Configure OSPF Connection in a Virtual Link Environment

Contents

Introduction

This document describes an Open Shortest Path First (OSPF) connection with the use of a virtual link.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- How to configure OSPF
- OSPF Inter-Area Routing

Components Used

This document is not restricted to specific software or hardware versions.

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

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Background Information

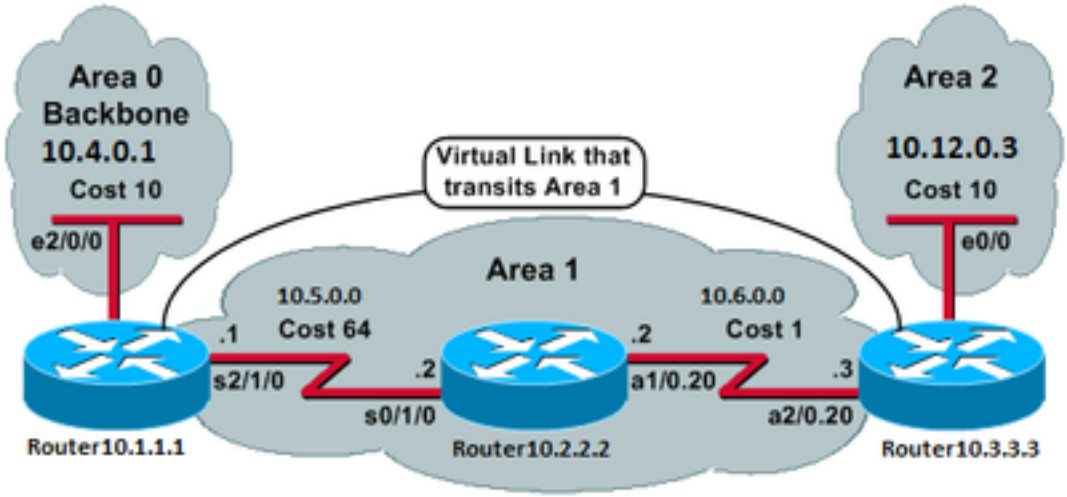
All areas in an Open Shortest Path First (OSPF) autonomous system must be physically connected to the backbone area (Area 0). In some cases, where this is not possible, you can use a virtual link to connect to the backbone through a non-backbone area. You can also use virtual links to connect two parts of a partitioned backbone through a non-backbone area. The area through which you configure the virtual link, known as a *transit area* , must have full routing information. The transit area cannot be a stub area. This document examines the OSPF database in a virtual link environment. You can read more about virtual links in the OSPF Design Guide.

Configure

In this section, you are presented with the information to configure the features described in this document.

Network Diagram

This document uses this network setup:



Network Diagram

Configurations

This document uses these configurations:

- Router10.1.1.1
- Router10.2.2.2
- Router10.3.3.3

Router10.1.1.1

```
Current configuration:

hostname Router10.1.1.1
!
```

```
interface Loopback0
 ip address 10.1.1.1 255.255.0.0
!
interface Ethernet2/0/0
ip address 10.4.0.1 255.255.0.0 !
interface Serial2/1/0
ip address 10.5.0.1 255.255.0.0
!
router ospf 2
network 10.4.0.0 0.0.255.255 area 0
network 10.5.0.0 0.0.255.255 area 1
area 1 virtual-link 10.3.3.3
!
end

!--- Area 1 is the transit area.
!--- IP address 10.3.3.3 is the router
!--- ID of the router between Area 1
!--- and Area 2 (Router10.3.3.3). See
!--- the next Note.
```

Note: The OSPF router ID is usually the highest IP address on the box or the highest loopback address, if one exists. The router ID is only calculated at boot time or at any time that the OSPF process is restarted. Issue the **show ip ospf interface** command to find the router ID.

