



OSPFv2 User Guide

Version 23.8.1.2, 06 November 2023

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Table of Contents

1. Introduction to OSPF	4
1.1. Understanding OSPF Areas	4
1.1.1. Backbone Area	4
1.1.2. Area Border Router	4
1.1.3. Autonomous System Boundary Router	5
1.2. OSPF DR and BDR Election	5
1.3. Supported OSPF Standards	6
1.4. Supported Platforms	6
2. Configuring OSPF	7
2.1. Configuration Hierarchy	7
2.2. Configuration Syntax and Commands	7
2.2.1. OSPF Instance Configuration	7
2.2.2. OSPF Address Family Configuration	8
2.2.2.1. OSPF Router ID Configuration	8
2.2.2.2. OSPF Interface Configuration	9
2.2.2.3. OSPF Area Configuration	11
2.2.2.4. OSPF Metric Configuration	12
2.2.2.5. OSPF Opaque Capability Configuration	13
2.2.2.6. Segment Routing Configuration	14
2.2.2.7. OSPF Redistribution Configuration	14
2.2.2.8. ECMP Routing Configuration	15
2.2.3. OSPF Authentication Configuration	16
2.2.3.1. Configuring an Authentication Profile	16
3. OSPF Operational Commands	19
3.1. OSPF Show Commands	19
3.1.1. OSPF Summary	19
3.1.2. OSPF Interface	20
3.1.3. OSPF Neighbor	21
3.1.4. OSPF Database	22
3.1.5. OSPF SPF	24
3.1.6. OSPF Route	26
3.1.7. OSPF Route Area Border	27
3.1.8. OSPF Route Autonomous System Boundary	27
3.1.9. OSPF LSA Request List	28
3.1.10. OSPF Transmission List	29
3.1.11. OSPF Statistics	29
3.2. OSPF Clear Commands	30
3.2.1. Clear OSPF Neighbor	30

3.2.2. Clear OSPF Statistics 31

1. Introduction to OSPF

OSPF (Open Shortest Path First) is an Interior Gateway Protocol that distributes routing information within a single Autonomous System (AS) in an IP network. OSPF is a link-state routing protocol that uses link-state information to form a routing table and exchange the routing information with the neighbors.

OSPF routers flood LSAs (link-state advertisements) to all other routers in an autonomous system. Routers generate routing tables using the information received from the LSAs and calculate the best path to other routers in the network. OSPF uses the Dijkstra (Shortest Path First) algorithm to calculate the best path.

LSAs contain local state information such as interfaces and the reachability of neighbors. Other routers, which receive this information as LSAs, build their LSDB (link-state database) using this information. In an OSPF network, all routers build and maintain information about the topology of that network.

1.1. Understanding OSPF Areas

OSPF allows for a logical partition of the autonomous system by dividing it into areas. This logical partitioning helps to limit the flooding of link-state updates within an area.

An OSPF Autonomous System can be maintained as a single-area network or can be divided as a multi-area network. In a single area AS, the topology provides link-state information of routers in the entire autonomous system.

In a multi-area AS, the topology provides the link-state information of routers belonging to that particular area, not about routers in other areas in the autonomous system. Within an area, all OSPF routers maintain separate databases which are identical.

In a multi-area OSPF network, all areas are connected to the backbone area, known as Area 0.

1.1.1. Backbone Area

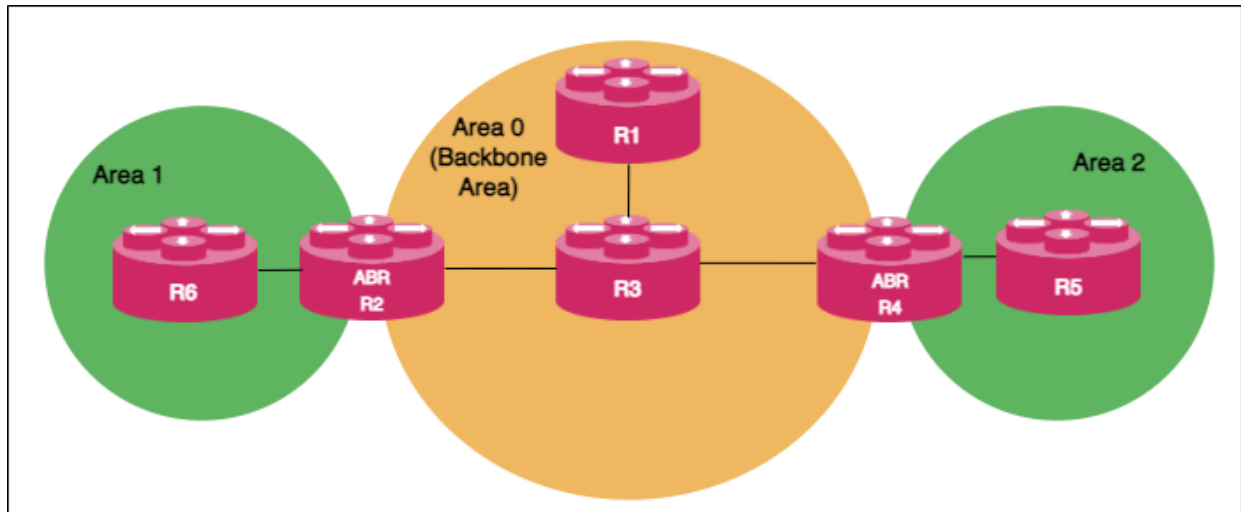
The backbone area, also known as Area 0, is connected to all other areas in an OSPF network. The backbone area, which acts as a central point of communication, receives LSAs from other areas and disseminates the same to other areas.

1.1.2. Area Border Router

Routers that connect one or more areas with the backbone area are called Area Border Router (ABR). One interface of the ABR is connected to the backbone, while other interfaces are connected to other areas. ABRs, which belong to multiple areas in an OSPF network, maintain separate LSDBs for each area that they are

connected to.

The following OSPF architectural diagram shows a simple OSPF network that is divided into areas. Area 1 and Area 2 are connected to the backbone area (Area 0) through the ABRs. Area 1 and Area 2 are not directly connected. They receive link state advertisements from each other from Area 0 which acts as the central point of communication for all other areas.



