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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, 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 8920, and OSPF Flexible Algorithm.

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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 [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].

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].

RFC8920: OSPF Application-Specific Link Attributes [RFC8920].

RFC9350: IGP Flexible Algorithm [RFC9350].

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 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-addr
  | +--ro local-if-ipv6-addr*    inet:ipv6-address
+--ro remote-if-ipv6-addr
  | +--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@2023-06-27.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";
    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 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 2023-06-27 {
  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 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 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 Intra-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@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>

```

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@2023-06-27.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";
}

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 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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    (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 Graceful Link Shutdown.";
}

/* 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 Extension 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@2023-06-27.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:yqu@futurewei.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 2023-06-27 {  
  description  
    "Initial version";  
  reference  
    "RFC XXXX: A YANG Data Model for OSPF Link-Local Signaling  
      (LLS) Extensions for Local Interface ID  
      Advertisement.";  
}
```

```
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 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:interfaces/ospf:interface/ospf:database
  /ospf:link-scope-lsa-type/ospf:link-scope-lsas
  /ospf:link-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
  /ospf:body/ospf:opaque/ospf:extended-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: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:database
  /ospf:as-scope-lsa-type/ospf:as-scope-lsas/ospf:as-scope-lsa
  /ospf:version/ospf:ospfv2/ospf:ospfv2/ospf:body/ospf:opaque
  /ospf:extended-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:
+--ro link-msd-sub-tlv
  +--ro link-msds* [msd-type]
    +--ro msd-type      identityref
    +--ro msd-value?    uint8

```

```
<CODE BEGINS> file "ietf-ospf-msd@2023-06-27.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;
  }

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

    Author:   Yingzhen Qu
              <mailto:yingzhen.qu@futurewei.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.

    Copyright (c) 2023 IETF Trust and the persons identified as
    authors of the code.  All rights reserved.
```

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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 2023-06-27 {
  description
    "Initial Version";
  reference "RFC XXXX: YANG Data Model for OSPF MSD.";
}
```

```
identity msd-base-type {
  description
    "Base identity for MSD Type";
}
```

```
identity base-mpls-msd {
  base msd-base-type;
  description
    "Base MPLS Imposition MSD.";
  reference
    "RFC 8491: Singling MSD using IS-IS.";
}
```

```
identity erld-msd {
  base msd-base-type;
  description
    "ERLD-MSD is defined to advertise the ERLD.";
  reference
    "RFC 8662: Entropy Label for Source Packet Routing in
      Networking (SPRING) Tunnels";
}
```

```
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 msd-base-type;
      }
      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 msd-base-type;
        }
        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:interfaces/ospf:interface/ospf:database/"
    + "ospf:link-scope-lsa-type/ospf:link-scope-lsas/"
    + "ospf:link-scope-lsa/ospf:version/ospf:ospfv2/"
    + "ospf:ospfv2/ospf:body/ospf:opaque/"
    + "ospf:extended-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: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:database/"
    + "ospf:as-scope-lsa-type/ospf:as-scope-lsas/"
    + "ospf:as-scope-lsa/ospf:version/ospf:ospfv2/"
    + "ospf:ospfv2/ospf:body/ospf:opaque/"
    + "ospf:extended-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" {
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>

```

7. YANG Module for OSPF Application-Specific Link Attributes

This document defines a YANG module for OSPF Application-Specific Link Attributes feature as defined in [RFC8920]. 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@2023-06-27.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";
    reference "RFC 9129 - YANG Data Model for the OSPF
              Protocol";
  }

  import ietf-ospfv3-extended-lsa {

```

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

  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>
    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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    authors of the code.  All rights reserved.

    Redistribution and use in source and binary forms, with or
    without modification, is permitted pursuant to, and subject to
    the license terms contained in, the Revised BSD License set
    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.

    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 2023-06-27 {
    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.";
      }
    }
  }
}
```

```
        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>

```

8. YANG Module for OSPF Flexible Algorithm

This document defines a YANG module for OSPF Flexible Algorithm as defined in [RFC9350]. It is an augmentation of the OSPF base model.