Router10.2.2.2

```
Current configuration:

hostname Router10.2.2.2
!
interface Loopback0
 ip address 10.2.2.2 255.255.0.0
!
interface Serial0/1/0
 ip address 10.5.0.2 255.255.0.0
!
interface ATM1/0.20 point-to-point
 ip address 10.6.0.2 255.255.0.0
!
router ospf 2
 network 10.6.0.0 0.0.255.255 area 1
 network 10.5.0.0 0.0.255.255 area 1
!
end
```

Router10.3.3.3

```
Current configuration:

hostname Router10.3.3.3
!
interface Loopback0
 ip address 10.3.3.3 255.255.0.0
!
interface Ethernet0/0
 ip address 10.12.03 255.255.0.0
!
interface ATM2/0.20 point-to-point
 ip address 10.6.0.3 255.255.0.0
```

```
!
router ospf 2
 network 10.12.0.0 0.0.255.255 area 2
 network 10.6.0.0 0.0.255.255 area 1
 area 1 virtual-link 10.1.1.1
!
end
!--- Area 1 is the transit area.
!--- IP address 10.1.1.1 is the router
!--- ID of the router between Area 1
!--- and Area 0 (Router10.1.1.1).
```

How the Virtual Link Operates

Initially, the virtual link is down because Router10.1.1.1 does not know how to reach Router10.3.3.3 (the other end of the virtual link). All of the link-state advertisements (LSAs) in Area 1 need to be flooded, and the shortest path first (SPF) algorithm must be run within Area 1 by all three routers, for Router10.1.1.1 to know how to reach Router10.3.3.3 through Area 1.

After the routers know how to reach each other through the transit area, they try to form adjacency across the virtual link. The OSPF packets between the two ends of the virtual link are not multicast packets. They are tunneled packets from source 10.5.0.1 to the destination 10.6.0.3, because they are tunneled to the other end of the virtual link. It is important to note that if there is a firewall in between the virtual-link routers, you need to enable the OSPF (IP protocol 89) port between the virtual-link tunnel outgoing interface IPs that are between 10.5.0.1 and 10.6.0.3.

Once the routers become adjacent on the virtual link, Router10.3.3.3 considers itself an area border router (ABR), because it now has a link in Area 0. As a result, Router10.3.3.3 creates a summary LSA for 10.12.0.0/16 in Area 0 and in Area 1.

If the virtual link is misconfigured for some reason, then Router10.3.3.3 does not consider itself an ABR because it does not have any interfaces in Area 0. If this is the case, it does not create summary LSAs or advertise 10.12.0.0/16 into Area 1.

> **Note**: OSPF runs on top of IP and uses protocol number 89. OSPF does not rely on any other transport protocols, such as TCP and UDP.

Calculate the Shortest Path

This section calculates the shortest path from the perspective of Router10.2.2.2.

Router10.2.2.2 looks in its own LSA and sees that Router10.3.3.3 is a neighbor. It then looks at the LSA of Router10.3.3.3 to verify that Router10.3.3.3 sees Router10.2.2.2 as a neighbor. If both routers see each other as neighbors, then they are considered reachable.

Each router also checks its local neighbor table (which you can see with the **show ip ospf neighbor** command) to verify that its interface and the interface of the neighbor are on a common IP subnet.

> **Note**: This check is not performed on an unnumbered interface.

If they are on a common subnet, the routers install routes for any stub networks listed in the router

LSA of their neighbor. In this example, 10.6.0.0/16 is the only stub network listed in the LSA of Router10.3.3.3 in Area 1, to which Router10.2.2.2 is already directly connected.

Router10.3.3.3 does the same examination for the LSA of Router10.1.1.1, but there are not any useful stub networks in the LSA of Router10.1.1.1.

After all of the reachable router LSAs in Area 1 are examined, Router10.2.2.2 looks at summary LSAs in the database. It finds two summary LSAs for 10.12.0.0/16 in Area 1 and chooses the one with the lowest total cost, which is the metric to reach the advertising router plus the metric of the summary LSA.

- Router10.2.2.2 can reach 10.12.0.0 through Router10.1.1.1 with a cost of 64 + 75 = 139.
- Router10.2.2.2 can reach 10.12.0.0 through Router10.3.3.3 with a cost of 1 + 10 = 11.
- Router10.2.2.2 installs a route in its routing table through Router10.3.3.3 with a metric of 11.

