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OSPF YANG Model Augmentations for Additional Features - Release 1
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Abstract

This document defines YANG data modules that augment the IETF OSPF YANG model to support various OSPF extensions and features, including Traffic Engineering Extensions to OSPF Version 3 as defined in RFC 5329, OSPF Two-Part Metric as defined in RFC 8042, OSPF Graceful Link Shutdown as defined in RFC 8379, OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement as defined in RFC 8510, OSPF MSD as defined in RFC 8476, OSPF Application-Specific Link Attributes as defined in RFC 9492, and OSPF Flexible Algorithm as defined in RFC 9350.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Overview

YANG [RFC7950] 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 YANG data modules augmenting the IETF OSPF YANG model [RFC9129], which itself augments [RFC8349], to provide support for configuration and operational state for the following OSPF features:

RFC5329: Traffic Engineering Extensions to OSPF Version 3 [RFC5329].

RFC5392: OSPF Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering [RFC5392].

RFC8042: OSPF Two-Part Metric [RFC8042].

RFC8379: OSPF Graceful Link Shutdown [RFC8379].

RFC8476: Signaling Maximum SID Depth (MSD) Using OSPF[RFC8476].

RFC8510: OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement [RFC8510].

RFC9356: Advertising Layer 2 Bundle Member Link Attributes in OSPF [RFC9356].

I-D:ietf-lsr-flex-algo-bw-con: IGP Flexible Algorithms: Bandwidth, Delay, Metrics and Constraints [I-D.ietf-lsr-flex-algo-bw-con].

The augmentations defined in this document requires support for the OSPF base model[RFC9129] which defines basic OSPF configuration and state. The OSPF YANG model augments the ietf-routing YANG model defined in [RFC8349].

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. YANG Module for Traffic Engineering Extensions to OSPF

This document defines a YANG module for Traffic Engineering Extensions to OSPF as defined in [RFC3630] and [RFC5329]. It is an augmentation of the OSPF base model.

```
   module: ietf-ospfv3-te
   augment /rt:routing/rt:control-plane-protocols
           /rt:control-plane-protocol/ospf:ospf/ospf:mpls:
     +--rw traffic-eng
        +--rw enable?   boolean
   augment /rt:routing/rt:control-plane-protocols
           /rt:control-plane-protocol/ospf:ospf/ospf:areas
           /ospf:area/ospf:interfaces/ospf:interface:
     +--rw traffic-eng
          +--rw enable?   boolean
   augment /rt:routing/rt:control-plane-protocols
           /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
           /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
           /ospf:area-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
           /ospf:body:
     +--ro ospfv3-intra-area-te
        +--ro router-address-tlv
        |  +--ro router-address?   inet:ipv6-address
        +--ro link-tlv
           +--ro link-type                   ospf:router-link-type
           +--ro local-if-ipv6-addrs
           |  +--ro local-if-ipv6-addr*   inet:ipv6-address
           +--ro remote-if-ipv6-addrs
           |  +--ro remote-if-ipv6-addr*   inet:ipv6-address
           +--ro te-metric?                  uint32
           +--ro max-bandwidth?
           |      rt-types:bandwidth-ieee-float32
           +--ro max-reservable-bandwidth?
           |      rt-types:bandwidth-ieee-float32
           +--ro unreserved-bandwidths
           |  +--ro unreserved-bandwidth*
           |     +--ro priority?               uint8
           |     +--ro unreserved-bandwidth?
           |            rt-types:bandwidth-ieee-float32
           +--ro admin-group?                uint32
           +--ro neighbor-id
           |  +--ro nbr-interface-id    uint32
           |  +--ro nbr-router-id       rt-types:router-id
           +--ro unknown-tlvs
              +--ro unknown-tlv*
                 +--ro type?     uint16
                 +--ro length?   uint16
                 +--ro value?    yang:hex-string
```

```
   <CODE BEGINS> file "ietf-ospf-te@2025-02-27.yang"
   module ietf-ospf-te {
     yang-version 1.1;
     namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-te";

     prefix ospf-te;

     import ietf-inet-types {
       prefix inet;
       reference
         "RFC 6991: Common YANG Data Types";
     }

     import ietf-routing-types {
       prefix rt-types;
       reference
         "RFC 8294: Common YANG Data Types for the Routing Area";
     }

     import ietf-routing {
       prefix rt;
       reference
         "RFC 8349: A YANG Data Model for Routing
                    Management (NMDA Version)";
     }

     import ietf-ospf {
       prefix ospf;
       reference
         "RFC 9129: YANG Data Model for the OSPF Protocol";
     }

     organization
       "IETF LSR - Link State Routing Working Group";

     contact
        "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
         WG List:  <mailto:lsr@ietf.org>

         Author:   Yingzhen Qu
                   <mailto:yqu@futurewei.com>
         Author:   Acee Lindem
                   <mailto:acee.ietf@gmail.com>";

     description
       "This YANG module defines the configuration and operational
        state for Traffic Engineering (TE) Extensions to OSPF Version 2
        as defined in RFC 3630 and OSPFv3 extensions to support
```

```
        intra-area Traffic Engineering (TE) as defined in RFC 5329.

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        Relating to IETF Documents
        (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX;
        see the RFC itself for full legal notices.";

    reference "RFC XXXX";

    revision 2025-02-27 {
      description
        "Initial version";
      reference
        "RFC XXXX: OSPF YANG Model Augmentations for Additional
                   Features - Version 1";
    }

    identity ospfv3-intra-area-te-lsa {
      base ospf:ospfv3-lsa-type;
      description
        "OSPFv3 Intrea-area TE LSA.";
    }

    grouping ospfv3-intra-area-te {
      description
        "Grouping for OSPFv3 intra-area-te-lsa.";
      container ospfv3-intra-area-te {
        container router-address-tlv {
          description
            "The router IPv6 address tlv advertises a
             reachable IPv6 address.";
          leaf router-address {
            type inet:ipv6-address;
            description
              "Router IPv6 address.";
          }
        }

        container link-tlv {
          description
```

```
            "Describes a single link, and it is constructed
             of a set of Sub-TLVs.";
          leaf link-type {
            type ospf:router-link-type;
            mandatory true;
            description
              "Link type.";
          }

          container local-if-ipv6-addrs {
            description
              "All local interface IPv6 addresses.";
            leaf-list local-if-ipv6-addr {
              type inet:ipv6-address;
              description
                "List of local interface IPv6 addresses.";
            }
          }

          container remote-if-ipv6-addrs {
            description
              "All remote interface IPv6 addresses.";
            leaf-list remote-if-ipv6-addr {
              type inet:ipv6-address;
              description
                "List of remote interface IPv6 addresses.";
            }
          }

          leaf te-metric {
            type uint32;
            description
              "TE metric.";
          }

          leaf max-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            description
              "Maximum bandwidth.";
          }

          leaf max-reservable-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            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 rt-types:bandwidth-ieee-float32;
                description
                  "Unreserved bandwidth.";
              }
              description
                "List of unreserved bandwidths for different
                 priorities.";
            }
          }

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

          container neighbor-id {
            description
              "Neighbor link identification.";
            leaf nbr-interface-id {
              type uint32;
              mandatory true;
              description
                "The neighbor's interface ID.";
            }
            leaf nbr-router-id {
              type rt-types:router-id;
              mandatory true;
              description
                "The neighbor's router ID.";
            }
          }

          uses ospf:unknown-tlvs;
        }

        description
```

```
          "OSPFv3 Intra-Area-TE-LSA.";
        reference
          "RFC 5329: Traffic Engineering Extensions to OSPF Version 3";
      }
    }

    /* Configuration */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol"
          + "/ospf:ospf/ospf:mpls" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
            + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
           description
             "This augments the OSPF routing protocol when used.";
       }
      description
        "This augments OSPF protocol configuration
         with MPLS TE configuration.";
      container traffic-eng {
        description
          "OSPF MPLS TE configuration.";
        leaf enable {
          type boolean;
          default "false";
          description
            "Enables traffic engineering advertisement in OSPF.";
        }
        reference
          "RFC 3630: Traffic Engineering (TE) Extensions to OSPF
                     Version 2
           RFC 5329: Traffic Engineering Extensions to OSPF Version 3";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
            + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
        description
          "This augments the OSPF routing protocol interface
           configuration.";
      }
      description
        "This augments OSPF interface with MPLS TE configuration.";
      container traffic-eng {
        description
          "OSPF interface MPLS TE configuration.";
```

```
          leaf enable {
            type boolean;
            default "false";
            description
              "Enables OSPF MPLS traffic engineering functionality on
               the interface.";
          }
        }
      }

      /* Database */
      augment "/rt:routing/"
            + "rt:control-plane-protocols/rt:control-plane-protocol/"
            + "ospf:ospf/ospf:areas/"
            + "ospf:area/ospf:database/"
            + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
            + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
            + "ospf:ospfv3/ospf:body" {
        when "../../../../../../../../../"
           + "rt:type = 'ospf:ospfv3'" {
          description
            "This augmentation is only valid for OSPFv3.";
        }
        description
          "OSPFv3 Intra-Area-TE-LSA.";

        uses ospfv3-intra-area-te;
      }
    }
    <CODE ENDS>
```

