

Internet  
Internet-Draft  
Intended status: Informational  
Expires: September 22, 2016

D. Yeung  
Y. Qu  
Cisco Systems  
J. Zhang  
Juniper Networks  
D. Bogdanovic

K. Sreenivasa  
Cisco Systems  
March 21, 2016

Yang Data Model for OSPF Protocol  
draft-ietf-ospf-yang-04

## Abstract

This document defines a YANG data model that can be used to configure and manage OSPF.

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## [1.](#) Overview

YANG [[RFC6020](#)] is a data definition language used to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [[RFC6241](#)]. YANG is proving relevant beyond its initial confines, as bindings to other interfaces (e.g., ReST) and encodings other than XML (e.g., JSON) are being defined. Furthermore, YANG data models can be used as the basis for implementation of other interfaces, such as CLI and programmatic APIs.

This document defines a YANG data model that can be used to configure and manage OSPF and it is an augmentation to the core routing data

model. A core routing data model is defined in [[I-D.ietf-netmod-routing-cfg](#)], and it provides the basis for the development of data models for routing protocols. The interface data model is defined in [[RFC7223](#)] and is used for referencing interfaces from the routing protocol. The key-chain data model used for OSPF

authentication is defined in [[I-D.acee-rtg-yang-key-chain](#)] and provides both a reference to configured key-chains and an enumeration of cryptographic algorithms.

Both OSPFv2 [[RFC2328](#)] and OSPFv3 [[RFC5340](#)] are supported. In addition to the core OSPF protocol, features described in other OSPF RFCs are also supported. They includes demand circuit [[RFC1793](#)], traffic engineering [[RFC3630](#)], multiple address family [[RFC5838](#)], graceful restart [[RFC3623](#)] [[RFC5187](#)], NSSA [[RFC3101](#)], and sham link [[RFC4577](#)]. These non-core features are made optional in the OSPF data model.

### [1.1.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

## [2.](#) Design of Data Model

Although the basis of OSPF configuration elements like routers, areas, and interfaces remains the same, the detailed configuration model varies among router vendors. Differences are observed in terms of how the protocol engine is tied to routing domain, how multiple protocol engines are be instantiated, and configuration inheritance, among others.

The goal of this document is to define a data model that provides a common user interface to the OSPFv2 and OSPFv3 protocol. There is very little information that is designated as "mandatory", providing freedom for vendors to adapt this data model to their respective product implementations.

### [2.1.](#) Overview

The OSPF YANG module defined in this document has all the common

building blocks for the OSPF protocol.

The OSPF YANG module augments the routing/routing-instance/routing-protocols/routing-protocol path defined in the ietf-routing module.

```
module: ospf
+--rw routing
+--rw routing-protocols
+--rw routing-protocol [name]
+--rw ospf
  .
  .
+--rw all-instances-inherit {instance-inheritance}?
|   .
|   .
+--rw instance* [routing-instance af]
  .
  .
+--rw areas
|   +--rw area* [area-id]
|   |   .
|   |   .
|   |   +--rw all-interfaces-inherit {interface-inheritance}?
|   |   .
|   |   .
|   |   +--rw virtual-links
|   |   |   +--rw virtual-link* [router-id]
|   |   |   |   .
|   |   |   |   .
|   |   +--rw sham-links
|   |   |   +--rw sham-link* [local-id remote-id]
|   |   |   |   .
|   |   |   |   .
|   |   +--rw interfaces
```

```

|         |  +--rw interface* [interface]
|         |      .
|         |      .
|         |      .
|         |      .
+--rw topologies
    +--rw topology* [name]

```

The ospf module is intended to match to the vendor specific OSPF configuration construct that is identified by a local identifier 'name'. The field 'version' allows support for OSPFv2 and OSPFv3.

The ospf container includes one or more OSPF protocol engines, each enclosed in a separate instance entity. Each instance includes information for the routing domain based on the [routing-instance af] specification. There is no default routing domain assumed by the data model. For example, to enable OSPF on a vendor's default IPv4 routing domain, an explicit instance entity with a specification like

["default" "ipv4-unicast"] is required. The instance also contains OSPF router level configuration

The instance/area and instance/area/interface containers respectively define the OSPF configuration for OSPF areas and interfaces.

The instance/topology container defines the OSPF configuration for OSPF topologies when the multi-topology feature is supported.

## [2.2.](#) OSPFv2 and OSPFv3

The data model defined herein supports both OSPFv2 and OSPFv3.

The field 'version' is used to indicate the OSPF version and is mandatory. Based on the configured version, the data model varies to accommodate the differences between OSPFv2 and OSPFv3.

## [2.3.](#) Optional Features

Optional features are beyond the basic OSPF configuration and it is the responsibility of each vendor to decide whether to support a given feature on a particular device.

This model defines a number of features, such as NSR, max-LSA, etc. It is expected that vendors will support additional features through vendor specific augmentations.

#### [2.4.](#) Inheritance

This data model supports configuration inheritance at different levels including instance-level, area-level, and interface-level inheritance.

The all-instances-inherit, all-areas-inherit, and all-interfaces-inherit containers are defined to provide a consistent way to configure inheritable configuration parameters. For example, parameters defined in the all-instances-inherit container apply to all OSPF instances. However, a particular instance configuration can override this inheritance.

Inheritance is defined as an optional feature, and vendors are permitted to augment the inheritance containers with their own vendor specific parameters.

#### [2.5.](#) OSPF Router Configuration

The ospf container is the top level container in this data model. It contains shared information among the OSPF instances configured within the container.

```
module: ospf
  +--rw ospf
    +--rw all-instances-inherit {instance-inheritance}?
      | +--rw area
      | +--rw interface
    +--rw operation-mode?          identityref
    +--rw instance* [af]
      .
      .
```

## 2.6. OSPF Instance Configuration

The instance container represents an OSPF protocol engine and contains the router level configuration. The routing domain for each instance is dictated through the specification of [routing-instance af].

The all-areas-inherit container contains area configuration that may be inherited by configured OSPF areas.

```
module: ospf
+--rw ospf
  .
  .
+--rw instance* [af]
  +--rw af identityref
  +--rw all-areas-inherit {area-inheritance}?
    | +--rw area
    | +--rw interface
  +--rw explicit-router-id? yang:dotted-quad {explicit-router-id}?
  +--rw admin-distance
    | +--rw (scope)?
    |   +--:(single-value)
    |     | +--rw all? uint8
    |   +--:(multi-values)
    |     +--rw (granularity)?
    |       | +--:(detail)
    |       |   +--rw intra-area? uint8
    |       |   +--rw inter-area? uint8
    |       |   +--:(coarse)
    |       |     +--rw internal? uint8
    |       +--rw external? uint8
```

```
+--rw nsr {nsr}?
  | +--rw enable? boolean
+--rw graceful-restart {graceful-restart}?
  | +--rw enable? boolean
  | +--rw helper-enable? boolean
  | +--rw restart-interval? uint16
  | +--rw helper-strict-lsa-checking? boolean
+--rw enable? boolean {admin-control}?
```

```

+---rw auto-cost {auto-cost}?
|   +---rw enable?                boolean
|   +---rw reference-bandwidth?   uint32
+---rw spf-control
|   +---rw paths?    uint16 {max-ecmp}?
+---rw database-control
|   +---rw max-lsa?   uint32 {max-lsa}?
+---rw stub-router {stub-router}?
|   +---rw (trigger)?
|       +---:(always)
|       +---rw always!
+---rw mpls
|   +---rw te-rid {te-rid}?
|   |   +---rw (source)?
|   |       +---:(interface)
|   |       |   +---rw interface?    if:interface-ref
|   |       |   +---:(explicit)
|   |       +---rw router-id?    inet:ipv4-address
|   +---rw ldp
|       +---rw igp-sync?        boolean {ldp-igp-sync}?
|       +---rw autoconfig?     boolean {ldp-igp-autoconfig}?
+---rw fast-reroute {fast-reroute}?
|   +---rw lfa {lfa}?

```

## 2.7. OSPF Area Configuration

The area container contains OSPF area configuration and the list of interface containers representing all the OSPF interfaces in the area.

The all-interfaces-inherit contains interface configuration that may be inherited by all OSPF area interfaces.

```

module: ospf
+---rw ospf
.
.
+---rw instance* [routing-instance af]
.
.

```

```
+---rw areas
```



```

+--rw area* [area-id]
|   +--rw area-id                area-id-type
|   +--rw all-interfaces-inherit {interface-inheritance}?
|   |   +--rw interface
|   +--rw area-type?             identityref
|   +--rw summary?               boolean
|   +--rw default-cost?          uint32
|   +--rw ranges
|   |   +--rw range* [prefix]
|   |   |   +--rw prefix          inet:ip-prefix
|   |   |   +--rw advertise?      boolean
|   |   |   +--rw cost?           uint24
|   +--rw virtual-links
|   |   +--rw virtual-link* [router-id]
|   |   |   +--rw router-id        yang:dotted-quad
|   |   |   +--rw cost?            uint16
|   |   |   +--rw hello-interval?  uint16
|   |   |   +--rw dead-interval?    uint16
|   |   |   +--rw retransmit-interval? uint16
|   |   |   +--rw transmit-delay?   uint16
|   |   |   +--rw mtu-ignore?       boolean {mtu-ignore}?
|   |   |   +--rw lls?              boolean {lls}?
|   |   |   +--rw prefix-suppression? boolean {prefix-suppression}?
|   |   |   +--rw ttl-security {ttl-security}?
|   |   |   |   +--rw enable?      boolean
|   |   |   |   +--rw hops?        uint8
|   |   |   +--rw enable?          boolean {admin-control}?
|   |   +--rw authentication
|   |   |   +--rw (auth-type-selection)?
|   |   |   |   +--:(auth-ipsec) {ospfv3-authentication-ipsec}?
|   |   |   |   |   +--rw sa?          string
|   |   |   |   +--:(auth-trailer-key-chain)
|   |   |   |   |   +--rw key-chain?    key-chain:key-chain-ref
|   |   |   |   +--:(auth-trailer-key)
|   |   |   |   |   +--rw key?          string
|   |   |   |   +--rw crypto-algorithm
|   |   |   |   |   +--rw (algorithm)?
|   |   |   |   |   |   +--:(hmac-sha-1-12) {crypto-hmac-sha-1-12}?
|   |   |   |   |   |   |   +--rw hmac-sha1-12?  empty
|   |   |   |   |   |   +--:(md5)
|   |   |   |   |   |   |   +--rw md5?            empty
|   |   |   |   |   |   +--:(sha-1)
|   |   |   |   |   |   |   +--rw sha-1?          empty
|   |   |   |   |   |   +--:(hmac-sha-1)
|   |   |   |   |   |   |   +--rw hmac-sha-1?      empty
|   |   |   |   |   |   +--:(hmac-sha-256)
|   |   |   |   |   |   |   +--rw hmac-sha-256?    empty

```

```

|
|
|         +---:(hmac-sha-384)
|         |   +---rw hmac-sha-384?    empty
|         +---:(hmac-sha-512)
|         |   +---rw hmac-sha-512?    empty
|         +---:(clear-text) {clear-text}?
|         |   +---rw clear-text?      empty
+---rw sham-link
|   +---rw sham-link* [local-id remote-id]
|   +---rw local-id          inet:ip-address
|   +---rw remote-id         inet:ip-address
|   +---rw cost?             uint16
|   +---rw hello-interval?   uint16
|   +---rw dead-interval?    uint16
|   +---rw retransmit-interval? uint16
|   +---rw transmit-delay?   uint16
|   +---rw mtu-ignore?       boolean {mtu-ignore}?
|   +---rw lls?              boolean {lls}?
|   +---rw prefix-suppression? boolean {prefix-suppression}?
|   +---rw bfd?              boolean {bfd}?
|   +---rw ttl-security {ttl-security}?
|   |   +---rw enable?       boolean
|   |   +---rw hops?         uint8
+---rw enable?               boolean {admin-control}?
+---rw authentication
|   +---rw (auth-type-selection)?
|   |   +---:(auth-ipsec) {ospfv3-authentication-ipsec}?
|   |   |   +---rw sa?          string
|   |   +---:(auth-trailer-key-chain)
|   |   |   +---rw key-chain?    key-chain:key-chain-ref
|   |   +---:(auth-trailer-key)
|   |   |   +---rw key?          string
|   |   +---rw crypto-algorithm
|   |   |   +---rw (algorithm)?
|   |   |   |   +---:(hmac-sha-1-12) {crypto-hmac-sha-1-12}?
|   |   |   |   |   +---rw hmac-sha1-12?    empty
|   |   |   |   +---:(md5)
|   |   |   |   |   +---rw md5?             empty
|   |   |   |   +---:(sha-1)
|   |   |   |   |   +---rw sha-1?           empty
|   |   |   |   +---:(hmac-sha-1)
|   |   |   |   |   +---rw hmac-sha-1?      empty
|   |   |   |   +---:(hmac-sha-256)
|   |   |   |   |   +---rw hmac-sha-256?    empty
|   |   |   |   +---:(hmac-sha-384)
|   |   |   |   |   +---rw hmac-sha-384?    empty
|   |   |   |   +---:(hmac-sha-512)

```

```

| | | | +--rw hmac-sha-512? empty
| | | | +--:(clear-text) {clear-text}?

```

```

| | | | +--rw clear-text? empty

```

## 2.8. OSPF Interface Configuration

The interface container contains OSPF interface configuration.

```

module: ospf
+--rw ospf
  .
  .
  +--rw instance* [routing-instance af]
    .
    .
    +--rw areas
      | +--rw area* [area-id]
        .
        .
        +--rw interfaces
          +--rw interface* [interface]
            +--rw interface if:interface-ref
            +--rw network-type? enumeration
            +--rw passive? boolean
            +--rw demand-circuit? boolean {demand-circuit}?
            +--rw multi-areas
              | +--rw multi-area* [multi-area-id] {multi-area-adj}?
              |   +--rw multi-area-id area-id-type
              |   +--rw cost? uint16
            +--rw static-neighbors
              | +--rw neighbor* [address]
              |   +--rw address inet:ip-address
              |   +--rw cost? uint16
              |   +--rw poll-interval? uint16
              |   +--rw priority? uint8
            +--rw node-flag? boolean {node-flag}?
            +--rw fast-reroute {fast-reroute}?
              | +--rw lfa {lfa}?
              |   +--rw candidate-disabled? boolean
              |   +--rw enabled? boolean
              |   +--rw remote-lfa {remote-lfa}?

```

```

|           +---rw enabled?    boolean
+---rw cost?                    uint16
+---rw hello-interval?         uint16
+---rw dead-interval?          uint16
+---rw retransmit-interval?    uint16
+---rw transmit-delay?         uint16
+---rw mtu-ignore?             boolean {mtu-ignore}?
+---rw lls?                    boolean {lls}?
+---rw prefix-suppression?     boolean {prefix-suppression}?

```

```

+---rw ttl-security {ttl-security}?
|   +---rw enable?    boolean
|   +---rw hops?      uint8
+---rw enable?                boolean {admin-control}?
+---rw authentication
|   +---rw (auth-type-selection)?
|       +---:(auth-ipsec) {ospfv3-authentication-ipsec}?
|           |   +---rw sa?                string
|       +---:(auth-trailer-key-chain)
|           |   +---rw key-chain?          key-chain:key-chain-ref
|       +---:(auth-trailer-key)
|           +---rw key?                    string
|           +---rw crypto-algorithm
|               +---rw (algorithm)?
|                   +---:(hmac-sha-1-12) {crypto-hmac-sha-1-12}?
|                       |   +---rw hmac-sha1-12?    empty
|                   +---:(md5)
|                       |   +---rw md5?              empty
|                   +---:(sha-1)
|                       |   +---rw sha-1?            empty
|                   +---:(hmac-sha-1)
|                       |   +---rw hmac-sha-1?       empty
|                   +---:(hmac-sha-256)
|                       |   +---rw hmac-sha-256?     empty
|                   +---:(hmac-sha-384)
|                       |   +---rw hmac-sha-384?     empty
|                   +---:(hmac-sha-512)
|                       |   +---rw hmac-sha-512?     empty
|                   +---:(clear-text) {clear-text}?
|                       +---rw clear-text?          empty
+---rw topologies
|   +---rw topology* [name]

```

```

|           |           +--rw name      leafref
|           |           +--rw cost?    uint32
|           +--rw instance-id?          uint8

```

## 2.9. OSPF notification

This YANG model defines a list of notifications that inform YANG clients of important events detected during protocol operation. The defined notifications cover the common set of traps from the OSPFv2 MIB [[RFC4750](#)] and OSPFv3 MIB [[RFC5643](#)].

```

module: ospf
notifications:
  +---n if-state-change
  |   +--ro routing-instance?          string
  |   +--ro routing-protocol-type?    -> ...