1.1.3. Autonomous System Boundary Router

ASBR (Autonomous System Boundary Router) serves as a gateway router to the OSPF autonomous system. ASBR can operate multiple protocols and work with other autonomous system routers that run other interior gateway protocols such as EIGRP, IS-IS, i-BGP, and so on. ASBR can import and translate different protocol routes into OSPF through the redistribution mechanism.

1.2. OSPF DR and BDR Election

An OSPF network chooses one router as a Designated Router (DR) and another as a Backup Designated Router (BDR) for a broadcast network.

DR acts as a central point of communication by receiving and distributing topology information. BDR takes over the role of DR if the DR fails. Routers in an OSPF network do not directly exchange routing information with each other. Instead, every router in the network updates routing information only with DR and BDR. DR, in turn, distributes the topology information with all other routers. This mechanism reduces network traffic significantly. OSPF chooses one router as DR and another router as BDR based on the following criteria:

- The router with the highest priority value becomes the designated router and the router with the second highest priority value becomes the BDR. You can define the priority values for routers during the interface configuration.
- If multiple routers have the same highest priority value, then the router with

the highest router ID is elected as DR and the router with the second highest router ID value becomes the BDR.

You can choose a priority value from the range 0 - 255. Routers with the priority value '0' do not participate in the DR or BDR election.

1.3. Supported OSPF Standards

RBFS supports the following RFCs, which define standards for OSPF version 2 (OSPFv2).

- RFC 2328, OSPF Version 2
- RFC 5709, OSPFv2 HMAC-SHA Cryptographic Authentication
- RFC 8665, OSPF Extensions for Segment Routing



RFc and draft compliance are partial except as specified.

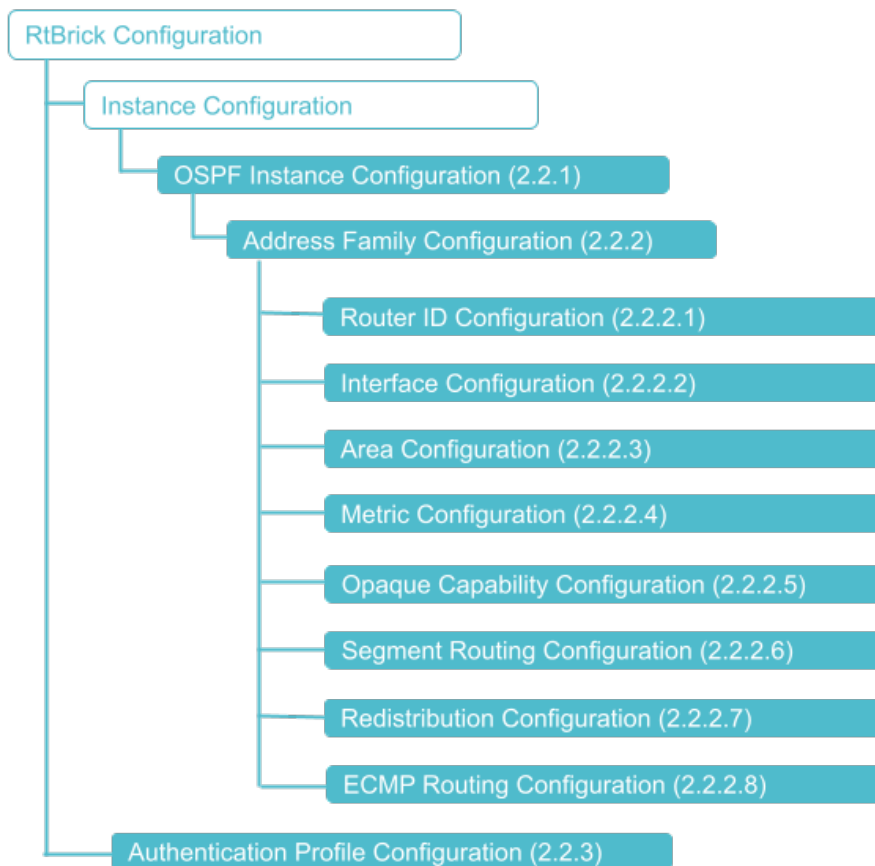
1.4. Supported Platforms

Not all features are necessarily supported on each hardware platform. Refer to the *Platform Guide* for the features and the sub-features that are or are not supported by each platform.

2. Configuring OSPF

2.1. Configuration Hierarchy

The diagram illustrates the OSPF configuration hierarchy. All OSPF configuration is performed within an instance, for example, the default instance or a VPN service instance. The OSPF instance configuration hierarchy includes parameters that are generic to the respective OSPF instance. The sub-hierarchies include parameters that are specific to redistribution or authentication.



2.2. Configuration Syntax and Commands

The following sections describe the OSPF configuration syntax and commands.

2.2.1. OSPF Instance Configuration

At this configuration hierarchy, you can configure an OSPF instance.

Syntax:

set instance <instance-name> **protocol ospf**

Attribute	Description
<instance-name>	Name of the OSPF instance.

2.2.2. OSPF Address Family Configuration

At this configuration level, you configure OSPF protocol address family. IPv4 is the currently supported address family.



You must complete configuring OSPF address family on an OSPF instance before configuring other OSPF features supported.

Syntax

set instance <instance-name> **protocol ospf address-family ipv4**

Attribute	Description
<instance-name>	Name of the instance
ipv4 <ipv4>	Address family identifier (AFI). Supported value: IPv4.

The following example shows OSPF address family (IPv4) configuration.

Example: OSPF Instance Address Family Configuration

```

supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4
{
  "rtbrick-config:address-family": [
    {
      "afi-type": "ipv4",
      "router-id": "198.51.100.10",
      "area": [
        {
          "area-id": "0.0.0.0",
          "interface": [
            {
              "name": "lo-0/0/0/1"
            },
            {
              "name": "if1-0/1/2/12",
              "network-type": "p2p"
            }
          ]
        }
      ]
    }
  ]
}

```

2.2.2.1. OSPF Router ID Configuration

The router ID is an IP address that OSPF uses to identify a device on the network. The router ID should be configured under the address family hierarchy.