3. YANG Module for OSPF Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering

This document defines a YANG module for OSPF Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering as defined in [RFC5392].

```
module: ietf-ospf-inter-as-te
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf
          /ospf:mpls/ospf-te:traffic-eng:
    +--rw inter-as-te!
       +--rw flood-as-wide?   boolean
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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 inter-as-te-v2
       +--ro link-tlv
          +--ro link-type                   ospf:router-link-type
          +--ro local-if-ipv4-addrs
          |  +--ro local-if-ipv4-addr*   inet:ipv4-address
          +--ro remote-if-ipv4-addrs
          |  +--ro remote-if-ipv4-addr*   inet:ipv4-address
          +--ro te-metric?                  uint32
          +--ro max-bandwidth?              rt-types:bandwidth-ieee-float32
          +--ro max-reservable-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro unreserved-bandwidths
          |  +--ro unreserved-bandwidth* []
          |     +--ro priority?               uint8
          |     +--ro unreserved-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro admin-group?                uint32
          +--ro remote-as-number            uint32
          +--ro ipv4-remote-asbr-id?        inet:ipv4-address
          +--ro ipv6-remote-asbr-id?        inet:ipv6-address
          +--ro unknown-tlvs
             +--ro unknown-tlv* []
                +--ro type?     uint16
                +--ro length?   uint16
                +--ro value?    yang:hex-string
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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 inter-as-te-v2
       +--ro link-tlv
          +--ro link-type                   ospf:router-link-type
          +--ro local-if-ipv4-addrs
          |  +--ro local-if-ipv4-addr*   inet:ipv4-address
          +--ro remote-if-ipv4-addrs
          |  +--ro remote-if-ipv4-addr*   inet:ipv4-address
          +--ro te-metric?                  uint32
          +--ro max-bandwidth?              rt-types:bandwidth-ieee-float32
          +--ro max-reservable-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro unreserved-bandwidths
          |  +--ro unreserved-bandwidth* []
          |     +--ro priority?               uint8
          |     +--ro unreserved-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro admin-group?                uint32
          +--ro remote-as-number            uint32
          +--ro ipv4-remote-asbr-id?        inet:ipv4-address
          +--ro ipv6-remote-asbr-id?        inet:ipv6-address
          +--ro unknown-tlvs
```

```
            +--ro unknown-tlv* []
               +--ro type?     uint16
               +--ro length?   uint16
               +--ro value?    yang:hex-string
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body:
    +--ro inter-as-te-v3
       +--ro link-tlv
          +--ro link-type                   ospf:router-link-type
          +--ro local-if-ipv6-addrs
          |  +--ro local-if-ipv6-addr*   inet:ipv6-address
          +--ro remote-if-ipv6-addrs
          |  +--ro remote-if-ipv6-addr*   inet:ipv6-address
          +--ro te-metric?                  uint32
          +--ro max-bandwidth?              rt-types:bandwidth-ieee-float32
          +--ro max-reservable-bandwidth?  rt-types:bandwidth-ieee-float32
          +--ro unreserved-bandwidths
          |  +--ro unreserved-bandwidth* []
          |     +--ro priority?               uint8
          |     +--ro unreserved-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro admin-group?                uint32
          +--ro remote-as-number            uint32
          +--ro ipv4-remote-asbr-id?        inet:ipv4-address
          +--ro ipv6-remote-asbr-id?        inet:ipv6-address
          +--ro unknown-tlvs
             +--ro unknown-tlv* []
                +--ro type?     uint16
                +--ro length?   uint16
                +--ro value?    yang:hex-string
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:database
          /ospf:as-scope-lsa-type/ospf:as-scope-lsas
          /ospf:as-scope-lsa/ospf:version/ospf:ospfv3
          /ospf:ospfv3/ospf:body:
    +--ro inter-as-te-v3
       +--ro link-tlv
          +--ro link-type                   ospf:router-link-type
          +--ro local-if-ipv6-addrs
          |  +--ro local-if-ipv6-addr*   inet:ipv6-address
          +--ro remote-if-ipv6-addrs
          |  +--ro remote-if-ipv6-addr*   inet:ipv6-address
          +--ro te-metric?                  uint32
          +--ro max-bandwidth?              rt-types:bandwidth-ieee-float32
          +--ro max-reservable-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro unreserved-bandwidths
```

```
          |  +--ro unreserved-bandwidth* []
          |     +--ro priority?               uint8
          |     +--ro unreserved-bandwidth?   rt-types:bandwidth-ieee-float32
          +--ro admin-group?                  uint32
          +--ro remote-as-number              uint32
          +--ro ipv4-remote-asbr-id?          inet:ipv4-address
          +--ro ipv6-remote-asbr-id?          inet:ipv6-address
          +--ro unknown-tlvs
             +--ro unknown-tlv* []
                +--ro type?     uint16
                +--ro length?   uint16
                +--ro value?    yang:hex-string
```

```
  <CODE BEGINS> file "ietf-ospf-inter-as-te@2025-02-27.yang"
  module ietf-ospf-inter-as-te {
    yang-version 1.1;
    namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-inter-as-te";

    prefix ospf-inter-as-te;

    import ietf-inet-types {
      prefix inet;
      reference
        "RFC 6991: Common YANG Data Types";
    }

    import ietf-routing-types {
      prefix rt-types;
      reference
        "RFC 8294: Common YANG Data Types for the Routing Area";
    }

    import ietf-routing {
      prefix rt;
      reference
        "RFC 8349: A YANG Data Model for Routing
                   Management (NMDA Version)";
    }

    import ietf-ospf {
      prefix ospf;
      reference
        "RFC 9129: YANG Data Model for the OSPF Protocol";
    }

    import ietf-ospf-te {
      prefix ospf-te;
      reference
```

```
        "RFC 3630: Traffic Engineering (TE) Extensions to OSPF Version 2
         RFC 5329: Traffic Engineering Extensions to OSPF Version 3";
    }

    organization
      "IETF LSR - Link State Routing Working Group";

    contact
       "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
        WG List:  <mailto:lsr@ietf.org>

        Author:   Yingzhen Qu
                  <mailto:yqu@futurewei.com>
        Author:   Acee Lindem
                  <mailto:acee.ietf@gmail.com>";

    description
      "This YANG module defines the configuration and operational
       state for OSPF Extensions in Support of Inter-Autonomous
       System (AS) MPLS and GMPLS Traffic Engineering as defined
       in RFC 5392.

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       forth in Section 4.c of the IETF Trust's Legal Provisions
       Relating to IETF Documents
       (https://trustee.ietf.org/license-info).

       This version of this YANG module is part of RFC XXXX;
       see the RFC itself for full legal notices.";

    reference "RFC XXXX";

    revision 2025-02-27 {
      description
        "Initial version";
      reference
        "RFC XXXX: OSPF YANG Model Augmentations for Additional
                   Features - Version 1";
    }

    identity ospfv3-intra-area-te-lsa {
      base ospf:ospfv3-lsa-type;
      description
```

```
        "OSPFv3 Intrea-area TE LSA.";
    }

    grouping inter-as-te-v2-lsa {
      description
        "Grouping for OSPF Inter-AS-TE-2 LSA.";
      container inter-as-te-v2 {
        description
          "The Inter-AS-TE-v2 LSA.";

        container link-tlv {
          description
            "Describes a single link.  It is constructed
             from a set of sub-TLVs.";
          leaf link-type {
            type ospf:router-link-type;
            mandatory true;
            description
              "Link type.";
          }
          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 rt-types:bandwidth-ieee-float32;
            description
              "Maximum bandwidth.";
          }
```

```
          leaf max-reservable-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            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 rt-types:bandwidth-ieee-float32;
                description
                  "Unreserved bandwidth.";
              }
              description
                "List of unreserved bandwidths for different
                 priorities.";
            }
          }
          leaf admin-group {
            type uint32;
            description
              "Administrative Group / Resource Class/Color.";
          }
          leaf remote-as-number {
            type uint32;
            mandatory true;
            description
              "Remote AS number.";
          }
          leaf ipv4-remote-asbr-id {
            type inet:ipv4-address;
            description
              "The neighboring ASBR IPv4 address.";
          }
          leaf ipv6-remote-asbr-id {
            type inet:ipv6-address;
            description
              "The neighboring ASBR IPv6 address.";
          }
          uses ospf:unknown-tlvs;
```

```
        }
      }
    }
    grouping inter-as-te-v3 {
      description
        "Grouping for OSPFv3 inter-as-te-v3 lsa.";
      container inter-as-te-v3 {
        container link-tlv {
          description
            "Describes a single link, and it is constructed
             of a set of Sub-TLVs.";
          leaf link-type {
            type ospf:router-link-type;
            mandatory true;
            description
              "Link type.";
          }

          container local-if-ipv6-addrs {
            description
              "All local interface IPv6 addresses.";
            leaf-list local-if-ipv6-addr {
              type inet:ipv6-address;
              description
                "List of local interface IPv6 addresses.";
            }
          }

          container remote-if-ipv6-addrs {
            description
              "All remote interface IPv6 addresses.";
            leaf-list remote-if-ipv6-addr {
              type inet:ipv6-address;
              description
                "List of remote interface IPv6 addresses.";
            }
          }

          leaf te-metric {
            type uint32;
            description
              "TE metric.";
          }

          leaf max-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            description
              "Maximum bandwidth.";
```

```
          }

          leaf max-reservable-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            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 rt-types:bandwidth-ieee-float32;
                description
                  "Unreserved bandwidth.";
              }
              description
                "List of unreserved bandwidths for different
                 priorities.";
            }
          }

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

          leaf remote-as-number {
            type uint32;
            mandatory true;
            description
              "Remote AS number.";
          }
          leaf ipv4-remote-asbr-id {
            type inet:ipv4-address;
            description
              "The neighboring ASBR IPv4 address.";
          }
          leaf ipv6-remote-asbr-id {
```

```
            type inet:ipv6-address;
            description
              "The neighboring ASBR IPv6 address.";
          }
          uses ospf:unknown-tlvs;
        }

        description
          "OSPFv3 Inter-AS-TE-v3 LSA.";
        reference
          "RFC 5392: TOSPF Extensions in Support of Inter-Autonomous
           System (AS) MPLS and GMPLS Traffic Engineering";
      }
    }

    /* Configuration */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:mpls/ospf-te:traffic-eng" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
        description
          "This augment OSPF routing protocol when used";
      }
      description
        "This augments OSPF protocol traffic engineering configuration
         with Inter-AS-TE configuration.";
      container inter-as-te {
        presence "Enable Inter-AS-TE";
        description
          "OSPFv3 MPLS TE configuration.";
        leaf flood-as-wide {
          type boolean;
          default "false";
          description
            "Enables as-scoped traffic engineering advertisement. By
             default, the inter-as TE link advertisement is limited to
             within the single area.";
        }
        reference
          "RFC 5392: OSPF Extensions in Support of Inter-Autonomous
                     System (AS) MPLS and GMPLS Traffic Engineering";
      }
    }

    /* Database */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
```

```
          + "ospf:ospf/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 "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augments OSPFv2 routing protocol when used";
          }
        description
          "OSPFv2 type 10 Opaque LSA.";
        uses inter-as-te-v2-lsa;
      }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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 "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augments OSPFv2 routing protocol when used";
          }
        description
          "OSPFv2 type 11 Opaque LSA.";
        uses inter-as-te-v2-lsa;
      }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augmentation is only valid for OSPFv3.";
      }
      description
        "OSPFv3 Intra-Area-TE-LSA.";

      uses inter-as-te-v3;
    }
```

```
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:database/"
          + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
          + "ospf:as-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augmentation is only valid for OSPFv3.";
      }
      description
        "OSPFv3 Intra-Area-TE-LSA.";

      uses inter-as-te-v3;
    }
  }
```

