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YANG Model for OSPFv3 Extended LSAs

Abstract

This document defines a YANG data model augmenting the IETF OSPF YANG model to provide support for OSPFv3 Link State Advertisement (LSA) Extensibility as defined in RFC 8362. OSPFv3 Extended LSAs provide extensible TLV-based LSAs for the base LSA types defined in RFC 5340.

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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 augmenting the IETF OSPF YANG model [[RFC9129](#)], which itself augments [[RFC8349](#)], to provide support for configuration and operational state for OSPFv3 Extended LSAs as defined in [[RFC8362](#)].

The YANG modules in this document conform 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](#)] [[RFC8174](#)].

2. Tree Diagrams

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

3. OSPFv3 Extended LSAs

This document defines a model for the OSPFv3 Extended LSA feature. It is an augmentation of the OSPF base model provided support for OSPFv3 Link State Advertisement (LSA) Extensibility [[RFC8362](#)].

OSPFv3 Extended LSAs provide extensible TLV-based LSAs for the base LSA types defined in [[RFC5340](#)].

The OSPFv3 Extended LSA YANG module 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 [[RFC8022](#)]. The augmentations defined in the ietf-ospfv3-extended-lsa YANG model will provide global configuration, area configuration, and addition of OSPFv3 Extended LSAs to the Link State Database (LSDB) operational state.

```

module: ietf-ospfv3-extended-lsa
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf:
    +-rw extended-lsa-support?    boolean
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area:
    +-rw extended-lsa-support?    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:ospfv3
    /ospf:ospfv3/ospf:body:
+-ro e-link
    +-ro rtr-priority?    uint8
    +-ro lsa-options
    | +-ro lsa-options*    identityref
    +-ro e-link-tlvs* []
        +-ro unknown-tlv
        | +-ro type?        uint16
        | +-ro length?      uint16
        | +-ro value?       yang:hex-string
    +-ro intra-prefix-tlv
    | +-ro intra-prefix-tlv-length?    uint16
    | +-ro metric?                    rt-types:uint24
    | +-ro prefix?                    inet:ip-prefix
    | +-ro prefix-options
    | | +-ro prefix-options*    identityref
    | +-ro prefix-length?        uint8
    | +-ro sub-tlvs* []
    |     +-ro unknown-sub-tlv
    |         +-ro type?        uint16
    |         +-ro length?      uint16
    |         +-ro value?       yang:hex-string
    +-ro ipv6-link-local-tlv
    | +-ro ipv6-link-local-tlv-length?    uint16
    | +-ro link-local-address?            inet:ipv6-address
    | +-ro sub-tlvs* []
    |     +-ro unknown-sub-tlv
    |         +-ro type?        uint16
    |         +-ro length?      uint16
    |         +-ro value?       yang:hex-string
    +-ro ipv4-link-local-tlv
        +-ro ipv4-link-local-tlv-length?    uint16
        +-ro link-local-address?            inet:ipv4-address
        +-ro sub-tlvs* []
            +-ro unknown-sub-tlv
                +-ro type?        uint16
                +-ro length?      uint16