Syntax

set instance <instance-name> **protocol ospf address-family ipv4 router-id** <router-id>

Attribute	Description
router-id <ipv4-address>	The router ID of the routing instance. It is recommended to specify the router ID.

Example: OSPF Router Identifier Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 router-id
{
  "rtbrick-config:router-id": "198.51.100.15"
}
```

2.2.2.2. OSPF Interface Configuration

Enable OSPF protocol on the router interfaces.

Syntax:

set instance <instance-name> **protocol ospf address-family ipv4 area** <area-id>
interface <interface-name> <options>

Attribute	Description
ldp-synchronization <enable disable>	Enable or disable LDP OSPF Synchronization. Default: Disable
metric <metric>	Specify the metric value of an OSPF interface.
network-type <broadcast p2p>	broadcast - Sets the network type to broadcast; p2p - Sets the network type to point-to-point. By default, the network-type is broadcast .
router-priority <router-priority>	Sets the router priority for an interface. Allowed range: 0 - 255, Default: 1. Routers with priority value '0' do not participate in the DR or BDR election.
segment-routing ipv4 index	Sets the prefix segment identifier (SID) index for the specified interface.

Attribute	Description
timer <hello dead>	<p>Interface timer for configuring hello timer and dead timer</p> <ul style="list-style-type: none"> • hello: Sets interval time for sending hello packets to a neighbor and this time is identical on OSPF neighbor routers. Default: 10 seconds. • dead: Sets interval time within which if the interface does not receive any hello packet from its neighbor, the interface comes to know that the neighbor is down. Default: 40 seconds.
mtu-ignore <enable disable>	<p>If there is an MTU mismatch on both sides of the link where OSPF runs, the OSPF adjacency will not come up as the MTU value carried in the Database Description (DBD) packets. To avoid MTU validation in the Database Description (DBD) packets, configure mtu-ignore command. By default, it is disabled.</p>
authentication <authentication-profile>	<p>Specifies the authentication profile name used to create an attachment point at the interface level.</p>
no-authentication-check <enable>	<p>When enabled, OSPF packets received here will not undergo authentication validation at the interface level, even if the user has enabled authentication.</p>



If an authentication profile is attached to an interface and an area, the authentication profile attached to the interface takes priority.

Example 1: OSPF Interface Configuration

```

supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 area 0.0.0.0
interface
{
  "rtbrick-config:interface": [
    {
      "name": "198.51.100.0"
    },
    {
      "name": "ifp-0/1/2/10",
      "authentication-profile": "auth-profile1",
      "metric": 20000,
      "network-type": "p2p"
    },
    {
      "name": "ifl-0/0/1/1",
      "metric": 40000,
      "network-type": "p2p"
    },
    {
      "name": "ifl-0/0/1/100",
      "metric": 30000
    },
    {
      "name": "ifl-0/0/4/1",
      "metric": 60000
    },
    {
      "name": "lo-0/0/0/1"
    },
    {
      "name": "lo-0/0/0/2"
    }
  ]
}

```

Example 2: LDP OSPF Synchronization

```

supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 area 0.0.0.0
{
  "rtbrick-config:area": [
    {
      "area-id": "0.0.0.0",
      "interface": [
        {
          "name": "ifl-0/0/1/1",
          "network-type": "p2p",
          "ldp-synchronization": "enable",
          "authentication": {
            "type": "md5",
            "key-id": 1,q
            "encrypted-text": "$2fd842673283fbff1623ba4bc2664eb5c"
          }
        }
      ]
    }
  ]
}

```

2.2.2.3. OSPF Area Configuration

A particular area is defined by its area ID.

set instance <instance-name> **protocol ospf address-family ipv4 area** <area-id>
<options>

Attribute	Description
metric	Area scope metric. Range: 1 - 65535. Default: 10000.
area-type stub	A stub area is an area through which or into which AS external advertisements are not flooded.
area-type totally-stub	Totally stub area is an area in which type-3 LSAs are not allowed.
authentication-profile <authentication-profile>	Specifies the authentication profile name used to create an attachment point at the area level.
no-authentication-check <enable>	When enabled, OSPF packets received here will not undergo authentication validation, even if the user has enabled authentication. However, OSPF will continue to send authenticated packets from this interface.

Example: Area Configuration

```

supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 area 0.0.0.0
{
  "rtbrick-config:area": [
    {
      "area-id": "0.0.0.0",
      "interface": [
        {
          "name": "if1-0/0/0/1"
        },
        {
          "name": "if1-0/1/2/10",
          "authentication-profile": "auth-profile1",
          "metric": 20000,
          "network-type": "p2p"
        },
        {
          "name": "if1-0/0/1/1",
          "metric": 40000,
          "network-type": "p2p"
        },
        {
          "name": "if1-0/0/1/100",
          "metric": 30000
        },
        {
          "name": "if1-0/0/4/1",
          "metric": 60000
        },
        {
          "name": "lo-0/0/0/1"
        },
        {
          "name": "lo-0/0/0/2"
        }
      ]
    }
  ]
}

```


2.2.2.4. OSPF Metric Configuration

Metric is the cost that OSPF uses to calculate and identify the best paths to other

routers.

Syntax

set instance <instance-name> **protocol ospf address-family ipv4 metric** <metric>

Attribute	Description
metric <metric>	<p>OSPF address-family metric. Allowed range: 1 - 65535. Default: 10000.</p> <div style="display: flex; align-items: center; margin-top: 10px;">  <p>If you configure the metric at the address-family, it will be applicable to the configured areas of the address-family. If you configure a metric for an area, this configured metric value will take precedence over the address-family metric configurations of this area.</p> </div> <p>If you specify a metric value for an area on an interface will override any area and address-family metric configurations for this area.</p>

Example: OSPF Metric Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 metric
{
  "rtbrick-config:metric": 1000
}
```

2.2.2.5. OSPF Opaque Capability Configuration

Enables opaque link-state advertisements. Routers in the OSPF network can receive and advertise Type-9, Type-10 and Type-11 opaque LSAs.

Syntax

set instance <instance-name> **protocol ospf address-family ipv4 opaque-capability** <options>

Attribute	Description
opaque-capability <enable disable>	Enable or disable opaque LSA advertisement and reception. Set as 'enable' to enable the router to receive and advertise opaque LSAs.

