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YANG Data Model for OSPF Segment Routing

Abstract

This document defines a YANG data module that can be used to configure and manage OSPF Extensions for Segment Routing. It also defines a module for management of Signaling Maximum SID Depth (MSD) Using OSPF.

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1. Overview

YANG [[RFC7950](#)] is a data definition language used to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [[RFC6241](#)]. YANG is proving relevant beyond its initial confines, as bindings to other interfaces (e.g., ReST) and encodings other than XML (e.g., JSON) are being defined. Furthermore, YANG data models can be used as the basis for implementation of other interfaces, such as CLI and programmatic APIs.

This document defines a YANG data model that can be used to configure and manage OSPFv2 extensions for Segment Routing [[RFC8665](#)] and it is an augmentation to the OSPF YANG data model.

This document also defines a YANG data model for Signaling Maximum SID Depth (MSD) Using OSPF [[RFC8476](#)], which augments the base OSPF YANG data model.

The YANG module in this document conforms to the Network Management Datastore Architecture (NMDA) [[RFC8342](#)].

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](#)].

1.2. Tree Diagrams

This document uses the graphical representation of data models defined in [[RFC8340](#)].

2. OSPF 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

```

2.1. OSPF MSD YANG Module

<CODE BEGINS> file "ietf-ospf-msd@2022-01-02.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;
  }

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

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

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

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

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

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```

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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 MSD.";

```
revision 2022-01-02 {  
  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.";
    }
}
}

```



```

        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>

3. OSPF Segment Routing

This document defines a model for OSPF Segment Routing feature [[RFC8665](#)]. It is an augmentation of the OSPF base model.

The OSPF SR YANG module requires support for the base segment routing module [[RFC9020](#)], which defines the global segment routing configuration independent of any specific routing protocol configuration, and support of OSPF base model [[I-D.ietf-ospf-yang](#)] which defines basic OSPF configuration and state.

```

module: ietf-ospf-sr
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf:
    +--rw segment-routing
    |   +--rw enabled?      boolean
    |   +--rw bindings {mapping-server}?
    |   |   +--rw advertise
    |   |   |   +--rw policies* -> /rt:routing/sr:segment-routing
    |   |   |   |   /sr-mpls:sr-mpls/bindings
    |   |   |   |   /mapping-server/policy/name
    |   |   +--rw receive?    boolean
    +--rw protocol-srgb {sr-mpls:protocol-srgb}?
    |   +--rw srgb* [lower-bound upper-bound]
    |   |   +--rw lower-bound    uint32
    |   |   +--rw upper-bound    uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
    /ospf:interfaces/ospf:interface:
    +--rw segment-routing
    |   +--rw adjacency-sid
    |   |   +--rw adj-sids* [value]
    |   |   |   +--rw value-type?    enumeration
    |   |   |   +--rw value          uint32
    |   |   |   +--rw protected?     boolean
    |   |   |   +--rw weight?        uint8
    |   |   +--rw advertise-adj-group-sid* [group-id]
    |   |   |   +--rw group-id        uint32
    |   |   +--rw advertise-protection?    enumeration
    +--rw ti-lfa {ti-lfa}?
    |   +--rw enable?    boolean
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
    /ospf:interfaces/ospf:interface/ospf:fast-reroute:
    +--rw ti-lfa {ti-lfa}?
    |   +--rw enable?    boolean
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:
    +--ro extended-prefix-range-tlvs
    |   +--ro extended-prefix-range-tlv* []
    |   |   +--ro prefix-length?          uint8
    |   |   +--ro af?                    uint8
    |   |   +--ro range-size?             uint16
    |   |   +--ro extended-prefix-range-flags
    |   |   |   +--ro bits*    identityref
    |   |   +--ro prefix?          inet:ip-prefix
    |   |   +--ro prefix-sid-sub-tlvs
    |   |   |   +--ro prefix-sid-sub-tlv* []