4. YANG Module for OSPF Two-Part Metric

This document defines a YANG module for OSPF Two-Part Metric feature as defined in [RFC8042]. It is an augmentation of the OSPF base model.

```
   module: ietf-ospf-two-part-metric
   augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
          /ospf:interfaces/ospf:interface:
    +--rw two-part-metric
       +--rw enable?           boolean
       +--rw int-input-cost?   ospf:ospf-link-metric
   augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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-opaque
          /ospf:extended-link-tlv:
    +--ro network-to-router-metric-sub-tlvs
       +--ro net-to-rtr-sub-tlv*
          +--ro mt-id?       uint8
          +--ro mt-metric?   uint16
   augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:te-opaque/ospf:link-tlv:
    +--ro network-to-router-te-metric?   uint32
   augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
          /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
          /ospf:area-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
          /ospf:body/ospfv3-te:ospfv3-intra-area-te/ospfv3-te:link-tlv:
    +--ro network-to-router-te-metric?   uint32

   <CODE BEGINS> file "ietf-ospf-two-part-metric@2023-06-27.yang"
   module ietf-ospf-two-part-metric {
     yang-version 1.1;
     namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-two-part-metric";

     prefix ospf-two-metric;

     import ietf-routing {
       prefix "rt";
       reference "RFC 8349: A YANG Data Model for Routing
                  Management (NMDA Version)";
     }

     import ietf-ospf {
       prefix "ospf";
       reference "RFC 9129 - YANG Data Model for the OSPF
                  Protocol";
     }
```

```
     import ietf-ospfv3-te {
       prefix "ospfv3-te";
     }

     organization
       "IETF LSR - Link State Routing Working Group";

     contact
        "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
         WG List:  <mailto:lsr@ietf.org>

         Author:   Yingzhen Qu
                   <mailto:yqu@futurewei.com>
         Author:   Acee Lindem
                   <mailto:acee.ietf@gmail.com>";

     description
       "This YANG module defines the configuration and operational
       state for OSPF Two-Part Metric feature as defined in RFC 8042.

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        (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX;
        see the RFC itself for full legal notices.";

     reference "RFC XXXX";

     revision 2023-06-27 {
       description
         "Initial version";
       reference
         "RFC XXXX: A YANG Data Model for OSPF Two-Part Metric.";
     }

     identity two-part-metric {
       base ospf:informational-capability;
       description
         "When set, the router is capable of supporting OSPF
          two-part metrics.";
       reference
```

```
        "RFC 8042: OSPF Two-Part Metric";
    }

    /* RFC 8042 */
    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "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 two-part metric.";

      container two-part-metric {
        when "enum-value(../ospf:interface-type) = 2" {
          description
            "Two-part metric when link type is multi-access.";
        }
        leaf enable {
          type boolean;
          default false;
          description
            "Enable two-part metric.";
        }
        leaf int-input-cost {
          type ospf:ospf-link-metric;
          description
            "Link state metric from the two-part-metric network
             to this router.";
        }
        description
          "Interface two part metric configuration.";
      }
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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-opaque/ospf:extended-link-tlv" {
      when "../../../../../../../../../../../../../"
```

```
          + "rt:type = 'ospf:ospfv2'" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "Network-to-Router metric sub tlv for OSPFv2 extended link TLV
         in type 10 opaque LSA.";

         container network-to-router-metric-sub-tlvs {
           description "Network-to-Router metric sub TLV.";
           list net-to-rtr-sub-tlv {
             leaf mt-id {
               type uint8;
               description "Multi-Topology Identifier (MT-ID).";
             }
             leaf mt-metric {
               type uint16;
               description "Network-to-router metric.";
             }
             description
               "Network-to-Router metric sub-TLV.";
           }
         }
      }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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:te-opaque/"
          + "ospf:link-tlv" {
      when "../../../../../../../../../../../../"
         + "rt:type = 'ospf:ospfv2'" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "Traffic Engineering Network-to-Router Sub-TLV.";
        leaf network-to-router-te-metric {
          type uint32;
          description "Network to Router TE metric.";
          reference
            "RFC 8042 - OSPF Two-Part Metric";
        }
    }
```

```
     augment "/rt:routing/"
           + "rt:control-plane-protocols/rt:control-plane-protocol/"
           + "ospf:ospf/ospf:areas/"
           + "ospf:area/ospf:database/"
           + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
           + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
           + "ospf:ospfv3/ospf:body/ospfv3-te:ospfv3-intra-area-te/"
           + "ospfv3-te:link-tlv" {
       when "../../../../../../../../../../"
          + "rt:type = 'ospf:ospfv3'" {
         description
           "This augmentation is only valid for OSPFv3.";
       }
       description
         "Traffic Engineering Network-to-Router Sub-TLV.";
         leaf network-to-router-te-metric {
           type uint32;
           description "Network to Router TE metric.";
           reference
             "RFC 8042 - OSPF Two-Part Metric";
         }
     }
   }
   <CODE ENDS>
```

5. YANG Module for OSPF Graceful Link Shutdown

This document defines a YANG module for OSPF Graceful Link Shutdown feature as defined in [RFC8379]. It is an augmentation of the OSPF base model.

```
module: ietf-ospf-graceful-link-shutdown
augment /rt:routing/rt:control-plane-protocols
       /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
       /ospf:interfaces/ospf:interface:
 +--rw graceful-link-shutdown
    +--rw enable?   boolean
augment /rt:routing/rt:control-plane-protocols
       /rt:control-plane-protocol/ospf:ospf/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-opaque
       /ospf:extended-link-tlv:
 +--ro graceful-link-shutdown-sub-tlv!
 +--ro remote-address-sub-tlv
 |  +--ro remote-address?   inet:ipv4-address
 +--ro local-remote-int-id-sub-tlv
    +--ro local-int-id?    uint32
    +--ro remote-int-id?   uint32
augment /rt:routing/rt:control-plane-protocols
       /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
       /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
       /ospf:area-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
       /ospf:body/ospfv3-e-lsa:e-router/ospfv3-e-lsa:e-router-tlvs
       /ospfv3-e-lsa:link-tlv:
 +--ro graceful-link-shutdown-sub-tlv!
```

```
<CODE BEGINS> file "ietf-ospf-graceful-link-shutdown@2024-07-01.yang"
module ietf-ospf-graceful-link-shutdown {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-ospf-graceful-link-shutdown";

  prefix ospf-grace-linkdown;

  import ietf-inet-types {
    prefix "inet";
    reference "RFC 6991: Common YANG Data Types";
  }

  import ietf-routing {
    prefix "rt";
    reference "RFC 8349: A YANG Data Model for Routing
               Management (NMDA Version)";
  }

  import ietf-ospf {
    prefix "ospf";
```

```
      reference "RFC 9129 - YANG Data Model for the OSPF
                 Protocol";
    }

    import ietf-ospfv3-extended-lsa {
      prefix "ospfv3-e-lsa";
      reference "RFC 9587: YANG Data Model for OSPFv3 Extended Link
                 State Advertisements (LSAs)";
    }

    organization
      "IETF LSR - Link State Routing Working Group";

    contact
       "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
        WG List:  <mailto:lsr@ietf.org>

        Author:   Yingzhen Qu
                  <mailto:yingzhen.ietf@gmail.com>
        Author:   Acee Lindem
                  <mailto:acee.ietf@gmail.com>";

    description
      "This YANG module defines the configuration and operational
       state for OSPF Graceful Link Shutdown feature as defined
       in RFC 8379.

       This YANG model conforms to the Network Management
       Datastore Architecture (NDMA) as described in RFC 8342.

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       This version of this YANG module is part of RFC XXXX;
       see the RFC itself for full legal notices.";

    reference "RFC XXXX";

    revision 2024-07-01 {
      description
        "Initial version";
```

```
      reference
        "RFC XXXX: OSPF YANG Model Augmentations for Additional
                   Features - Version 1.";
    }


    /* RFC 8379 */
    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "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.";

      container graceful-link-shutdown {
        leaf enable {
          type boolean;
          default false;
          description
            "Enable OSPF graceful link shutdown.";
        }
        description
          "OSPF Graceful Link Shutdown.";
      }
    }


    /* Database */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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-opaque/ospf:extended-link-tlv" {
      when "../../../../../../../../../../../../"
         + "rt:type = 'ospf:ospfv2'" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
```

```
        "OSPF graceful link shutdown for OSPFv2 extended link TLV
         in type 10 opaque LSA.";

      container graceful-link-shutdown-sub-tlv {
        presence "Enable graceful link shutdown";
        description
          "Graceful-Link-Shutdown sub-TLV identifies the link as being
           gracefully shutdown.";
      }

      container remote-address-sub-tlv {
        leaf remote-address {
           type inet:ipv4-address;
           description
             "Remote IPv4 address used to identify a particular link
              on the remote side.";
        }
        description
          "This sub-TLV specifies the IPv4 address of the remote
           endpoint on the link.";
      }

      container local-remote-int-id-sub-tlv {
        leaf local-int-id {
           type uint32;
           description "Local interface ID.";
        }
        leaf remote-int-id {
           type uint32;
           description "Remote interface ID.";
        }
        description
          "This sub-TLV specifies Local and Remote Interface IDs.";
      }
    }

    augment "/rt:routing/"
         + "rt:control-plane-protocols/rt:control-plane-protocol/"
         + "ospf:ospf/ospf:areas/ospf:area/ospf:database/"
         + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
         + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
         + "ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router"
         + "/ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv" {
         when "'ospf:../../../../../../../../../'
           + "rt:type' = 'ospf:ospfv3'" {
           description
             "This augmentation is only valid for OSPFv3
              E-Router LSAs";
```

```
          }
        container graceful-link-shutdown-sub-tlv {
          presence "Enable graceful link shutdown";
          description
            "Graceful-Link-Shutdown sub-TLV identifies the link as being
             gracefully shutdown.";
        }
        description
          "Augment OSPFv3 Area scope router-link TLV.";
      }
    }
    <CODE ENDS>
```