Example: OSPF Opaque Capability Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 opaque-
capability
{
  "rtbrick-config:opaque-capability": "enable"
}
```

2.2.2.6. Segment Routing Configuration

Enable segment routing for OSPF. For configuring segment routing, you must enable the opaque capability by defining it as 'true'. For information, see the section: "Opaque Capability Configuration".

Syntax

set instance <instance-name> **protocol ospf address-family ipv4 segment-routing** <options>

Attribute	Description
srgb base <value>	Specifies the segment routing global block (SRGB) in source packet routing. SRGB is used for prefix SIDs. Supported MPLS label values are 0 - 1048575. The reserved MPLS label range is 0 - 15. In RBFS, BGP uses the label range 20000 - 100000. It is recommended to assign label values outside of these reserved ranges to avoid conflicts.
srgb range <value>	OSPF system range of labels from the base label.
status <disable enable>	Enable or disable the segment routing feature. By default, the status is disabled.

Example: Segment routing Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 segment-
routing
{
  "rtbrick-config:segment-routing": {
    "status": "enable",
    "srgb": {
      "base": 1000,
      "range": 1000
    }
  }
}
```

2.2.2.7. OSPF Redistribution Configuration

Enable route redistribution for the routes originating from other sources or

protocols such as **BGP**, **Direct**, **IPoE**, **IS-IS**, **PPP**, and **Static**.

Syntax

set instance <instance-name> **protocol ospf ipv4 redistribute** <options>

Attribute	Description
redistribute <protocol>	Specifies the source protocol from which the routes are to be redistributed. The available options include BGP , Direct , IPoE , IS-IS , PPP , and Static .
metric <metric>	Specifies the metric value for the redistributed routes
metric-type <type 1 type 2>	Specifies the external metric type for the redistributed routes.
policy	Specifies the name of the policy map. The redistribute attach point allows routes from other sources to be advertised by OSPFv2.

Example 1: Redistribution Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 redistribute
bgp
{
  "rtbrick-config:redistribute": [
    {
      "source": "bgp",
      "metric": 2000
    }
  ]
}
```

Example 2: Redistribution Policy

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 redistribute
{
  "rtbrick-config:redistribute": [
    {
      "source": "direct",
      "policy": "ospf_policy_1"
    }
  ]
}
```

2.2.2.8. ECMP Routing Configuration

ECMP (equal-cost multiple paths) routing is a mechanism in which routers forward packets to a destination using the multiple available best paths. This mechanism can increase network bandwidth substantially by load-balancing traffic through multiple best paths.

Syntax

set instance <instance-name> **protocol ospf address-family ipv4 max-load-balance** <value>

Attribute	Description
<max-load-balance>	Maximum number of equal-cost multiple paths to be calculated for load balancing. Default: 16. Allowed range: 1 - 255.

Example: ECMP Routing Configuration

```
supervisor@rtbrick>SPINE01: cfg> show config instance default protocol ospf address-family ipv4 max-load-balance
{
  "rtbrick-config:max-load-balance": 100
}
```

2.2.3. OSPF Authentication Configuration

OSPF supports secure exchange of routing updates through authentication. You can enable authentication by attaching an authentication profile at the area or interface level. OSPF allows multiple keys to be attached to prevent session interruption.

OSPF supports the following authentication types:

- Clear Text
- HMAC-SHA-1
- HMAC-SHA-256
- HMAC-SHA-384
- HMAC-SHA-512
- MD5



In order to authenticate OSPF, there must be a global authentication profile present.

2.2.3.1. Configuring an Authentication Profile

set authentication-profile <attribute> <value>

Attribute	Description
<name>	Specifies the authentication profile name.
<name> key <key-id>	Specifies the message digest key identifier to be used by the neighboring routers for the OSPF password authentication. Allowed range: 1 - 255.

Attribute	Description
<name> key <key-id> type <auth-type>	Specifies the type of authentication that is being used, such as MD5, HMAC-SHA-1, and others.
<name> key <key-id> plain-text <text>	Specifies the password in plain text format.
<name> key <key-id> encrypted-text <text>	Specifies the password in an encrypted text format.
<name> key prefer-key-id <key-id>	Preferred key-id configuration will be used while sending out the packet with the specified key.



- When an authentication profile is available, you can configure an authentication attachment point at the area or interface level.
- When an authentication profile contains multiple key-IDs, and the preferred key-ID is not configured, the packet is sent using the highest key-ID.

In the example below, the authentication profile "auth-profile1" has **md5**, **hmac-sha-1**, and **clear-text** enabled. The preferred key-id being 20, the **hmac-sha-1** method will be used for authentication.

```
"rtbrick-config:instance": [
  {
    "name": "default",
    "protocol": {
      "ospf": {
        "address-family": [
          {
            "afi-type": "ipv4",
            "router-id": "198.51.100.85",
            "area": [
              {
                "area-id": "0.0.0.0",
                "interface": [
                  {
                    "name": "if1-0/1/2/10",
                    "authentication-profile": "auth-profile1"
                  },
                  {
                    "name": "if1-0/1/2/20"
                  }
                ]
              }
            ]
          }
        ]
      }
    }
  },
  {
    "name": "auth-profile1",
    "prefer-key-id": 20,
    "key": [
      {
        "key-id": 10,
        "type": "md5",
        "encrypted-text": "$2e439bba256caf1d623bb1094bbec0003"
      },
      {
        "key-id": 20,
        "type": "hmac-sha-1",
        "encrypted-text": "$2e439bba256caf1d623bb1094bbec0003"
      },
      {
        "key-id": 30,
        "type": "clear-text",
        "encrypted-text": "$2e439bba256caf1d623bb1094bbec0003"
      }
    ]
  }
]
}
```

3. OSPF Operational Commands

3.1. OSPF Show Commands

3.1.1. OSPF Summary

Displays the OSPF protocol summary information.

Syntax:

show ospf summary <options>

Option	Description
-	Without any option, the command displays the information for all instances.
instance <instance-name>	OSPF summary information for the given instance.