```

```

|   +--ro routing-protocol-name?    -> ...
|   +--ro af?                       -> ...
|   +--ro (if-link-type-selection)?
|   |   +--:(interface)
|   |   |   +--ro interface
|   |   |   |   +--ro interface?    if:interface-ref
|   |   +--:(virtual-link)
|   |   |   +--ro virtual-link
|   |   |   |   +--ro area-id?       area-id-type
|   |   |   |   +--ro neighbor-router-id?  yang:dotted-quad
|   |   +--:(sham-link)
|   |   |   +--ro sham-link
|   |   |   |   +--ro area-id?       area-id-type
|   |   |   |   +--ro local-ip-addr?  inet:ip-address
|   |   |   |   +--ro remote-ip-addr? inet:ip-address
|   +--ro state?                    if-state-type
+---n if-config-error
|   +--ro routing-instance?          string
|   +--ro routing-protocol-type?    -> ...
|   +--ro routing-protocol-name?    -> ...
|   +--ro af?                       -> ...
|   +--ro (if-link-type-selection)?
|   |   +--:(interface)
|   |   |   +--ro interface
|   |   |   |   +--ro interface?    if:interface-ref

```

```

| | | +--:(virtual-link)
| | | | +--ro virtual-link
| | | | | +--ro area-id?          area-id-type
| | | | | +--ro neighbor-router-id?  yang:dotted-quad
| | | +--:(sham-link)
| | | | +--ro sham-link
| | | | | +--ro area-id?          area-id-type
| | | | | +--ro local-ip-addr?    inet:ip-address
| | | | | +--ro remote-ip-addr?   inet:ip-address
| | | +--ro packet-source?        yang:dotted-quad
| | | +--ro packet-type?          packet-type
| | | +--ro error?                 enumeration
+---n nbr-state-change
| | +--ro routing-instance?        string
| | +--ro routing-protocol-type?   -> ...
| | +--ro routing-protocol-name?   -> ...
| | +--ro af?                      -> ...
| | +--ro (if-link-type-selection)?
| | | +--:(interface)
| | | | +--ro interface
| | | | | +--ro interface?    if:interface-ref
| | | +--:(virtual-link)
| | | | +--ro virtual-link

```

```

| | | | +--ro area-id?          area-id-type
| | | | | +--ro neighbor-router-id?  yang:dotted-quad
| | | +--:(sham-link)
| | | | +--ro sham-link
| | | | | +--ro area-id?          area-id-type
| | | | | +--ro local-ip-addr?    inet:ip-address
| | | | | +--ro remote-ip-addr?   inet:ip-address
| | | +--ro neighbor-router-id?    yang:dotted-quad
| | | +--ro neighbor-ip-addr?      yang:dotted-quad
| | | +--ro state?                  nbr-state-type
+---n nbr-restart-helper-status-change
| | +--ro routing-instance?        string
| | +--ro routing-protocol-type?   -> ...
| | +--ro routing-protocol-name?   -> ...
| | +--ro af?                      -> ...
| | +--ro (if-link-type-selection)?
| | | +--:(interface)
| | | | +--ro interface

```

```

| | | +--ro interface?   if:interface-ref
| | | +---:(virtual-link)
| | | | +--ro virtual-link
| | | | | +--ro area-id?           area-id-type
| | | | | +--ro neighbor-router-id? yang:dotted-quad
| | | +---:(sham-link)
| | | | +--ro sham-link
| | | | | +--ro area-id?           area-id-type
| | | | | +--ro local-ip-addr?    inet:ip-address
| | | | | +--ro remote-ip-addr?   inet:ip-address
| | +--ro neighbor-router-id?      yang:dotted-quad
| | +--ro neighbor-ip-addr?        yang:dotted-quad
| | +--ro status?                  restart-helper-status-type
| | +--ro age?                     uint32
| | +--ro exit-reason?             restart-exit-reason-type
+---n rx-bad-packet
| | +--ro routing-instance?        string
| | +--ro routing-protocol-type?   -> ...
| | +--ro routing-protocol-name?   -> ...
| | +--ro af?                      -> ...
| | +--ro (if-link-type-selection)?
| | | +---:(interface)
| | | | +--ro interface
| | | | | +--ro interface?   if:interface-ref
| | | +---:(virtual-link)
| | | | +--ro virtual-link
| | | | | +--ro area-id?           area-id-type
| | | | | +--ro neighbor-router-id? yang:dotted-quad
| | | +---:(sham-link)
| | | | +--ro sham-link

```

```

| | | +--ro area-id?           area-id-type
| | | +--ro local-ip-addr?    inet:ip-address
| | | +--ro remote-ip-addr?   inet:ip-address
| | +--ro packet-source?      yang:dotted-quad
| | +--ro packet-type?        packet-type
+---n lsdbs-approaching-overflow
| | +--ro routing-instance?    string
| | +--ro routing-protocol-type? -> ...
| | +--ro routing-protocol-name? -> ...
| | +--ro af?                  -> ...
| | +--ro ext-lsdb-limit?      uint32

```

```

+---n lsdb-overflow
|  +--ro routing-instance?      string
|  +--ro routing-protocol-type? -> ...
|  +--ro routing-protocol-name? -> ...
|  +--ro af?                    -> ...
|  +--ro ext-lsdb-limit?        uint32
+---n nssa-translator-status-change
|  +--ro routing-instance?      string
|  +--ro routing-protocol-type? -> ...
|  +--ro routing-protocol-name? -> ...
|  +--ro af?                    -> ...
|  +--ro area-id?               area-id-type
|  +--ro status?                nssa-translator-state-type
+---n restart-status-change
|  +--ro routing-instance?      string
|  +--ro routing-protocol-type? -> ...
|  +--ro routing-protocol-name? -> ...
|  +--ro af?                    -> ...
|  +--ro status?                restart-status-type
|  +--ro restart-interval?      uint16
|  +--ro exit-reason?           restart-exit-reason-type

```

### 3. OSPF Segment Routing

In addition to the OSPF base YANG model, this document also defines a model for the OSPF segment routing feature.

The OSPF SR YANG module requires support for the base segment routing module [[I-D.ietf-spring-sr-yang](#)], which defines the global segment routing configuration independent of any specific routing protocol configuration.

```

module: ietf-ospf-sr
augment /rt:routing/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance:
    +--rw segment-routing
    |  +--rw enabled?      boolean

```

```

|  +--rw bindings
|  |  +--rw advertise
|  |  |  +--rw policies*  string
|  |  +--rw receive?      boolean

```



```

    +--rw protocol-srgb {sr:protocol-srgb}?
      +--rw srgb* [lower-bound upper-bound]
        +--rw lower-bound    uint32
        +--rw upper-bound    uint32
augment /rt:routing/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance
  /ospf:areas/ospf:area/ospf:interfaces/ospf:interface:
    +--rw segment-routing
      +--rw adjacency-sid
        +--rw advertise-adj-group-sid* [group-id]
          | +--rw group-id    uint32
          +--rw advertise-protection?    enumeration
augment /rt:routing/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance/ospf:areas
  /ospf:area/ospf:interfaces/ospf:interface/ospf:fast-reroute:
    +--rw ti-lfa {ti-lfa}?
      +--rw enable?    boolean
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance:
    +--ro segment-routing
      | +--ro enabled?    boolean
      | +--ro bindings
      |   +--ro advertise
      |     | +--ro policies*    string
      |     +--ro receive?    boolean
    +--ro protocol-srgb {sr:protocol-srgb}?
      +--ro srgb* [lower-bound upper-bound]
        +--ro lower-bound    uint32
        +--ro upper-bound    uint32
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance
  /ospf:areas/ospf:area/ospf:interfaces/ospf:interface:
    +--ro segment-routing
      +--ro adjacency-sid
        +--ro advertise-adj-group-sid* [group-id]
          | +--ro group-id    uint32
          +--ro advertise-protection?    enumeration
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance/ospf:areas
  /ospf:area/ospf:interfaces/ospf:interface/ospf:database
  /ospf:link-scope-lsa-type/ospf:link-scope-lsas
  /ospf:link-scope-lsa/ospf:version/ospf:ospfv2
  /ospf:ospfv2/ospf:body/ospf:opaque
  /ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv:

```

```

+--ro prefix-sid-sub-tlvs
| +--ro prefix-sid-sub-tlv*
|   +--ro flags?          bits
|   +--ro mt-id?          uint8
|   +--ro algorithm?      uint8
|   +--ro sid?            uint32
+--ro sid-binding-sub-tlvs
  +--ro sid-binding-sub-tlv*
    +--ro flags?          bits
    +--ro mt-id?          uint8
    +--ro weight?         uint8
    +--ro sid-sub-tlv
    | +--ro sid?          uint32
    +--ro ero-metric-sub-tlv
    | +--ro metric?       uint32
    +--ro ipv4-ero-sub-tlv
    | +--ro flags?        bits
    | +--ro ipv4-address? inet:ipv4-address
    +--ro unnumbered-ero-sub-tlv
    | +--ro flags?        bits
    | +--ro router-id?    yang:dotted-quad
    | +--ro interface-id? uint32
    +--ro ipv4-backup-ero-sub-tlv
    | +--ro flags?        bits
    | +--ro ipv4-address? inet:ipv4-address
    +--ro unnumbered-backup-ero-sub-tlv
    +--ro flags?          bits
    +--ro router-id?      yang:dotted-quad
    +--ro interface-id?   uint32
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance
  /ospf:areas/ospf:area/ospf:database
  /ospf:area-scope-lsa-type/ospf:area-scope-lsas
  /ospf:area-scope-lsa/ospf:version/ospf:ospfv2
  /ospf:ospfv2/ospf:body/ospf:opaque
  /ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv:
+--ro prefix-sid-sub-tlvs
| +--ro prefix-sid-sub-tlv*
|   +--ro flags?          bits
|   +--ro mt-id?          uint8
|   +--ro algorithm?      uint8
|   +--ro sid?            uint32
+--ro sid-binding-sub-tlvs
  +--ro sid-binding-sub-tlv*
    +--ro flags?          bits
    +--ro mt-id?          uint8
    +--ro weight?         uint8

```

+++ro sid-sub-tlv

```

    |  +++ro sid?    uint32
  +-+ro ero-metric-sub-tlv
    |  +++ro metric?  uint32
  +-+ro ipv4-ero-sub-tlv
    |  +++ro flags?      bits
    |  +++ro ipv4-address?  inet:ipv4-address
  +-+ro unnumbered-ero-sub-tlv
    |  +++ro flags?      bits
    |  +++ro router-id?   yang:dotted-quad
    |  +++ro interface-id? uint32
  +-+ro ipv4-backup-ero-sub-tlv
    |  +++ro flags?      bits
    |  +++ro ipv4-address?  inet:ipv4-address
  +-+ro unnumbered-backup-ero-sub-tlv
    |  +++ro flags?      bits
    |  +++ro router-id?   yang:dotted-quad
    |  +++ro interface-id? uint32
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance
  /ospf:database/ospf:as-scope-lsa-type/ospf:as-scope-lsas
  /ospf:as-scope-lsa/ospf:version/ospf:ospfv2
  /ospf:ospfv2/ospf:body/ospf:opaque
  /ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv:
  +-+ro prefix-sid-sub-tlvs
    |  +++ro prefix-sid-sub-tlv*
    |    +++ro flags?      bits
    |    +++ro mt-id?      uint8
    |    +++ro algorithm?  uint8
    |    +++ro sid?        uint32
  +-+ro sid-binding-sub-tlvs
    |  +++ro sid-binding-sub-tlv*
    |    +++ro flags?      bits
    |    +++ro mt-id?      uint8
    |    +++ro weight?     uint8
    |  +-+ro sid-sub-tlv
    |    |  +++ro sid?    uint32
    |  +-+ro ero-metric-sub-tlv
    |    |  +++ro metric?  uint32
    |  +-+ro ipv4-ero-sub-tlv
    |    |  +++ro flags?      bits
```

```

|   +---ro ipv4-address?    inet:ipv4-address
+---ro unnumbered-ero-sub-tlv
|   +---ro flags?          bits
|   +---ro router-id?      yang:dotted-quad
|   +---ro interface-id?   uint32
+---ro ipv4-backup-ero-sub-tlv
|   +---ro flags?          bits
|   +---ro ipv4-address?    inet:ipv4-address

```

```

+---ro unnumbered-backup-ero-sub-tlv
+---ro flags?          bits
+---ro router-id?      yang:dotted-quad
+---ro interface-id?   uint32
augment /rt:routing-state/rt:routing-protocols
/rt:routing-protocol/ospf:ospf/ospf:instance
/ospf:areas/ospf:area/ospf:database
/ospf:area-scope-lsa-type/ospf:area-scope-lsas
/ospf:area-scope-lsa/ospf:version/ospf:ospfv2
/ospf:ospfv2/ospf:body/ospf:opaque
/ospf:extended-link-tlvs/ospf:extended-link-tlv:
+---ro adj-sid-sub-tlvs
| +---ro adj-sid-sub-tlv*
|   +---ro flags?      bits
|   +---ro mt-id?      uint8
|   +---ro weight?     uint8
|   +---ro sid?        uint32
+---ro lan-adj-sid-sub-tlvs
+---ro lan-adj-sid-sub-tlv*
+---ro flags?          bits
+---ro mt-id?          uint8
+---ro weight?         uint8
+---ro neighbor-router-id? yang:dotted-quad
+---ro sid?            uint32
augment /rt:routing-state/rt:routing-protocols
/rt:routing-protocol/ospf:ospf/ospf:instance/ospf:areas
/ospf:area/ospf:interfaces/ospf:interface
/ospf:database/ospf:link-scope-lsa-type/ospf:link-scope-lsas
/ospf:link-scope-lsa/ospf:version/ospf:ospfv2
/ospf:ospfv2/ospf:body/ospf:opaque:
+---ro extended-prefix-range-tlvs
| +---ro extended-prefix-range-tlv*
|   +---ro range-size?      uint16

```

```

|      +---ro flags?                bits
|      +---ro prefix?              inet:ip-prefix
|      +---ro perfix-sid-sub-tlvs
|      |      +---ro prefix-sid-sub-tlv*
|      |      |      +---ro flags?        bits
|      |      |      +---ro mt-id?        uint8
|      |      |      +---ro algorithm?    uint8
|      |      |      +---ro sid?         uint32
|      +---ro sid-binding-sub-tlvs
|      |      +---ro sid-binding-sub-tlv*
|      |      |      +---ro flags?        bits
|      |      |      +---ro mt-id?        uint8
|      |      |      +---ro weight?       uint8
|      |      |      +---ro sid-sub-tlv
|      |      |      |      +---ro sid?    uint32

```

```

|      |      +---ro ero-metric-sub-tlv
|      |      |      +---ro metric?    uint32
|      +---ro ipv4-ero-sub-tlv
|      |      +---ro flags?            bits
|      |      +---ro ipv4-address?    inet:ipv4-address
|      +---ro unnumbered-ero-sub-tlv
|      |      +---ro flags?            bits
|      |      +---ro router-id?       yang:dotted-quad
|      |      +---ro interface-id?    uint32
|      +---ro ipv4-backup-ero-sub-tlv
|      |      +---ro flags?            bits
|      |      +---ro ipv4-address?    inet:ipv4-address
|      +---ro unnumbered-backup-ero-sub-tlv
|      |      +---ro flags?            bits
|      |      +---ro router-id?       yang:dotted-quad
|      |      +---ro interface-id?    uint32
|      +---ro unknown-tlvs
|      |      +---ro unknown-tlv*
|      |      |      +---ro type?      uint16
|      |      |      +---ro length?    uint16
|      |      |      +---ro value?     yang:hex-string
|      +---ro sr-algorithm-tlv
|      |      +---ro sr-algorithm*    uint8
|      +---ro sid-range-tlvs
|      |      +---ro sid-range-tlv*
|      |      |      +---ro range-size?    ospf:uint24