6. YANG Module for OSPF LLS Extenstion for Local Interface ID Advertisement

This document defines a YANG module for OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement feature as defined in [RFC8510]. It is an augmentation of the OSPF base model.

```
module: ietf-ospf-lls-local-id
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf:
    +--rw lls-int-id
       +--rw enable?   boolean
```

```
<CODE BEGINS> file "ietf-ospf-lls-local-id@2024-07-01.yang"
module ietf-ospf-lls-local-id {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-lls-local-id";

  prefix ospf-lls-localid;

  import ietf-routing {
    prefix "rt";
    reference "RFC 8349: A YANG Data Model for Routing
               Management (NMDA Version)";
  }

  import ietf-ospf {
    prefix "ospf";
    reference "RFC 9129: YANG Data Model for the OSPF
               Protocol";
  }

  organization
    "IETF LSR - Link State Routing Working Group";
```

```
     contact
        "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
         WG List:  <mailto:lsr@ietf.org>

         Author:   Yingzhen Qu
                   <mailto:yingzhen.ietf@gmail.com>
         Author:   Acee Lindem
                   <mailto:acee.ietf@gmail.com>";

     description
       "This YANG module defines the configuration and operational
       state for OSPF Link-Local Signaling (LLS) Extensions for Local
       Interface ID Advertisement feature as defined in RFC 8510.

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        This version of this YANG module is part of RFC XXXX;
        see the RFC itself for full legal notices.";

     revision 2024-07-01 {
       description
         "Initial version";
       reference
         "RFC XXXX: OSPF YANG Model Augmentations for Additional
                    Features - Version 1.";
     }

     augment "/rt:routing/rt:control-plane-protocols"
           + "/rt:control-plane-protocol/ospf:ospf" {
       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
          to support LLS extesnions for interfacde ID as
          defined in RFC 8510.";
       container lls-int-id {
         leaf enable {
```

```
            type boolean;
            default false;
            description
              "Enable LLS to advertise local interface ID.";
          }
          description
            "OSPF LLS Extensions for interface ID.";
        }
      }
    }
    <CODE ENDS>
```

7. YANG Module for OSPF Maximum SID Depth (MSD)

This document defines a model for Signaling Maximum SID Depth (MSD) Using OSPF [RFC8476]. It is an augmentation of the OSPF base model.

```
module: ietf-ospf-msd
augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ri-opaque:
  +--ro node-msd-tlv
     +--ro node-msds* [msd-type]
        +--ro msd-type     identityref
        +--ro msd-value?   uint8
augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ri-opaque:
  +--ro node-msd-tlv
     +--ro node-msds* [msd-type]
        +--ro msd-type     identityref
        +--ro msd-value?   uint8
augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
          /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
          /ospf:area-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
          /ospf:body/ospf:router-information:
  +--ro node-msd-tlv
     +--ro node-msds* [msd-type]
        +--ro msd-type     identityref
        +--ro msd-value?   uint8
augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:database
          /ospf:as-scope-lsa-type/ospf:as-scope-lsas/ospf:as-scope-lsa
```

```
           /ospf:version/ospf:ospfv3/ospf:ospfv3/ospf:body
           /ospf:router-information:
     +--ro node-msd-tlv
        +--ro node-msds* [msd-type]
           +--ro msd-type     identityref
           +--ro msd-value?   uint8
   augment /rt:routing/rt:control-plane-protocols
           /rt:control-plane-protocol/ospf:ospf/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-opaque
           /ospf:extended-link-tlv:
     +--ro link-msd-sub-tlv
        +--ro link-msds* [msd-type]
           +--ro msd-type     identityref
           +--ro msd-value?   uint8
   augment /rt:routing/rt:control-plane-protocols
           /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
           /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
           /ospf:area-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
           /ospf:body/ospfv3-e-lsa:e-router/ospfv3-e-lsa:e-router-tlvs
           /ospfv3-e-lsa:link-tlv::
     +--ro link-msd-sub-tlv
        +--ro link-msds* [msd-type]
           +--ro msd-type     identityref
           +--ro msd-value?   uint8

   <CODE BEGINS> file "ietf-ospf-msd@2025-03-01.yang"
   module ietf-ospf-msd {
     yang-version 1.1;
     namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-msd";
     prefix ospf-msd;

     import ietf-routing {
       prefix rt;
       reference "RFC 8349: A YANG Data Model for Routing
                  Management (NMDA Version)";
     }

     import ietf-ospf {
       prefix ospf;
       reference "RFC 9129: YANG Data Model for the OSPF
                  Protocol";
     }

     import ietf-ospfv3-extended-lsa {
       prefix ospfv3-e-lsa;
       reference "RFC 9587: YANG Data Model for OSPFv3 Extended Link
```

```
                State Advertisements (LSAs)";
    }

    import iana-msd-types {
      prefix iana-msd-types;
    }

    organization
      "IETF LSR - LSR Working Group";
    contact
      "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
       WG List:  <mailto:lsr@ietf.org>

       Author:    Yingzhen Qu
                  <mailto:yingzhen.ietf@gmail.com>
       Author:    Acee Lindem
                  <mailto:acee.ietf@gmail.com>
       Author:    Stephane Litkowski
                  <mailto:slitkows.ietf@gmail.com>
       Author:    Jeff Tantsura
                  <jefftant.ietf@gmail.com>

      ";
    description
      "The YANG module augments the base OSPF model to
       manage different types of MSDs.

       This YANG model conforms to the Network Management
       Datastore Architecture (NMDA) as described in RFC 8342.

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       Relating to IETF Documents
       (https://trustee.ietf.org/license-info).

       This version of this YANG module is part of RFC XXXX;
       see the RFC itself for full legal notices.

       The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL
       NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED',
       'MAY', and 'OPTIONAL' in this document are to be interpreted as
       described in BCP 14 (RFC 2119) (RFC 8174) when, and only when,
       they appear in all capitals, as shown here.";
```

```
     reference "RFC XXXX: YANG Data Model for OSPF MSD.";

     revision 2025-03-01 {
       description
         "Initial Version";
       reference
         "RFC XXXX: OSPF YANG Model Augmentations for Additional
                    Features - Version 1.";
     }

     grouping node-msd-tlv {
       description
         "Grouping for node MSD.";
       container node-msd-tlv {
         list node-msds {
           key "msd-type";
           leaf msd-type {
             type identityref {
             base iana-msd-types:msd-base-mpls;
             }
             description
               "MSD-Types";
           }
           leaf msd-value {
             type uint8;
             description
               "MSD value, in the range of 0-255.";
           }
           description
             "Node MSD is the smallest link MSD supported by
              the node.";
         }
         description
           "Node MSD is the number of SIDs supported by a node.";
         reference
           "RFC 8476: Signaling Maximum SID Depth (MSD) Using OSPF";
       }
     }

     grouping link-msd-sub-tlv {
       description
         "Link Maximum SID Depth (MSD) grouping for an interface.";
       container link-msd-sub-tlv {
         list link-msds {
           key "msd-type";
           leaf msd-type {
             type identityref {
               base iana-msd-types:msd-base-mpls;
```

```
            }
            description
              "MSD-Types";
          }
          leaf msd-value {
            type uint8;
            description
              "MSD value, in the range of 0-255.";
          }
          description
            "List of link MSDs";
        }
        description
          "Link MSD sub-tlvs.";
      }
    }

    /* Node MSD TLV */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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:ri-opaque" {
      when "../../../../../../../../../../"
         + "rt:type = 'ospf:ospfv2'" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "Node MSD TLV is an optional TLV of OSPFv2 RI Opaque
         LSA (RFC7770) and has a type of 12.";

      uses node-msd-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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:ri-opaque" {
      when "../../../../../../../../../../"
         + "rt:type = 'ospf:ospfv2'" {
        description
```

```
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "Node MSD TLV is an optional TLV of OSPFv2 RI Opaque
         LSA (RFC7770) and has a type of 12.";

      uses node-msd-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf:router-information" {
      when "../../../../../../../../../../"
         + "rt:type = 'ospf:ospfv3'" {
        description
          "This augmentation is only valid for OSPFv3.";
      }
      description
        "Node MSD TLV is an optional TLV of OSPFv3 RI Opaque
         LSA (RFC7770) and has a type of 12.";

      uses node-msd-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:database/"
          + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
          + "ospf:as-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf:router-information" {
      when "../../../../../../../../../"
         + "rt:type = 'ospf:ospfv3'" {
        description
          "This augmentation is only valid for OSPFv3.";
      }
      description
        "Node MSD TLV is an optional TLV of OSPFv3 RI Opaque
         LSA (RFC7770) and has a type of 12.";

      uses node-msd-tlv;
    }

    /* link MSD sub-tlv */
    augment "/rt:routing/"
```

```
           + "rt:control-plane-protocols/rt:control-plane-protocol/"
           + "ospf:ospf/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-opaque/ospf:extended-link-tlv" {
       when "../../../../../../../../../../../../../"
          + "rt:type = 'ospf:ospfv2'" {
         description
           "This augmentation is only valid for OSPFv2.";
       }
       description
         "Link MSD sub-TLV is an optional sub-TLV of OSPFv2 extended
          link TLV as defined in RFC 7684 and has a type of 6.";

       uses link-msd-sub-tlv;
     }

     augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router/"
          + "ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv" {
          when "'ospf:../../../../../../../../../"
            + "rt:type' = 'ospf:ospfv3'" {
            description
              "This augmentation is only valid for OSPFv3
               E-Router LSAs";
          }
       description
         "Augment OSPFv3 Area scope router-link TLV.";

       uses link-msd-sub-tlv;
     }
   }
   <CODE ENDS>
```