```

```

        +--ro value?      yang:hex-string
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area
    /ospf:database/ospf:area-scope-lsa-type
    /ospf:area-scope-lsas/ospf:area-scope-lsa
    /ospf:version/ospf:ospfv3/ospf:ospfv3/ospf:body:
+--ro e-router
| +--ro router-bits
| | +--ro rtr-lsa-bits*  identityref
| +--ro lsa-options
| | +--ro lsa-options*  identityref
| +--ro e-router-tlvs* []
|   +--ro unknown-tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16
|   | +--ro value?     yang:hex-string
|   +--ro link-tlv
|   | +--ro link-tlv-length?      uint16
|   | +--ro interface-id?         uint32
|   | +--ro neighbor-interface-id? uint32
|   | +--ro neighbor-router-id?   rt-types:router-id
|   | +--ro type?                 uint8
|   | +--ro metric?              uint16
|   | +--ro sub-tlvs* []
|   |   +--ro unknown-sub-tlv
|   |   | +--ro type?      uint16
|   |   | +--ro length?    uint16
|   |   | +--ro value?     yang:hex-string
+--ro e-network
| +--ro lsa-options
| | +--ro lsa-options*  identityref
| +--ro e-network-tlvs* []
|   +--ro unknown--tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16
|   | +--ro value?     yang:hex-string
|   +--ro attached-router-tlv
|   | +--ro attached-router-tlv-length?  uint16
|   | +--ro Adjacent-neighbor-router-id* rt-types:router-id
|   | +--ro sub-tlvs* []
|   |   +--ro unknown-sub-tlv
|   |   | +--ro type?      uint16
|   |   | +--ro length?    uint16
|   |   | +--ro value?     yang:hex-string
+--ro e-inter-area-prefix
| +--ro e-inter-prefix-tlvs* []
|   +--ro unknown--tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16

```

```

|   | +--ro value?      yang:hex-string
| +--ro inter-prefix-tlv
|   +--ro inter-prefix-tlv-length?  uint16
|   +--ro metric?                  rt-types:uint24
|   +--ro prefix?                  inet:ip-prefix
|   +--ro prefix-options
|   | +--ro prefix-options*  identityref
|   +--ro prefix-length?        uint8
|   +--ro sub-tlvs* []
|       +--ro unknown-sub-tlv
|           +--ro type?      uint16
|           +--ro length?    uint16
|           +--ro value?     yang:hex-string
+--ro e-inter-area-router
| +--ro e-inter-router-tlvs* []
|   +--ro unknown-tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16
|   | +--ro value?     yang:hex-string
|   +--ro inter-router-tlv
|       +--ro inter-router-tlv-length?  uint16
|       +--ro router-bits
|       | +--ro rtr-lsa-bits*  identityref
|       +--ro lsa-options
|       | +--ro lsa-options*  identityref
|       +--ro metric?          rt-types:uint24
|       +--ro destination-router-id?  rt-types:router-id
|       +--ro sub-tlvs* []
|           +--ro unknown-sub-tlv
|               +--ro type?      uint16
|               +--ro length?    uint16
|               +--ro value?     yang:hex-string
+--ro e-intra-area-prefix
+--ro referenced-ls-type?      uint16
+--ro referenced-link-state-id?  uint32
+--ro referenced-adv-router?    rt-types:router-id
+--ro e-intra-prefix-tlvs* []
+--ro unknown-tlv
| +--ro type?      uint16
| +--ro length?    uint16
| +--ro value?     yang:hex-string
+--ro intra-prefix-tlv
+--ro intra-prefix-tlv-length?  uint16
+--ro metric?                  rt-types:uint24
+--ro prefix?                  inet:ip-prefix
+--ro prefix-options
| +--ro prefix-options*  identityref
+--ro prefix-length?        uint8
+--ro sub-tlvs* []

