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OSPF YANG Model Augmentations for Additional Features - Version 1
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Abstract

This document defines YANG data modules augmenting the IETF OSPF YANG model to provide support for Traffic Engineering Extensions to OSPF Version 3 as defined in RF 5329, OSPF Two-Part Metric as defined in RFC 8042, OSPF Graceful Link Shutdown as defined in RFC 8379 and OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement as defined in RFC 8510.

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1. Overview

YANG [RFC6020] [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 [I-D.ietf-ospf-yang], 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].

RFC8042: OSPF Two-Part Metric [RFC8042].

RFC8379: OSPF Graceful Link Shutdown [RFC8379].

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

The augmentations defined in this document requires support for the OSPF base model[I-D.ietf-ospf-yang] which defines basic OSPF configuration and state. The OSPF YANG model augments the ietf-routing YANG model defined in [RFC8022].

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 Extesions to OSPF Version 3

This document defines a YANG module for Traffic Engineering Extensions to OSPF Version 3 as defined in [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: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    inet:ipv4-address
          |  +--ro nbr-router-id       yang:dotted-quad
          +--ro unknown-tlvs
             +--ro unknown-tlv*
                +--ro type?     uint16
                +--ro length?   uint16
                +--ro value?    yang:hex-string
```

```
<CODE BEGINS> file "ietf-ospfv3-te@2020-04-24.yang"
module ietf-ospfv3-te {
yang-version 1.1;
namespace "urn:ietf:params:xml:ns:yang:ietf-ospfv3-te";

prefix ospfv3-te;

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

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

import ietf-ospf {
  prefix "ospf";
}

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

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

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

description
  "This YANG module defines the configuration and operational
  state for OSPFv3 extensions to support intra-area Traffic
  Engineering (TE) as defined in RFC 5329.
```

```
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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 2020-04-24 {
     description
       "Initial version";
     reference
       "RFC XXXX: A YANG Data Model for OSPFv3 TE.";
   }

   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 singel 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 identitification.";
          leaf nbr-interface-id {
            type inet:ipv4-address;
            mandatory true;
            description "The neighbor's interface ID.";
          }
          leaf nbr-router-id {
            type yang:dotted-quad;
            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.";
    }
  }

  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 Intrea-Area-TE-LSA.";

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

3. 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@2020-04-24.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";
     }

     import ietf-ospf {
       prefix "ospf";
     }

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

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

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

         Author:   Yingzhen Qu
                   <mailto:yqu@futurewei.com>
         Author:   Acee Lindem
                   <mailto:acee@cisco.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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        This version of this YANG module is part of RFC XXXX;
        see the RFC itself for full legal notices.";

     reference "RFC XXXX";

     revision 2020-04-24 {
       description
         "Initial version";
```

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

    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>
```

4. 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@2020-10-31.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";
  }

  import ietf-routing {
    prefix "rt";
  }

  import ietf-ospf {
    prefix "ospf";
  }

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

```
      prefix "ospfv3-e-lsa";
    }

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

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

        Author:   Yingzhen Qu
                  <mailto:yqu@futurewei.com>
        Author:   Acee Lindem
                  <mailto:acee@cisco.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 2020-10-31 {
      description
        "Initial version";
      reference
        "RFC XXXX: A YANG Data Model for OSPF.";
    }


    /* 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>
```

5. 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@2020-04-24.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";
  }

  import ietf-ospf {
    prefix "ospf";
  }

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

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

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

     reference "RFC XXXX";

     revision 2020-04-24 {
       description
         "Initial version";
       reference
         "RFC XXXX: A YANG Data Model for OSPF.";
     }