```

```

    +--ro sid-sub-tlv
      +--ro sid?    uint32
augment /rt:routing-state/rt:routing-protocols
  /rt:routing-protocol/ospf:ospf/ospf:instance/ospf:areas
  /ospf:area/ospf:database/ospf:area-scope-lsa-type
  /ospf:area-scope-lsas/ospf:area-scope-lsa
  /ospf:version/ospf:ospfv2/ospf:ospfv2/ospf:body/ospf:opaque:
+--ro extended-prefix-range-tlvs
|  +--ro extended-prefix-range-tlv*
|    +--ro range-size?          uint16
|    +--ro flags?               bits
|    +--ro prefix?              inet:ip-prefix
|    +--ro prefix-sid-sub-tlvs
|      +--ro prefix-sid-sub-tlv*
|        +--ro flags?          bits
|        +--ro mt-id?          uint8
|        +--ro algorithm?      uint8
|        +--ro sid?            uint32
|    +--ro sid-binding-sub-tlvs
|      +--ro sid-binding-sub-tlv*
|        +--ro flags?          bits
|        +--ro mt-id?          uint8

```

```

|  |  +--ro weight?          uint8
|  |  +--ro sid-sub-tlv
|  |    |  +--ro sid?    uint32
|  |  +--ro ero-metric-sub-tlv
|  |    |  +--ro metric?  uint32
|  |  +--ro ipv4-ero-sub-tlv
|  |    |  +--ro flags?    bits
|  |    |  +--ro ipv4-address?  inet:ipv4-address
|  |  +--ro unnumbered-ero-sub-tlv
|  |    |  +--ro flags?    bits
|  |    |  +--ro router-id?  yang:dotted-quad
|  |    |  +--ro interface-id?  uint32
|  |  +--ro ipv4-backup-ero-sub-tlv
|  |    |  +--ro flags?    bits
|  |    |  +--ro ipv4-address?  inet:ipv4-address
|  |  +--ro unnumbered-backup-ero-sub-tlv
|  |    +--ro flags?    bits
|  |    +--ro router-id?  yang:dotted-quad
|  |    +--ro interface-id?  uint32

```

```

|      +---ro unknown-tlvs
|      +---ro unknown-tlv*
|          +---ro type?      uint16
|          +---ro length?    uint16
|          +---ro value?     yang:hex-string
+---ro sr-algorithm-tlv
| +---ro sr-algorithm*      uint8
+---ro sid-range-tlvs
| +---ro sid-range-tlv*
|     +---ro range-size?    ospf:uint24
|     +---ro sid-sub-tlv
|         +---ro sid?      uint32
augment /rt:routing-state/rt:routing-protocols
        /rt:routing-protocol/ospf:ospf/ospf:instance/ospf:database
        /ospf:as-scope-lsa-type/ospf:as-scope-lsas/ospf:as-scope-lsa
        /ospf:version/ospf:ospfv2/ospf:ospfv2/ospf:body/ospf:opaque:
+---ro extended-prefix-range-tlvs
| +---ro extended-prefix-range-tlv*
|     +---ro range-size?          uint16
|     +---ro flags?              bits
|     +---ro prefix?             inet:ip-prefix
|     +---ro prefix-sid-sub-tlvs
|         +---ro prefix-sid-sub-tlv*
|             +---ro flags?      bits
|             +---ro mt-id?      uint8
|             +---ro algorithm?  uint8
|             +---ro sid?        uint32
|     +---ro sid-binding-sub-tlvs
|         +---ro sid-binding-sub-tlv*

```

```

|      |      +---ro flags?          bits
|      |      +---ro mt-id?         uint8
|      |      +---ro weight?        uint8
|      |      +---ro sid-sub-tlv
|      |      | +---ro sid?      uint32
|      |      +---ro ero-metric-sub-tlv
|      |      | +---ro metric?   uint32
|      |      +---ro ipv4-ero-sub-tlv
|      |      | +---ro flags?     bits
|      |      | +---ro ipv4-address?  inet:ipv4-address
|      |      +---ro unnumbered-ero-sub-tlv
|      |      | +---ro flags?     bits

```

```

|         |         | +--ro router-id?      yang:dotted-quad
|         |         | +--ro interface-id?   uint32
|         |         +--ro ipv4-backup-ero-sub-tlv
|         |         | +--ro flags?          bits
|         |         | +--ro ipv4-address?    inet:ipv4-address
|         |         +--ro unnumbered-backup-ero-sub-tlv
|         |         | +--ro flags?          bits
|         |         | +--ro router-id?      yang:dotted-quad
|         |         | +--ro interface-id?   uint32
|         +--ro unknown-tlvs
|         +--ro unknown-tlv*
|         | +--ro type?      uint16
|         | +--ro length?    uint16
|         | +--ro value?     yang:hex-string
+--ro sr-algorithm-tlv
| +--ro sr-algorithm*   uint8
+--ro sid-range-tlvs
  +--ro sid-range-tlv*
    +--ro range-size?    ospf:uint24
    +--ro sid-sub-tlv
      +--ro sid?        uint32

```

#### 4. OSPF BFD Yang Module

Additionally this document defines a module that can be used to configure and monitor the OSPF BFD feature.

Bidirectional Forwarding Detection (BFD) [[RFC5880](#)] is a network protocol that is used for liveness detection of arbitrary paths between systems. A YANG data model is defined in [[I-D.ietf-bfd-yang](#)] that supports BFD configuration and management.

As a client of BFD, the OSPF protocol uses the services provided by BFD. The OSPF BFD YANG augments the base OSPF module and is defined as a separate module. So any implementation that does not support

BFD can still use the OSPF base model without having to import the BFD module [[I-D.ietf-bfd-yang](#)].

```

module: ietf-ospf-bfd
augment /rt:routing/rt:routing-protocols

```



```

        /rt:routing-protocol/ospf:ospf/ospf:instance
        /ospf:areas/ospf:area/ospf:interfaces/ospf:interface:
+--rw bfd
    +--rw enabled?                               boolean
augment /rt:routing-state/rt:routing-protocols
    /rt:routing-protocol/ospf:ospf/ospf:instance
    /ospf:areas/ospf:area/ospf:interfaces/ospf:interface:
+--ro bfd
    +--ro enabled?                               boolean

```

## 5. OSPF Yang Module

```

<CODE BEGINS> file "ietf-ospf@2016-03-20.yang"
module ietf-ospf {
    namespace "urn:ietf:params:xml:ns:yang:ietf-ospf";

    prefix ospf;

    import ietf-inet-types {
        prefix "inet";
    }

    import ietf-yang-types {
        prefix "yang";
    }

    import ietf-interfaces {
        prefix "if";
    }

    import ietf-routing {
        prefix "rt";
    }

    import ietf-routing-key-chain {
        prefix "key-chain";
    }

    organization
        "Cisco Systems
        170 West Tasman Drive
        San Jose, CA 95134-1706
        USA";

```

#### contact

"WG Web: <<http://tools.ietf.org/wg/ospf/>>  
WG List: <<mailto:ospf@ietf.org>>  
  
WG Chair: Acee Lindem  
<<mailto:acee@cisco.com>>  
  
WG Chair: Abhay Roy  
<<mailto:akr@cisco.com>>  
  
Editor: Derek Yeung  
<<mailto:myeung@cisco.com>>  
Author: Derek Yeung  
<<mailto:myeung@cisco.com>>  
Author: Yingzhen Qu  
<<mailto:yiqu@cisco.com>>  
Author: Jeffrey Zhang  
<<mailto:zzhang@juniper.net>>  
Author: Ing-Wher Chen  
<<mailto:ing-wher.chen@ericsson.com>>  
Author: Dean Bogdanovic  
<<mailto:ivandean@gmail.com>>  
Author: Kiran Agrahara Sreenivasa  
<<mailto:kkoushik@cisco.com>>";

#### description

"This YANG module defines the generic configuration and operational state for the OSPF protocol common to all vendor implementations. It is intended that the module will be extended by vendors to define vendor-specific OSPF configuration parameters and policies, for example route maps or route policies.

#### Terms and Acronyms

OSPF (ospf): Open Shortest Path First

IP (ip): Internet Protocol

IPv4 (ipv4): Internet Protocol Version 4

IPv6 (ipv6): Internet Protocol Version 6

MTU (mtu) Maximum Transmission Unit  
";

revision 2016-03-20 {  
description

Internet-Draft

OSPF Yang Data Model

March 2016

```
    "* Reorganize *-config and *-operation groupings.
    * Use *-config under state tree for applied config.
    * Rename config router-id to explicit-router-id.
    * Rename feature router-id to explicit-router-id.
    * Add OSPFv3 instance ID.
    * Add OSPFv3 interface ID.
    * Add ip-address for DR and BDR.
    * Remove routing-instance.
    * Change import module name to ietf-routing-key-chain.";
reference
    "RFC XXXX: A YANG Data Model for OSPF.";
}

revision 2015-10-19 {
    description
        "* Remove the abstract identity ospf.
        * Make area-id-type dotted-quad only.
        * Use area-id-type for all area-id leafs.
        * Restructure notifications.
        * Move BFD support to the new ietf-ospf-bfd module.
        * Update author information.
        * Editorial changes.";
reference
    "RFC XXXX: A YANG Data Model for OSPF.";
}

revision 2015-09-02 {
    description
        "* Author information update.
        * Editorial changes";
reference
    "RFC XXXX: A YANG Data Model for OSPF.";
}

revision 2015-07-06 {
    description
        "* Remove support for protocol-centric config.
        * Enclose list in container, except for instance.
        * Replace protocol-shutdown with admin-control.
        * Add IP-FRR per-interface config.
        * Reorganize max-path etc node.
        * Add node-flag.
```

- \* Align config/operation hierarchy.
- \* Use relative path for reference to rib.
- \* Add ability to set single admin distance.
- \* Make unreserved bandwidth into list.
- \* Add F and T bit to OSPFv3 external LSA.
- \* Remove key statement inside LSA body.

```

    * Add stub router support.
    * Fix usage of af-area-config.
    * Add statistics to operation data.
    * Add local rib.
    * Use dotted-quad for all router-id fields.
    * Support more than one multi-area per interface.
    * Use uint16 for LSA type.
    * Update grouping notification-instance-hdr.
    * Rework condition for opaque type and id in OSPFv2 LSA.
    * Rename local-remote-ipv4-addr with remote-if-ipv4-addr.
    * Add virtual-link/sham-link to operation state.
    * Allow multiple link TLVs in one LSA.
    * Fix bug in as-scope-lsas.
    * Remove OSPFv3 restriction in link-scope-lsas.
    * Editorial changes.";
  reference
    "RFC XXXX: A YANG Data Model for OSPF.";
}

revision 2015-03-09 {
  description
    "Initial revision.";
  reference
    "RFC XXXX: A YANG Data Model for OSPF.";
}

identity ospfv2 {
  base "rt:routing-protocol";
  description "OSPFv2";
}

identity ospfv3 {
  base "rt:routing-protocol";
  description "OSPFv3";
}

```

```

identity operation-mode {
    description
        "OSPF operation mode.";
}

identity ships-in-the-night {
    base operation-mode;
    description
        "Ships-in-the-night operation mode in which
        each OSPF instance carries only one address family";
}

```

```

identity area-type {
    description "Base identity for OSPF area type.";
}

identity normal {
    base area-type;
    description "OSPF normal area.";
}

identity stub {
    base area-type;
    description "OSPF stub area.";
}

identity nssa {
    base area-type;
    description "OSPF NSSA area.";
}

typedef uint24 {
    type uint32 {
        range "0 .. 16777215";
    }
    description
        "24-bit unsigned integer.";
}

typedef area-id-type {

```

```

    type yang:dotted-quad;
    description
        "Area ID type.";
}

typedef route-type {
    type enumeration {
        enum intra-area {
            description "OSPF intra-area route.";
        }
        enum inter-area {
            description "OSPF inter-area route.";
        }
        enum external-1 {
            description "OSPF type 1 external route.";
        }
        enum external-2 {
            description "OSPF type 2 external route.";
        }
        enum nssa-1 {

```

```

        description "OSPF type 1 NSSA route.";
    }
    enum nssa-2 {
        description "OSPF type 2 NSSA route.";
    }
}
description "OSPF route type.";
}

typedef if-state-type {
    type enumeration {
        enum Down {
            value "1";
            description
                "Interface down state.";
        }
        enum Loopback {
            value "2";
            description
                "Interface loopback state.";
        }
    }
}

```

```

enum Waiting {
    value "3";
    description
        "Interface waiting state.";
}
enum Point-to-Point {
    value "4";
    description
        "Interface point-to-point state.";
}
enum DR {
    value "5";
    description
        "Interface Designated Router (DR) state.";
}
enum BDR {
    value "6";
    description
        "Interface Backup Designated Router (BDR) state.";
}
enum DR-Other {
    value "7";
    description
        "Interface Other Designated Router state.";
}
}
description

```

```

    "OSPF interface state type.";
}

typedef nbr-state-type {
    type enumeration {
        enum Down {
            value "1";
            description
                "Neighbor down state.";
        }
        enum Attempt {
            value "2";
            description
                "Neighbor attempt state.";
        }
    }
}

```

```

    }
    enum Init {
        value "3";
        description
            "Neighbor init state.";
    }
    enum 2-Way {
        value "4";
        description
            "Neighbor 2-Way state.";
    }
    enum ExStart {
        value "5";
        description
            "Neighbor exchange start state.";
    }
    enum Exchange {
        value "6";
        description
            "Neighbor exchange state.";
    }
    enum Loading {
        value "7";
        description
            "Neighbor loading state.";
    }
    enum Full {
        value "8";
        description
            "Neighbor full state.";
    }
}
description
    "OSPF neighbor state type.";

```

```

}

typedef restart-helper-status-type {
    type enumeration {
        enum Not-Helping {
            value "1";
            description

```



```

        "Restart helper status not helping.";
    }
    enum Helping {
        value "2";
        description
            "Restart helper status helping.";
    }
}
description
    "Restart helper status type.";
}

typedef restart-exit-reason-type {
    type enumeration {
        enum None {
            value "1";
            description
                "Not attempted.";
        }
        enum InProgress {
            value "2";
            description
                "Restart in progress.";
        }
        enum Completed {
            value "3";
            description
                "Successfully completed.";
        }
        enum TimedOut {
            value "4";
            description
                "Timed out.";
        }
        enum TopologyChanged {
            value "5";
            description
                "Aborted due to topology change.";
        }
    }
}
description

```

```

        "Describes the outcome of the last attempt at a
        graceful restart, either by itself or acting
        as a helper.";
    }
typedef packet-type {
    type enumeration {
        enum Hello {
            value "1";
            description
                "OSPF hello packet.";
        }
        enum Database-Descripton {
            value "2";
            description
                "OSPF database description packet.";
        }
        enum Link-State-Request {
            value "3";
            description
                "OSPF link state request packet.";
        }
        enum Link-State-Update {
            value "4";
            description
                "OSPF link state update packet.";
        }
        enum Link-State-Ack {
            value "5";
            description
                "OSPF link state acknowledgement packet.";
        }
    }
    description
        "OSPF packet type.";
}

typedef nssa-translator-state-type {
    type enumeration {
        enum Enabled {
            value "1";
            description
                "NSSA translator enabled state.";
        }
        enum Elected {
            description
                "NSSA translator elected state.";
        }
        enum Disabled {

```

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```
        value "3";
        description
            "NSSA translator disabled state.";
    }
}
description
    "OSPF NSSA translator state type.";
}

typedef restart-status-type {
    type enumeration {
        enum Not-Restarting {
            value "1";
            description
                "Router is not restarting.";
        }
        enum Planned-Restart {
            description
                "Router is going through planned restart.";
        }
        enum Unplanned-Restart {
            value "3";
            description
                "Router is going through unplanned restart.";
        }
    }
}
description
    "OSPF graceful restart status type.";
}

feature multi-topology {
    description
        "Support Multiple-Topology Routing (MTR).";
}

feature multi-area-adj {
    description
        "OSPF multi-area adjacency support as in RFC 5185.";
}

feature explicit-router-id {
    description
        "Set Router-ID per instance explicitly.";
}
```