```

```

        +--ro unknown-sub-tlv
            +--ro type?      uint16
            +--ro length?    uint16
            +--ro value?     yang:hex-string
augment /rt:routing/rt:control-plane-protocols
/rt:control-plane-protocol/ospf:ospf/ospf:database
/ospf:as-scope-lsa-type/ospf:as-scope-lsas
/ospf:as-scope-lsa/ospf:version/ospf:ospfv3
/ospf:ospfv3/ospf:body:
+--ro e-as-external
| +--ro e-external-tlvs* []
|   +--ro unknown-tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16
|   | +--ro value?     yang:hex-string
|   +--ro external-prefix-tlv
|   | +--ro external-prefix-tlv-length?  uint16
|   | +--ro flags
|   | | +--ro ospfv3-e-external-prefix-bits*  identityref
|   | +--ro metric?                          rt-types:uint24
|   | +--ro prefix?                          inet:ip-prefix
|   | +--ro prefix-options
|   | | +--ro prefix-options*  identityref
|   | +--ro prefix-length?          uint8
|   | +--ro sub-tlvs* []
|   |   +--ro unknown-sub-tlv
|   |   | +--ro type?      uint16
|   |   | +--ro length?    uint16
|   |   | +--ro value?     yang:hex-string
|   |   +--ro ipv6-fwd-addr-sub-tlv
|   |   | +--ro ipv6-fwd-addr-sub-tlv-length?  uint16
|   |   | +--ro forwarding-address?          inet:ipv6-address
|   |   +--ro ipv4-fwd-addr-sub-tlv
|   |   | +--ro ipv4-fwd-addr-sub-tlv-length?  uint16
|   |   | +--ro forwarding-address?          inet:ipv4-address
|   |   +--ro route-tag-sub-tlv
|   |   | +--ro route-tag-sub-tlv-length?  uint16
|   |   | +--ro route-tag?                uint32
+--ro e-nssa
| +--ro e-external-tlvs* []
|   +--ro unknown-tlv
|   | +--ro type?      uint16
|   | +--ro length?    uint16
|   | +--ro value?     yang:hex-string
|   +--ro external-prefix-tlv
|   | +--ro external-prefix-tlv-length?  uint16
|   | +--ro flags
|   | | +--ro ospfv3-e-external-prefix-bits*  identityref
|   | +--ro metric?                          rt-types:uint24

```

```
+--ro prefix?                               inet:ip-prefix
+--ro prefix-options
| +--ro prefix-options*   identityref
+--ro prefix-length?      uint8
+--ro sub-tlvs* []
  +--ro unknown-sub-tlv
  | +--ro type?      uint16
  | +--ro length?    uint16
  | +--ro value?     yang:hex-string
  +--ro ipv6-fwd-addr-sub-tlv
  | +--ro ipv6-fwd-addr-sub-tlv-length?  uint16
  | +--ro forwarding-address?            inet:ipv6-address
  +--ro ipv4-fwd-addr-sub-tlv
  | +--ro ipv4-fwd-addr-sub-tlv-length?  uint16
  | +--ro forwarding-address?            inet:ipv4-address
  +--ro route-tag-sub-tlv
    +--ro route-tag-sub-tlv-length?  uint16
    +--ro route-tag?                 uint32
```

Figure 1

4. OSPFv3 Extended LSA Yang Module

The following RFCs and drafts are not referenced in the document text but are referenced in the `ietf-ospfv3-extended-lsa.yang` module: [[RFC6991](#)], [[RFC8294](#)].

```

<CODE BEGINS> file "ietf-ospfv3-extended-lsa@2023-02-22.yang"
module ietf-ospfv3-extended-lsa {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-ospfv3-extended-lsa";

  prefix ospfv3-e-lsa;

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

  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 YYYY - A YANG Data Model for OSPF
              Protocol";
  }

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

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

    Author:   Acee Lindem
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    Author:   Sharmila Palani
              <mailto:sharmila.palani@microsoft.com>
    Author:   Yingzhen Qu
              <mailto:yingzhen.qu@futurewei.com>";

  description
    "This YANG module defines the configuration
    and operational state for OSPFv3 Extended LSAs, which is
    common across all of the vendor implementations. The
    semantics and encodings for OSPFv3 Extended LSAs is

```

described in RFC 8362.