8. YANG Module for Advertising Layer 2 Bundle Member Link Attributes in OSPF

This document defines a YANG Moduel for Advertising Layer 2 Bundle Member Link Attributes in OSPF as defined in [RFC9356].

```
   module: ietf-ospf-l2-bundle
     augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:areas
             /ospf:area/ospf:interfaces/ospf:interface:
       +--rw l2-mbr-attrs
          +--rw l2-mbr-attr* [l2-bdl-mbr-dscpr]
             +--rw l2-bdl-mbr-dscpr    uint32
             +--rw adj-sid?            uint32
             +--rw lan-adj-sid?        uint32
     augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/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-opaque/ospf:extended-link-tlv:
       +--ro l2-bdl-mbr-attr
          +--ro l2-bdl-mbrs* []
             +--ro l2-bdl-mbr-dscpr?                  uint32
             +--ro adj-sid-sub-tlvs
             |  +--ro adj-sid-sub-tlv* []
             |     +--ro adj-sid-flags
             |     |  +--ro flags*   identityref
             |     +--ro mt-id?           uint8
             |     +--ro weight?          uint8
             |     +--ro sid?             uint32
             +--ro lan-adj-sid-sub-tlv
             |  +--ro lan-adj-sid-sub-tlv* []
             |     +--ro lan-adj-sid-flags
             |     |  +--ro flags*   identityref
             |     +--ro mt-id?               uint8
             |     +--ro weight?              uint8
             |     +--ro neighbor-router-id?  rt-types:router-id
             |     +--ro sid?                 uint32
             +--ro app-specific-link-attr-sub-tlvs
                +--ro asla-sub-tlvs* []
                   +--ro sabm-length?                   uint8
                   +--ro udabm-length?                  uint8
                   +--ro sabm
                   |  +--ro sabm-bits*   identityref
                   +--ro udabm
                   +--ro link-attributes-sub-sub-tlvs
                      +--ro unknown-tlvs
                         +--ro unknown-tlv* []
                            +--ro type?     uint16
                            +--ro length?   uint16
                            +--ro value?    yang:hex-string
     augment /rt:routing/rt:control-plane-protocols
             /rt:control-plane-protocol/ospf:ospf/ospf:areas
```

```
            /ospf:area/ospf:database/ospf:area-scope-lsa-type
            /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
            /ospf:ospfv3/ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router
            /ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv:
       +--ro l2-bdl-mbr-attr
          +--ro l2-bdl-mbrs* []
             +--ro l2-bdl-mbr-dscpr?                 uint32
             +--ro adj-sid-sub-tlvs
             |  +--ro adj-sid-sub-tlv* []
             |     +--ro adj-sid-flags
             |     |  +--ro flags*   identityref
             |     +--ro weight?          uint8
             |     +--ro sid?             uint32
             +--ro lan-adj-sid-sub-tlvs
             |  +--ro lan-adj-sid-sub-tlv* []
             |     +--ro lan-adj-sid-flags
             |     |  +--ro flags*   identityref
             |     +--ro weight?               uint8
             |     +--ro neighbor-router-id?   rt-types:router-id
             |     +--ro sid?                  uint32
             +--ro app-specific-link-attr-sub-tlvs
                +--ro asla-sub-tlvs* []
                   +--ro sabm-length?                   uint8
                   +--ro udabm-length?                  uint8
                   +--ro sabm
                   |  +--ro sabm-bits*   identityref
                   +--ro udabm
                   +--ro link-attributes-sub-sub-tlvs
                      +--ro unknown-tlvs
                         +--ro unknown-tlv* []
                            +--ro type?     uint16
                            +--ro length?   uint16
                            +--ro value?    yang:hex-string
```

```
<CODE BEGINS> file "ietf-ospf-l2-bundle@2025-02-27.yang"
module ietf-ospf-l2-bundle {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-l2-bundle";

  prefix ospf-l2-bundle;

  import ietf-routing-types {
    prefix rt-types;
    reference
      "RFC 8294: Common YANG Data Types for the Routing Area";
  }
```

```
     import ietf-routing {
       prefix rt;
       reference
         "RFC 8349: A YANG Data Model for Routing
                    Management (NMDA Version)";
     }

     import ietf-ospf {
       prefix ospf;
       reference
         "RFC 9129: YANG Data Model for the OSPF Protocol";
     }

     import ietf-ospf-link-attr {
       prefix ospf-link-attr;
     }

     import ietf-ospfv3-extended-lsa {
       prefix ospfv3-e-lsa;
       reference
         "RFC 9587 - YANG Data Model for OSPFv3 Extended LSAs";
     }

     import ietf-ospf-sr-mpls {
       prefix ospf-sr-mpls;
     }

     organization
       "IETF LSR - Link State Routing Working Group";

     contact
        "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
         WG List:  <mailto:lsr@ietf.org>

         Author:   Yingzhen Qu
                   <mailto:yqu@futurewei.com>
         Author:   Acee Lindem
                   <mailto:acee.ietf@gmail.com>";

     description
       "This YANG module defines the configuration and operational
        state for Advertising Layer 2 Bundle Member Link Attributes
        in OSPF as defined in RFC 9356.

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```

```
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        Relating to IETF Documents
        (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX;
        see the RFC itself for full legal notices.";

    reference "RFC XXXX";

    revision 2025-02-27 {
      description
        "Initial version";
      reference
        "RFC XXXX: OSPF YANG Model Augmentations for Additional
                   Features - Version 1";
    }

    /* Groupings */
    grouping ospfv2-member-link-attr-sub-tlvs {
      description
        "OSPFv2 L2 Bundle Member Attributes sub-TLV (RFC 9356).";

      container adj-sid-sub-tlvs {
        list adj-sid-sub-tlv {
          description
            "List of adj-sid sub-tlvs.";
          container adj-sid-flags {
            leaf-list flags {
              type identityref {
                base ospf-sr-mpls:adj-sid-flag;
              }
            description
              "Adj-SID sub-TLV flags.";
            }
            description
              "Adj-sid sub-TLV flags.";
          }
          leaf mt-id {
            type uint8;
            description
              "Multi-topology ID. Topologies range from 0-127 and
               return of any other value would indicate an error.";
            reference
              "RFC 4915 - Multi-Topology (MT) Routing in OSPF";
          }
          leaf weight {
```

```
            type uint8;
            description
              "Weight used for load-balancing.";
          }
          leaf sid {
            type uint32;
            description
              "Segment Identifier (SID) - A 20 bit label or
               an index into the SID/Label space.";
          }
        }
        description
          "Adjacency SID sub-tlvs.";
      }
      container lan-adj-sid-sub-tlv {
        description
          "LAN Adj-SID optional sub-TLVs.";
        list lan-adj-sid-sub-tlv {
          description
            "List of LAN Adj-SID sub-TLVs.";
          container lan-adj-sid-flags {
            leaf-list flags {
              type identityref {
                base ospf-sr-mpls:adj-sid-flag;
              }
              description
                "LAN Adj-SID sub-TLV flags.";
            }
            description
              "LAN Adj-SID sub-TLV flags.";
          }
          leaf mt-id {
            type uint8;
            description
              "Multi-topology ID. Topologies range from 0-127 and
               return of any other value would indicate an error.";
            reference
              "RFC 4915 - Multi-Topology (MT) Routing in OSPF";
          }
          leaf weight {
            type uint8;
            description
              "Weight used for load-balancing.";
          }
          leaf neighbor-router-id {
            type rt-types:router-id;
            description
              "Neighbor router ID.";
```

```
          }
          leaf sid {
            type uint32;
            description
              "Segment Identifier (SID) - A 20 bit label or
               an index into the SID/Label space.

               If the  V-Flag is set to 0 and L-Flag is set to 0:
               The SID/Index/Label field is a 4-octet index defining
               the offset in the SID/Label space advertised by this
               router.