```
feature demand-circuit {  
  description  
    "OSPF demand circuit support as in RFC 1793.";  
}
```

```
feature mtu-ignore {  
  description  
    "Disable OSPF Database Description packet MTU  
    mismatch checking.";  
}  
  
feature lls {  
  description  
    "OSPF link-local signaling (LLS) as in RFC 5613.";  
}  
  
feature prefix-suppression {  
  description  
    "OSPF prefix suppression support as in RFC 6860.";  
}  
  
feature ttl-security {  
  description  
    "OSPF TTL security check.";  
}  
  
feature nsr {  
  description  
    "Non-Stop-Routing (NSR).";  
}  
  
feature graceful-restart {  
  description  
    "Graceful OSPF Restart as defined in RFC 3623 and  
    RFC 5187.";  
}  
  
feature admin-control {  
  description  
    "Administrative control of the protocol state.";  
}
```

```
feature auto-cost {
  description
    "Calculate OSPF interface cost according to
    reference bandwidth.";
}

feature max-ecmp {
  description
    "Setting maximum number of ECMP paths.";
}
```

```
feature max-lsa {
  description
    "Setting maximum number of LSAs the OSPF instance
    will accept.";
}

feature te-rid {
  description
    "TE Router-ID.";
}

feature ldp-igp-sync {
  description
    "LDP IGP synchronization.";
}

feature ldp-igp-autoconfig {
  description
    "LDP IGP auto-config.";
}

feature ospfv3-authentication-ipsec {
  description
    "Use IPsec for OSPFv3 authentication.";
}

feature fast-reroute {
  description
    "Support of IP Fast Reroute (IP-FRR).";
}
```

```

}

feature node-flag {
  description
    "Support of node flag.";
}
feature lfa {
  description
    "Support of Loop Free Alternates (LFAs).";
}

feature remote-lfa {
  description
    "Support of Remote Loop Free Alternates (R-LFA).";
}

feature stub-router {
  description
    "Support of RFC 6987 OSPF Stub Router Advertisement.";
}

```

```

}

feature instance-inheritance {
  description
    "Support instance inheritance";
}

feature area-inheritance {
  description
    "Support area inheritance";
}

feature interface-inheritance {
  description
    "Support interface inheritance";
}

grouping tlv {
  description
    "TLV";
  leaf type {
    type uint16;
  }
}

```

```

        description "TLV type.";
    }
    leaf length {
        type uint16;
        description "TLV length.";
    }
    leaf value {
        type yang:hex-string;
        description "TLV value.";
    }
}

grouping unknown-tlvs {
    description
        "Unknown TLVs grouping - Used for unknown TLVs or
        unknown sub-TLVs.";
    container unknown-tlvs {
        description "All unknown TLVs.";
        list unknown-tlv {
            description "Unknown TLV.";
            uses tlv;
        }
    }
}

grouping ospfv2-router-link {

```

```

description "OSPFv2 router link.";
leaf link-id {
    type union {
        type inet:ipv4-address;
        type yang:dotted-quad;
    }
    description "Link ID.";
}
leaf link-data {
    type union {
        type inet:ipv4-address;
        type uint32;
    }
    description "Link data.";
}

```

```

    leaf type {
      type uint8;
      description "Link type.";
    }
  }

  grouping ospfv2-lsa-body {
    description "OSPFv2 LSA body.";
    container router {
      when "../../header/type = 1" {
        description
          "Only applies to Router LSAs.";
      }
      description
        "Router LSA.";
      leaf flags {
        type bits {
          bit V {
            description
              "When set, the router is an endpoint of one or
              more virtual links.";
          }
          bit E {
            description
              "When set, the router is an AS Boundary Router
              (ASBR).";
          }
          bit B {
            description
              "When set, the router is an Area Border
              Router (ABR).";
          }
        }
      }
    }
  }

```

```

    description "Flags.";
  }
  leaf num-of-links {
    type uint16;
    description "Number of links.";
  }
  container links {
    description "All router Links.";
  }

```



```

list link {
  description "Router LSA link.";
  uses ospfv2-router-link;
  container topologies {
    description "All topologies for the link.";
    list topology {
      description
        "Topology specific information.";
      leaf mt-id {
        type uint8;
        description
          "The MT-ID for the topology enabled on
            the link.";
      }
      leaf metric {
        type uint16;
        description "Metric for the topology.";
      }
    }
  }
}

container network {
  when "../../header/type = 2" {
    description
      "Only applies to Network LSAs.";
  }
  description
    "Network LSA.";
  leaf network-mask {
    type inet:ipv4-address;
    description
      "The IP address mask for the network.";
  }
  container attached-routers {
    description "All attached routers.";
    leaf-list attached-router {
      type yang:dotted-quad;
      description

```

"List of the routers attached to the network.";

```

    }
  }
}
container summary {
  when "../..header/type = 3 or "
    + "../..header/type = 4" {
    description
      "Only applies to Summary LSAs.";
  }
  description
    "Summary LSA.";
  leaf network-mask {
    type inet:ipv4-address;
    description
      "The IP address mask for the network";
  }
  container topologies {
    description "All topologies for the summary LSA.";
    list topology {
      description
        "Topology specific information.";
      leaf mt-id {
        type uint8;
        description
          "The MT-ID for the topology enabled for
            the summary.";
      }
      leaf metric {
        type uint24;
        description "Metric for the topology.";
      }
    }
  }
}
container external {
  when "../..header/type = 5 or "
    + "../..header/type = 7" {
    description
      "Only applies to AS-external LSAs and NSSA LSAs.";
  }
  description
    "External LSA.";
  leaf network-mask {
    type inet:ipv4-address;
    description
      "The IP address mask for the network";
  }
}

```

```
container topologies {
  description "All topologies for the external.";
  list topology {
    description
      "Topology specific information.";
    leaf mt-id {
      type uint8;
      description
        "The MT-ID for the topology enabled for the
         external or NSSA prefix.";
    }
    leaf flags {
      type bits {
        bit E {
          description
            "When set, the metric specified is a Type 2
             external metric.";
        }
      }
      description "Flags.";
    }
    leaf metric {
      type uint24;
      description "Metric for the topology.";
    }
    leaf forwarding-address {
      type inet:ipv4-address;
      description
        "Forwarding address.";
    }
    leaf external-route-tag {
      type uint32;
      description
        "Route tag for the topology.";
    }
  }
}

container opaque {
  when "../../header/type = 9 or "
    + "../../header/type = 10 or "
    + "../../header/type = 11" {
    description
      "Only applies to Opaque LSAs.";
  }
  description
```

"Opaque LSA.";

```
uses unknown-tlvs;

container router-address-tlv {
  description
    "Router address TLV.";
  leaf router-address {
    type inet:ipv4-address;
    description
      "Router address.";
  }
}

container link-tlvs {
  description "All link TLVs in the LSA.";
  container link-tlv {
    description "Link TLV.";
    leaf link-type {
      type uint8;
      mandatory true;
      description "Link type.";
    }
    leaf link-id {
      type union {
        type inet:ipv4-address;
        type yang:dotted-quad;
      }
      mandatory true;
      description "Link ID.";
    }
  }
  container local-if-ipv4-addrs {
    description "All local interface IPv4 addresses.";
    leaf-list local-if-ipv4-addr {
      type inet:ipv4-address;
      description
        "List of local interface IPv4 addresses.";
    }
  }
  container remote-if-ipv4-addrs {
    description "All remote interface IPv4 addresses.";
```

```

    leaf-list remote-if-ipv4-addr {
        type inet:ipv4-address;
        description
            "List of remote interface IPv4 addresses.";
    }
}
leaf te-metric {
    type uint32;
    description "TE metric.";
}

```

```

}
leaf max-bandwidth {
    type decimal64 {
        fraction-digits 2;
    }
    description "Maximum bandwidth.";
}
leaf max-reservable-bandwidth {
    type decimal64 {
        fraction-digits 2;
    }
    description "Maximum reservable bandwidth.";
}
container unreserved-bandwidths {
    description "All unreserved bandwidths.";
    list unreserved-bandwidth {
        leaf priority {
            type uint8 {
                range "0 .. 7";
            }
            description "Priority from 0 to 7.";
        }
        leaf unreserved-bandwidth {
            type decimal64 {
                fraction-digits 2;
            }
            description "Unreserved bandwidth.";
        }
    }
    description
        "List of unreserved bandwidths for different
        priorities.";
}
}

```

```

    }
    leaf admin-group {
        type uint32;
        description
            "Administrative group/Resource Class/Color.";
    }
    uses unknown-tlvs;
}

container extended-prefix-tlvs {
    description "All extended prefix TLVs in the LSA.";
    list extended-prefix-tlv {
        description "Extended prefix TLV.";
        leaf route-type {
            type enumeration {

```

```

        enum unspecified {
            value "0";
            description "Unspecified.";
        }
        enum intra-area {
            value "1";
            description "OSPF intra-area route.";
        }
        enum inter-area {
            value "3";
            description "OSPF inter-area route.";
        }
        enum external {
            value "5";
            description "OSPF External route.";
        }
        enum nssa {
            value "7";
            description "OSPF NSSA external route.";
        }
    }
    description "Route type.";
}
leaf flags {
    type bits {

```

```

        bit A {
            description
                "Attach flag.";
        }
        bit N {
            description
                "Node flag.";
        }
    }
    description "Flags.";
}
leaf prefix {
    type inet:ip-prefix;
    description "Address prefix.";
}
uses unknown-tlvs;
}

container extended-link-tlvs {
    description "All extended link TLVs in the LSA.";
    list extended-link-tlv {
        description "Extended link TLV.";
    }
}

```

```

        uses ospfv2-router-link;
        uses unknown-tlvs;
    }
}
}

grouping ospfv3-lsa-options {
    description "OSPFv3 LSA options";
    leaf options {
        type bits {
            bit DC {
                description
                    "When set, the router supports demand circuits.";
            }
            bit R {
                description
                    "When set, the originator is an active router.";
            }
        }
    }
}

```

```

    }
    bit N {
        description
            "If set, the router is attached to an NSSA";
    }
    bit E {
        description
            "This bit describes the way AS-external LSAs
            are flooded";
    }
    bit V6 {
        description
            "If clear, the router/link should be excluded
            from IPv6 routing calculaton";
    }
}
mandatory true;
description "OSPFv3 LSA options.";
}
}

grouping ospfv3-lsa-prefix {
    description
        "OSPFv3 LSA prefix.";

    leaf prefix {
        type inet:ip-prefix;
        description
            "Prefix.";
    }
}

```

```

leaf prefix-options {
    type bits {
        bit NU {
            description
                "When set, the prefix should be excluded
                from IPv6 unicast calculations.";
        }
        bit LA {
            description
                "When set, the prefix is actually an IPv6 interface
                address of the Advertising Router.";
        }
    }
}

```



```

    }
    bit P {
        description
            "When set, the NSSA area prefix should be
            translated to an AS External LSA and readvertised
            by the translating NSSA Border Router.";
    }
    bit DN {
        description
            "When set, the inter-area-prefix LSA or
            AS-external LSA prefix has been advertised as an
            L3VPN prefix.";
    }
}
mandatory true;
description "Prefix options.";
}

grouping ospfv3-lsa-external {
    description
        "AS-External and NSSA LSA.";
    leaf metric {
        type uint24;
        description "Metric";
    }

    leaf flags {
        type bits {
            bit E {
                description
                    "When set, the metric specified is a Type 2
                    external metric.";
            }
            bit F {
                description
                    "When set, a Forwarding Address is included

```

```

        in the LSA.";
    }
    bit T {
        description

```

```

        "When set, an External Route Tag is included
        in the LSA.";
    }
}
description "Flags.";
}

leaf referenced-ls-type {
    type uint16;
    description "Referenced Link State type.";
}

uses ospfv3-lsa-prefix;

leaf forwarding-address {
    type inet:ipv6-address;
    description
        "Forwarding address.";
}

leaf external-route-tag {
    type uint32;
    description
        "Route tag.";
}

leaf referenced-link-state-id {
    type uint32;
    description
        "Referenced Link State ID.";
}
}

grouping ospfv3-lsa-body {
    description "OSPFv3 LSA body.";
    container router {
        when "../../header/type = 8193" { // 0x2001
            description
                "Only applies to Router LSAs.";
        }
        description "Router LSA.";
        leaf flags {
            type bits {
                bit V {
                    description

```

```
        "When set, the router is an endpoint of one or
        more virtual links.";
    }
    bit E {
        description
            "When set, the router is an AS Boundary Router
            (ASBR).";
    }
    bit B {
        description
            "When set, the router is an Area Border
            Router (ABR).";
    }
    bit Nt {
        description
            "When set, the router is an NSSA border router
            that is unconditionally translating NSSA LSAs
            into AS-external LSAs.";
    }
}
mandatory true;
description "Router LSA flags.";
}

uses ospfv3-lsa-options;

container links {
    description "All router link.";
    list link {
        description "Router LSA link.";
        leaf interface-id {
            type uint32;
            description "Interface ID.";
        }
        leaf neighbor-interface-id {
            type uint32;
            description "Neighbor Interface ID.";
        }
        leaf neighbor-router-id {
            type yang:dotted-quad;
            description "Neighbor Router ID.";
        }
        leaf type {
            type uint8;
            description "Link type.";
        }
        leaf metric {
```

```
type uint16;
```

```
        description "Metric.";
    }
}
}
container network {
    when "../header/type = 8194" { // 0x2002
        description
            "Only applies to Network LSA.";
    }
    description "Network LSA.";

    uses ospfv3-lsa-options;

    container attached-routers {
        description "All attached routers.";
        leaf-list attached-router {
            type yang:dotted-quad;
            description
                "List of the routers attached to the network.";
        }
    }
}
container inter-area-prefix {
    when "../header/type = 8195" { // 0x2003
        description
            "Only applies to Inter-Area-Prefix LSAs.";
    }
    leaf metric {
        type uint24;
        description "Metric";
    }
    uses ospfv3-lsa-prefix;
    description "Inter-Area-Prefix LSA.";
}
container inter-area-router {
    when "../header/type = 8196" { // 0x2004
        description
            "Only applies to Inter-Area-Router LSAs.";
    }
}
```

```

uses ospfv3-lsa-options;
leaf metric {
    type uint24;
    description "Metric.";
}
leaf destination-router-id {
    type yang:dotted-quad;
    description

```

```

    "The Router ID of the router being described by the LSA.";
}
description "Inter-Area-Router LSA.";
}
container as-external {
    when "../..header/type = 16389" { // 0x4005
        description
            "Only applies to AS-external LSAs.";
    }

    uses ospfv3-lsa-external;

    description "AS-External LSA.";
}
container nssa {
    when "../..header/type = 8199" { // 0x2007
        description
            "Only applies to NSSA LSAs.";
    }
    uses ospfv3-lsa-external;

    description "NSSA LSA.";
}
container link {
    when "../..header/type = 8" { // 0x0008
        description
            "Only applies to Link LSAs.";
    }
    leaf rtr-priority {
        type uint8;
        description "Router Priority for the interface.";
    }
}
uses ospfv3-lsa-options;

```

```

leaf link-local-interface-address {
    type inet:ipv6-address;
    description
        "The originating router's link-local
        interface address for the link.";
}

leaf num-of-prefixes {
    type uint32;
    description "Number of prefixes.";
}

container prefixes {
    description "All prefixes for the link.";
}

```

```

    list prefix {
        description
            "List of prefixes associated with the link.";
        uses ospfv3-lsa-prefix;
    }
}
description "Link LSA.";
}
container intra-area-prefix {
    when "../../header/type = 8201" { // 0x2009
        description
            "Only applies to Intra-Area-Prefix LSA.";
    }
    description "Intra-Area-Prefix LSA.";

    leaf referenced-ls-type {
        type uint16;
        description "Referenced Link State type.";
    }
    leaf referenced-link-state-id {
        type uint32;
        description
            "Referenced Link State ID.";
    }
    leaf referenced-adv-router {
        type inet:ipv4-address;
    }
}

```