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.";

reference "RFC XXXX - YANG Model for OSPFv3 Extended LSAs";

```
revision 2023-02-22 {  
  description  
    "Initial revision."  
  reference  
    "RFC XXXX: A YANG Data Model for OSPFv3 Extended LSAs."  
}
```

```
/*  
 * OSPFv3 Extend LSA Type Identities  
 */  
identity ospfv3-e-router-lsa {  
  base ospf:ospfv3-lsa-type;  
  description  
    "OSPFv3 Extended Router LSA - Type 0xA021";  
  reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)  
    Extensibility, Section 4.1";  
}
```

```
identity ospfv3-e-network-lsa {  
  base ospf:ospfv3-lsa-type;  
  description  
    "OSPFv3 Extended Network LSA - Type 0xA022";  
  reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
```

```

        Extensibility, Section 4.2";
    }

identity ospfv3-e-summary-lsa-type {
    base ospf:ospfv3-lsa-type;
    description
        "OSPFv3 Extended Summary LSA types";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.3 and Section 4.4";
}

identity ospfv3-e-inter-area-prefix-lsa {
    base ospfv3-e-summary-lsa-type;
    description
        "OSPFv3 Extended Inter-area Prefix LSA - Type 0xA023";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.3";
}

identity ospfv3-e-inter-area-router-lsa {
    base ospfv3-e-summary-lsa-type;
    description
        "OSPFv3 Extended Inter-area Router LSA - Type 0xA024";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.3";
}

identity ospfv3-e-external-lsa-type {
    base ospf:ospfv3-lsa-type;
    description
        "OSPFv3 Extended External LSA types";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.5 and Section 4.6";
}

identity ospfv3-e-as-external-lsa {
    base ospfv3-e-external-lsa-type;
    description
        "OSPFv3 Extended AS-External LSA - Type 0xC025";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.5";
}

identity ospfv3-e-nssa-lsa {
    base ospfv3-e-external-lsa-type;
    description
        "OSPFv3 Extended Not-So-Stubby-Area (NSSA) LSA -
        Type 0xA027";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)

```

```

        Extensibility, Section 4.6";
    }

identity ospfv3-e-link-lsa {
    base ospf:ospfv3-lsa-type;
    description
        "OSPFv3 Extended Link LSA - Type 0x8028";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.7";
}

identity ospfv3-e-intra-area-prefix-lsa {
    base ospf:ospfv3-lsa-type;
    description
        "OSPFv3 Extended Intra-area Prefix LSA - Type 0xA029";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.8";
}

identity ospfv3-e-prefix-option {
    description
        "Base identity for OSPFv3 Prefix Options.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity nu-bit {
    base ospfv3-e-prefix-option;
    description
        "When set, the prefix should be excluded
        from IPv6 unicast calculations.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity la-bit {
    base ospfv3-e-prefix-option;
    description
        "When set, the prefix is actually an IPv6 interface
        address of the Advertising Router.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity p-bit {
    base ospfv3-e-prefix-option;
    description
        "When set, the NSSA area prefix should be
        translated to an AS External LSA and advertised

```

```

        by the translating NSSA Border Router.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity dn-bit {
    base ospfv3-e-prefix-option;
    description
        "When set, the inter-area-prefix LSA or
        AS-external LSA prefix has been advertised as an
        L3VPN prefix.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity n-bit {
    base ospfv3-e-prefix-option;
    description
        "When set, the prefix is a host address that identifies
        the advertising router.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
}

identity ospfv3-e-external-prefix-option {
    description
        "Base identity for OSPFv3 External Prefix Options.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.6";
}

identity e-bit {
    base ospfv3-e-external-prefix-option;
    description
        "When set, the metric specified is a Type 2
        external metric.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.6";
}

grouping unknown-sub-tlv {
    description
        "Unknown TLV grouping";
    container unknown-sub-tlv {
        uses ospf:tlv;
        description "Unknown External TLV Sub-TLV";
    }
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 6.3";
}