Example: OSPF summary for the default instance

```

supervisor@rtbrick>SPINE01: op> show ospf summary
Global Information:
Neighbor State Information:
  Full       : 5
  Loading    : 0
  Exchange   : 0
  ExStart    : 0
  TwoWay     : 0
  Init       : 0
  Attempt    : 0
  Down       : 0
Instance: default
General information:
Router ID: 192.168.0.10, Area count: 1, Flood interval: 1000ms
Opaque capability: True, Segment routing capability: True
Flags: -|-|-|-|-, Cost: 10000
SPF initial delay: 50ms, SPF short delay: 200ms, SPF long delay: 5000ms
Area: 198.51.100.0
Interface count: 7
Interface: ifl-0/0/0/1
  Address: 198.51.100.85, State: Backup, Type: broadcast, Priority: 1
  Designated router: 198.51.100.0, Backup designated router: 198.51.100.1
  Hello interval: 10 sec, Dead interval: 40 sec
  Cost: 10000, MTU: 1500
Interface: ifl-0/0/0/100
  Address: 198.51.100.86, State: P2P, Type: p2p, Priority: 1
  Designated router: 198.51.100.101, Backup designated router: 198.51.100.2
  Hello interval: 10 sec, Dead interval: 40 sec
  Cost: 20000, MTU: 1500
Interface: ifl-0/0/1/1
  Address: 198.51.100.87, State: P2P, Type: p2p, Priority: 1
  Designated router: 198.51.100.102, Backup designated router: 198.51.100.3
  Hello interval: 10 sec, Dead interval: 40 sec
  Cost: 40000, MTU: 1500
<...>

```

3.1.2. OSPF Interface

Displays OSPF interface information.

Syntax:

show ospf interface <options>

Option	Description
-	Without any option, the command displays the interface information for all instances.
detail	Displays the detailed interface information.
interface <interface-name> detail	Displays detailed information for the specified interface.
instance <instance-name>	OSPF interface information for the given instance.

Option	Description
instance <instance-name> detail	Displays detailed information for the given instance.
instance <instance-name> <interface-name>	Displays information for a specified interface for a given instance.

Example 1: OSPF interface information for the default instance

```

supervisor@rtbrick>SPINE01: op> show ospf interface
Instance: default
Interface      Area          IP Address    State  Type      Cost  Priority DR          BDR
MTU
ifl-0/0/0/1   0.0.0.0      198.51.100.85 BDR   broadcast 10000 1    198.51.100.27 198.51.100.85 1500
ifl-0/0/0/100 0.0.0.0      198.51.100.77 P2P   p2p       20000 1    198.51.100.0  198.51.100.0  1500
lo-0/0/0/1    0.0.0.0      198.51.100.15 P2P   p2p       10000 1    198.51.100.0  198.51.100.0  1500

```

Example 2: OSPF interface detailed information

```

supervisor@rtbrick>SPINE01: op> show ospf interface ifl-0/0/1/100 detail
Instance: default
Interface: ifl-0/0/1/100, Area: 0.0.0.1
State: DR, Type: broadcast, Primary IPv4: 56.0.1.6, Router priority: 1
Designated router: 56.0.1.6, Backup designated router: 56.0.1.5
Hello interval: 10, Router dead interval: 40, Wait timer: 40
Metric: 10000, IPv4 MTU: 1500, Auth profile: MD5_1, Auth Key: 1
Capabilities: *|O|-|-|-|E|*
Received messages:
Hello: 661, Data descriptor: 13, LS request: 2
LS update: 152, LS acknowledgement: 78
Sent messages:
Hello: 663, Data descriptor: 14, LS request: 3
LS update: 96, LS acknowledgement: 90
supervisor@rtbrick>SPINE01: op>

```

3.1.3. OSPF Neighbor

Displays OSPF neighbor information.

Syntax:

show ospf neighbor <options>

Option	Description
-	Without any option, the command displays the neighbor information for all instances.
instance <instance-name>	OSPF neighbor information for the given instance.
detail	Displays the detailed neighbor information.

Option	Description
interface <interface-name>	Displays the neighbor information for a specified interface.
instance <instance-name> detail	Displays detailed OSPF neighbor information for the given instance.
instance <instance-name> interface <interface-name>	Displays OSPF neighbor information for the specified interface for the given instance.
instance <instance-name> interface <interface-name> detail	Displays detailed OSPF neighbor information for the specified interface for the given instance.
interface <interface-name> detail	Displays detailed neighbor information for a specified interface.
log	Logs neighbor event information.
log instance <instance-name>	Logs neighbor event information for the specified instance.
log neighbor <neighbor-address>	Logs neighbor event information for the specified neighbor.

Example 1: OSPF neighbor information for the default instance

```

supervisor@rtbrick>SPINE01: op> show ospf neighbor
Instance: default
Address      Interface      Router ID      Area      State  Priority  DR      BDR      Uptime
Expires
198.51.100.27 ifl-0/0/0/1  198.51.100.20  0.0.0.0   Full  1    198.51.100.27  198.51.100.85
0d:01h:31m:57s  38 Seconds
198.51.100.4  ifl-0/0/0/100 198.51.100.20  0.0.0.0   Full  1    198.51.100.0   198.51.100.0
0d:01h:32m:36s  39 Seconds

```

Example 2: OSPF neighbor event log information

```

supervisor@rtbrick>SPINE01: op> show ospf neighbor log
Instance: default, Neighbor router ID: 198.51.100.20
  Sequence number: 143, Interface: ifl-0/0/0/1, Neighbor interface address: 198.51.100.27
  Current state: Full, Next state: Full, Event: Adjacency ok
  DD flags: -|-|-
Instance: default, Neighbor router ID: 198.51.100.20
  Sequence number: 142, Interface: ifl-0/0/0/1, Neighbor interface address: 198.51.100.27
  Current state: Full, Next state: Depends, Event: Adjacency ok
  DD flags: -|-|-

<...>

```

3.1.4. OSPF Database

Displays information from OSPF link-state database that contains data about link-state advertisements (LSAs).