```

module: ietf-ospf-flex-algo
augment /rt:routing/rt:control-plane-protocols
/rt:control-plane-protocol/ospf:ospf:
  +--rw ospf-flex-algo
    +--rw flex-algo* [algo-number]
      +--rw algo-number          uint8
      +--rw advertise-definition? boolean
      +--rw admin-groups {te-types:extended-admin-groups,
                          te-types:named-extended-admin-groups}?
      | +--rw exclude-admin-groups* -> /te:te/globals
      |                               /named-admin-groups
      |                               /named-admin-group/name
      | +--rw include-any-admin-groups* -> /te:te/globals
      |                               /named-admin-groups
      |                               /named-admin-group/name
      | +--rw include-all-admin-groups* -> /te:te/globals
      |                               /named-admin-groups
      |                               /named-admin-group/name
      +--rw exclude-srlgs*       -> /te:te/globals/named-srlgs
      |                           /named-srlg/name
      |                           {te-types:named-srlg-groups}?
      +--rw fast-reroute?        boolean
      +--rw metric-type?         identityref
      +--rw microloop-avoidance? boolean
      +--rw prefix-metric!
      +--rw priority?            uint8
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:
+---ro fad-tlvs
+---ro fad-tlv* []
+---ro flex-algo?          uint8
+---ro metric-type?        identityref
+---ro calc-type?          uint8
+---ro priority?           uint8
+---ro fa-ex-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fa-in-any-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fa-in-all-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fad-flags-sub-tlv
|   +---ro fad-flags*  identityref
+---ro fa-ex-srlg-sub-tlv
|   +---ro srlgs*  uint32
+---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:ospfv2/ospf:ospfv2
    /ospf:body/ospf:opaque/ospf:ri-opaque:
+---ro fad-tlvs
+---ro fad-tlv* []
+---ro flex-algo?          uint8
+---ro metric-type?        identityref
+---ro calc-type?          uint8
+---ro priority?           uint8
+---ro fa-ex-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fa-in-any-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fa-in-all-ag-sub-tlv
|   +---ro extended-admin-groups*  uint64
+---ro fad-flags-sub-tlv
|   +---ro fad-flags*  identityref
+---ro fa-ex-srlg-sub-tlv
|   +---ro srlgs*  uint32
+---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
/ospf:ri-opaque:
+---ro fad-tlvs
+---ro fad-tlv* []
    +---ro flex-algo?          uint8
    +---ro metric-type?        identityref
    +---ro calc-type?          uint8
    +---ro priority?           uint8
    +---ro fa-ex-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64
    +---ro fa-in-any-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64
    +---ro fa-in-all-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64
    +---ro fad-flags-sub-tlv
    | +---ro fad-flags*  identityref
    +---ro fa-ex-srlg-sub-tlv
    | +---ro srlgs*  uint32
    +---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: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:
+---ro fad-tlvs
+---ro fad-tlv* []
    +---ro flex-algo?          uint8
    +---ro metric-type?        identityref
    +---ro calc-type?          uint8
    +---ro priority?           uint8
    +---ro fa-ex-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64
    +---ro fa-in-any-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64
    +---ro fa-in-all-ag-sub-tlv
    | +---ro extended-admin-groups*  uint64

```

```

    +---ro fad-flags-sub-tlv
    |   +---ro fad-flags*   identityref
    +---ro fa-ex-srlg-sub-tlv
    |   +---ro srlgs*      uint32
    +---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/ospf:router-information:
+---ro fad-tlvs
+---ro fad-tlv* []
    +---ro flex-algo?          uint8
    +---ro metric-type?        identityref
    +---ro calc-type?          uint8
    +---ro priority?           uint8
    +---ro fa-ex-ag-sub-tlv
    |   +---ro extended-admin-groups*   uint64
    +---ro fa-in-any-ag-sub-tlv
    |   +---ro extended-admin-groups*   uint64
    +---ro fa-in-all-ag-sub-tlv
    |   +---ro extended-admin-groups*   uint64
    +---ro fad-flags-sub-tlv
    |   +---ro fad-flags*   identityref
    +---ro fa-ex-srlg-sub-tlv
    |   +---ro srlgs*      uint32
    +---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
/ospf:router-information:
+---ro fad-tlvs
+---ro fad-tlv* []
    +---ro flex-algo?          uint8
    +---ro metric-type?        identityref
    +---ro calc-type?          uint8
    +---ro priority?           uint8
    +---ro fa-ex-ag-sub-tlv
    |   +---ro extended-admin-groups*   uint64

```