               If V-Flag is set to 1 and L-Flag is set to 1: The
               SID/Index/Label field is a 3-octet local label where
               the 20 rightmost bits are used for encoding the label
               value.";
          }
        }
      }

      uses ospf-link-attr:app-specific-link-attr-sub-tlvs;
    }

    grouping ospfv3-member-link-attr-sub-tlvs {
      description
        "OSPFv3 L2 Bundle Member Attributes sub-TLV (RFC 9356).";

      uses ospf-sr-mpls:ospfv3-adj-sid-sub-tlvs;
      uses ospf-sr-mpls:ospfv3-lan-adj-sid-sub-tlvs;
      uses ospf-link-attr:app-specific-link-attr-sub-tlvs;
    }

    /* Configuration */
    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
        description
          "This augments the OSPF routing protocol when used.";
      }
      description
        "This augments the OSPF interface configuration with L2
         Bundle Member Attributes.";

      container l2-mbr-attrs {
        description
          "L2 member attributes configuration.";
```

```
        list l2-mbr-attr {
          key l2-bdl-mbr-dscpr;
          leaf l2-bdl-mbr-dscpr {
            type uint32;
            description
              "L2 bundle member descriptor: a 4-octet link-local
               identifier for the member link.";
          }
          leaf adj-sid {
            type uint32;
            description
              "Value of the Adj-SID.";
          }
          leaf lan-adj-sid {
            type uint32;
            description
              "Value of the LAN-Adj-SID.";
          }
          /* More configuration can be added here */
          description
            "List of L2 bundle members.";
        }
      }

    }

    /* Database */
    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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-opaque/ospf:extended-link-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "OSPFv2 L2 Bundle Member Attributes sub-TLV is
         a sub-TLV of OSPFv2 Extended Link TLV (RFC7684).";

      container l2-bdl-mbr-attr {
        list l2-bdl-mbrs {
          description
            "List of L2 bundle members.";
```

```
          leaf l2-bdl-mbr-dscpr {
            type uint32;
            description
              "L2 bundle member descriptor: a 4-octet link-local
               identifier for the member link.";
          }
          uses ospfv2-member-link-attr-sub-tlvs;
        }
        description
          "OSPFv2 L2 Bundle Member Attributes sub-TLV.";
      }
    }

    augment "/rt:routing/"
         + "rt:control-plane-protocols/rt:control-plane-protocol/"
         + "ospf:ospf/ospf:areas/ospf:area/ospf:database/"
         + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
         + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
         + "ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router/"
         + "ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
           description
             "This augmentation is only valid for OSPFv3
              E-Router LSAs";
         }
      description
        "Augment OSPFv3 Area scope router-link TLV.";

      container l2-bdl-mbr-attr {
        list l2-bdl-mbrs {
          description
            "List of L2 bundle members.";
          leaf l2-bdl-mbr-dscpr {
            type uint32;
            description
              "L2 bundle member descriptor: a 4-octet link-local
               identifier for the member link.";
          }
          uses ospfv3-member-link-attr-sub-tlvs;
        }
        description
          "OSPFv3 L2 Bundle Member Attributes sub-TLV.";
      }
    }
  }
```

9. YANG Module for OSPF Flexible Algorithms: Bandwidth, Delay, Metrics and Constraints

This document defines a YANG module for OSPF Flexible Algorithms: Bandwidth, Delay, Metrics and Constraints [I-D.ietf-lsr-flex-algo-bw-con]. It is an augmentation of the OSPF base model and the Flexible Algorithm YANG module .

```
module: ietf-ospf-flex-algo-bw-con
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:interfaces/ospf:interface:
    +--rw generic-metrics
       +--rw generic-metric* [metric-type]
          +--rw metric-type     identityref
          +--rw metric-value?   uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf
          /ospf-flex-algo:ospf-flex-algo/ospf-flex-algo:flex-algo:
    +--rw bandwidth-constraints
    |  +--rw constraint* [constraint-type]
    |     +--rw constraint-type    identityref
    |     +--rw bandwidth-value?   te-types:te-bandwidth
    |     +--rw threshold?         uint8
    +--rw (metric-derivation-method)?
    |  +--:(reference-bandwidth)
    |  |  +--rw reference-bandwidth
    |  |     +--rw reference-bandwidth?     rt-types:bandwidth-ieee-float32
    |  |     +--rw granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    |  +--:(bandwidth-thresholds)
    |     +--rw bandwidth-thresholds
    |        +--rw bandwidth-threshold* [bandwidth-threshold]
    |           +--rw bandwidth-threshold    rt-types:bandwidth-ieee-float32
    |           +--rw threshold-metric?      uint32
    +--rw exclude-min-bw?              rt-types:bandwidth-ieee-float32
    +--rw exclude-max-delay?           rt-types:uint24
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:te-opaque
          /ospf:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
```

```
          /rt:control-plane-protocol/ospf:ospf/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-inter-as-te:inter-as-te-v2/ospf-inter-as-te:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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-inter-as-te:inter-as-te-v2/ospf-inter-as-te:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body
          /ospf-te:ospfv3-intra-area-te/ospf-te:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body
          /ospf-inter-as-te:inter-as-te-v3/ospf-inter-as-te:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:database
          /ospf:as-scope-lsa-type/ospf:as-scope-lsas
          /ospf:as-scope-lsa/ospf:version/ospf:ospfv3/ospf:ospfv3
          /ospf:body/ospf-inter-as-te:inter-as-te-v3
          /ospf-inter-as-te:link-tlv:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
```

```
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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-opaque/ospf:extended-link-tlv
          /ospf-link-attr:app-specific-link-attr-sub-tlvs:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router
          /ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv
          /ospf-link-attr:app-specific-link-attr-sub-tlvs:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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-opaque/ospf:extended-link-tlv
          /ospf-l2-bundle:l2-bdl-mbr-attr/ospf-l2-bundle:l2-bdl-mbrs:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router
          /ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv
          /ospf-l2-bundle:l2-bdl-mbr-attr/ospf-l2-bundle:l2-bdl-mbrs:
    +--ro generic-metric-sub-tlvs
       +--ro generic-metric-sub-tlv* []
          +--ro metric-type?   identityref
          +--ro value?         uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ri-opaque
          /ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv:
    +--ro faemb-sub-tlv
    |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro faemd-sub-tlv
    |  +--ro max-link-delay?   rt-types:uint24
    +--ro fadrb-sub-tlv
    |  +--ro fadrb-flags*             identityref
    |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
    |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro fadbt-sub-tlv
       +--ro fadbt-flags*           identityref
       +--ro bandwidth-threshold* []
          +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
          +--ro threshold-metric?      uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ri-opaque
          /ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv:
    +--ro faemb-sub-tlv
    |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro faemd-sub-tlv
    |  +--ro max-link-delay?   rt-types:uint24
    +--ro fadrb-sub-tlv
    |  +--ro fadrb-flags*             identityref
    |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
    |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro fadbt-sub-tlv
       +--ro fadbt-flags*           identityref
       +--ro bandwidth-threshold* []
          +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
          +--ro threshold-metric?      uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ri-opaque/ospf-flex-algo:fad-tlvs
          /ospf-flex-algo:fad-tlv:
    +--ro faemb-sub-tlv
    |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro faemd-sub-tlv
    |  +--ro max-link-delay?   rt-types:uint24
    +--ro fadrb-sub-tlv
    |  +--ro fadrb-flags*             identityref
    |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
```

```
    |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro fadbt-sub-tlv
       +--ro fadbt-flags*           identityref
       +--ro bandwidth-threshold* []
          +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
          +--ro threshold-metric?      uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/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:ospfv3
          /ospf:ospfv3/ospf:body/ospf:router-information
          /ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv:
    +--ro faemb-sub-tlv
    |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro faemd-sub-tlv
    |  +--ro max-link-delay?   rt-types:uint24
    +--ro fadrb-sub-tlv
    |  +--ro fadrb-flags*             identityref
    |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
    |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro fadbt-sub-tlv
       +--ro fadbt-flags*           identityref
       +--ro bandwidth-threshold* []
          +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
          +--ro threshold-metric?      uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:areas
          /ospf:area/ospf:database/ospf:area-scope-lsa-type
          /ospf:area-scope-lsas/ospf:area-scope-lsa/ospf:version
          /ospf:ospfv3/ospf:ospfv3/ospf:body/ospf:router-information
          /ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv:
    +--ro faemb-sub-tlv
    |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro faemd-sub-tlv
    |  +--ro max-link-delay?   rt-types:uint24
    +--ro fadrb-sub-tlv
    |  +--ro fadrb-flags*             identityref
    |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
    |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro fadbt-sub-tlv
       +--ro fadbt-flags*           identityref
       +--ro bandwidth-threshold* []
          +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
          +--ro threshold-metric?      uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf/ospf:database
          /ospf:as-scope-lsa-type/ospf:as-scope-lsas/ospf:as-scope-lsa
```

```
         /ospf:version/ospf:ospfv3/ospf:ospfv3/ospf:body
         /ospf:router-information/ospf-flex-algo:fad-tlvs
         /ospf-flex-algo:fad-tlv:
   +--ro faemb-sub-tlv
   |  +--ro min-bandwidth?   rt-types:bandwidth-ieee-float32
   +--ro faemd-sub-tlv
   |  +--ro max-link-delay?   rt-types:uint24
   +--ro fadrb-sub-tlv
   |  +--ro fadrb-flags*             identityref
   |  +--ro reference-bandwidth?     rt-types:bandwidth-ieee-float32
   |  +--ro granularity-bandwidth?   rt-types:bandwidth-ieee-float32
   +--ro fadbt-sub-tlv
      +--ro fadbt-flags*           identityref
      +--ro bandwidth-threshold* []
         +--ro bandwidth-threshold?   rt-types:bandwidth-ieee-float32
         +--ro threshold-metric?      uint32
```