Syntax:

show ospf database <options>

Option	Description
advertising-router <router-id>	Displays LSDB information for the specified advertising router.
advertising-router <router-id> detail	Displays the detailed LSDB information for the specified advertising router.
advertising-router <router-id> ls-id <ls-id>	Displays the LSDB information for the specified link-state ID for the advertising router.
advertising-router <router-id> ls-type external	Displays the LSDB information for the specified LSA type for the advertising router. Link-state advertisement type includes external, network, router, and summary.
detail	Displays detailed information from LSDB.
instance <instance-name>	Displays OSPF database information for the given instance.
ls-id <ls-id>	OSPF database information for a specific link-state identifier.
ls-type <type>	OSPF database information for the specified link-state type. Link-state advertisement type includes external, network, router and summary.
area <area-id>	Displays database information for the specified OSPF area.
area <area-id> advertising-router <router-id>	Displays LSDB information for the specified advertising router for a specified OSPF area.
area <area-id> detail	Displays detailed LSDB information for the specified OSPF area.
area <area-id> ls-id <ls-id>	Displays LSDB information for the specified link-state identifier for the specified OSPF area.
area <area-id> ls-type <type>	Displays LSDB information for the specified link-state type for the specified OSPF area. Link-state advertisement type includes external, network, router, and summary.
instance <instance-name> advertising router <router- id>	Displays LSDB information for the specified advertising router for the given instance.
instance <instance-name> area <area-id>	Displays LSDB information for the specified area for the given instance.

Option	Description
instance <instance-name> ls-id <ls-id>	Displays LSDB information for the specified link-state identifier for the given instance.
instance <instance-name> ls-type <type>	Displays LSDB information for the specified type of the given instance. Link-state advertisement type includes external, network, router and summary.

Example 1: OSPF database information for the default instance

```

supervisor@rtbrick>SPINE01: cfg> show ospf database
Instance: default, Area: 0.0.0.0
  Type          Link State ID  Advertising Router  Age    Sequence      Checksum    Cost  Link Count
  Router        198.51.100.15  198.51.100.15      71     0x80000009    0x7cb6      -     4
  Router        198.51.100.20  198.51.100.20      57     0x8000000a    0x2f7d      -     4
  Network       198.51.100.27  198.51.100.20      329    0x80000004    0x7e5c      -     2
  Summary-Network 198.51.100.65  198.51.100.20      374    0x80000004    0xbc36      15000 -
  Summary-Network 198.51.100.22  198.51.100.20      374    0x80000004    0x7aae      10000 -
  Summary-Asbr  198.51.100.32  198.51.100.20      324    0x80000004    0xe7aa      30000 -
Instance: default
  Type          Link State ID  Advertising Router  Age    Sequence      Checksum    Cost  Link Count
  External      198.50.100.53  198.51.100.32      374    0x80000004    0xba29      16777214 -

```

Example 2: OSPF database detailed information

```

supervisor@rtbrick>SPINE01: cfg> show ospf database detail
Instance: default, Area: 0.0.0.0 LSAs
  LSA ID: 198.51.100.15
  Advertising router: 198.51.100.15, LSA type: Router
  Sequence number: 0x8000000f, Checksum: 0x1831, LSA age: 1671
  Length: 132, Options: *|-|-|-|-|E|*, Flags: -|-|-|-
  Number of links: 9
  Link ID: 198.51.100.20
    Link data: 198.51.100.30, Type: P2P
    Type of service: 0, Metric: 20000
  Link ID: 198.51.100.15
    Link data: 255.255.255.252, Type: Stub
    Type of service: 0, Metric: 20000
<...>

```

Example 3: OSPF database for an advertising router

```

supervisor@rtbrick>SPINE01: cfg> show ospf database advertising-router 198.51.100.15
Instance: default, Area: 0.0.0.0
  Type          Link State ID  Advertising Router  Age    Sequence      Checksum    Cost  Link Count
  Router        198.51.100.15  198.51.100.15      690    0x80000009    0x7cb6      -     4

```

3.1.5. OSPF SPF

Displays SPF results and event logs.

Syntax:

show ospf spf <options>

Option	Description
result	Displays the SPF result of all instances.
result area <area-id>	Displays SPF result for the specified area.
result instance <instance-name>	Name of the instance
result node-id <node-id>	Displays SPF result for the specified node identifier.
result area <area-id> <node-id>	Displays SPF result for the specified node identifier for a specified area.
result instance <instance-name> area <area-id>	Displays SPF result for the specified area for a given instance.
result instance <instance-name> node-id <node-id>	Displays SPF result for the specified node identifier for a given instance.
log	Displays SPF event logs for all instances.
log instance <instance-name>	Displays SPF event logs for the specified instance.

Example 1: OSPF SPF Result for the default instance

```

supervisor@rtbrick>SPINE01: op> show ospf spf result
Instance: default, Area: 0.0.0.0
Node ID      Type      Cost      Advertising Router  Flags      Neighbor Node      Interface      Nexthop
198.51.100.27 NETWORK  10000     198.51.100.20      -|-|-|-    -                  local          -
198.51.100.15 ROUTER    0         198.51.100.15      -|-|-|-    -                  local          -
198.51.100.20 ROUTER    10000     198.51.100.20      -|-|-|B    198.51.100.20     if1-0/0/0/1    198.51.100.27
                                           198.51.100.20     if1-0/0/0/100  198.51.100.4

```

Example 2: OSPF SPF Result for the specified node identifier for the given area

```

supervisor@rtbrick>SPINE01: op> show ospf spf result area 0.0.0.0 node-id 198.51.100.27
Instance: default, Area: 0.0.0.0
Node ID      Type      Cost      Advertising Router  Flags      Neighbor Node      Interface      Nexthop
198.51.100.27 NETWORK  10000     198.51.100.20      -|-|-|-    -                  local          -

```

Example 3: OSPF SPF Event Logs

```

supervisor@rtbrick>SPINE01: op> show ospf spf log
Instance: default, Router ID: 198.51.100.20
Sequence number: 25, Area ID: 0.0.0.0, LSA type: Network
Reason: Network LSA change, Back off timer: 5000, LSA count: 1
LS ID: 198.51.100.20, Schedule timestamp: 2023-11-02 06:58:20, Number of schedule request: 1
SPF start time: 2023-11-02 06:58:25, Number of nodes: 7, Number of links: 22
Number of stub links: 12, SPF calculation time: 21us , SPF run time: 159us
Router LSA change count: 23, Network LSA change count: 6
Route information change: -

```

3.1.6. OSPF Route

Displays OSPF routing table information.