     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>

6. YANG Module for OSPF Application-Specific Link Attributes

This document defines a YANG module for OSPF Application-Specific Link Attributes feature as defined in [I-D.ietf-ospf-te-link-attr-reuse]. It is an augmentation of the OSPF base model.

```
module: ietf-ospf-link-attr
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/ospf:ospf:
    +--rw ospf-link-attr
       +--rw (link-attr-op-mode)
          +--:(legacy)
          |  +--rw legacy?         empty
          +--:(transition)
          |  +--rw transition?     empty
          +--:(app-specific)
             +--rw app-specific?   empty
  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 application-specific-link-attributes-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 application-specific-link-attributes-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-link-attr@2020-10-31.yang"
module ietf-ospf-link-attr {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-link-attr";

  prefix ospf-link-attr;

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

  import ietf-ospf {
    prefix "ospf";
  }

  import ietf-ospfv3-extended-lsa {
    prefix "ospfv3-e-lsa";
  }

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

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

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

  description
    "This YANG module defines the configuration and operational
```

```
     state for OSPF application specific link attributes feature
     as defined in RFC xxxx.

     This YANG model conforms to the Network Management
     Datastore Architecture (NMDA) 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.

     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";

  revision 2020-10-31 {
    description
      "Initial version";
    reference
      "RFC XXXX: A YANG Data Model for OSPF application specific
      link attributes.";
  }

  identity sabm-bit {
    description
      "Base identity for sabm bits.";
  }

  identity rsvp-te-bit {
    base sabm-bit;
    description
      "R bit, RSVP-TE.";
  }

  identity sr-policy-bit {
    base sabm-bit;
```

```
    description
      "S bit, Segment Routing Policy.";
  }

  identity lfa-bit {
    base sabm-bit;
    description
      "F bit, Loop Free Alternate (LFA). Includes all LFA types.";
  }

  grouping application-specific-link-attributes-sub-tlvs {
    description
      "OSPF Application-Specific Link Attributes (ASLA) sub-TLV.
       The ASLA sub-TLV is a sub-TLV of the OSPFv2 Extended Link
       TLV [RFC7684] and OSPFv3 Router-Link TLV [RFC8362].";

    container application-specific-link-attributes-sub-tlvs {
      description "Application-Specific Link Attributes sub-TLV.";
      list asla-sub-tlvs {
        leaf sabm-length {
          type uint8;
          description
            "Standard Application Identifier Bit Mask Length in
             octets.";
        }
        leaf udabm-length {
          type uint8;
          description
          "User Defined Application Identifier Bit Mask Length
          in octets.";
        }
        container sabm {
          leaf-list sabm-bits {
            type identityref {
              base sabm-bit;
            }
            description
              "SABM bits list. This list will contain
               identities for the bits which are set in the
               SABA bits.";
          }
          description
            "Standard Application Identifier Bit Mask.";
        }
        container udabm {
          description
            "User Defined Application Identifier Bit Mask.
             This container is to be augmented by user defined
```

```
             applications.";
        }
        container link-attributes-sub-sub-tlvs {
          uses ospf:unknown-tlvs;
          description
            "Link Attributes sub-sub-TLVs.";
        }
        description
          "List of application-Specific Link Attributes sub-TLVs.";
      }
    }
  }

  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 OSPF protocol configuration
       with application-specific link attributes.";

    container ospf-link-attr {
      choice link-attr-op-mode {
        mandatory "true";
        leaf legacy {
          type empty;
          description
            "Only send legacy advertisements.";
        }
        leaf transition {
          type empty;
          description
            "Send both application-specific and legacy advertisements.";
        }
        leaf app-specific{
          type empty;
          description
            "Only send application-specific advertisements.";
        }
        description
          "Link attributes mode";
      }
      description
        "Link attributes operation mode.";
    }
```

```
  }

  /* 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 Application-Specific Link Attributes (ASLA) sub-TLV is
       a sub-TLV of OSPFv2 Extended Link TLV (RFC7684).";

    uses application-specific-link-attributes-sub-tlvs;
  }

  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 application-specific-link-attributes-sub-tlvs;
  }
}
  <CODE ENDS>
```

7. 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.

8. 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-ospfv3-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-link-attr
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-ospfv3-te
namespace: urn:ietf:params:xml:ns:yang:ietf-ospfv3-te
prefix: ospfv3-te
reference: RFC XXXX

name: ietf-ospf-two-metric
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-two-metric
prefix: ospf-two-metric
reference: RFC XXXX

name: ietf-ospf-grace-linkdown
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-grace-linkdown
prefix: ospf-grace-linkdown
reference: RFC XXXX

name: ietf-ospf-lls-localid
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-lls-localid
prefix: ospf-lls-localid
reference: RFC XXXX

name: ietf-ospf-link-attr
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-link-attr
prefix: ospf-link-attr
reference: RFC XXXX
```

9. Acknowledgements

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

The YANG model was developed using the suite of YANG tools written and maintained by numerous authors.

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