```
<CODE BEGINS> file "ietf-ospf-flex-algo-bw-con@2025-07-06.yang"
module ietf-ospf-flex-algo-bw-con {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-flex-algo-bw-con";
  prefix ospf-flex-algo-bw-con;

  import ietf-routing {
    prefix rt;
    reference "RFC 8349: A YANG Data Model for Routing
               Management (NMDA Version)";
  }

  import ietf-routing-types {
    prefix rt-types;
    reference
      "RFC 8294: Common YANG Data Types for the Routing Area";
  }

  import ietf-te-types {
    prefix te-types;
    reference
      "RFC8776: Common YANG Data Types for Traffic Engineering.";
  }

  import ietf-ospf {
    prefix ospf;
    reference
      "RFC 9129: YANG Data Model for the OSPF Protocol";
  }

  import ietf-ospfv3-extended-lsa {
```

```
     prefix ospfv3-e-lsa;
     reference
       "RFC 9587: YANG Data Model for OSPFv3 Extended Link
                  State Advertisements (LSAs)";
   }

   import ietf-ospf-te {
     prefix ospf-te;
   }

   import ietf-ospf-flex-algo {
     prefix ospf-flex-algo;
     reference
       "RFC XXXX";
   }

   import ietf-ospf-link-attr {
     prefix ospf-link-attr;
   }

   import ietf-ospf-inter-as-te {
     prefix ospf-inter-as-te;
   }

   import ietf-ospf-l2-bundle {
     prefix ospf-l2-bundle;
   }

   import iana-igp-metric-types {
     prefix iana-metric-type;
   }

   organization
     "IETF LSR - Link State Routing Working Group";
   contact
     "WG Web:   <https://datatracker.ietf.org/wg/lsr/>
      WG List:  <mailto:lsr@ietf.org>


      Author:    Yingzhen Qu
                 <mailto:yingzhen.ietf@gmail.com>
      Author:    Acee Lindem
                 <mailto:acee.ietf@gmail.com>
     ";

   description
     "The YANG module defines the configuration and operational
      state for OSPF protocol as defined in
```

```
      draft-ietf-lsr-flex-algo-bw-con, IGP Flexible Algorithms:
      Bandwidth, Delay, Metrics and Constraints

      This YANG model conforms to the Network Management
      Datastore Architecture (NMDA) as described in RFC 8342.

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      Relating to IETF Documents
      (https://trustee.ietf.org/license-info).

      This version of this YANG module is part of RFC XXXX;
      see the RFC itself for full legal notices.

      The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL
      NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED',
      'MAY', and 'OPTIONAL' in this document are to be interpreted as
      described in BCP 14 (RFC 2119) (RFC 8174) when, and only when,
      they appear in all capitals, as shown here.";


   reference "RFC XXXX: YANG Data Model for OSPF Flexible Algorithm.";

   revision 2025-07-06 {
     description
       "Initial Version";
     reference
       "RFC XXXX: OSPF YANG Model Augmentations for Additional
                  Features - Version 1.";
   }

   /* Identities */

   identity bandwidth-constraint-type {
     description
       "Base identity for bandwidth constraint types.";
   }

   identity min-bw {
     base bandwidth-constraint-type;
     description
       "Minimum bandwidth constraint.";
   }
```

```
   identity max-bw {
     base bandwidth-constraint-type;
     description
       "Maximum bandwidth constraint.";
   }

   identity fadrb-flags {
     description
       "Base identity for OSPF Flexible Algorithm Definition
        Reference Bandwidth sub-tlv flags.";
   }

   identity g-bit {
     base fadrb-flags;
     description
       "G bit, when set, interface group mode MUST be used to
        derive total link bandwidth.";
   }

   identity fadbt-flags {
     description
       "Base identity for OSPF Flexible Algorithm Definition
        Reference Bandwidth sub-tlv flags.";
   }

   identity gp-bit {
     base fadbt-flags;
     description
       "G bit, when set, interface group mode MUST be used to
        derive total link bandwidth.";
   }

   /* Groupings */
   grouping bandwidth-constraint {
     description
       "Grouping for bandwidth constraints in Flex-Algo.";
     container bandwidth-constraints {
       list constraint {
         key "constraint-type";
         description
           "List of bandwidth constraints for the Flex-Algo.";
         leaf constraint-type {
           type identityref {
             base bandwidth-constraint-type;
           }
           description
             "Type of bandwidth constraint (e.g., min-bw, max-bw).";
         }
```

```
        leaf bandwidth-value {
          type te-types:te-bandwidth;
          description
            "Bandwidth value for the constraint.";
        }
        leaf threshold {
          type uint8 {
            range "1..100";
          }
          units "percent";
          description
            "Threshold percentage for triggering re-optimization.";
        }
      }
      description
        "Bandwidth constraints configuration for flex-algo.";
    }
  }

  grouping generic-metric-sub-tlv {
    container generic-metric-sub-tlvs {
      list generic-metric-sub-tlv {
        leaf metric-type {
          type identityref {
            base iana-metric-type:metric-type;
          }
            description
              "Type of metric to be used during the calculation.";
        }
        leaf value {
          type uint32;
          description
            "A 32-bit unsigned integer representing the metric value.";
        }
        description
          "The list of generic metric sub-tlvs.";
      }
      description
        "The generic metric sub-tlv.";
    }
    description
      "The grouping for generic metric sub-tlv.";
  }

  grouping faemb-sub-tlv {
    container faemb-sub-tlv {
      leaf min-bandwidth {
        type rt-types:bandwidth-ieee-float32;
```

```
        description
          "A 32-bit field specifying the link bandwidth in IEEE
           floating point format (IEEE754). The units are
           bytes-per-second.";
      }
      description
        "Flex-algo Exclude Minimum Bandwidth sub-tlv (FAEMB).";
    }
    description
      "Grouping for FAEMB sub-tlv.";
  }

  grouping faemd-sub-tlv {
    container faemd-sub-tlv {
      leaf max-link-delay {
        type rt-types:uint24;
        description
          "A 24-bit field specifying the maximum link delay in
           microseconds.";
      }
      description
        "The Flex-algo Exclude Maximum Delay sub-tlv (FAEMD).";
    }
    description
      "Grouping for FAEMD sub-tlv.";
  }

  grouping fadrb-sub-tlv {
    container fadrb-sub-tlv {
      leaf-list fadrb-flags {
        type identityref {
          base fadrb-flags;
        }
        description
          "Flex-algo definition reference bandwidth sub-tlv
           flags list.";
      }
      leaf reference-bandwidth {
        type rt-types:bandwidth-ieee-float32;
        description
          "A 32-bit field specifying the link bandwidth in IEEE
           floating point format (IEEE754). The units are
           bytes-per-second.";
      }
      leaf granularity-bandwidth {
        type rt-types:bandwidth-ieee-float32;
        description
          "A 32-bit field specifying the link bandwidth in IEEE
```

```
            floating point format (IEEE754). The units are
            bytes-per-second.";
        }
        description
          "The Flex-algo Reference Bandwidth sub-tlv (FAEMD).";
      }
      description
        "Grouping for FADRB sub-tlv.";
    }

    grouping fadbt-sub-tlv {
      container fadbt-sub-tlv {
        leaf-list fadbt-flags {
          type identityref {
            base fadbt-flags;
          }
          description
            "Flex-algo definition bandwidth thresholds sub-tlv
             flags list.";
        }
        list bandwidth-threshold {
          leaf bandwidth-threshold {
            type rt-types:bandwidth-ieee-float32;
            description
              "Maximum link bandwidth. A 32-bit field specifying the
               link bandwidth in IEEE floating point format (IEEE754).
               The units are bytes-per-second.";
          }

          leaf threshold-metric {
            type uint32;
            description
              "Metric value range 1 - 4,294,967,296 (0xFFFFFFFF).";
          }
          description
            "List of bandwidth thresholds and metrics.";
        }
        description
          "The Flex-algo Bandwidth Thresholds sub-tlv (FADBT).";
      }
      description
        "Grouping for FADBT sub-tlv.";
    }

    /* Configurations */
    augment "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/ospf:ospf/"
          + "ospf:areas/ospf:area/ospf:interfaces/ospf:interface" {
```

```
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
        description
          "This augments the OSPF interface configuration
           when used.";
      }
      description
        "This augments the OSPF protocol interface
         configuration with generic metric configuration.";

      container generic-metrics {
        list generic-metric {
          key "metric-type";
          leaf metric-type {
            type identityref {
              base iana-metric-type:metric-type;
            }
            description
              "Type of metric to be used during the calculation.";
          }
          leaf metric-value {
            type uint32;
            description
              "Metric value, range is from 0 to 0xFFFFFFFF.";
          }
          description
            "Interface generic metric configuration per metric-type.";
        }
        description
          "Interface generic metric configuration.";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols/"
       + "rt:control-plane-protocol/ospf:ospf/"
       + "ospf-flex-algo:ospf-flex-algo/ospf-flex-algo:flex-algo" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospf')" {
        description
          "This augments the OSPF routing protocol when used.";
      }
      description
        "This augments OSPF protocol Flexible Algorithm with
         bandwidth constraints.";

      uses bandwidth-constraint;

      choice metric-derivation-method {
```

```
      description
        "Choice of automatic metric derivation methods.";
      container reference-bandwidth {
        description
          "Metric is inversely proportional to the link
           bandwidth.";
        leaf reference-bandwidth {
          type rt-types:bandwidth-ieee-float32;
          description
            "A 32-bit field specifying the link bandwidth in IEEE
             floating point format (IEEE754). The units are
             bytes-per-second.";
        }
        leaf granularity-bandwidth {
          type rt-types:bandwidth-ieee-float32;
          description
            "A 32-bit field specifying the link bandwidth in IEEE
             floating point format (IEEE754). The units are
             bytes-per-second.";
        }
      }
      container bandwidth-thresholds {
        description
          "Pre-define non-proportional metric values from the varying
           ranges of link bandwidth.";
        list bandwidth-threshold {
          key bandwidth-threshold;
          leaf bandwidth-threshold {
            type rt-types:bandwidth-ieee-float32;
            description
              "Maximum link bandwidth. A 32-bit field specifying the
               link bandwidth in IEEE floating point format (IEEE754).
               The units are bytes-per-second.";
          }
          leaf threshold-metric {
            type uint32;
            description
              "Metric value range 1 - 4,294,967,296 (0xFFFFFFFF).";
          }
          description
            "List of bandwidth thresholds and metrics.";
        }
      }
    }

    leaf exclude-min-bw {
      type rt-types:bandwidth-ieee-float32;
      description
```

