Designated Router)
  Suppress hello for 0 neighbor(s)
```

Configurations for NBMA (Using Neighbor Statements)

| Router1 |
|--|
| <pre>interface Loopback0 ip address 3.3.3.3 255.255.255.255 ! interface Serial2 ip address 1.1.1.2 255.255.255.0 encapsulation frame-relay ip ospf priority 2 no keepalive frame-relay map ip 1.1.1.1 16</pre> |

```

!
router ospf 1
 network 1.1.1.0 0.0.0.255 area 0
 neighbor 1.1.1.1
!

```

Router2

```

interface Loopback0
 ip address 2.2.2.2 255.255.255.255
!
interface Serial1/0
 ip address 1.1.1.1 255.255.255.0
 encapsulation frame-relay
 no keepalive
 clockrate 2000000
 frame-relay map ip 1.1.1.2 16
!
router ospf 1
 network 1.1.1.0 0.0.0.255 area 0
 neighbor 1.1.1.2
!

```

Note: In the configurations shown above, the **ip ospf priority 2** command on Router1 sets a higher interface priority than the default priority value of 1, which makes it a DR and Router2 the BDR for the NBMA network. If needed, you can set the priority value to 0 to configure a router to never become a DR/BDR. This is necessary in hub and spoke networks where the hub should be configured to become the DR, where as the spokes should neither be DR nor BDR. Though configuring the **neighbor** statement on one end is sufficient to form adjacency, it is a good practice to have it configured on both the ends as shown. Also, the **frame-relay map** commands do not need to have the **broadcast** parameter because the OSPF packets are unicasted with the **neighbor** statement.

Verification Tips

Below is the **show** command output for Router1.

```
Router1# show ip ospf neighbors
```

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|----------|-----------|---------|-----------|
| 2.2.2.2 | 1 | FULL/BDR | 00:01:39 | 1.1.1.1 | Serial2 |

```
Router1# show ip ospf interface s2
```

```

Serial2 is up, line protocol is up
 Internet Address 1.1.1.2/24, Area 0
 Process ID 1, Router ID 3.3.3.3, Network Type NON_BROADCAST, Cost: 64
 Transmit Delay is 1 sec, State DR, Priority 1
 Designated Router (ID) 3.3.3.3, Interface address 1.1.1.2
 Backup Designated router (ID) 2.2.2.2, Interface address 1.1.1.1
 Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5
 Hello due in 00:00:19
 Index 1/1, flood queue length 0
 Next 0x0(0)/0x0(0)
 Last flood scan length is 2, maximum is 2
 Last flood scan time is 0 msec, maximum is 0 msec
 Neighbor Count is 1, Adjacent neighbor count is 1
   Adjacent with neighbor 2.2.2.2 (Backup Designated Router)
 Suppress hello for 0 neighbor(s)

```

And the output for Router2 is as follows.

```
Router2# show ip ospf neighbor
```

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|---------|-----------|---------|-----------|
| 3.3.3.3 | 1 | FULL/DR | 00:01:49 | 1.1.1.2 | Serial1/0 |

```

Router2# show ip ospf interface s1/0
Serial1/0 is up, line protocol is up
Internet Address 1.1.1.1/24, Area 0
Process ID 1, Router ID 2.2.2.2, Network Type NON_BROADCAST, Cost: 64
Transmit Delay is 1 sec, State BDR, Priority 1
Designated Router (ID) 3.3.3.3, Interface address 1.1.1.2
Backup Designated router (ID) 2.2.2.2, Interface address 1.1.1.1
Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5
Hello due in 00:00:01
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 2, maximum is 2
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with neighbor 3.3.3.3 (Designated Router)
Suppress hello for 0 neighbor(s)

```

Configurations for Point-to-Multipoint

| Router1 |
|--|
| <pre> interface Loopback0 ip address 3.3.3.3 255.255.255.255 ! interface Serial2 ip address 1.1.1.2 255.255.255.0 encapsulation frame-relay ip ospf network point-to-multipoint no keepalive frame-relay map ip 1.1.1.1 16 broadcast ! router ospf 1 network 1.1.1.0 0.0.0.255 area 0 ! </pre> |

| Router2 |
|--|
| <pre> interface Loopback0 ip address 2.2.2.2 255.255.255.255 ! interface Serial1/0 ip address 1.1.1.1 255.255.255.0 encapsulation frame-relay ip ospf network point-to-multipoint no keepalive clockrate 2000000 frame-relay map ip 1.1.1.2 16 broadcast ! router ospf 1 network 1.1.1.0 0.0.0.255 area 0 </pre> |

Verification Tips

Below is the **show** command output for Router1.

```

Router1# show ip ospf neighbors

```

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|---------|-----------|---------|-----------|
| 2.2.2.2 | 1 | FULL/ - | 00:01:53 | 1.1.1.1 | Serial2 |

```

Router1# show ip ospf interface s2
Serial2 is up, line protocol is up
Internet Address 1.1.1.2/24, Area 0
Process ID 1, Router ID 3.3.3.3, Network Type POINT_TO_MULTIPOINT, Cost: 64
Transmit Delay is 1 sec, State POINT_TO_MULTIPOINT,
Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5
Hello due in 00:00:18
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 1, Adjacent neighbor count is 1
Adjacent with neighbor 2.2.2.2
Suppress hello for 0 neighbor(s)

```

And the output for Router2 is as follows.

```

Router2# show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
3.3.3.3          1     FULL/ -         00:01:58    1.1.1.2        Serial1/0

Router2# show ip ospf interface s1/0
Serial1/0 is up, line protocol is up
Internet Address 1.1.1.1/24, Area 0
Process ID 1, Router ID 2.2.2.2, Network Type POINT_TO_MULTIPOINT, Cost: 64
Transmit Delay is 1 sec, State POINT_TO_MULTIPOINT,
Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5
Hello due in 00:00:18
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 1, Adjacent neighbor count is 1
Adjacent with neighbor 3.3.3.3
Suppress hello for 0 neighbor(s)

```

Note: There are no DR and BDR elected when the NBMA network is configured as Point-to-Multipoint as shown in the outputs, since it is treated as a collection of point-to-point links.

For more information, see [Configuring OSPF over Different Physical Networks](#).

Related Information

- [What Does the show ip ospf interface Command Reveal?](#)
 - [OSPF Point-to-Multipoint Networks with Neighbors](#)
 - [OSPF Routers Connected by a Multi-Access Network](#)
 - [OSPF Neighbor States](#)
 - [OSPF: Frequently Asked Questions](#)
 - [OSPF Support Page](#)
 - [IP Routing Protocols Support Page](#)
 - [Technical Support – Cisco Systems](#)
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