This output shows the OSPF routes in the routing table of each router previously described:

```
Router10.1.1.1#show ip route ospf

!--- Output suppressed. O 10.6.0.0/16 [110/65] via 10.5.0.2, 00:38:12, Serial2/1/0 O
IA 10.12.0.0/16 [110/75] via 10.5.0.2, 00:38:02, Serial2/1/0 Router10.2.2.2#show ip
route ospf

!--- Output suppressed. O IA 10.4.0.0/16 [110/74] via 10.5.0.1, 00:38:08, Serial0/1/0
O IA 10.12.0.0/16 [110/11] via 10.6.0.3, 00:38:12, ATM1/0.20

!--- This is the route in this example. Router10.3.3.3#show ip route ospf

!--- Output suppressed. O 10.4.0.0/16 [110/75] via 10.6.0.2, 00:38:18, ATM2/0.20 O
10.5.0.0/16 [110/65] via 10.6.0.2, 00:38:28, ATM2/0.20
```

Use a GRE Tunnel Instead of a Virtual Link

You can also build a generic routing encapsulation (GRE) tunnel between Router10.1.1.1 and Router10.3.3.3 and put the tunnel in Area 0. The main differences between a GRE tunnel and a virtual link are described in this table:

GRE Tunnel	Virtual Link
All traffic in the tunnel is encapsulated and decapsulated by the tunnel endpoints.	The routing updates are tunneled, but the data traffic is sent nativel
Tunnel headers in every packet cause overhead.	Data traffic is not subject to any tunnel overhead.
The tunnel can go through a stub area.	The transit area cannot be a stub area, because routers in the stub do not have routes for external destinations. Because data is sent natively, if a packet destined for an external destination is sent into stub area which is also a transit area, then the packet is not routed correctly. The routers in the stub area do not have routes for specif external destinations.

Verify

Use this section to confirm that your configuration works properly.

Note: Only registered Cisco users have access to internal Cisco tools and information.

The Cisco CLI Analyzer supports certain **show** commands. Use the tool to view an analysis of show command output.

- show ip ospf database — Displays a list of the LSAs and types them into a link-state database. This list shows only the information in the LSA header.
- **show ip ospf database [router] [link-state-id]** — Displays a list of all of the LSAs of a router in the database. LSAs are produced by every router. These fundamental LSAs list all of the links of the routers or interfaces, along with the states and outgoing costs of the links, and they are flooded only within the area in which they originate.
- show ip ospf [process-id [area-id]] database [summary] [link-state-id] — Displays information only about the network summary LSAs in the database.
- show ip ospf database [summary] [self-originate] — Displays only self-originated LSAs (from the local router).