```

        description
            "Referenced Advertising Router.";
    }

    leaf num-of-prefixes {
        type uint16;
        description "Number of prefixes.";
    }
    container prefixes {
        description "All prefixes in this LSA.";
        list prefix {
            description "List of prefixes in this LSA.";
            uses ospfv3-lsa-prefix;
            leaf metric {
                type uint24;
                description "Prefix Metric.";
            }
        }
    }
}

```

```

grouping lsa-header {
    description
        "Common LSA for OSPFv2 and OSPFv3";
    leaf age {
        type uint16;
        mandatory true;
        description "LSA age.";
    }
    leaf type {
        type uint16;
        mandatory true;
        description "LSA type.";
    }
    leaf adv-router {
        type yang:dotted-quad;
        mandatory true;
        description "LSA advertising router.";
    }
    leaf seq-num {

```

```

        type uint32;
        mandatory true;
        description "LSA sequence number.";
    }
    leaf checksum {
        type uint16;
        mandatory true;
        description "LSA checksum.";
    }
    leaf length {
        type uint16;
        mandatory true;
        description "LSA length.";
    }
}

grouping ospfv2-lsa {
    description
        "OSPFv2 LSA.";
    container header {
        must "(type = 9 or type = 10 or type = 11) and "
            + "opaque-id and opaque-type "
            + "or (type != 9 and type != 10 and type != 11) "
            + "and not(opaque-id) and "
            + "not(opaque-type)" {
            description
                "Opaque type and ID only apply to Opaque LSAs.";
        }
        description

```

```

        "Decoded OSPFv2 LSA header data.";
    leaf option {
        type bits {
            bit DC {
                description
                    "When set, the router supports demand circuits.";
            }
            bit P {
                description
                    "Only used in type-7 LSA. When set, an NSSA
                     border router should translate the type-7 LSA
                     to a type-5 LSA.";
            }
        }
    }
}

```



```

    }
    bit MC {
        description
            "When set, the router supports MOSPF.";
    }
    bit E {
        description
            "This bit describes the way AS-external LSAs
            are flooded";
    }
}
mandatory true;
description "LSA options.";
}
leaf lsa-id {
    type inet:ipv4-address;
    mandatory true;
    description "LSA ID.";
}

leaf opaque-type {
    type uint8;
    description "Opaque type.";
}

leaf opaque-id {
    type uint24;
    description "Opaque ID.";
}

uses lsa-header;
}
container body {
    description
        "Decoded OSPFv2 LSA body data.";
    uses ospfv2-lsa-body;
}

```

```

    }
}

grouping ospfv3-lsa {
    description

```

```

        "Decoded OSPFv3 LSA.";
    container header {
        description
            "Decoded OSPFv3 LSA header data.";
        leaf lsa-id {
            type uint32;
            mandatory true;
            description "LSA ID.";
        }
        uses lsa-header;
    }
    container body {
        description
            "Decoded OSPF LSA body data.";
        uses ospfv3-lsa-body;
    }
}

grouping lsa-common {
    description
        "Common field for OSPF LSA represenation.";
    leaf decoded-completed {
        type boolean;
        description
            "The OSPF LSA body is fully decoded.";
    }
    leaf raw-data {
        type yang:hex-string;
        description
            "The complete LSA in network byte
            order hexadecimal as received or originated.";
    }
}

grouping lsa {
    description
        "OSPF LSA.";
    uses lsa-common;
    choice version {
        description
            "OSPFv2 or OSPFv3 LSA body.";
        container ospfv2 {
            description "OSPFv2 LSA";
            uses ospfv2-lsa;
        }
    }
}

```

```

    }
    container ospfv3 {
        description "OSPFv3 LSA";
        uses ospfv3-lsa;
    }
}

```

```

grouping lsa-key {
    description
        "OSPF LSA key.";
    leaf lsa-id {
        type union {
            type inet:ipv4-address;
            type uint32;
        }
        description
            "LSA ID.";
    }
    leaf adv-router {
        type inet:ipv4-address;
        description
            "Advertising router.";
    }
}

```

```

grouping instance-stat {
    description "Per-instance statistics";
    leaf originate-new-lsa-count {
        type yang:counter32;
        description "The number of new LSAs originated.";
    }
    leaf rx-new-lsas-count {
        type yang:counter32;
        description "The number of LSAs received.";
    }
    leaf as-scope-lsa-count {
        type yang:gauge32;
        description "The number of AS Scope LSAs.";
    }
    leaf as-scope-lsa-chksum-sum {
        type uint32;
        description
            "The sum of the LSA checksums for AS Scope LSAs.";
    }
    container database {
        description "Container for per AS-scope LSA statistics.";
        list as-scope-lsa-type {

```

```
        description "List of AS-scope LSA statistics";
        leaf lsa-type {
            type uint16;
            description "AS-scope LSA type.";
        }
        leaf lsa-count {
            type yang:gauge32;
            description "The number of LSAs of the LSA type.";
        }
        leaf lsa-cksum-sum {
            type int32;
            description
                "The sum of the LSA checksums of the LSA type.";
        }
    }
}

grouping area-stat {
    description "Per-area statistics.";
    leaf spf-runs-count {
        type yang:counter32;
        description
            "The number of times the intra-area SPF has run.";
    }
    leaf abr-count {
        type yang:gauge32;
        description
            "The total number of Area Border Routers (ABRs)
            reachable within this area.";
    }
    leaf asbr-count {
        type yang:gauge32;
        description
            "The total number of AS Border Routers (ASBRs).";
    }
    leaf ar-nssa-translator-event-count {
        type yang:counter32;
        description
            "The number of NSSA translator-state changes.";
    }
    leaf area-scope-lsa-count {
```

```

    type yang:gauge32;
    description
        "The number of area scope LSAs in the area.";
}
leaf area-scope-lsa-cksum-sum {
    type int32;

```

```

    description "The sum of the area scope LSAs checksums.";
}
container database {
    description "Container for area scope LSA type statistics.";
    list area-scope-lsa-type {
        description "List of area scope LSA statistics";
        leaf lsa-type {
            type uint16;
            description "Area scope LSA type.";
        }
        leaf lsa-count {
            type yang:gauge32;
            description "The number of LSAs of the LSA type.";
        }
        leaf lsa-cksum-sum {
            type int32;
            description
                "The sum of the LSA checksums of the LSA type.";
        }
    }
}

grouping interface-stat {
    description "Per-interface statistics";
    leaf if-event-count {
        type yang:counter32;
        description
            "The number of times this interface has changed its
            state or an error has occurred.";
    }
    leaf link-scope-lsa-count {
        type yang:gauge32;
        description "The number of link scope LSAs.";
    }
}

```

```

leaf link-scope-lsa-cksum-sum {
    type uint32;
    description "The sum of link scope LSA checksums.";
}
container database {
    description "Container for link scope LSA type statistics.";
    list link-scope-lsa-type {
        description "List of link scope LSA statistics";
        leaf lsa-type {
            type uint16;
            description "Link scope LSA type.";
        }
        leaf lsa-count {

```

```

        type yang:gauge32;
        description "The number of LSAs of the LSA type.";
    }
    leaf lsa-cksum-sum {
        type int32;
        description
            "The sum of the LSA checksums of the LSA type.";
    }
}
}
}

grouping neighbor-stat {
    description "Per-neighbor statistics.";
    leaf nbr-event-count {
        type yang:counter32;
        description
            "The number of times this neighbor has changed
            state or an error has occurred.";
    }
    leaf nbr-retrans-qlen {
        type yang:gauge32;
        description
            "The current length of the retransmission queue.";
    }
}

grouping instance-fast-reroute-config {

```

```

description
  "This group defines global configuration of IP-FRR.";
container fast-reroute {
  if-feature fast-reroute;
  description
    "This container may be augmented with global
      parameters for IP-FRR.";
  container lfa {
    if-feature lfa;
    description
      "This container may be augmented with
        global parameters for LFA. Container creation
        has no effect on LFA activation.";
  }
}

grouping interface-fast-reroute-config {
  description
    "This group defines interface configuration of IP-FRR.";

```

```

container fast-reroute {
  if-feature fast-reroute;
  container lfa {
    if-feature lfa;
    leaf candidate-disabled {
      type boolean;
      description
        "Prevent the interface to be used as backup.";
    }
    leaf enabled {
      type boolean;
      description
        "Activates LFA - Per-prefix LFA computation
          is assumed.";
    }
  }
  container remote-lfa {
    if-feature remote-lfa;
    leaf enabled {
      type boolean;
      description
        "Activates Remote LFA (R-LFA).";
    }
  }
}

```

```

    }
    description
        "Remote LFA configuration.";
    }
    description
        "LFA configuration.";
    }
    description
        "IP Fast-reroute configuration.";
    }
}

grouping interface-common-config {
    description
        "Common configuration for all types of interfaces,
        including virtual links and sham links.";

    leaf cost {
        type uint16 {
            range "1..65535";
        }
        description
            "Interface cost.";
    }
    leaf hello-interval {
        type uint16 {
            range "1..65535";
        }
    }
}

```

```

    }
    units seconds;
    description
        "Interval between hello packets in seconds.";
    }

    leaf dead-interval {
        type uint16 {
            range "1..65535";
        }
        units seconds;
        must "../dead-interval > ../hello-interval" {
            error-message "The dead interval must be "
                + "larger than the hello interval";
        }
    }
}

```



```

        description
            "The value MUST be greater than 'hello-interval'.";
    }
    description
        "Interval after which a neighbor is
        declared down in seconds.";
}

leaf retransmit-interval {
    type uint16 {
        range "1..65535";
    }
    units seconds;
    description
        "Interval between retransmitting unacknowledged Link
        State Advertisements (LSAs) in seconds.";
}

leaf transmit-delay {
    type uint16 {
        range "1..65535";
    }
    units seconds;
    description
        "Estimated time needed to transmit Link State Update
        packets on the interface in seconds.";
}

leaf mtu-ignore {
    if-feature mtu-ignore;
    type boolean;
    description
        "Enable/Disable bypassing the MTU mismatch check in
        Database Description packets.";
}

```

```

}

leaf lls {
    if-feature lls;
    type boolean;
    description
        "Enable/Disable link-local signaling (LLS) support.";
}

```

```

}

leaf prefix-suppression {
    if-feature prefix-suppression;
    type boolean;
    description
        "Suppress advertisement of the prefixes associated
         with the interface.";
}

container ttl-security {
    if-feature ttl-security;
    description "TTL security check.";
    leaf enable {
        type boolean;
        description
            "Enable/Disable TTL security check.";
    }
    leaf hops {
        type uint8 {
            range "1..254";
        }
        description
            "Maximum number of hops that an OSPF packet may
             have traversed before reception.";
    }
}

leaf enable {
    if-feature admin-control;
    type boolean;
    default true;
    description
        "Enable/disable protocol on the interface.";
}

container authentication {
    description "Authentication configuration.";
    choice auth-type-selection {
        description
            "Options for expressing authentication setting.";
        case auth-ipsec {

```

```

        when "../../../../../../rt:type = 'ospf:ospfv3'" {
            description "Applied to OSPFv3 only.";
        }
        if-feature ospfv3-authentication-ipsec;
        leaf sa {
            type string;
            description
                "Security Association name.";
        }
    }
    case auth-trailer-key-chain {
        leaf key-chain {
            type key-chain:key-chain-ref;
            description
                "key-chain name.";
        }
    }
    case auth-trailer-key {
        leaf key {
            type string;
            description
                "Key string in ASCII format.";
        }
        container crypto-algorithm {
            uses key-chain:crypto-algorithm-types;
            description
                "Cryptographic algorithm associated with key.";
        }
    }
}
}
} // interface-common-config

grouping interface-config {
    description "Configuration for real interfaces.";

    leaf network-type {
        type enumeration {
            enum "broadcast" {
                description
                    "Specify OSPF broadcast multi-access network.";
            }
            enum "non-broadcast" {
                description
                    "Specify OSPF Non-Broadcast Multi-Access
                    (NBMA) network.";
            }
            enum "point-to-multipoint" {

```

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```
        description
            "Specify OSPF point-to-multipoint network.";
    }
    enum "point-to-point" {
        description
            "Specify OSPF point-to-point network.";
    }
}
description
    "Network type.";
}

leaf passive {
    type boolean;
    description
        "Enable/Disable passive interface - a passive interface's
        prefix will be advertised but no neighbor adjacencies
        will be formed on the interface.";
}

leaf demand-circuit {
    if-feature demand-circuit;
    type boolean;
    description
        "Enable/Disable demand circuit.";
}

container multi-areas {
    description "Container for multi-area config.";
    list multi-area {
        if-feature multi-area-adj;
        key multi-area-id;
        description
            "Configure OSPF multi-area adjacency.";
        leaf multi-area-id {
            type area-id-type;
            description
                "Multi-area adjacency area ID.";
        }
        leaf cost {
            type uint16;
            description
                "Interface cost for multi-area adjacency.";
        }
    }
}
```

```
    }  
  }  
}
```

```
container static-neighbors {
```

```
  description "Statically configured neighbors.";

  list neighbor {
    key "address";
    description
      "Specify a static OSPF neighbor.";

    leaf address {
      type inet:ip-address;
      description "Neighbor IP address.";
    }

    leaf cost {
      type uint16 {
        range "1..65535";
      }
      description "Neighbor cost.";
    }

    leaf poll-interval {
      type uint16 {
        range "1..65535";
      }
      units seconds;
      description "Neighbor poll interval in seconds.";
    }

    leaf priority {
      type uint8 {
        range "1..255";
      }
      description "Neighbor priority for DR election.";
    }
  }
}

leaf node-flag {
  if-feature node-flag;
```

```

    type boolean;
    default false;
    description
        "Set prefix as a segment routing (SR) node
        representative prefix.";
}
uses interface-fast-reroute-config;
uses interface-common-config;
} // grouping interface-config

grouping neighbor-operation {
    description

```

```

    "OSPF neighbor operation data.";

    leaf address {
        type inet:ip-address;
        description
            "Neighbor address.";
    }
    leaf dr-router-id {
        type yang:dotted-quad;
        description "Neighbor's Designated Router (DR) router ID.";
    }

    leaf dr-ip-addr {
        type inet:ip-address;
        description "Neighbor's Designated Router (DR) IP address.";
    }

    leaf bdr-router-id {
        type yang:dotted-quad;
        description
            "Neighbor's Backup Designated Router (BDR) router ID.";
    }

    leaf bdr-ip-addr {
        type inet:ipv4-address;
        description
            "Neighbor's Backup Designated Router (BDR) IP Address.";
    }
    leaf state {

```

```

    type nbr-state-type;
    description
        "OSPF neighbor state.";
}
container statistics {
    description "Per neighbor statistics";
    uses neighbor-stat;
}
}

grouping interface-common-operation {
    description
        "OSPF interface common operation state.";
    reference "RFC2328 Section 9";

    leaf state {
        type if-state-type;
        description "Interface state.";
    }
}

```

```

leaf hello-timer {
    type uint32;
    units "milliseconds";
    description "Hello timer.";
}

leaf wait-timer {
    type uint32;
    units "milliseconds";
    description "Wait timer.";
}

leaf dr-router-id {
    type yang:dotted-quad;
    description "Designated Router (DR) router ID.";
}

leaf dr-ip-addr {
    type inet:ip-address;
    description "Designated Router (DR) IP address.";
}

```

```

leaf bdr-router-id {
    type yang:dotted-quad;
    description "Backup Designated Router (BDR) router ID.";
}

leaf bdr-ip-addr {
    type inet:ipv4-address;
    description "Backup Designated Router (BDR) IP Address.";
}

container statistics {
    description "Per interface statistics";
    uses interface-stat;
}

container neighbors {
    description "All neighbors for the interface.";
    list neighbor {
        key "neighbor-router-id";
        description
            "List of OSPF neighbors.";
        leaf neighbor-router-id {
            type yang:dotted-quad;
            description
                "Neighbor router ID.";
        }
    }
}

```

```

        uses neighbor-operation;
    } // list of OSPF neighbors
}

} // interface-common-operation

grouping interface-operation {
    description
        "OSPF interface operation state.";
    reference "RFC2328 Section 9";

    uses interface-common-operation;

    container database {
        description "Link scope LSA database.";
        list link-scope-lsa-type {