```

```

|      +--ro prefix-sid-flags
|      | +--ro bits*   identityref
|      +--ro mt-id?      uint8
|      +--ro algorithm?  uint8
|      +--ro sid?        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:extended-prefix-opaque:
+--ro extended-prefix-range-tlvs
    +--ro extended-prefix-range-tlv* []
        +--ro prefix-length?      uint8
        +--ro af?                  uint8
        +--ro range-size?          uint16
        +--ro extended-prefix-range-flags
            | +--ro bits*   identityref
        +--ro prefix?              inet:ip-prefix
        +--ro prefix-sid-sub-tlvs
            | +--ro prefix-sid-sub-tlv* []
            | +--ro prefix-sid-flags
            | | +--ro bits*   identityref
            | +--ro mt-id?      uint8
            | +--ro algorithm?  uint8
            | +--ro sid?        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:extended-prefix-opaque:
+--ro extended-prefix-range-tlvs
    +--ro extended-prefix-range-tlv* []
        +--ro prefix-length?      uint8
        +--ro af?                  uint8
        +--ro range-size?          uint16
        +--ro extended-prefix-range-flags
            | +--ro bits*   identityref
        +--ro prefix?              inet:ip-prefix
        +--ro prefix-sid-sub-tlvs

```

```

| +--ro prefix-sid-sub-tlv* []
|   +--ro prefix-sid-flags
|     | +--ro bits* identityref
|     +--ro mt-id?          uint8
|     +--ro algorithm?      uint8
|     +--ro sid?            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 prefix-sid-sub-tlvs
  +--ro prefix-sid-sub-tlv* []
  +--ro prefix-sid-flags
  | +--ro bits* identityref
  +--ro mt-id?          uint8
  +--ro algorithm?      uint8
  +--ro sid?            uint32
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
  /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
  /ospf:area-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
  /ospf:body/ospf:opaque/ospf:extended-prefix-opaque
  /ospf:extended-prefix-tlv:
+--ro prefix-sid-sub-tlvs
  +--ro prefix-sid-sub-tlv* []
  +--ro prefix-sid-flags
  | +--ro bits* identityref
  +--ro mt-id?          uint8
  +--ro algorithm?      uint8
  +--ro sid?            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 prefix-sid-sub-tlvs
  +--ro prefix-sid-sub-tlv* []
  +--ro prefix-sid-flags
  | +--ro bits* identityref
  +--ro mt-id?          uint8
  +--ro algorithm?      uint8

```



```

    +--ro sid?                uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
    /ospf:database/ospf:area-scope-lsa-type/ospf:area-scope-lsas
    /ospf:area-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
    /ospf:body/ospf:opaque/ospf:extended-link-opaque
    /ospf:extended-link-tlv:
+--ro adj-sid-sub-tlvs
| +--ro adj-sid-sub-tlv* []
|   +--ro adj-sid-flags
|   | +--ro bits*      identityref
|   +--ro mt-id?        uint8
|   +--ro weight?        uint8
|   +--ro sid?          uint32
+--ro lan-adj-sid-sub-tlvs
    +--ro lan-adj-sid-sub-tlv* []
    +--ro lan-adj-sid-flags
    | +--ro bits*      identityref
    +--ro mt-id?        uint8
    +--ro weight?        uint8
    +--ro neighbor-router-id? yang:dotted-quad
    +--ro sid?          uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
    /ospf:interfaces/ospf:interface/ospf:database
    /ospf:link-scope-lsa-type/ospf:link-scope-lsas
    /ospf:link-scope-lsa/ospf:version/ospf:ospfv2/ospf:ospfv2
    /ospf:body/ospf:opaque/ospf:ri-opaque:
+--ro sr-algorithm-tlv
| +--ro sr-algorithm*      uint8
+--ro sid-range-tlvs
| +--ro sid-range-tlv* []
|   +--ro range-size?      uint24
|   +--ro sid-sub-tlv
|   | +--ro sid?          uint32
+--ro local-block-tlvs
| +--ro local-block-tlv* []
|   +--ro range-size?      uint24
|   +--ro sid-sub-tlv
|   | +--ro sid?          uint32
+--ro srms-preference-tlv
    +--ro preference?      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:ri-opaque:
+--ro sr-algorithm-tlv
| +--ro sr-algorithm*      uint8