Examine the OSPF Database

This is how the OSPF database looks, given this network environment, when you issue the **show ip ospf database** command.

```
Router10.1.1.1#show ip ospf database

       OSPF Router with ID (10.1.1.1) (Process ID 2)

                Router Link States (Area 0)

Link ID   ADV Router    Age             Seq#          Checksum   Link count
10.1.1.1   10.1.1.1       919             0x80000003    0xD5DF         2
10.3.3.3   10.3.3.3       5     (DNA)     0x80000002    0x3990         1

                Summary Net Link States (Area 0)

Link ID   ADV Router    Age                 Seq#         Checksum
10.5.0.0   10.1.1.1       1945                0x80000002   0xAA48
10.5.0.0   10.3.3.3       9     (DNA)         0x80000001   0x7A70
10.6.0.0   10.1.1.1       1946                0x80000002   0xA749
10.6.0.0   10.3.3.3       9     (DNA)         0x80000001   0xEA3F
10.12.0.0  10.3.3.3       9     (DNA)         0x80000001   0xF624

                Router Link States (Area 1)

Link ID   ADV Router    Age             Seq#          Checksum   Link count
10.1.1.1   10.1.1.1       1946            0x80000005    0xDDA6         2
10.2.2.2   10.2.2.2       10              0x80000009    0x64DD         4
10.3.3.3   10.3.3.3       930             0x80000006    0xA14C         2

                Summary Net Link States (Area 1)

Link ID   ADV Router    Age             Seq#           Checksum
10.4.0.0   10.1.1.1       1947            0x80000002     0x9990
10.4.0.0   10.3.3.3       911             0x80000001     0xEBF5
10.12.0.0  10.1.1.1       913             0x80000001     0xBF22
10.12.0.0  10.3.3.3       931             0x80000001     0xF624
```

```
Router10.2.2.2#show ip ospf database

       OSPF Router with ID (10.2.2.2) (Process ID 2)

                Router Link States (Area 1)

Link ID   ADV Router    Age     Seq#          Checksum   Link count
10.1.1.1   10.1.1.1       1988    0x80000005    0xDDA6        2
10.2.2.2   10.2.2.2       50      0x80000009    0x64DD        4
10.3.3.3   10.3.3.3       969     0x80000006    0xA14C        2

                Summary Net Link States (Area 1)

Link ID   ADV Router    Age      Seq#          Checksum
10.4.0.0   10.1.1.1       1988     0x80000002    0x9990
10.4.0.0   10.3.3.3       950      0x80000001    0xEBF5
10.12.0.0  10.1.1.1       955      0x80000001    0xBF22
10.12.0.0  10.3.3.3       970      0x80000001    0xF624

Router10.3.3.3#show ip ospf database

       OSPF Router with ID (10.3.3.3) (Process ID 2)

                Router Link States (Area 0)

Link ID   ADV Router    Age          Seq#          Checksum   Link count
10.1.1.1   10.1.1.1       6   (DNA)    0x80000003    0xD5DF         2
10.3.3.3   10.3.3.3       977          0x80000002    0x3990         1

                Summary Net Link States (Area 0)

Link ID   ADV Router    Age            Seq#          Checksum
10.5.0.0   10.1.1.1       1027  (DNA)    0x80000002    0xAA48
10.5.0.0   10.3.3.3       986            0x80000001    0x7A70
10.6.0.0   10.1.1.1       1027  (DNA)    0x80000002    0xA749
10.6.0.0   10.3.3.3       987            0x80000001    0xEA3F
10.12.0.0  10.3.3.3       987            0x80000001    0xF624

                Router Link States (Area 1)

Link ID   ADV Router    Age    Seq#          Checksum   Link count
10.1.1.1   10.1.1.1       2007   0x80000005    0xDDA6        2
10.2.2.2   10.2.2.2       68     0x80000009    0x64DD        4
10.3.3.3   10.3.3.3       987    0x80000006    0xA14C        2

                Summary Net Link States (Area 1)

Link ID   ADV Router    Age      Seq#          Checksum
10.4.0.0   10.1.1.1       2007     0x80000002    0x9990
10.4.0.0   10.3.3.3       967      0x80000001    0xEBF5
10.12.0.0  10.1.1.1       973      0x80000001    0xBF22
10.12.0.0  10.3.3.3       987      0x80000001    0xF624

                Router Link States (Area 2)

Link ID   ADV Router    Age    Seq#          Checksum   Link count
10.3.3.3   10.3.3.3       987    0x80000003    0xCF5          1

                Summary Net Link States (Area 2)

Link ID   ADV Router    Age    Seq#        Checksum
10.4.0.0   10.3.3.3       968    0x80000001  0xEBF5
10.5.0.0   10.3.3.3       988    0x80000001  0x7A70
10.6.0.0   10.3.3.3       988    0x80000001  0xEA3F
```