```



```

    key "lsa-type";
    description
        "List OSPF link scope LSA databases.";
    leaf lsa-type {
        type uint16;
        description "OSPF link scope LSA type.";
    }
    container link-scope-lsas {
        description
            "All link scope LSAs of this LSA type.";
        list link-scope-lsa {
            key "lsa-id adv-router";
            description "List of OSPF link scope LSAs";
            uses lsa-key;
            uses lsa {
                refine "version/ospfv2/ospfv2" {
                    must "../..../..../..../..../..../..../..../..../..../"
                        + "rt:type = 'ospf:ospfv2'" {
                        description "OSPFv2 LSA.";
                    }
                }
                refine "version/ospfv3/ospfv3" {
                    must "../..../..../..../..../..../..../..../..../..../"
                        + "rt:type = 'ospf:ospfv3'" {
                        description "OSPFv3 LSA.";
                    }
                }
            }
        }
    } // list link-scope-lsas
}

```

```

grouping virtual-link-config {
    description
        "OSPF virtual link configuration state.";

    uses interface-common-config;
}

grouping virtual-link-operation {

```

```

    description
        "OSPF virtual link operation state.";

    uses interface-common-operation;
}

grouping sham-link-config {
    description
        "OSPF sham link configuration state.";

    uses interface-common-config;
}

grouping sham-link-operation {
    description
        "OSPF sham link operation state.";

    uses interface-common-operation;
}

grouping af-area-config {
    description
        "OSPF address-family specific area config state.";

    container ranges {
        description "Container for summary ranges";

        list range {
            key "prefix";
            description
                "Summarize routes matching address/mask
                (Area Border Routers (ABRs) only)";
            leaf prefix {
                type inet:ip-prefix;
                description
                    "IPv4 or IPv6 prefix";
            }
            leaf advertise {
                type boolean;
                description

```

```

        "Advertise or hide.";

```

```

    }
    leaf cost {
        type uint24 {
            range "0..16777214";
        }
        description
            "Advertised cost of summary route.";
    }
}
}
}

grouping area-common-config {
    description
        "OSPF area common configuration state.";

    leaf summary {
        when "../area-type = 'ospf:stub' or "
            + "../area-type = 'ospf:nssa'" {
            description
                "Summary advertisement into the stub/NSSA area.";
        }
        type boolean;
        description
            "Enable/Disable summary advertisement into the stub or
            NSSA area.";
    }
    leaf default-cost {
        when "../area-type = 'ospf:stub' or "
            + "../area-type = 'ospf:nssa'" {
            description
                "Cost for LSA default route advertised into the
                stub or NSSA area.";
        }
        type uint32 {
            range "1..16777215";
        }
        description
            "Set the summary default route cost for a
            stub or NSSA area.";
    }
}

grouping area-config {
    description
        "OSPF area configuration state.";
}

```

```
    container all-interfaces-inherit {
      if-feature interface-inheritance;
      description
        "Inheritance for all interfaces";
      container interface {
        description
          "Interface config to be inherited by all
            interfaces in the area.";
      }
    }
  }

  leaf area-type {
    type identityref {
      base area-type;
    }
    default normal;
    description
      "Area type.";
  }

  uses area-common-config;

  uses af-area-config {
    when "../../operation-mode = "
      + "'ospf:ships-in-the-night'" {
      description
        "Ships in the night configuration.";
    }
  }
}

grouping area-operation {
  description
    "OSPF area operation state.";

  container statistics {
    description "Per area statistics";
    uses area-stat;
  }

  container database {
    description "Area scope LSA database.";
    list area-scope-lsa-type {
      key "lsa-type";
      description "List OSPF area scope LSA databases.";
      leaf lsa-type {
```



```

}
container next-hops {
  description "All next hops for the route.";
  list next-hop {
    key "next-hop";
    description "List of next hop for the route";
    leaf outgoing-interface {
      type if:interface-ref;
      description

```

```

        "Name of the outgoing interface.";
      }
      leaf next-hop {
        type inet:ip-address;
        description "Nexthop address.";
      }
    }
  }
  leaf metric {
    type uint32;
    description "Metric for this route.";
  }
  leaf route-type {
    type route-type;
    description "Route type for this route.";
  }
  leaf route-tag {
    type uint32;
    description "Route tag for this route.";
  }
}
}
}

grouping instance-config {
  description
    "OSPF instance config state.";

  container all-areas-inherit {
    if-feature area-inheritance;
    description
      "Inheritance for all areas.";
  }
}

```

```

    container area {
        description
            "Area config to be inherited by all areas.";
    }
    container interface {
        description
            "Interface config to be inherited by all interfaces
            in all areas.";
    }
}

leaf explicit-router-id {
    if-feature explicit-router-id;
    type yang:dotted-quad;
    description
        "Defined in RFC 2328. A 32-bit number

```

```

        that uniquely identifies the router.";
    }

    container admin-distance {
        description "Admin distance config state.";
        choice scope {
            description
                "Options for expressing admin distance
                as single or multiple values.";
            case single-value {
                leaf all {
                    type uint8;
                    description
                        "Admin distance for intra-area, inter-area and
                        external routes.";
                }
            }
            case multi-values {
                choice granularity {
                    description
                        "Options for expressing admin distance
                        for intra-area and inter-area routes.";
                    case detail {
                        leaf intra-area {
                            type uint8;

```

```

        description
            "Admin distance for intra-area routes.";
    }
    leaf inter-area {
        type uint8;
        description
            "Admin distance for inter-area routes.";
    }
}
case coarse {
    leaf internal {
        type uint8;
        description
            "Admin distance for both intra-area and
            inter-area routes.";
    }
}
}
leaf external {
    type uint8;
    description
        "Admin distance for external routes.";
}

```

```

    }
}
}

container nsr {
    if-feature nsr;
    description
        "Non-Stop Routing (NSR) config state.";
    leaf enable {
        type boolean;
        description
            "Enable/Disable NSR.";
    }
}

container graceful-restart {
    if-feature graceful-restart;
    description

```



```

    "Graceful restart config state.";
  leaf enable {
    type boolean;
    description
      "Enable/Disable graceful restart as defined in RFC 3623
        for OSPFv2 and RFC 5187 for OSPFv3.";
  }
  leaf helper-enable {
    type boolean;
    description
      "Enable graceful restart helper support for restarting
        routers (RFC 3623 Section 3).";
  }
  leaf restart-interval {
    type uint16 {
      range "1..1800"; // Range is defined in RFC 3623.
    }
    units seconds;
    default "120"; // Default is defined in RFC 3623.
    description
      "Interval in seconds to attempt graceful restart prior
        to failing (RFC 3623 Section B.1).";
  }
  leaf helper-strict-lsa-checking {
    type boolean;
    description
      "Terminate graceful restart when an LSA topology change
        is detected (RFC 3623 Section B.2).";
  }
}

```

```

leaf enable {
  if-feature admin-control;
  type boolean;
  default true;
  description
    "Enable/Disable the protocol.";
}

container auto-cost {
  if-feature auto-cost;
  description

```

```

    "Interface Auto-cost configuration state.";
  leaf enable {
    type boolean;
    description
      "Enable/Disable interface auto-cost.";
  }
  leaf reference-bandwidth {
    when "../enable = 'true'" {
      description "Only when auto cost is enabled";
    }
    type uint32 {
      range "1..4294967";
    }
    units Mbits;
    description
      "Configure reference bandwidth used to automatically
       determine interface cost (Mbits). The cost is the
       reference bandwidth divided by the interface speed
       with 1 being the minimum cost.";
  }
}

container spf-control {
  leaf paths {
    if-feature max-ecmp;
    type uint16 {
      range "1..32";
    }
    description
      "Maximum number of Equal-Cost Multi-Path (ECMP) paths.";
  }
  description "SPF calculation control.";
}

container database-control {
  leaf max-lsa {
    if-feature max-lsa;

```

```

    type uint32 {
      range "1..4294967294";
    }
    description

```

```

        "Maximum number of LSAs OSPF the router will accept.";
    }
    description "Database maintenance control.";
}

container stub-router {
    if-feature stub-router;
    description "Set maximum metric configuration";

    choice trigger {
        description
            "Specific triggers which will enable stub
            router state.";
        container always {
            presence
                "Enables unconditional stub router support";
            description
                "Unconditional stub router state (advertise
                transit links with max metric";
        }
    }
}

container mpls {
    description
        "OSPF MPLS config state.";
    container te-rid {
        if-feature te-rid;
        description
            "Stable OSPF Router IP Address used for Traffic
            Engineering (TE)";
        choice source {
            description
                "Different options for specifying TE router ID.";
            case interface {
                leaf interface {
                    type if:interface-ref;
                    description
                        "Use the interface's IPv4 address as TE
                        router ID.";
                }
            }
            case explicit {
                leaf router-id {

```

```
        type inet:ipv4-address;
        description
            "Explicitly configure the TE router ID.";
    }
}
}
}
container ldp {
    description
        "OSPF MPLS LDP config state.";
    leaf igp-sync {
        if-feature ldp-igp-sync;
        type boolean;
        description
            "Enable LDP IGP synchronization.";
    }
    leaf autoconfig {
        if-feature ldp-igp-autoconfig;
        type boolean;
        description
            "Enable LDP IGP interface auto-configuration.";
    }
}
}
uses instance-fast-reroute-config;
}

grouping instance-operation {
    description
        "OSPF Address Family operation state.";

    leaf router-id {
        type yang:dotted-quad;
        description
            "Defined in RFC 2328. A 32-bit number
            that uniquely identifies the router.";
    }

    uses local-rib;

    container statistics {
        description "Per instance statistics";
        uses instance-stat;
    }

    container database {
        description "AS scope LSA database.";
    }
}
```

```
list as-scope-lsa-type {
```

```
    key "lsa-type";
    description "List OSPF AS scope LSA databases.";
    leaf lsa-type {
        type uint16;
        description "OSPF AS scope LSA type.";
    }
    container as-scope-lsas {
        description "All AS scope of LSA of this LSA type.";
        list as-scope-lsa {
            key "lsa-id adv-router";
            description "List of OSPF area scope LSAs";
            uses lsa-key;
            uses lsa {
                refine "version/ospfv2/ospfv2" {
                    must "../..../rt:type = "
                        + "'ospf:ospfv2'" {
                        description "OSPFv2 LSA.";
                    }
                }
                refine "version/ospfv3/ospfv3" {
                    must "../..../rt:type = "
                        + "'ospf:ospfv3'" {
                        description "OSPFv3 LSA.";
                    }
                }
            }
        }
    }
} // list as-scope-lsas
}

grouping ospf-config {
    description
        "OSPF top configuration state.";

    container all-instances-inherit {
        if-feature instance-inheritance;
        description
            "Inheritance support to all instances.";
    }
}
```

```

    container area {
        description
            "Area config to be inherited by all areas
            in all instances.";
    }
    container interface {
        description
            "Interface config to be inherited by all

```

```

        interfaces in all instances.";
    }
}

leaf operation-mode {
    type identityref {
        base operation-mode;
    }
    default ospf:ships-in-the-night;
    description
        "OSPF operation mode.";
}

grouping ospf-operation {
    description
        "OSPF top operation state.";
}

grouping multi-topology-area-config {
    description
        "OSPF multi-topology area configuration state.";

    uses area-common-config;

    uses af-area-config {
        when "../..../operation-mode = "
            + "'ospf:ships-in-the-night'" {
            description
                "Ships in the night configuration.";
        }
    }
}
}

```

```

grouping multi-topology-area-operation {
  description
    "OSPF multi-topology area operation state.";
}

```

```

grouping multi-topology-config {
  description
    "OSPF multi-topology configuration state.";
}

```

```

grouping multi-topology-operation {
  description
    "OSPF multi-topology operation state.";
}

```

```

  uses local-rib;
}

```

```

grouping multi-topology-interface-config {
  description
    "OSPF multi-topology configuration state.";
}

```

```

  leaf cost {
    type uint32;
    description
      "Interface cost for this topology.";
  }
}

```

```

grouping multi-topology-interface-operation {
  description
    "OSPF multi-topology operation state.";
}

```

```

grouping ospfv3-interface-config {
  description
    "OSPFv3 interface specific configuration state.";

  leaf instance-id {
    type uint8 {
      range "0 .. 31";
    }
  }
}

```

```

    }
    description
        "OSPFv3 instance ID.";
    }
}

grouping ospfv3-interface-operation {
    description
        "OSPFv3 interface specific operation state.";

    leaf interface-id {
        type uint16;
        description
            "OSPFv3 interface ID.";
    }
}

augment "/rt:routing/rt:routing-protocols/"
    + "rt:routing-protocol" {
    when "rt:type = 'ospf:ospfv2' or rt:type = 'ospf:ospfv3'" {
        description
            "This augmentation is only valid for a routing protocol

```

```

        instance of OSPF (type 'ospfv2' or 'ospfv3').";
    }
    description "OSPF augmentation.";

    container ospf {
        description
            "OSPF.";

        uses ospf-config;

        list instance {
            key "af";
            description
                "An OSPF routing protocol instance.";

            leaf af {
                type identityref {
                    base rt:address-family;
                }
            }
        }
    }
}

```



```

    description
        "Address-family of the instance.";
}

uses instance-config;

container areas {
    description "All areas.";
    list area {
        key "area-id";
        description
            "List of OSPF areas";
        leaf area-id {
            type area-id-type;
            description
                "Area ID.";
        }
    }

    uses area-config;

    container virtual-links {
        description "All virtual links.";
        list virtual-link {
            when "../..area-id != '0' and "
                + "../..area-type = 'ospf:normal'" {
                description
                    "Transit area must be a non-backbone
                    normal area.";
            }
        }
    }
}

```

```

        key "router-id";
        description
            "OSPF virtual link";
        leaf router-id {
            type yang:dotted-quad;
            description
                "Virtual Link remote endpoint router ID.";
        }

        uses virtual-link-config;
    }
}

```

```

    container sham-links {
      description "All sham links.";
      list sham-link {
        key "local-id remote-id";
        description
          "OSPF sham link";
        leaf local-id {
          type inet:ip-address;
          description
            "Address of the local Sham Link endpoint.";
        }
        leaf remote-id {
          type inet:ip-address;
          description
            "Address of the remote Sham Link endpoint.";
        }
        uses sham-link-config;
      }
    }
    container interfaces {
      description "All interfaces.";
      list interface {
        key "interface";
        description
          "List of OSPF interfaces.";
        leaf interface {
          type if:interface-ref;
          description
            "Interface.";
        }
        uses interface-config;
      } // list of interfaces
    } // list of areas
  } // list of instance
}

```

```

  } // container ospf
}

```

```

augment "/rt:routing/rt:routing-protocols/"
  + "rt:routing-protocol/ospf:ospf/ospf:instance" {

```

```

when "../../../rt:type = 'ospf:ospfv2' or
    ../../../rt:type = 'ospf:ospfv3'" {
    description
        "This augmentation is only valid for OSPF
        (type 'ospfv2' or 'ospfv3').";
}
if-feature multi-topology;
description
    "OSPF multi-topology instance configuration
    state augmentation.";
container topologies {
    description "All topologies.";
    list topology {
        // Topology must be in the same routing-instance
        // and of same AF as the container.
        key "name";
        description "OSPF topology.";
        leaf name {
            type leafref {
                path "../../../rt:ribs/rt:rib/rt:name";
            }
            description "RIB";
        }
    }

    uses multi-topology-config;

    container areas {
        description "All areas in the topology.";
        list area {
            key "area-id";
            description
                "List of OSPF areas";
            leaf area-id {
                type area-id-type;
                description
                    "Area ID.";
            }
            uses multi-topology-area-config;
        }
    }
}
}
}
}

```

```

augment "/rt:routing/rt:routing-protocols/"
  + "rt:routing-protocol/ospf:ospf/ospf:instance/"
  + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
when "../..../rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
if-feature ospf:multi-topology;
description
  "OSPF multi-topology interface configuration state
  augmentation.";
container topologies {
  description "All topologies for the interface.";
  list topology {
    key "name";
    description "OSPF interface topology.";
    leaf name {
      type leafref {
        path "../..../rt:ribs/rt:rib/rt:name";
      }
      description
        "One of the topologies enabled on this interface.";
    }
  }
  uses multi-topology-interface-config;
}
}
}

```

```

augment "/rt:routing/rt:routing-protocols/"
  + "rt:routing-protocol/ospf:ospf/ospf:instance/"
  + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
when "../..../rt:type = 'ospf:ospfv3'" {
  description
    "This augmentation is only valid for OSPFv3.";
}
description
  "OSPFv3 interface specific configuration state
  augmentation.";
uses ospfv3-interface-config;
}

```

```

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol" {
when "rt:type = 'ospf:ospfv2' or "
  + "rt:type = 'ospf:ospfv3'" {
  description

```

```

    "This augmentation is only valid for a routing protocol
    instance of type 'ospfv2' or 'ospfv3'.";
}
description
    "OSPF operational state.";
container ospf {
    description "OSPF";

    uses ospf-config;
    uses ospf-operation;

    list instance {
        key "af";
        description
            "An OSPF routing protocol instance.";

        leaf af {
            type identityref {
                base rt:address-family;
            }
            description
                "Address-family of the instance.";
        }

        uses instance-config;
        uses instance-operation;

        container areas {
            description "All areas";
            list area {
                key "area-id";
                description "List of OSPF areas";
                leaf area-id {
                    type area-id-type;
                    description "Area ID.";
                }

                uses area-config;
                uses area-operation;

                container virtual-links {
                    description "All virtual links.";

```

```

list virtual-link {
  description
    "OSPF virtual link";
  leaf router-id {
    type yang:dotted-quad;
    description

```

```

    "Virtual link router ID.";
  }

  uses virtual-link-config;
  uses virtual-link-operation;
}
}
container sham-links {
  description "All sham links.";
  list sham-link {
    description
      "OSPF sham link";
    leaf local-id {
      type inet:ip-address;
      description
        "Address of the local Sham Link endpoint.";
    }
    leaf remote-id {
      type inet:ip-address;
      description
        "Address of the remote Sham Link endpoint.";
    }
    uses sham-link-config;
    uses sham-link-operation;
  }
}

container interfaces {
  description "All interfaces in the area.";
  list interface {
    key "interface";
    description
      "List of OSPF interfaces.";
    leaf interface {
      // Should it refer to config state leaf?