Syntax:

show ospf route <options>

Option	Description
-	Without any option, the command displays the OSPF route information for all instances.
instance <instance-name>	OSPF route information for the given instance.
instance <instance-name> <afi>	Displays OSPF route information for the specified address family and instance. The supported AFI value is IPv4.
instance <instance-name> AFI <ipv4> <unicast labeled-unicast>	Displays OSPF route information for the specified SAFI for a specified address family.
instance <instance-name> label <label>	Displays OSPF route information for the specified label and instance.
instance <instance-name> mpls unicast label <label> type <type>	Displays OSPF route information for the specified MPLS unicast label or type for the instance.
prefix <ip>	Displays OSPF route information for the specified match prefix.
type	Displays information for OSPF route type. The route types include external-type-1 , external-type-2 , inter-area , intra-area , and ospf-direct .
ipv4 prefix <ip>	Displays OSPF route information for the specified IPv4 prefix.
label <label>	Displays information about the OSPF-labeled routes.
mpls unicast <label type>	Displays information about OSPF MPLS routes.
area-border	Displays the OSPF Area Border Router (ABR) information. Refer to section "3.1.7. OSPF Route ABR" for the interface configuration details.
autonomous-system- boundary	Displays Autonomous System Border Router information. Refer to section "3.1.7. OSPF Route ABR" for the interface configuration details.

Example: OSPF route information for the default instance

```

supervisor@rtbrick>SPINE01: op> show ospf route
Instance: default, AFI: ipv4, SAFI: unicast
  Prefix          Area           Type           Cost    Next Hop           Interface
  12.0.0.0/24     0.0.0.0        ospf-direct    10000   n/a                local
  12.1.0.0/24     0.0.0.0        ospf-direct    10000   n/a                local
  24.0.1.0/24     0.0.0.0        inter-area     25000   198.51.100.27     if1-0/0/0/1
                                     198.51.100.4     if1-0/0/0/100
  24.1.1.0/24     0.0.0.0        inter-area     20000   198.51.100.27     if1-0/0/0/1
                                     198.51.100.4     if1-0/0/0/100
  25.0.1.0/24     0.0.0.0        inter-area     35000   198.51.100.27     if1-0/0/0/1
                                     198.51.100.4     if1-0/0/0/100
  198.51.100.15/32 0.0.0.0        ospf-direct    10000   n/a                local
  198.51.100.20/32 0.0.0.0        intra-area     20000   198.51.100.27     if1-0/0/0/1

```

3.1.7. OSPF Route Area Border

Displays the OSPF Area Border Router (ABR) information.

Syntax:

show ospf route area-border

Example: OSPF Route ABR information

```

supervisor@rtbrick>SPINE01: cfg> show ospf route area-border
Instance: default, Area: 198.51.100.0
  Node ID          Cost           Advertising Router  Flags           Interface
  Nexthop
  198.51.100.20    10000          198.51.100.20      -|-|-|B        if1-0/0/0/1
  198.51.100.27
  198.51.100.30    20000          198.51.100.30      -|-|-|B        if1-0/0/0/1
  198.51.100.27
  198.51.100.40    55000          198.51.100.40      -|-|-|B        if1-0/0/0/1
  198.51.100.27
  198.51.100.50    55000          198.51.100.50      -|-|-|B        if1-0/0/0/1
  198.51.100.27

```

3.1.8. OSPF Route Autonomous System Boundary

Displays Autonomous System Boundary Router information.

Syntax:

show ospf route autonomous-system-boundary

Example: OSPF Route ASBR information

```

supervisor@rtbrick>SPINE01: cfg> show ospf route autonomous-system-boundary
Instance: default, Area:
  Node ID          Cost      Advertising Router  Flags      Interface      Nexthop
  198.51.100.32    40000    198.51.100.20      /         ifl-0/0/0/1
  198.51.100.27

```

3.1.9. OSPF LSA Request List

Displays the list of all link-state advertisements (LSAs) requests that have been sent or received by a router.

Syntax:

show ospf request-list <options>

Option	Description
-	Without any option,, this command displays the list of all link-state advertisement (LSA) requests that have been sent from the router.
detail	Provides detailed information on the requests that have been sent from the router.

Example 1: OSPF LSA requests sent to a neighbor

```

supervisor@rtbrick>SPINE01: op> show ospf request-list
Instance: default
  Type          Link State ID  Advertising Router      Age      Sequence      Checksum
  Summary-Network 11.0.0.0      198.51.100.20          42      0x80000003    0x76e5
  Summary-Network 12.0.0.0      198.51.100.20          42      0x80000003    0x603d
  Summary-Network 12.1.0.0      198.51.100.20          42      0x80000003    0x481f
  Summary-Network 12.2.0.0      198.51.100.20          42      0x80000003    0x4aab
  Summary-Network 12.3.0.0      198.51.100.20          42      0x80000003    0xc5e4
  Summary-Network 23.0.0.0      198.51.100.20          42      0x80000003    0xd5bb
  Summary-Network 23.1.0.0      198.51.100.20          42      0x80000003    0xca2a

```

Example 2: Detailed information for OSPF LSA requests sent to a neighbor

```

supervisor@rtbrick>SPINE01: op> show ospf request-list detail
Instance: default LSAs
  LSA ID: 11.0.0.0
    Advertising router: 198.51.100.20, LSA type: Summary-Network, Router ID: 192.168.0.20
    Sequence number: 0x80000003, Checksum: 0x76e5, LSA age: 42
    Interface: hostif-0/0/0/1, Neighbor address: 25.0.1.2
    Length: 0, Options: *|---|---|---|*
  LSA ID: 12.0.0.0
    Advertised router: 198.51.100.20, LSA type: Summary-Network, Router ID: 192.168.0.20
    Sequence number: 0x80000003, Checksum: 0x603d, LSA age: 42
    Interface: hostif-0/0/0/1, Neighbor address: 25.0.1.2
    Length: 0, Options: *|---|---|---|*
  LSA ID: 12.1.0.0
    Advertised router: 198.51.100.20, LSA type: Summary-Network, Router ID: 192.168.0.20
    Sequence number: 0x80000003, Checksum: 0x481f, LSA age: 42
    Interface: hostif-0/0/0/1, Neighbor address: 25.0.1.2
    Length: 0, Options: *|---|---|---|*
  LSA ID: 12.2.0.0
    Advertised router: 198.51.100.20, LSA type: Summary-Network, Router ID: 192.168.0.20
    Sequence number: 0x80000003, Checksum: 0x4aab, LSA age: 42
    Interface: hostif-0/0/0/1, Neighbor address: 25.0.1.2
    Length: 0, Options: *|---|---|---|*

<...>

```

3.1.10. OSPF Transmission List

Displays the list of all LSAs waiting to be re-sent or transmitted from the router.