Notice that LSAs learned through the virtual link have the`DoNotAge`option. The virtual link is treated like a demand circuit.

```
Router10.1.1.1#show ip ospf database router 10.1.1.1

       OSPF Router with ID (10.1.1.1) (Process ID 2)

                Router Link States (Area 0)

  LS age: 1100
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 10.1.1.1

!--- For router links, Link State ID is always the same as the Advertising Router.
Advertising Router: 10.1.1.1

!--- This is the router ID of the router that created this LSA. LS Seq Number:
80000003 Checksum: 0xD5DF Length: 48 Area Border Router

!--- Bit B in the router LSA indicates that this router is an ABR. Number of Links: 2

!--- There are two links in Area 0. Link connected to: a Virtual Link (Link ID)
Neighboring Router ID: 10.3.3.3

!--- Router ID of the neighbor on the other end of the virtual link. (Link Data)
Router Interface address: 10.5.0.1

!--- The interface that this router uses to send packets to the neighbor. Number of
TOS metrics: 0 TOS 0 Metrics: 65

!--- The metric comes from the cost for this router to reach the neighboring router:
!--- the ATM link has a cost of 1 and the serial link has a cost of 64. Link
connected to: a Stub Network

!--- This represents the Ethernet segment 10.4.0.0/16. (Link ID) Network/subnet
number: 10.4.0.0 (Link Data) Network Mask: 255.255.0.0 Number of TOS metrics: 0 TOS 0
Metrics: 10 Router Link States (Area 1) LS age: 122 Options: (No TOS-capability, DC)
LS Type: Router Links Link State ID: 10.1.1.1 Advertising Router: 10.1.1.1 LS Seq
Number: 80000006 Checksum: 0xDBA7 Length: 48 Area Border Router Number of Links: 2

!--- There are two links in Area 1. Link connected to: another Router (point-to-
point) (Link ID) Neighboring Router ID: 10.2.2.2 (Link Data) Router Interface
address: 10.5.0.1 Number of TOS metrics: 0 TOS 0 Metrics: 64 Link connected to: a
Stub Network (Link ID) Network/subnet number: 10.5.0.0 (Link Data) Network Mask:
255.255.0.0 Number of TOS metrics: 0 TOS 0 Metrics: 64 Router10.1.1.1#show ip ospf
database router 10.2.2.2

       OSPF Router with ID (10.1.1.1) (Process ID 2)

                Router Link States (Area 1)

  LS age: 245
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 10.2.2.2
  Advertising Router: 10.2.2.2
  LS Seq Number: 80000009
  Checksum: 0x64DD
  Length: 72
   Number of Links: 4
```

```
!--- There are four links in Area 1. Link connected to: another Router (point-to-
point) (Link ID) Neighboring Router ID: 10.3.3.3 (Link Data) Router Interface
address: 10.6.0.2 Number of TOS metrics: 0 TOS 0 Metrics: 1 Link connected to: a Stub
Network (Link ID) Network/subnet number: 10.6.0.0 (Link Data) Network Mask:
255.255.0.0 Number of TOS metrics: 0 TOS 0 Metrics: 1 Link connected to: another
Router (point-to-point) (Link ID) Neighboring Router ID: 10.1.1.1 (Link Data) Router
Interface address: 10.5.0.2 Number of TOS metrics: 0 TOS 0 Metrics: 64 Link connected
to: a Stub Network (Link ID) Network/subnet number: 10.5.0.0 (Link Data) Network
Mask: 255.255.0.0 Number of TOS metrics: 0 TOS 0 Metrics: 64 Router10.1.1.1#show ip
ospf database router 10.3.3.3

       OSPF Router with ID (10.1.1.1) (Process ID 2)

                Router Link States (Area 0)

  Routing Bit Set on this LSA
  LS age: 5 (DoNotAge)
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 10.3.3.3
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000002
  Checksum: 0x3990
  Length: 36
  Area Border Router
   Number of Links: 1

!--- There is one link in Area 0. Link connected to: a Virtual Link (Link ID)
Neighboring Router ID: 10.1.1.1 (Link Data) Router Interface address: 10.6.0.3
      Number of TOS metrics: 0
       TOS 0 Metrics: 65

                Router Link States (Area 1)

  Routing Bit Set on this LSA
  LS age: 1137
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 10.3.3.3
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000006
  Checksum: 0xA14C
  Length: 48
  Area Border Router
   Number of Links: 2

!--- There are two links in Area 1. Link connected to: another Router (point-to-
point) (Link ID) Neighboring Router ID: 10.2.2.2 (Link Data) Router Interface
address: 10.6.0.3 Number of TOS metrics: 0 TOS 0 Metrics: 1 Link connected to: a Stub
Network (Link ID) Network/subnet number: 10.6.0.0 (Link Data) Network Mask:
255.255.0.0 Number of TOS metrics: 0 TOS 0 Metrics: 1
```