```

```

        type if:interface-ref;
        description "Interface.";
    }

    uses interface-config;
    uses interface-operation;
} // list of OSPF interfaces
}
} // list of OSPF areas
}
} // list of instances
} // container ospf
}

```

```

augment "/rt:routing-state/"
+ "rt:routing-protocols/rt:routing-protocol/"
+ "ospf:ospf/ospf:instance" {
when "../..//rt:type = 'ospf:ospfv2'" {
description
    "This augmentation is only valid for OSPFv2.";
}
if-feature multi-topology;
description
    "OSPF multi-topology instance operation state
    augmentation.";
container topologies {
description "All topologies.";
list topology {
// Topology must be in the same routing-instance
// and of same AF as the container.
key "name";
description "OSPF topology.";
leaf name {
type leafref {
path "../..//../..//../..//../..//.."
+ "rt:ribs/rt:rib/rt:name";
}
description "RIB";
}
}

uses multi-topology-config;
uses multi-topology-operation;

```

```

    container areas {
      description "All areas in the topology.";
      list area {
        key "area-id";
        description
          "List of OSPF areas";
        leaf area-id {
          type area-id-type;
          description
            "Area ID.";
        }
        uses multi-topology-area-config;
        uses multi-topology-area-operation;
      }
    }
  }
}

```

```

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
  + "ospf:interfaces/ospf:interface" {
when "../..../rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
if-feature ospf:multi-topology;
description
  "OSPF multi-topology interface operation state
  augmentation.";
container topologies {
  description "All topologies.";
  list topology {
    key "name";
    description "OSPF interface topology.";
    leaf name {
      type leafref {
        path "../..../rt:ribs/rt:rib/rt:name";
      }
    }
  }
}

```



```

    }
    description
        "One of the topologies enabled on this interface.";
    }
    uses multi-topology-interface-config;
    uses multi-topology-interface-operation;
}
}
}

augment "/rt:routing-state/"
    + "rt:routing-protocols/rt:routing-protocol/"
    + "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
    + "ospf:interfaces/ospf:interface" {
    when "../..../rt:type = 'ospf:ospfv3'" {
        description
            "This augmentation is only valid for OSPFv3.";
    }
    description
        "OSPFv3 interface specific operation state
        augmentation.";
    uses ospfv3-interface-config;
    uses ospfv3-interface-operation;
}

grouping route-content {
    description

```

```

    "This grouping defines OSPF-specific route attributes.";
    leaf metric {
        type uint32;
        description "OSPF route metric.";
    }
    leaf tag {
        type uint32;
        default "0";
        description "OSPF route tag.";
    }
    leaf route-type {
        type route-type;
        description "OSPF route type";
    }
}

```

```

}

augment "/rt:routing-state/"
  + "rt:ribs/rt:rib/rt:routes/rt:route" {
    when "rt:source-protocol = 'ospf:ospfv2' or "
      + "rt:source-protocol = 'ospf:ospfv3'" {
      description
        "This augmentation is only valid for a routes whose
        source protocol is OSPF.";
    }
    description
      "OSPF-specific route attributes.";
    uses route-content;
  }

grouping notification-instance-hdr {
  description
    "This group describes common instance specific
    data for notifications.";

  /*
   * TBD:
   * Need to define a way to reference routing-instance.
   */
  leaf routing-instance {
    type string;
    description
      "Describe the routing instance.";
  }

  leaf routing-protocol-type {
    type leafref {
      path "/rt:routing/rt:routing-protocols/"
        + "rt:routing-protocol/rt:type";
    }
  }
}

```

```

}
must ". = 'ospf:ospfv2' or . = 'ospf:ospfv3'" {
  description "Only applies to the OSPF routing protocol.";
}
description
  "OSPF routing protocol type (OSPFv2 or OSPFv3).";
}

```

```

leaf routing-protocol-name {
  type leafref {
    path "/rt:routing/"
      + "rt:routing-protocols/rt:routing-protocol"
      + "[rt:type=current()/../routing-protocol-type]/"
      + "rt:name";
  }
  description
    "OSPF routing protocol instance name.";
}

leaf af {
  type leafref {
    path "/rt:routing/"
      + "rt:routing-protocols/rt:routing-protocol"
      + "[rt:name=current()/../routing-protocol-name]"
      + "[rt:type=current()/../routing-protocol-type]/"
      + "ospf:ospf/ospf:instance/af";
  }
  description
    "Address family of the OSPF instance.";
}
}

grouping notification-interface {
  description
    "This grouping provides the interface information
      for the notifications.";

  choice if-link-type-selection {
    description
      "Options for link type.";
    container interface {
      description "Normal interface.";
      leaf interface {
        type if:interface-ref;
        description "Interface.";
      }
    }
    container virtual-link {

```

```

        description "virtual-link.";
        leaf area-id {
            type area-id-type;
            description "Area ID.";
        }
        leaf neighbor-router-id {
            type yang:dotted-quad;
            description "Neighbor Router ID.";
        }
    }
    container sham-link {
        description "sham-link.";
        leaf area-id {
            type area-id-type;
            description "Area ID.";
        }
        leaf local-ip-addr {
            type inet:ip-address;
            description "Sham link local address.";
        }
        leaf remote-ip-addr {
            type inet:ip-address;
            description "Sham link remote address.";
        }
    }
}

grouping notification-neighbor {
    description
        "This grouping provides the neighbor information
        for the notifications.";

    leaf neighbor-router-id {
        type yang:dotted-quad;
        description "Neighbor Router ID.";
    }

    leaf neighbor-ip-addr {
        type yang:dotted-quad;
        description "Neighbor address.";
    }
}

notification if-state-change {
    uses notification-instance-hdr;
    uses notification-interface;
}

```

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```
leaf state {
  type if-state-type;
  description "Interface state.";
}
description
  "This notification is sent when an interface
  state change is detected.";
}

notification if-config-error {
  uses notification-instance-hdr;
  uses notification-interface;

  leaf packet-source {
    type yang:dotted-quad;
    description "Source address.";
  }

  leaf packet-type {
    type packet-type;
    description "OSPF packet type.";
  }

  leaf error {
    type enumeration {
      enum "badVersion" {
        description "Bad version.";
      }
      enum "areaMismatch" {
        description "Area mistmatch.";
      }
      enum "unknownNbmaNbr" {
        description "Unknown NBMA neighbor.";
      }
      enum "unknownVirtualNbr" {
        description "Unknown virtual link neighbor.";
      }
      enum "authTypeMismatch" {
        description "Auth type mismatch.";
      }
      enum "authFailure" {
        description "Auth failure.";
      }
    }
  }
}
```

```

enum "netMaskMismatch" {
    description "Network mask mismatch.";
}
enum "helloIntervalMismatch" {
    description "Hello interval mismatch.";
}

```

```

}
enum "deadIntervalMismatch" {
    description "Dead interval mismatch.";
}
enum "optionMismatch" {
    description "Option mismatch.";
}
enum "mtuMismatch" {
    description "MTU mismatch.";
}
enum "duplicateRouterId" {
    description "Duplicate router ID.";
}
enum "noError" {
    description "No error.";
}
}
description "Error code.";
}
description
    "This notification is sent when interface
    config error is detected.";
}

notification nbr-state-change {
    uses notification-instance-hdr;
    uses notification-interface;
    uses notification-neighbor;

    leaf state {
        type nbr-state-type;
        description "Neighbor state.";
    }

    description
        "This notification is sent when neighbor

```

```

        state change is detected.";
    }

    notification nbr-restart-helper-status-change {
        uses notification-instance-hdr;
        uses notification-interface;
        uses notification-neighbor;

        leaf status {
            type restart-helper-status-type;
            description "Restart helper status.";
        }
    }

```

```

    leaf age {
        type uint32;
        units seconds;
        description
            "Remaining time in current OSPF graceful restart
            interval, if the router is acting as a restart
            helper for the neighbor.";
    }

    leaf exit-reason {
        type restart-exit-reason-type;
        description
            "Restart helper exit reason.";
    }
    description
        "This notification is sent when a neighbor restart
        helper status change is detected.";
}

notification rx-bad-packet {
    uses notification-instance-hdr;
    uses notification-interface;

    leaf packet-source {
        type yang:dotted-quad;
        description "Source address.";
    }

    leaf packet-type {

```

```

        type packet-type;
        description "OSPF packet type.";
    }

    description
        "This notification is sent when an OSPF packet that
        cannot be parsed is received on an OSPF interface.";
}
notification lsdb-approaching-overflow {
    uses notification-instance-hdr;

    leaf ext-lsdb-limit {
        type uint32;
        description
            "The maximum number of non-default AS-external LSAs
            entries that can be stored in the link state database.";
    }

    description

```

```

        "This notification is sent when the number of LSAs
        in the router's link state database has exceeded
        ninety percent of the ext-lsdb-limit.";
    }

    notification lsdb-overflow {
        uses notification-instance-hdr;

        leaf ext-lsdb-limit {
            type uint32;
            description
                "The maximum number of non-default AS-external LSAs
                entries that can be stored in the link state database.";
        }

        description
            "This notification is sent when the number of LSAs
            in the router's link state database has exceeded
            ext-lsdb-limit.";
    }

    notification nssa-translator-status-change {

```



```

    uses notification-instance-hdr;

    leaf area-id {
        type area-id-type;
        description "Area ID.";
    }

    leaf status {
        type nssa-translator-state-type;
        description
            "NSSA translator status.";
    }

    description
        "This notification is sent when there is a change
        in the router's role in translating OSPF NSSA LSAs
        to OSPF AS-External LSAs.";
}

notification restart-status-change {
    uses notification-instance-hdr;

    leaf status {
        type restart-status-type;
        description
            "Restart status.";
    }
}

```

```

}

leaf restart-interval {
    type uint16 {
        range "1..1800";
    }
    units seconds;
    default "120";
    description
        "Restart interval.";
}

leaf exit-reason {
    type restart-exit-reason-type;
    description

```

```

        "Restart exit reason.";
    }

    description
        "This notification is sent when the graceful restart
        state for the router has changed.";
    }
}
<CODE ENDS>

```

## 6. OSPF Segment Routing Yang Module

```

<CODE BEGINS> file "ietf-ospf-sr@2016-03-20.yang"
module ietf-ospf-sr {
    namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-sr";

    prefix ospf-sr;

    import ietf-inet-types {
        prefix "inet";
    }

    import ietf-yang-types {
        prefix "yang";
    }

    import ietf-routing {
        prefix "rt";
    }
    import ietf-segment-routing {
        prefix "sr";
    }
    import ietf-ospf {

```

```

    prefix "ospf";
}

organization
    "Cisco Systems
    170 West Tasman Drive
    San Jose, CA 95134-1706
    USA";

```

contact

"WG Web: <<http://tools.ietf.org/wg/ospf/>>

WG List: <<mailto:ospf@ietf.org>>

WG Chair: Acee Lindem

<<mailto:acee@cisco.com>>

WG Chair: Abhay Roy

<<mailto:akr@cisco.com>>

Editor: Derek Yeung

<<mailto:myeung@cisco.com>>

Author: Derek Yeung

<<mailto:myeung@cisco.com>>

Author: Yingzhen Qu

<<mailto:yiqu@cisco.com>>

Author: Acee Lindem

<<mailto:acee@cisco.com>>

Author: Jeffrey Zhang

<<mailto:zzhang@juniper.net>>

Author: Ing-Wher Chen

<<mailto:ing-wher.chen@ericsson.com>>

Author: Greg Hankins

<<mailto:greg.hankins@alcatel-lucent.com>>";

description

"This YANG module defines the generic configuration and operational state for OSPF Segment Routing, which is common across all of the vendor implementations. It is intended that the module will be extended by vendors to define vendor-specific OSPF Segment Routing configuration and operational parameters and policies.

Terms and Acronyms

OSPF (ospf): Open Shortest Path First

IP (ip): Internet Protocol

```

    IPv6 (ipv6): Internet Protocol Version 6
";

revision 2016-03-20 {
    description
        "* Remove routing-instance.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF Segment Routing.";
}

revision 2015-10-19 {
    description
        "* Add per-protocol SRGB support.
        * Editorial changes.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF Segment Routing.";
}

revision 2015-09-02 {
    description
        "* Author list update.
        * Editorial changes.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF Segment Routing.";
}

revision 2015-07-06 {
    description
        "Initial revision.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF Segment Routing.";
}

feature ti-lfa {
    description
        "Topology-Independent Loop-Free Alternate (TI-LFA)
        computation using segment routing.";
}

/* Configuration */

augment "/rt:routing/rt:routing-protocols"
    + "/rt:routing-protocol/ospf:ospf/ospf:instance" {
    when "../rt:type = 'ospf:ospfv2' or "
        + "../rt:type = 'ospf:ospfv3'" {
        description

```

```
        "This augments the OSPF routing protocol when used.";
    }
    description
        "This augments the OSPF protocol configuration
        with segment routing.";
    uses sr:controlplane-cfg;
    container protocol-srgb {
        if-feature sr:protocol-srgb;
        uses sr:srgb-cfg;
        description
            "Per-protocol SRGB.";
    }
}

augment "/rt:routing/rt:routing-protocols/"
    + "rt:routing-protocol/ospf:ospf/ospf:instance/"
    + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
    when "../..../rt:type = 'ospf:ospfv2' or "
        + "../..../rt:type = 'ospf:ospfv3'" {
        description
            "This augments the OSPF interface configuration
            when used.";
    }
    description
        "This augments the OSPF protocol interface
        configuration with segment routing.";

    uses sr:igp-interface-cfg;
}

augment "/rt:routing/rt:routing-protocols/"
    + "rt:routing-protocol/ospf:ospf/ospf:instance/"
    + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface/"
    + "ospf:fast-reroute" {
    when "../..../rt:type = 'ospf:ospfv2' or "
        + "../..../rt:type = 'ospf:ospfv3'" {
        description
            "This augments the OSPF routing protocol when used.";
    }
    description
        "This augments the OSPF protocol IP-FRR with TI-LFA.";

    container ti-lfa {
        if-feature ti-lfa;
        leaf enable {
            type boolean;
        }
    }
}
```