```

```

+--ro sid-range-tlvs
| +--ro sid-range-tlv* []
|   +--ro range-size?   uint24
|   +--ro sid-sub-tlv
|     +--ro sid?   uint32
+--ro local-block-tlvs
| +--ro local-block-tlv* []
|   +--ro range-size?   uint24
|   +--ro sid-sub-tlv
|     +--ro sid?   uint32
+--ro srms-preference-tlv
  +--ro preference?   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 sr-algorithm-tlv
| +--ro sr-algorithm*   uint8
+--ro sid-range-tlvs
| +--ro sid-range-tlv* []
|   +--ro range-size?   uint24
|   +--ro sid-sub-tlv
|     +--ro sid?   uint32
+--ro local-block-tlvs
| +--ro local-block-tlv* []
|   +--ro range-size?   uint24
|   +--ro sid-sub-tlv
|     +--ro sid?   uint32
+--ro srms-preference-tlv
  +--ro preference?   uint8

```

3.1. OSPF Segment Routing YANG Module

<CODE BEGINS> file "ietf-ospf-sr@2022-01-02.yang"

```
module ietf-ospf-sr {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospf-sr";

  prefix ospf-sr;

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

  import ietf-segment-routing-common {
    prefix "sr-cmn";
    reference "RFC 9020 - YANG Data Model for Segment
              Routing";
  }

  import ietf-segment-routing-mpls {
    prefix "sr-mpls";
    reference "RFC 9020 - YANG Data Model for Segment
              Routing";
  }

  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>

    Editor:   Derek Yeung
              <mailto:derek@arrcus.com>
    Author:   Derek Yeung
              <mailto:derek@arrcus.com>
    Author:   Yingzhen Qu
              <mailto:yingzhen.qu@futurewei.com>
```

Author: Acee Lindem
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Author: Ing-Wher Chen
<mailto:ingwherchen@mitre.org>
Author: Greg Hankins
<mailto:greg.hankins@alcatel-lucent.com>;

description

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

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 (<https://www.rfc-editor.org/info/rfcXXXX>); 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.

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

reference "RFC XXXX";

revision 2022-01-02 {
 description
 "Initial revision."
 reference

```

    "RFC XXXX: A YANG Data Model for OSPF Segment Routing.";
}

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

identity prefix-sid-bit {
    description
        "Base identity for prefix sid sub-tlv bits.";
}

identity np-bit {
    base prefix-sid-bit;
    description
        "No-PHP flag.";
}

identity m-bit {
    base prefix-sid-bit;
    description
        "Mapping server flag.";
}

identity e-bit {
    base prefix-sid-bit;
    description
        "Explicit-NULL flag.";
}

identity v-bit {
    base prefix-sid-bit;
    description
        "Value/Index flag.";
}

identity l-bit {
    base prefix-sid-bit;
    description
        "Local flag.";
}

identity extended-prefix-range-bit {
    description
        "Base identity for extended prefix range TLV bits.";
}

identity ia-bit {

```

```

    base extended-prefix-range-bit;
    description
        "Inter-Area flag. If set, advertisement is of inter-area type.";
}

identity adj-sid-bit {
    description
        "Base identity for adj sid sub-tlv bits.";
}

identity b-bit {
    base adj-sid-bit;
    description
        "Backup flag.";
}

identity vi-bit {
    base adj-sid-bit;
    description
        "Value/Index flag.";
}

identity lo-bit {
    base adj-sid-bit;
    description
        "Local/Global flag.";
}

identity g-bit {
    base adj-sid-bit;
    description
        "Group flag.";
}

identity p-bit {
    base adj-sid-bit;
    description
        "Persistent flag.";
}

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

/* Groupings */
grouping sid-sub-tlv {

```

```

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

```

```

grouping prefix-sid-sub-tlvs {
    description "Prefix Segment ID (SID) sub-TLVs.";
    container prefix-sid-sub-tlvs {
        description "Prefix SID sub-TLV.";
        list prefix-sid-sub-tlv {
            description "Prefix SID sub-TLV.";
            container prefix-sid-flags {
                leaf-list bits {
                    type identityref {
                        base prefix-sid-bit;
                    }
                    description
                        "Prefix SID Sub-TLV flag bits list.";
                }
                description "Segment Identifier (SID) Flags.";
            }
            leaf mt-id {
                type uint8;
                description "Multi-topology ID.";
            }
            leaf algorithm {
                type uint8;
                description
                    "The algorithm associated with the prefix-SID.";
            }
            leaf sid {
                type uint32;
                description "An index or label.";
            }
        }
    }
}
}