Router10.3.3.3 considers itself an ABR because it has a link to Area 0 (the virtual link). As a result, it generates a summary LSA for 10.12.0.0 into Area 1 and Area 0, which you can see when you issue the **show ip ospf database summary** command.

```
Router10.3.3.3#show ip ospf database summary 10.12.0.0

       OSPF Router with ID (10.3.3.3) (Process ID 2)

                Summary Net Link States (Area 0)
```

```
  LS age: 1779
  Options: (No TOS-capability, DC)
  LS Type: Summary Links(Network)
  Link State ID: 10.12.0.0 (summary Network Number)
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000001
  Checksum: 0xF624
  Length: 28
  Network Mask: /16
        TOS: 0  Metric: 10

                Summary Net Link States (Area 1)

  LS age: 1766
  Options: (No TOS-capability, DC)
  LS Type: Summary Links(Network)
  Link State ID: 10.12.0.0 (summary Network Number)
  Advertising Router: 10.1.1.1
  LS Seq Number: 80000001
  Checksum: 0xBF22
  Length: 28
  Network Mask: /16
        TOS: 0  Metric: 75

  LS age: 1781
  Options: (No TOS-capability, DC)
  LS Type: Summary Links(Network)
  Link State ID: 10.12.0.0 (summary Network Number)
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000001
  Checksum: 0xF624
  Length: 28
  Network Mask: /16
        TOS: 0  Metric: 10
```

Also, notice that Router10.3.3.3 creates summary LSAs in Area 2 for all of the information that it learned from Area 0 and Area 1.

```
Router10.3.3.3#show ip ospf database summary self-originate

       OSPF Router with ID (10.3.3.3) (Process ID 2)

                Summary Net Link States (Area 0)

  LS age: 155
  Options: (No TOS-capability, DC)
  LS Type: Summary Links(Network)
  Link State ID: 10.5.0.0 (summary Network Number)
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000002
  Checksum: 0x7871
  Length: 28
  Network Mask: /16
        TOS: 0  Metric: 65

  LS age: 155
  Options: (No TOS-capability, DC)
  LS Type: Summary Links(Network)
  Link State ID: 10.6.0.0 (summary Network Number)
  Advertising Router: 10.3.3.3
  LS Seq Number: 80000002
  Checksum: 0xE840
```

```
Length: 28
Network Mask: /16
      TOS: 0  Metric: 1

LS age: 156
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.12.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0xF425
Length: 28
Network Mask: /16
      TOS: 0  Metric: 10

               Summary Net Link States (Area 1)

LS age: 157
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.4.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0xE9F6
Length: 28
Network Mask: /16
      TOS: 0  Metric: 75

LS age: 165
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.12.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0xF425
Length: 28
Network Mask: /16
      TOS: 0  Metric: 10

               Summary Net Link States (Area 2)

LS age: 167
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.4.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0xE9F6
Length: 28
Network Mask: /16
      TOS: 0  Metric: 75

LS age: 168
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.5.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0x7871
Length: 28
Network Mask: /16
      TOS: 0  Metric: 65

LS age: 168
```

```
Options: (No TOS-capability, DC)
LS Type: Summary Links(Network)
Link State ID: 10.6.0.0 (summary Network Number)
Advertising Router: 10.3.3.3
LS Seq Number: 80000002
Checksum: 0xE840
Length: 28
Network Mask: /16
      TOS: 0  Metric: 1
```

Troubleshoot

Use this section to troubleshoot your configuration.

Troubleshoot Commands

> **Note**: Only registered Cisco users have access to internal Cisco tools and information.

The Cisco CLI Analyzer supports certain **show** commands. Use the OIT to view an analysis of **show** command output.

> **Note**: Refer to Important Information on Debug Commands before you use **debug** commands.

- **debug ip ospf adj**—Displays the events involved to build or break OSPF adjacency.