```

    +--ro fa-in-any-ag-sub-tlv
    |   +--ro extended-admin-groups*   uint64
    +--ro fa-in-all-ag-sub-tlv
    |   +--ro extended-admin-groups*   uint64
    +--ro fad-flags-sub-tlv
    |   +--ro fad-flags*   identityref
    +--ro fa-ex-srlg-sub-tlv
    |   +--ro srlgs*   uint32
    +--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:interfaces/ospf:interface/ospf:database
/ospf:link-scope-lsa-type/ospf:link-scope-lsas
/ospf:link-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
/ospf:body/ospf:opaque/ospf:extended-prefix-opaque
/ospf:extended-prefix-tlv:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
+--ro flex-algo?   uint8
+--ro fapm-flags*   identityref
+--ro 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:extended-prefix-opaque
/ospf:extended-prefix-tlv:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
+--ro flex-algo?   uint8
+--ro fapm-flags*   identityref
+--ro 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:extended-prefix-opaque/ospf:extended-prefix-tlv:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
+--ro flex-algo?   uint8
+--ro fapm-flags*   identityref
+--ro 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-e-lsa:e-inter-area-prefix
        /ospfv3-e-lsa:e-inter-prefix-tlvs
        /ospfv3-e-lsa:inter-prefix-tlv:
+---ro fapm-sub-tlvs
+---ro fapm-sub-tlv* []
+---ro flex-algo?      uint8
+---ro fapm-flags*    identityref
+---ro 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
        /ospfv3-e-lsa:e-as-external/ospfv3-e-lsa:e-external-tlvs
        /ospfv3-e-lsa:external-prefix-tlv:
+---ro fapm-sub-tlvs
+---ro fapm-sub-tlv* []
+---ro flex-algo?      uint8
+---ro fapm-flags*    identityref
+---ro 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:
+---ro eia-asbr-opaque
+---ro eia-asbr-tlv
|   +---ro asbr-rtr-id?      rt-types:router-id
|   +---ro faam-sub-tlvs
|   |   +---ro faam-sub-tlv* []
|   |   |   +---ro flex-algo?      uint8
|   |   |   +---ro metric?        uint32
|   +---ro unknown-tlvs
|   |   +---ro unknown-tlv* []
|   |   |   +---ro type?          uint16
|   |   |   +---ro length?       uint16
|   |   |   +---ro value?        yang:hex-string
+---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-inter-area-router

```

```
        /ospfv3-e-lsa:e-inter-router-tlvs
        /ospfv3-e-lsa:inter-router-tlv:
+---ro faam-sub-tlvs
    +---ro faam-sub-tlv* []
        +---ro flex-algo?   uint8
        +---ro metric?      uint32

<CODE BEGINS> file "ietf-ospf-flex-algo@2023-01-02.yang"
module ietf-ospf-flex-algo {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-flex-algo";
  prefix ospf-flex-algo;

  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";
  }

  import ietf-te {
    prefix "te";
  }

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


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

Author: Yingzhen Qu
<<mailto:yingzhen.qu@futurewei.com>>
Author: Acee Lindem
<<mailto:acee.ietf@gmail.com>>
Author: Stephane Litkowski
<<mailto:slitkows.ietf@gmail.com>>

";