```
description
  "Enables TI-LFA computation.";
```

```
    }
    description
      "Topology Independent Loop Free Alternate
       (TI-LFA) support.";
  }
}

/* Operational states */

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance" {
  when "../..//rt:type = 'ospf:ospfv2' or "
    + "../..//rt:type = 'ospf:ospfv3'" {
    description
      "This augments the OSPF routing protocol when used.";
  }
  description
    "This augments the OSPF protocol operational state
     with segment routing.";

  uses sr:controlplane-cfg;
  container protocol-srgb {
    if-feature sr:protocol-srgb;
    uses sr:srgb-cfg;
    description
      "Per-protocol SRGB.";
  }
}

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
  + "ospf:interfaces/ospf:interface" {
  when "../..//../..//../..//rt:type = 'ospf:ospfv2' or "
    + "../..//../..//../..//rt:type = 'ospf:ospfv3'" {
    description
      "This augments the OSPF routing protocol when used.";
  }
}
```

```

description
  "This augments the OSPF protocol interface
  operational state with segment routing.";

uses sr:igp-interface-cfg;
}

/* Database */

```

```

grouping sid-sub-tlv {
  description "SID/Label sub-TLV grouping.";
  container sid-sub-tlv {
    description
      "Used to advertise the SID/Label associated with a
      prefix or adjacency.";
    leaf sid {
      type uint32;
      description
        "Segment Identifier (SID) - A 20 bit label or
        32 bit SID.";
    }
  }
}

grouping prefix-sid-sub-tlvs {
  description "Prefix Segment ID (SID) sub-TLVs.";
  container prefix-sid-sub-tlvs {
    description "Prefix SID sub-TLV.";
    list prefix-sid-sub-tlv {
      description "Prefix SID sub-TLV.";
      leaf flags {
        type bits {
          bit NP {
            description
              "No-PHP flag.";
          }
          bit M {
            description
              "Mapping server flag.";
          }
          bit E {

```

```

        description
            "Explicit-NULL flag.";
    }
    bit V {
        description
            "Value/Index flag.";
    }
    bit L {
        description
            "Local flag.";
    }
}
description "Segment Identifier (SID) Flags.";
}
leaf mt-id {
    type uint8;

```

```

        description "Multi-topology ID.";
    }
    leaf algorithm {
        type uint8;
        description
            "The algorithm associated with the prefix-SID.";
    }
    leaf sid {
        type uint32;
        description "An index or label.";
    }
}
}
}

grouping sid-binding-sub-tlvs {
    description "SID/Label binding sub-TLV grouping.";
    container sid-binding-sub-tlvs {
        description "SID binding sub-TLVs.";
        list sid-binding-sub-tlv {
            description "SID binding sub-TLV.";
            leaf flags {
                type bits {
                    bit M {
                        description

```



```

        "Mirroring context flag.";
    }
}
description "Flags.";
}
leaf mt-id {
    type uint8;
    description "Multi-topology ID.";
}
leaf weight {
    type uint8;
    description "Weight for load-balancing purposes.";
}

uses sid-sub-tlv;

container ero-metric-sub-tlv {
    description
        "The cost of an Explicit Route Object (ERO) path.";
    leaf metric {
        type uint32;
        description "The aggregate IGP or TE path cost.";
    }
}

```

```

}

container ipv4-ero-sub-tlv {
    description
        "The IPv4 ERO sub-TLV describes a path segment
        using IPv4 address.";
    leaf flags {
        type bits {
            bit L {
                description
                    "If set, then the segment path is designated as
                    'loose'. Otherwise, the path is 'strict'.";
            }
        }
    }
    description "ERO Flags.";
}
leaf ipv4-address {
    type inet:ipv4-address;
}

```

```

        description "The address of the explicit route hop.";
    }
}
container unnumbered-ero-sub-tlv {
    description "The unnumbered interface ID ERO sub-TLV
        describes a path segment that includes an
        unnumbered interface.";
    leaf flags {
        type bits {
            bit L {
                description
                    "If set, then the segment path is designated as
                    'loose'. Otherwise as 'strict'.";
            }
        }
        description "ERO Flags.";
    }
    leaf router-id {
        type yang:dotted-quad;
        description "Router-id of the next-hop.";
    }
    leaf interface-id {
        type uint32;
        description
            "The identifier assigned to the link by the
            router specified by the router-id.";
    }
}
container ipv4-backup-ero-sub-tlv {
    description

```

```

        "The IPv4 backup ERO sub-TLV describes a path
        segment using IPv4 address.";
    leaf flags {
        type bits {
            bit L {
                description
                    "If set, then the segment path is designated as
                    'loose'. Otherwise as 'strict'.";
            }
        }
        description "Flags.";
    }
}

```



```

list extended-prefix-range-tlv {    //type=2?
  description "The range of prefixes.";
  leaf range-size {
    type uint16;
    description "The number of prefixes covered by the
                  advertisement.";
  }
  leaf flags {
    type bits {
      bit IA {
        description
          "Inter-Area flag.";
      }
    }
    description "Flags.";
  }
  leaf prefix {
    type inet:ip-prefix;
    description "Address prefix.";
  }
  uses prefix-sid-sub-tlvs;
  uses sid-binding-sub-tlvs;
  uses ospf:unknown-tlvs;
}
}

grouping sr-algorithm-tlv {
  description "SR algorithm TLV grouping.";
  container sr-algorithm-tlv {
    description "All SR algorithm TLVs.";
    leaf-list sr-algorithm {
      type uint8;
      description
        "The Segment Routing (SR) algorithms that the router is
          currently using.";
    }
  }
}

grouping sid-range-tlvs {
  description "SID Range TLV grouping.";
  container sid-range-tlvs {
    description "List of SID range TLVs.";
  }
}

```

```
    list sid-range-tlv {
      description "SID range TLV.";
      leaf range-size {
        type ospf:uint24;
        description "The SID range.";
      }
      uses sid-sub-tlv;
    }
  }
}

augment "/rt:routing-state/"
+ "rt:routing-protocols/rt:routing-protocol/"
+ "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
+ "ospf:interfaces/ospf:interface/ospf:database/"
+ "ospf:link-scope-lsa-type/ospf:link-scope-lsas/"
+ "ospf:link-scope-lsa/ospf:version/ospf:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/"
+ "ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../.../.../.../"
+ "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
description
  "SR specific TLVs for OSPFv2 extended prefix TLV
  in type 9 opaque LSA.";
uses prefix-sid-sub-tlvs;
uses sid-binding-sub-tlvs;
}

augment "/rt:routing-state/"
+ "rt:routing-protocols/rt:routing-protocol/"
+ "ospf:ospf/ospf:instance/ospf:areas/"
+ "ospf:area/ospf:database/"
+ "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
+ "ospf:area-scope-lsa/ospf:version/ospf:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/"
+ "ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../.../.../"
+ "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
description
  "SR specific TLVs for OSPFv2 extended prefix TLV
  in type 10 opaque LSA.";
uses prefix-sid-sub-tlvs;
```

```
uses sid-binding-sub-tlvs;
```

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```

}

augment "/rt:routing-state/"
+ "rt:routing-protocols/rt:routing-protocol/"
+ "ospf:ospf/ospf:instance/ospf:database/"
+ "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
+ "ospf:as-scope-lsa/ospf:version/ospf:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/"
+ "ospf:extended-prefix-tlvs/ospf:extended-prefix-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../.../..."
+ "rt:type = 'ospf:ospfv2'" {
description
"This augmentation is only valid for OSPFv2.";
}
description
"SR specific TLVs for OSPFv2 extended prefix TLV
in type 11 opaque LSA.";
uses prefix-sid-sub-tlvs;
uses sid-binding-sub-tlvs;
}

augment "/rt:routing-state/"
+ "rt:routing-protocols/rt:routing-protocol/"
+ "ospf:ospf/ospf:instance/ospf:areas/"
+ "ospf:area/ospf:database/"
+ "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
+ "ospf:area-scope-lsa/ospf:version/ospf:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/"
+ "ospf:extended-link-tlvs/ospf:extended-link-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../.../..."
+ "rt:type = 'ospf:ospfv2'" {
description
"This augmentation is only valid for OSPFv2.";
}
description
"SR specific TLVs for OSPFv2 extended link TLV
in type 10 opaque LSA.";

container adj-sid-sub-tlvs {
description "Adjacency SID optional sub-TLVs.";

```

```

list adj-sid-sub-tlv {
  description "List of Adjacency SID sub-TLVs.";
  leaf flags {
    type bits {
      bit B {
        description
          "Backup flag.";
      }
    }
  }
}

```

```

    bit V {
      description
        "Value/Index flag.";
    }
    bit L {
      description
        "Local/Global flag.";
    }
    bit S {
      description
        "Set flag.";
    }
  }
  description "Flags.";
}
leaf mt-id {
  type uint8;
  description "Multi-topology ID.";
}
leaf weight {
  type uint8;
  description "Weight used for load-balancing.";
}
leaf sid {
  type uint32;
  description "Segment Identifier (SID) index/label.";
}
}
}

container lan-adj-sid-sub-tlvs {
  description "LAN Adjacency SID optional sub-TLVs.";
  list lan-adj-sid-sub-tlv {

```

```

description "List of LAN adjacency SID sub-TLVs.";
leaf flags {
  type bits {
    bit B {
      description
        "Backup flag.";
    }
    bit V {
      description
        "Value/Index flag.";
    }
    bit L {
      description
        "Local/Global flag.";
    }
  }
}

```

```

    bit S {
      description
        "Set flag.";
    }
  }
  description "Flags.";
}
leaf mt-id {
  type uint8;
  description "Multi-topology ID.";
}
leaf weight {
  type uint8;
  description "Weight used for load-balancing.";
}
leaf neighbor-router-id {
  type yang:dotted-quad;
  description "Neighbor router ID.";
}
leaf sid {
  type uint32;
  description "Segment Identifier (SID) index/label.";
}
}
}
}

```



```

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
  + "ospf:interfaces/ospf:interface/ospf:database/"
  + "ospf:link-scope-lsa-type/ospf:link-scope-lsas/"
  + "ospf:link-scope-lsa/ospf:version/ospf:ospfv2/"
  + "ospf:ospfv2/ospf:body/ospf:opaque" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../..."
  + "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}

description
  "SR specific TLVs for OSPFv2 type 9 opaque LSA.";

uses extended-prefix-range-tlvs;
uses sr-algorithm-tlv;
uses sid-range-tlvs;
}

```

```

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:areas/"
  + "ospf:area/ospf:database/"
  + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
  + "ospf:area-scope-lsa/ospf:version/ospf:ospfv2/"
  + "ospf:ospfv2/ospf:body/ospf:opaque" {
when "../.../.../.../.../.../.../.../.../.../.../..."
  + "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}

description
  "SR specific TLVs for OSPFv2 type 10 opaque LSA.";

uses extended-prefix-range-tlvs;
uses sr-algorithm-tlv;
uses sid-range-tlvs;

```

```

}

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:database/"
  + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
  + "ospf:as-scope-lsa/ospf:version/ospf:ospfv2/"
  + "ospf:ospfv2/ospf:body/ospf:opaque" {
when "../../../../../../../../../../../../../../../"
  + "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
description
  "SR specific TLVs for OSPFv2 type 11 opaque LSA.";

  uses extended-prefix-range-tlvs;
  uses sr-algorithm-tlv;
  uses sid-range-tlvs;
}
}
<CODE ENDS>

```

## 7. OSPF BFD Yang Module

```

<CODE BEGINS> file "ietf-ospf-bfd@2016-03-20.yang"
module ietf-ospf-bfd {
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-bfd";

```

```

prefix ospf-bfd;

import ietf-routing {
  prefix "rt";
}
import ietf-ospf {
  prefix "ospf";
}

organization
  "Cisco Systems
  170 West Tasman Drive

```

San Jose, CA 95134-1706  
USA";

contact

"WG Web: <<http://tools.ietf.org/wg/ospf/>>

WG List: <<mailto:ospf@ietf.org>>

WG Chair: Acee Lindem  
<<mailto:acee@cisco.com>>

WG Chair: Abhay Roy  
<<mailto:akr@cisco.com>>

Editor: Derek Yeung  
<<mailto:myeung@cisco.com>>

Author: Derek Yeung  
<<mailto:myeung@cisco.com>>

Author: Yingzhen Qu  
<<mailto:yiqu@cisco.com>>

Author: Acee Lindem  
<<mailto:acee@cisco.com>>

Author: Jeffrey Zhang  
<<mailto:zzhang@juniper.net>>

Author: Ing-Wher Chen  
<<mailto:ing-wher.chen@ericsson.com>>

Author: Greg Hankins  
<<mailto:greg.hankins@alcatel-lucent.com>>";

description

"This YANG module defines the generic configuration and operational state for OSPF BFD, which is common across all of the vendor implementations. It is intended that the module will be extended by vendors to define vendor-specific OSPF BFD configuration and operational parameters and policies.

Terms and Acronyms

OSPF (ospf): Open Shortest Path First

IP (ip): Internet Protocol

```

    IPv4 (ipv4):Internet Protocol Version 4

    IPv6 (ipv6): Internet Protocol Version 6
";

revision 2016-03-20 {
    description
        "* Remove routing-instance.
        * Remove use of bfd-protocol-parms from ietf-bfd module.
        * Remove import of ietf-bfd module.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF BFD.";
}

revision 2015-10-19 {
    description
        "Initial revision.";
    reference
        "RFC XXXX: A YANG Data Model for OSPF BFD.";
}

/* Configuration */

augment "/rt:routing/rt:routing-protocols/"
    + "rt:routing-protocol/ospf:ospf/ospf:instance/"
    + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
    when "../..../rt:type = 'ospf:ospfv2' or "
        + "../..../rt:type = 'ospf:ospfv3'" {
        description
            "This augments the OSPF routing protocol when used";
    }
    description
        "This augments OSPF protocol configuration
        with BFD.";

    container bfd {
        description "BFD configuration.";
        leaf enabled {
            type boolean;
            default false;
            description
                "True if BFD is enabled for the OSPF interface.";
        }
    }
}

```

```

    }
  }
}

/* Operational states */

augment "/rt:routing-state/"
  + "rt:routing-protocols/rt:routing-protocol/"
  + "ospf:ospf/ospf:instance/ospf:areas/ospf:area/"
  + "ospf:interfaces/ospf:interface" {
  when "../../../rt:type = 'ospf:ospfv2' or "
    + "../../../rt:type = 'ospf:ospfv3'" {
    description
      "This augments the OSPF routing protocol when used";
  }
  description
    "This augments OSPF protocol operation
    with BFD.";

  container bfd {
    description "BFD operation.";
    leaf enabled {
      type boolean;
      description
        "True if BFD is enabled for the OSPF interface.";
    }
  }
}
}
<CODE ENDS>

```

## 8. Security Considerations

The data model defined does not create any security implications.

This draft does not change any underlying security issues inherent in [\[I-D.ietf-netmod-routing-cfg\]](#).

## 9. Acknowledgements

The authors wish to thank Acee Lindem, Yi Yang, Alexander Clemm, Gaurav Gupta, Ing-Wher Chen, Ladislav Lhotka, Stephane Litkowski, Greg Hankins, Manish Gupta and Alan Davey for their thorough reviews and helpful comments.

This document was produced using Marshall Rose's xml2rfc tool.

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#### Authors' Addresses

Derek Yeung  
Cisco Systems  
170 West Tasman Drive  
San Jose, CA 95134  
USA

EMail: [myeung@cisco.com](mailto:myeung@cisco.com)

Yingzhen Qu  
Cisco Systems  
170 West Tasman Drive  
San Jose, CA 95134  
USA

EMail: [yiqu@cisco.com](mailto:yiqu@cisco.com)

Jeffrey Zhang  
Juniper Networks  
10 Technology Park Drive



Westford, MA 01886  
USA

EMail: zzhang@juniper.net

Dean Bogdanovic

EMail: ivandean@gmail.com

Kiran Koushik Agrahara Sreenivasa  
Cisco Systems  
12515 Research Blvd, Bldg 4  
Austin, TX 78681  
USA

EMail: kkoushik@cisco.com