The routers become adjacent and exchange LSAs via the virtual link, similar to a physical link. You can see the adjacency if you examine the router LSA or the output of the **debug ip ospf adj** command:

```
Router10.3.3.3#
May 26 17:25:03.089: OSPF: Rcv hello from 10.1.1.1 area 0 from OSPF_VL3 10.5.0.1
May 26 17:25:03.091: OSPF: 2 Way Communication to 10.1.1.1 on OSPF_VL3, state 2WAY
May 26 17:25:03.091: OSPF: Send DBD to 10.1.1.1 on OSPF_VL3
                           seq 0xD1C opt 0x62 flag 0x7 len 32
May 26 17:25:03.135: OSPF: End of hello processing
May 26 17:25:03.139: OSPF: Rcv DBD from 10.1.1.1 on OSPF_VL3
                           seq 0x1617 opt 0x22 flag 0x7 len 32
                           mtu 0 state EXSTART
May 26 17:25:03.175: OSPF: First DBD and we are not SLAVE
May 26 17:25:03.179: OSPF: Rcv DBD from 10.1.1.1 on OSPF_VL3
                           seq 0xD1C opt 0x22 flag 0x2 len 172
                           mtu 0 state EXSTART
May 26 17:25:03.183: OSPF: NBR Negotiation Done. We are the MASTER
May 26 17:25:03.189: OSPF: Send DBD to 10.1.1.1 on OSPF_VL3
                           seq 0xD1D opt 0x62 flag 0x3 len 172
May 26 17:25:03.191: OSPF: Database request to 10.1.1.1
May 26 17:25:03.191: OSPF: sent LS REQ packet to 10.5.0.1, length 36
May 26 17:25:03.263: OSPF: Rcv DBD from 10.1.1.1 on OSPF_VL3
                           seq 0xD1D opt 0x22 flag 0x0 len 32
                           mtu 0 state EXCHANGE
May 26 17:25:03.267: OSPF: Send DBD to 10.1.1.1 on OSPF_VL3
                           seq 0xD1E opt 0x62 flag 0x1 len 32
May 26 17:25:03.311: OSPF: Rcv DBD from 10.1.1.1 on OSPF_VL3
                           seq 0xD1E opt 0x22 flag 0x0 len 32
```

```
                          mtu 0 state EXCHANGE
May 26 17:25:03.311: OSPF: Exchange Done with 10.1.1.1 on OSPF_VL3
May 26 17:25:03.315: OSPF: Synchronized with 10.1.1.1 on OSPF_VL3, state FULL
May 26 17:25:03.823: OSPF: Build router LSA for area 0,
                          router ID 10.3.3.3, seq 0x80000029
May 26 17:25:03.854: OSPF: Dead event ignored for 10.1.1.1 on demand circuit OSPF_VL3

Router10.3.3.3#show ip ospf neighbor

Neighbor ID       Pri       State        Dead Time       Address         Interface
10.2.2.2           1         FULL/  -     00:00:38        10.6.0.2         ATM2/0.20

Router10.3.3.3#show ip ospf virtual-links

Virtual Link OSPF_VL3 to router 10.1.1.1 is up
  Run as demand circuit
  DoNotAge LSA allowed.
  Transit area 1, via interface ATM2/0.20, Cost of using 65
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
    Adjacency State FULL (Hello suppressed)
    Index 1/2, 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
```

Notice that adjacencies over virtual links are not displayed in the **show ip ospf neighbor** command output. The only way to see them is to look at the router LSA and observe **debug** commands as the adjacency comes up, or issue the **show ip ospf virtual-links** command.

Related Information

- **What Are OSPF Areas and Virtual Links?**
- **Configure OSPF Authentication on a Virtual Link**
- **Configure a GRE Tunnel over IPSec with OSPF**
- **What Does the show ip ospf interface Command Reveal?**
- **How OSPF Propagates External Routes into Multiple Areas**
- **OSPF Database Explanation Guide**
- **IP Routing and OSPF Support**
- **Network Technologies and Protocols**
- **Cisco Technical Support & Downloads**