```
        "A 32-bit field specifying the link bandwidth in IEEE
         floating point format (IEEE754). The units are
         bytes-per-second.";
    }

    leaf exclude-max-delay {
      type rt-types:uint24;
      description
        "A 24-bit field specifying the maximum link delay in
         microseconds.";
    }
  }

  /* Database */

  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/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:te-opaque/"
        + "ospf:link-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
      description
        "This augmentation is only valid for OSPFv2.";
    }

    description
      "TE link TLV of OSPF TE LSA.";

    uses generic-metric-sub-tlv;
  }

  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/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-inter-as-te:inter-as-te-v2/"
        + "ospf-inter-as-te:link-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
      description
        "This augmentation is only valid for OSPFv2.";
    }
```

```
      description
        "Area scope TE link TLV of OSPFv2 Inter-AS-TE-v2 LSA.";

      uses generic-metric-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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-inter-as-te:inter-as-te-v2/"
          + "ospf-inter-as-te:link-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augment OSPFv2 routing protocol when used";
      }
      description
        "AS scope TE link TLV of OSPFv2 Inter-AS-TE-v2 LSA.";

      uses generic-metric-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf-te:ospfv3-intra-area-te/"
          + "ospf-te:link-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augmentation is only valid for OSPFv3.";
      }
      description
        "TE Link TLV of OSPFv3 Intra-Area-TE-LSA.";

      uses generic-metric-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
```

```
        + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
        + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
        + "ospf:ospfv3/ospf:body/ospf-inter-as-te:inter-as-te-v3/"
        + "ospf-inter-as-te:link-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
      description
        "This augmentation is only valid for OSPFv3.";
    }
    description
      "Area scope TE Link TLV of OSPFv3 Inter-AS-TE-v3 LSA.";

    uses generic-metric-sub-tlv;
  }

  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/ospf:database/"
        + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
        + "ospf:as-scope-lsa/ospf:version/ospf:ospfv3/"
        + "ospf:ospfv3/ospf:body/ospf-inter-as-te:inter-as-te-v3/"
        + "ospf-inter-as-te:link-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
      description
        "This augmentation is only valid for OSPFv3.";
    }
    description
      "AS scope TE Link TLV of OSPFv3 Inter-AS-TE-v3 LSA.";

    uses generic-metric-sub-tlv;
  }
  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/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-opaque/ospf:extended-link-tlv/"
        + "ospf-link-attr:app-specific-link-attr-sub-tlvs" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
      description
        "This augmentation is only valid for OSPFv2.";
    }
    description
      "OSPF Application-Specific Link Attributes (ASLA) sub-TLV is
```

```
        a sub-TLV of OSPFv2 Extended Link TLV (RFC7684).";

      uses generic-metric-sub-tlv;
    }

    augment "/rt:routing/"
         + "rt:control-plane-protocols/rt:control-plane-protocol/"
         + "ospf:ospf/ospf:areas/ospf:area/ospf:database/"
         + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
         + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
         + "ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router/"
         + "ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv/"
         + "ospf-link-attr:app-specific-link-attr-sub-tlvs" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
           description
             "This augmentation is only valid for OSPFv3
              E-Router LSAs";
         }
      description
        "Application-Specific Link Attributes (ASLA) sub-TLV (RFC9492)
         of the OSPFv3 Router-Link TLV (RFC8362).";

      uses generic-metric-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/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-opaque/ospf:extended-link-tlv/"
          + "ospf-l2-bundle:l2-bdl-mbr-attr/"
          + "ospf-l2-bundle:l2-bdl-mbrs" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
        description
          "This augmentation is only valid for OSPFv2.";
      }
      description
        "OSPFv2 L2 Bundle Member Attributes sub-TLV is
         a sub-TLV of OSPFv2 Extended Link TLV (RFC7684).";

      uses generic-metric-sub-tlv;
    }
```

```
   augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/ospf:areas/ospf:area/ospf:database/"
        + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
        + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
        + "ospf:ospfv3/ospf:body/ospfv3-e-lsa:e-router/"
        + "ospfv3-e-lsa:e-router-tlvs/ospfv3-e-lsa:link-tlv/"
        + "ospf-l2-bundle:l2-bdl-mbr-attr/"
        + "ospf-l2-bundle:l2-bdl-mbrs" {
     when "derived-from(/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
          description
            "This augmentation is only valid for OSPFv3
             E-Router LSAs";
        }
     description
       "OSPFv3 L2 Bundle Member Attributes sub-TLV in
        OSPFv3 Area scope router-link TLV.";

     uses generic-metric-sub-tlv;

   }

   augment "/rt:routing/"
         + "rt:control-plane-protocols/rt:control-plane-protocol/"
         + "ospf:ospf/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:ri-opaque/"
         + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
     when "derived-from(/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
       description
         "This augmentation is only valid for OSPFv2.";
     }

     description
       "Flex-algo definition TLVs for OSPFv2 type 9 opaque RI LSA.";

     uses faemb-sub-tlv;
     uses faemd-sub-tlv;
     uses fadrb-sub-tlv;
     uses fadbt-sub-tlv;
   }

   augment "/rt:routing/"
         + "rt:control-plane-protocols/rt:control-plane-protocol/"
```

```
        + "ospf:ospf/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:ri-opaque/"
        + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
      description
        "This augmentation is only valid for OSPFv2.";
    }

    description
      "Flex-algo definition TLVs for OSPFv2 type 10 opaque RI LSA.";

    uses faemb-sub-tlv;
    uses faemd-sub-tlv;
    uses fadrb-sub-tlv;
    uses fadbt-sub-tlv;
  }

  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/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:ri-opaque/"
        + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv2')" {
      description
        "This augmentation is only valid for OSPFv2.";
    }
    description
      "Flex-algo definition TLVs for OSPFv2 type 11 opaque RI LSA.";

    uses faemb-sub-tlv;
    uses faemd-sub-tlv;
    uses fadrb-sub-tlv;
    uses fadbt-sub-tlv;
  }

  augment "/rt:routing/"
        + "rt:control-plane-protocols/rt:control-plane-protocol/"
        + "ospf:ospf/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:ospfv3/"
```

```
        + "ospf:ospfv3/ospf:body/ospf:router-information/"
        + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augmentation is only valid for OSPFv3.";
      }

      description
        "Flex-algo definition TLVs for OSPFv3 Router
         Information (RI) LSA.";

      uses faemb-sub-tlv;
      uses faemd-sub-tlv;
      uses fadrb-sub-tlv;
      uses fadbt-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:areas/"
          + "ospf:area/ospf:database/"
          + "ospf:area-scope-lsa-type/ospf:area-scope-lsas/"
          + "ospf:area-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf:router-information/"
          + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
      when "derived-from(/rt:routing/rt:control-plane-protocols/"
           + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
        description
          "This augmentation is only valid for OSPFv3.";
      }

      description
        "Flex-algo definition TLVs for OSPFv3 Router
         Information (RI) LSA.";

      uses faemb-sub-tlv;
      uses faemd-sub-tlv;
      uses fadrb-sub-tlv;
      uses fadbt-sub-tlv;
    }

    augment "/rt:routing/"
          + "rt:control-plane-protocols/rt:control-plane-protocol/"
          + "ospf:ospf/ospf:database/"
          + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
          + "ospf:as-scope-lsa/ospf:version/ospf:ospfv3/"
          + "ospf:ospfv3/ospf:body/ospf:router-information/"
```

```
        + "ospf-flex-algo:fad-tlvs/ospf-flex-algo:fad-tlv" {
    when "derived-from(/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rt:type, 'ospf:ospfv3')" {
      description
        "This augmentation is only valid for OSPFv3.";
    }
    description
      "Flex-algo definition TLVs for OSPFv3 Router Information LSA.";

    uses faemb-sub-tlv;
    uses faemd-sub-tlv;
    uses fadrb-sub-tlv;
    uses fadbt-sub-tlv;
  }
}
```

10. Security Considerations

The YANG modules specified in this document define a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC5246].

The NETCONF access control model [RFC6536] provides the means to restrict access for particular NETCONF or RESTCONF users to a pre-configured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in the modules that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations.

Some of the readable data nodes in the modules may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes. The exposure of the Link State Database (LSDB) will expose the detailed topology of the network. This may be undesirable since both due to the fact that exposure may facilitate other attacks. Additionally, network operators may consider their topologies to be sensitive confidential data.

11. IANA Considerations

This document registers URIs in the IETF XML registry [RFC3688]. Following the format in [RFC3688], the following registrations is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-te
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-inter-as-te
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-two-metric
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-grace-linkdown
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-lls-localid
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-msd
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-l2-bundle
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-flex-algo-bw-con
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

This document registers the YANG modules in the YANG Module Names registry [RFC6020].

name: ietf-ospf-te
Maintained by IANA? N
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-te
prefix: ospf-te
reference: RFC XXXX

```
      name: ietf-ospf-inter-as-te
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-inter-as-te
      prefix: ospf-inter-as-te
      reference: RFC XXXX

      name: ietf-ospf-two-metric
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-two-metric
      prefix: ospf-two-metric
      reference: RFC XXXX

      name: ietf-ospf-grace-linkdown
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-grace-linkdown
      prefix: ospf-grace-linkdown
      reference: RFC XXXX

      name: ietf-ospf-lls-localid
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-lls-localid
      prefix: ospf-lls-localid
      reference: RFC XXXX

      name: ietf-ospf-msd
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-msd
      prefix: ospf-msd
      reference: RFC XXXX

      name: ietf-ospf-l2-bundle
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-l2-bundle
      prefix: ospf-l2-bundle
      reference: RFC XXXX

      name: ietf-ospf-flex-algo-bw-con
      Maintained by IANA?  N
      namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-flex-algo-bw-con
      prefix: ospf-flex-algo-bw-con
      reference: RFC XXXX
```

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13. Normative References

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