description

"The YANG module defines the configuration and operational state for OSPF Flexible Algorithm 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: YANG Data Model for OSPF Flexible Algorithm.";

```
revision 2023-06-27 {  
  description  
    "Initial Version";  
  reference  
    "RFC XXXX: YANG Data Model for OSPF Flexible Algorithm.";  
}
```

```
/* Identities */

identity metric-type {
  description
    "Base identity for route metric types.";
}

identity igp-metric {
  base metric-type;
  description
    "Identity for the IGP metric type.";
}

identity min-uni-delay {
  base metric-type;
  description
    "Min unidirectional link delay metric type.";
  reference
    "RFC 7471 - OSPF Traffic Engineering (TE) Metric Extensions";
}

identity te-metric {
  base metric-type;
  description
    "Traffic engineering metric type.";
  reference
    "RFC 3630 - Traffic Engineering (TE) Extensions to OSPF
      Version 2";
}

identity fad-flags {
  description
    "Base identity for OSPF FAD flags.";
}

identity m-bit {
  base fad-flags;
  description
    "M bit, when set, the fex-algo specific prefix and ASBR
      metric MUST be used for inter-area and external prefix
      calculation.";
}

identity fapm-flags {
  description
    "Base identity for OSPF flex-algo prefix metric flags.";
}
```

```
identity e-bit {
  base fapm-flags;
  description
    "External metric, if set, the metric specified is a
    type 2 external metric.";
}

/* Groupings */
grouping fa-ex-ag-sub-tlv {
  container fa-ex-ag-sub-tlv {
    leaf-list extended-admin-groups {
      type uint64;
      description
        "Extended administrative group as defined in RFC 7308.";
    }
    description
      "The flex-algo exclude admin group sub-tlv.";
  }
  description
    "The flex-algo exclude admin group sub-tlv.";
}

grouping fa-in-any-ag-sub-tlv {
  container fa-in-any-ag-sub-tlv {
    leaf-list extended-admin-groups {
      type uint64;
      description
        "Extended administrative group as defined in RFC 7308.";
    }
    description
      "The flex-algo include-any admin group sub-tlv.";
  }
  description
    "The flex-algo include-any admin group sub-tlv.";
}

grouping fa-in-all-ag-sub-tlv {
  container fa-in-all-ag-sub-tlv {
    leaf-list extended-admin-groups {
      type uint64;
      description
        "Extended administrative group as defined in RFC 7308.";
    }
    description
      "The flex-algo include-all admin group sub-tlv.";
  }
  description
    "The flex-algo include-all admin group sub-tlv.";
}
```

```
    }

    grouping fad-flags-sub-tlv {
      container fad-flags-sub-tlv {
        leaf-list fad-flags {
          type identityref {
            base fad-flags;
          }
          description
            "Flex-algo definition flags list.";
        }
        description
          "OSPF flex-algo definition flags.";
      }
      description
        "The flex-algo definition flags sub-tlv.";
    }

    grouping fa-ex-srlg-sub-tlv {
      container fa-ex-srlg-sub-tlv {
        leaf-list srlgs {
          type uint32;
          description
            "SRLG value as defined in RFC 4203.";
        }
        description
          "The flex-algo exclude SRLG sub-tlv.";
      }
      description
        "The flex-algo exclude SRLG sub-tlv.";
    }

    grouping fad-tlvs {
      container fad-tlvs {
        list fad-tlv {
          leaf flex-algo {
            type uint8;
            description
              "Flex-algo number, value between 128 and 255 inclusive.";
          }
          leaf metric-type {
            type identityref {
              base metric-type;
            }
            description
              "Type of metric to be used during the calculation.";
          }
          leaf calc-type {
```

```
    type uint8 {
      range "0..127";
    }
    description
      "IGP algorithm types, value from 0 to 127 as
      defined under 'Interior Gateway Protocol (IGP)
      Parameter' by IANA.";
  }
  leaf priority {
    type uint8;
    description
      "Priority of the advertisement.";
  }

  uses fa-ex-ag-sub-tlv;
  uses fa-in-any-ag-sub-tlv;
  uses fa-in-all-ag-sub-tlv;
  uses fad-flags-sub-tlv;
  uses fa-ex-srlg-sub-tlv;
  uses ospf:unknown-tlvs;

  description
    "List of flex-algo definition TLVs.";
}
description
  "OSPF Flexible Algorithm Definition TLV.";
}
description
  "OSPF Flexible Algorithm Definition (FAD) TLV.";
}

grouping fapm-sub-tlvs {
  container fapm-sub-tlvs {
    list fapm-sub-tlv {
      leaf flex-algo {
        type uint8;
        description
          "Flex-algo number, value between 128 and 255
          inclusive.";
      }
    }
    leaf-list fapm-flags {
      type identityref {
        base fapm-flags;
      }
      description
        "Flex-algo prefix metric flags list.";
    }
    leaf metric {
```

```
        type uint32;
        description
            "Prefix metric.";
    }
    description
        "List of flex-algo prefix sub-tlvs.";
}
description
    "Flex-algo prefix metric sub-tlvs.";
}
description
    "Flexible Algorithm Prefix Metric (FAPM) sub-TLVs.";
}

grouping faam-sub-tlvs {
    container faam-sub-tlvs {
        list faam-sub-tlv {
            leaf flex-algo {
                type uint8;
                description
                    "Flex-algo number, value between 128 and 255
                    inclusive.";
            }
            leaf metric {
                type uint32;
                description
                    "Prefix metric.";
            }
            description
                "List of faam sub-tlvs.";
        }
        description
            "Flexible Algorithm ASBR Metric (FAAM) Sub-TLVs.";
    }
    description
        "Flexible Algorithm ASBR Metric (FAAM) Sub-TLVs.";
}

/* Configurations */

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 with Flexible Algorithm.";