```

```

grouping extended-prefix-range-tlvs {
    description "Extended prefix range TLV grouping.";
}

```



```

container extended-prefix-range-tlvs {
  description "The list of range of prefixes.";
  list extended-prefix-range-tlv {
    description "The range of prefixes.";
    leaf prefix-length {
      type uint8;
      description "Length of prefix in bits.";
    }
    leaf af {
      type uint8;
      description "Address family for the prefix.";
    }
    leaf range-size {
      type uint16;
      description "The number of prefixes covered by the
        advertisement.";
    }
    container extended-prefix-range-flags {
      leaf-list bits {
        type identityref {
          base extended-prefix-range-bit;
        }
        description "Extended prefix range TLV flags list.";
      }
      description "Extended Prefix Range TLV flags.";
    }
    leaf prefix {
      type inet:ip-prefix;
      description "Address prefix.";
    }
    uses prefix-sid-sub-tlvs;
    uses ospf:unknown-tlvs;
  }
}

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

```

```

grouping sid-range-tlvs {
    description "SID Range TLV grouping.";
    container sid-range-tlvs {
        description "List of SID range TLVs.";
        list sid-range-tlv {
            description "SID range TLV.";
            leaf range-size {
                type uint24;
                description "The SID range.";
            }
            uses sid-sub-tlv;
        }
    }
}

grouping local-block-tlvs {
    description "The SR local block TLV contains the
                range of labels reserved for local SIDs.";
    container local-block-tlvs {
        description "List of SRLB TLVs.";
        list local-block-tlv {
            description "SRLB TLV.";
            leaf range-size {
                type uint24;
                description "The SID range.";
            }
            uses sid-sub-tlv;
        }
    }
}

grouping srms-preference-tlv {
    description "The SRMS preference TLV is used to advertise
                a preference associated with the node that acts
                as an SR Mapping Server.";
    container srms-preference-tlv {
        description "SRMS Preference TLV.";
        leaf preference {
            type uint8 {
                range "0 .. 255";
            }
            description "SRMS preference TLV, value from 0 to 255.";
        }
    }
}

/* Configuration */
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
    with segment routing.";
uses sr-mpls:sr-control-plane;
container protocol-srgb {
    if-feature sr-mpls:protocol-srgb;
    uses sr-cmn:srgb;
    description
        "Per-protocol SRGB.";
}
}

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.";

    uses sr-mpls:igp-interface;
}

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

container ti-lfa {
    if-feature ti-lfa;
    leaf enable {

```

```

        type boolean;
        description
            "Enables TI-LFA computation.";
    }
    description
        "Topology Independent Loop Free Alternate
        (TI-LFA) support.";
    }
}

/* 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:extended-prefix-opaque" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../.../..."
    + "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
    }
    description
        "SR specific TLVs for OSPFv2 extended prefix LSA
        in type 9 opaque LSA.";

    uses extended-prefix-range-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" {
when "../.../.../.../.../.../.../.../.../.../.../.../.../..."
    + "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
    }
    description
        "SR specific TLVs for OSPFv2 extended prefix LSA
        in type 10 opaque LSA.";

    uses extended-prefix-range-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" {
when "../../../../../../../../../../../"
+ "rt:type = 'ospf:ospfv2'" {
description
"This augmentation is only valid for OSPFv2.";
}
description
"SR specific TLVs for OSPFv2 extended prefix LSA
in type 11 opaque LSA.";

uses extended-prefix-range-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
"SR specific TLVs for OSPFv2 extended prefix TLV
in type 9 opaque LSA.";
uses prefix-sid-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
        "SR specific TLVs for OSPFv2 extended prefix TLV
        in type 10 opaque LSA.";
    uses prefix-sid-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
        "SR specific TLVs for OSPFv2 extended prefix TLV
        in type 11 opaque LSA.";
    uses prefix-sid-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-link-opaque/ospf:extended-link-tlv" {
when "../.../.../.../.../.../.../.../.../.../..."
    + "rt:type = 'ospf:ospfv2'" {
    description
        "This augmentation is only valid for OSPFv2.";
    }
    description
        "SR specific TLVs for OSPFv2 extended link TLV
        in type 10 opaque LSA.";

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