Syntax:

show ospf transmit-list <option>

Option	Description
detail	Provides detailed information on all LSAs waiting to be re-sent.

Example: OSPF LSA requests waiting to be transmitted.

```

supervisor@rtbrick>SPINE01: op> show ospf transmit-list
Instance: default, Area: 0.0.0.1, Interface: if1-0/0/4/1, Neighbor: 25.0.1.5
  LSA ID          LS type          Advertising router  Transmit interval
Retransmit count
  11.0.0.0        Summary-Network  198.51.100.20      5000              1
  12.0.0.0        Summary-Network  198.51.100.20      5000              1
  23.0.0.0        Summary-Network  198.51.100.20      5000              1
  12.1.0.0        Summary-Network  198.51.100.20      5000              1
  23.1.0.0        Summary-Network  198.51.100.20      5000              1
  12.2.0.0        Summary-Network  198.51.100.20      5000              1
  12.3.0.0        Summary-Network  198.51.100.20      5000              1

```

3.1.11. OSPF Statistics

Displays OSPF statistics information.

Syntax:

show ospf statistics <options>

Option	Description
interface <interface-name>	Displays packet statistics information for the specified interface.
interface <interface-name> detail	Displays detailed packet statistics information for the specified interface.
neighbor <neighbor-address>	Displays packet statistics information for the specified neighbor.
neighbor <neighbor-address> detail	Displays detailed packet statistics information for the specified neighbor.

```

supervisor@rtbrick>SPINE01: op> show ospf statistics interface if1-0/0/0/1 detail
Instance: default
  Interface: interface if1-0/0/0/1, Peer address: 56.0.1.5
    Hello packet:
      Recieved packets: 107, Sent packets: 109, Total errors: 1, Unsupported option: 0
      Area mismatch: 0, Area type option mistmatch: 0, Dead interval mismatch: 0
      Hello interval mismatch: 0, Mask mismatch: 0, Self router ID: 0
      Obj add fail: 0, Source address mismatch: 0, Misc: 0
    DD packet:
      Recieved packets: 11, Sent packets: 10, Total errors: 1, Unsupported option: 0
      Invalid state packet rcvd: 0, MTU mismatch: 0, DD obj add fail: 0, Misc: 0, Negotiation fail: 0
      Master bit mismatch: 0, Exchange state init pkt: 0, Capabilities mismatch: 0
      Expected seq mismatch: 0, Full state init pkt: 1
    LS request packet:
      Recieved packets: 0, Sent packets: 0, Total errors: 0, Invalid LSA type: 0
      Invalid state packet rcvd: 0, LSA lookup error: 0, LSA lookup fail: 0
      LSA obj add fail: 0, Misc: 0
    LS update packet:
      Recieved packets: 50, Sent packets: 0, Total errors: 4, Invalid LSA type: 0
      Zero length LSA: 0, LSA length exceeded: 0, LSA checksum fail: 0
      Invalid state packet rcvd: 4, LSA obj add fail: 0, Misc: 0
    Ls ack packet:
      Recieved packets: 11, Sent packets: 0, Total errors: 0, LSA obj add fail: 0
      Invalid state packet rcvd: 0, Misc: 0
    Sanity errors:
      Payload max len error: 0, Payload min len error: 0, Invalid version: 0
      Invalid auth data len: 0, Auth data missing: 0, Invalid packet min len: 0
      Invalid area ID: 0, Invalid network mask: 0, Authentication fail: 2

```

3.2. OSPF Clear Commands

3.2.1. Clear OSPF Neighbor

Clear OSPF neighbor state information.

Syntax:

clear ospf neighbor <options>

Option	Description
-	Without any option, the command clears all the OSPF neighbors.
instance <instance-name>	Clears OSPF neighbor information for the specified instance.
instance <instance-name> area <area-id>	Clears OSPF neighbor for the specified area of the specified instance.
instance <instance-name> area <area-id> interface <interface-name>	Clears OSPF neighbor for the specified interface for the specified area of the specified instance.
force	Forcefully clears all the OSPF neighbors. This may impact DR/BDR election.
force instance <instance-name>	Forcefully clears the neighbor for the specified instance.
force instance <instance-name> area <area-id>	Forcefully clears OSPF neighbor for the specified area of the specified instance.
force instance <instance-name> area <area-id> interface <interface-name>	Forcefully clears OSPF neighbor for a specific interface and area of the specified instance.

Example:

```
supervisor@rtbrick>SPINE01: cfg> clear ospf neighbor instance default area 198.51.100.0 interface ifl-
0/0/1/100
Instance [default], area[0.0.0.1], interface[ifl-0/0/1/100] clear triggered
```

3.2.2. Clear OSPF Statistics

Clear the OSPF statistics for all instances or for a specified instance.

Syntax:

clear ospf statistics <options>

Option	Description
-	Without any option, the command clears all the OSPF statistics.
instance <instance-name>	Clears OSPF statistics information for the specified instance.
instance <instance-name> area <area-id>	Clears OSPF statistics for the specified area of the specified instance.

Option	Description
instance <instance-name> area <area-id> interface <interface-name>	Clears OSPF statistics for the specified interface for the specified area of the specified instance.

Example:

```
supervisor@rtbrick>SPINE01: cfg> clear ospf statistics instance default area 0.0.0.0 interface if1-0/0/1/1
Cleared statistics for all neighbors under Instance [default] Area [0.0.0.0] Interface [if1-0/0/1/1]
```