```
container ospf-flex-algo {
  list flex-algo {
    key "algo-number";

    leaf algo-number {
      type uint8 {
        range "128..255";
      }
      description
        "An identifier in the range 128-255 that's associated
        with the Flexible Algorithm Definition.";
    }

    leaf advertise-definition {
      type boolean;
      default true;
      description
        "Enable to advertise the flex-algo definition.";
    }
  }

  container admin-groups {
    if-feature "te-types:extended-admin-groups";
    if-feature "te-types:named-extended-admin-groups";
    leaf-list exclude-admin-groups {
      type leafref {
        path "/te:te/te:globals/te:named-admin-groups/"
          + "te:named-admin-group/te:name";
      }
      description
        "Exclude rule used during the flex-algo
        path computation.";
    }
    leaf-list include-any-admin-groups {
      type leafref {
        path "/te:te/te:globals/te:named-admin-groups/"
          + "te:named-admin-group/te:name";
      }
      description
        "Include-any rule used during the flex-algo
        path computation.";
    }
    leaf-list include-all-admin-groups {
      type leafref {
        path "/te:te/te:globals/te:named-admin-groups/"
```

```
        + "te:named-admin-group/te:name";
    }
    description
        "Include-all rule used during the flex-algo
        path computation.";
    }
    description
        "Specify links for the flex-algo path computation.";
}

leaf-list exclude-srlgs {
    if-feature "te-types:named-srlg-groups";
    type leafref {
        path "/te:te/te:globals/te:named-srlgs/te:named-srlg/"
            + "te:name";
    }
    description
        "Shared Risk Link Groups (SRLGs) to be excluded during
        the flex-algo path computation.";
}

leaf fast-reroute {
    type boolean;
    default true;
    description
        "Enable fast reroute.";
}

leaf metric-type {
    type identityref {
        base metric-type;
    }
    description
        "Type of metric to be used during the calculation.";
}

leaf microloop-avoidance {
    type boolean;
    default true;
    description
        "Enable microloop avoidance.";
}

container prefix-metric {
    presence
        "Use flex-algo specific prefix metric.";
    description
        "Use flex-algo prefix metric.";
```



```

    }

    leaf priority {
      type uint8;
      description
        "Priority of the advertisement.";
    }

    description
      "List of flex-algo configurations.";
  }
  description
    "Flexible Algorithm configuration.";
}

/* 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:ri-opaque" {
  when "../.../.../.../.../.../.../.../.../.../..."
  + "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 fad-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:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/ospf:ri-opaque" {
  when "../.../.../.../.../.../.../.../.../.../..."
  + "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 fad-tlvs;
  }

  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
      "Flex-algo definition TLVs for OSPFv2 type 11 opaque RI LSA.";

    uses fad-tlvs;
  }

  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" {
    when "../.../.../.../.../.../.../.../.../.../.../"
      + "rt:type = 'ospf:ospfv3'" {
      description
        "This augmentation is only valid for OSPFv3.";
    }
  }

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

  uses fad-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/ospf:router-information" {
when "../.../.../.../.../.../.../.../.../..."
    + "rt:type = 'ospf:ospfv3'" {
    description
        "This augmentation is only valid for OSPFv3.";
    }