```

```

    container adj-sid-flags {
        leaf-list bits {
            type identityref {
                base adj-sid-bit;
            }
            description "Adj sid sub-tlv flags list.";
        }
        description "Adj-sid sub-tlv flags.";
    }
    leaf mt-id {
        type uint8;
        description "Multi-topology ID.";
    }
    leaf weight {
        type uint8;
        description "Weight used for load-balancing.";
    }
    leaf sid {
        type uint32;
        description "Segment Identifier (SID) index/label.";
    }
}

}

container lan-adj-sid-sub-tlvs {
    description "LAN Adjacency SID optional sub-TLVs.";
    list lan-adj-sid-sub-tlv {
        description "List of LAN adjacency SID sub-TLVs.";
        container lan-adj-sid-flags {
            leaf-list bits {
                type identityref {
                    base adj-sid-bit;
                }
                description "LAN adj sid sub-tlv flags list.";
            }
            description "LAN adj-sid sub-tlv flags.";
        }
        leaf mt-id {
            type uint8;
            description "Multi-topology ID.";
        }
        leaf weight {
            type uint8;
            description "Weight used for load-balancing.";
        }
        leaf neighbor-router-id {
            type yang:dotted-quad;
            description "Neighbor router ID.";
        }
    }
}

```

```

    leaf sid {
        type uint32;
        description "Segment Identifier (SID) index/label.";
    }
}
}
}

augment "/rt:routing/"
+ "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
    "SR specific TLVs for OSPFv2 type 9 opaque LSA.";

uses sr-algorithm-tlv;
uses sid-range-tlvs;
uses local-block-tlvs;
uses srms-preference-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
    "SR specific TLVs for OSPFv2 type 10 opaque LSA.";

uses sr-algorithm-tlv;
uses sid-range-tlvs;
uses local-block-tlvs;

```



```

    uses srms-preference-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
    "SR specific TLVs for OSPFv2 type 11 opaque LSA.";

    uses sr-algorithm-tlv;
    uses sid-range-tlvs;
    uses local-block-tlvs;
    uses srms-preference-tlv;
}
}

<CODE ENDS>

```

4. 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 [RFC8446].

The NETCONF Configuration Access Control model (NACM) [RFC8341] 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. These are the subtrees and data nodes and their sensitivity/vulnerability:

`/ospf:ospf/segment-routing/enabled` - Modification to the enablement for SR could result in a Denial-of-Service (Dos) attack. If an attacker disables SR, it will cause traffic disruption.

`/ospf:ospf/segment-routing/bindings` - Modification to the local bindings could result in a Denial-of-Service (Dos) attack.

`/ospf:ospf/protocol-srgb` - Modification of the protocol SRGB could be used to mount a DoS attack. For example, if the protocol SRGB size is reduced to a very small value, a lot of existing segments could no longer be installed leading to a traffic disruption.

`/ospf:interfaces/ospf:interface/segment-routing` - Modification of the Adjacency Segment Identifier (Adj-SID) could be used to mount a DoS attack. Change of an Adj-SID could be used to redirect traffic.

`/ospf:interfaces/ospf:interface/ospf:fast-reroute/ti-lfa` - Modification of the TI-LFA enablement could lead to traffic disruption.

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.

Both module `ietf-ospf-sr` and `ietf-ospf-msd` augment base OSPF module data base with various TLVs. Knowledge of these data nodes can be used to attack other routers in the OSPF domain.

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6. IANA Considerations

This document registers a URI in the IETF XML registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registration is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-ospf-sr
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.

This document registers a YANG module in the YANG Module Names registry [[RFC6020](#)].

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

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

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