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

    uses fad-tlvs;
}

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
    "Flex-algo definition TLVs for OSPFv3 Router Information LSA.";

    uses fad-tlvs;
}

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:extended-prefix-opaque/ospf:extended-prefix-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../..."
    + "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
    }
description

```

```

    "Flex-algo prefix metric sub-TLVs for OSPFv2 extended
    prefix TLV in type 9 opaque LSA.";
    uses fapm-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:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque/"
+ "ospf:extended-prefix-opaque/ospf:extended-prefix-tlv" {
when "../../../../../../../../../../../../../../../"
+ "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
}
description
    "Flex-algo prefix metric sub-TLVs for OSPFv2 extended
    prefix TLV in type 10 opaque LSA.";
    uses fapm-sub-tlvs;
}

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:extended-prefix-opaque/"
+ "ospf:extended-prefix-tlv" {
when "../../../../../../../../../../../"
+ "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
}
description
    "Flex-algo prefix metric sub-TLVs for OSPFv2 extended
    prefix TLV in type 11 opaque LSA.";
    uses fapm-sub-tlvs;
}

/* Flex-algo prefix metric Sub-TLV in OSPFv3 Inter-Area
   Prefix 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-inter-area-prefix/"
+ "ospfv3-e-lsa:e-inter-prefix-tlvs/"
+ "ospfv3-e-lsa:inter-prefix-tlv" {
when "../.../.../.../.../.../.../.../.../.../.../..."
+ "rt:type = 'ospf:ospfv3'" {
  description
    "This augmentation is only valid for OSPFv3
    E-Router LSAs";
}
uses fapm-sub-tlvs;
description
  "OSPFv3 Area-Scoped Inter-Area Prefix TLV.";
}

/* Flex-algo prefix metric Sub-TLV in OSPFv3 External Prefix 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/ospfv3-e-lsa:e-as-external/"
+ "ospfv3-e-lsa:e-external-tlvs/"
+ "ospfv3-e-lsa:external-prefix-tlv" {
when "'ospf:../.../.../.../.../.../.../.../.../.../.../..."
+ "rt:type' = 'ospf:ospfv3'" {
  description
    "This augmentation is only valid for OSPFv3.";
}
uses fapm-sub-tlvs;
description
  "OSPFv3 AS-Scoped External Prefix TLV.";
}

/* OSPFv2 Extended Inter-Area ASBR 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:ospfv2/"
+ "ospf:ospfv2/ospf:body/ospf:opaque" {
when "../.../.../.../.../.../.../.../.../.../.../..."
+ "rt:type = 'ospf:ospfv2'" {
  description
    "This augmentation is only valid for OSPFv2.";
}
}

```

```

    description
      "OSPFv2 Extended Inter-Area ASBR LSA in type 10
       opaque LSA.";

    container eia-asbr-opaque {
      container eia-asbr-tlv {
        leaf asbr-rtr-id {
          type rt-types:router-id;
          description
            "The OSPF Router ID of the ASBR.";
        }
        uses faam-sub-tlvs;
        uses ospf:unknown-tlvs;
        description
          "EIA-ASBR TLV, used to advertise additional attributes
           associated with the reachability of an ASBR.";
      }
      uses ospf:unknown-tlvs;

      description
        "OSPFv2 Extended Inter-Area (EIA-ASBR) opaque LSA.";
    }
  }

/* FAAM Sub-TLV in OSPFv3 Inter-Area-Router 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-inter-area-router/"
+ "ospfv3-e-lsa:e-inter-router-tlvs/"
+ "ospfv3-e-lsa:inter-router-tlv" {
  when "../.../.../.../.../.../.../.../.../.../..."
  + "rt:type = 'ospf:ospfv3'" {
    description
      "This augmentation is only valid for OSPFv3
       Inter-Area-Router TLV.";
  }
  uses faam-sub-tlvs;
  description
    "OSPFv3 Area-Scoped Inter-Area-Router TLV.";
}
}
<CODE ENDS>

```

9. 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.

10. 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-msd
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.

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-flex-algo
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-msd
namespace: urn:ietf:params:xml:ns:yang:ietf-ospf-msd
prefix: ospf-msd
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


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

11. Acknowledgements

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