```

```

}

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

    leaf prefix {
        type inet:ip-prefix;
        description
            "LSA Prefix";
    }
    container prefix-options {
        leaf-list prefix-options {
            type identityref {
                base ospfv3-e-prefix-option;
            }
            description
                "OSPFv3 prefix option flag list. This list will
                contain the identities for the OSPFv3 options
                that are set for the OSPFv3 prefix.";
        }
        description "Prefix options.";
        reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.1";
    }

    leaf prefix-length {
        type uint8 {
            range "0..128";
        }
        description "Prefix length.";
    }
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3";
}

grouping ipv6-fwd-addr-sub-tlv {
    container ipv6-fwd-addr-sub-tlv {
        description
            "IPv6 Forwarding Address Sub-TLV";
        leaf ipv6-fwd-addr-sub-tlv-length {
            type uint16;
            description
                "IPv6 Forwarding Addrss Sub-TLV Length - 16
                for IPv6 address";
        }
        leaf forwarding-address {
            type inet:ipv6-address;
            description

```

```

        "Forwarding address";
    }
}
description
    "IPv6 Forwarding Address Sub-TLV grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3.10";
}

grouping ipv4-fwd-addr-sub-tlv {
    container ipv4-fwd-addr-sub-tlv {
        description
            "IPv4 Forwarding Address Sub-TLV";
        leaf ipv4-fwd-addr-sub-tlv-length {
            type uint16;
            description
                "IPv4 Forwarding Addrss Sub-TLV Length - 4
                for IPv4 address";
        }
        leaf forwarding-address {
            type inet:ipv4-address;
            description
                "Forwarding address";
        }
    }
}
description
    "IPv4 Forwarding Address Sub-TLV grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3.11";
}

grouping route-tag-sub-tlv {
    container route-tag-sub-tlv {
        description
            "Route Tag Sub-TLV";
        leaf route-tag-sub-tlv-length {
            type uint16;
            description
                "Route Tag Sub-TLV Length - 4 for 32-bit tag";
        }
        leaf route-tag {
            type uint32;
            description
                "Route Tag";
        }
    }
}
description
    "Route Tag Sub-TLV grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)

```

```

        Extensibility, Section 3.12";
    }

    grouping external-prefix-tlv {
        container external-prefix-tlv {
            description "External Prefix LSA TLV";
            leaf external-prefix-tlv-length {
                type uint16;
                description
                    "External Prefix TLV Length - Variable dependent
                     on sub-TLVs";
            }
            container flags {
                leaf-list ospfv3-e-external-prefix-bits {
                    type identityref {
                        base ospfv3-e-external-prefix-option;
                    }
                    description "OSPFv3 external-prefix TLV bits list.";
                }
                description "External Prefix Flags";
            }
            leaf metric {
                type rt-types:uint24;
                description "External Prefix Metric";
            }
        }
        uses ospfv3-lsa-prefix;
        list sub-tlvs {
            description "External Prefix TLV Sub-TLVs";
            uses unknown-sub-tlv;
            uses ipv6-fwd-addr-sub-tlv;
            uses ipv4-fwd-addr-sub-tlv;
            uses route-tag-sub-tlv;
        }
    }
    description "External Prefix TLV Grouping";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 3.6";
}

grouping intra-area-prefix-tlv {
    container intra-prefix-tlv {
        description "Intra-Area Prefix LSA TLV";
        leaf intra-prefix-tlv-length {
            type uint16;
            description
                "Intra-Area Prefix TLV Length - Variable dependent
                 on sub-TLVs";
        }
    }
    leaf metric {

```

```

        type rt-types:uint24;
        description "Intra-Area Prefix Metric";
    }
    uses ospfv3-lsa-prefix;
    list sub-tlvs {
        description "Intra-Area Prefix TLV Sub-TLVs";
        uses unknown-sub-tlv;
    }
}
description "Intra-Area Prefix TLV Grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3.4";
}

grouping ipv6-link-local-tlv {
    container ipv6-link-local-tlv {
        description "IPv6 Link-Local LSA TLV";
        leaf ipv6-link-local-tlv-length {
            type uint16;
            description
                "IPv6 Link-Local TLV Length - Variable dependent
                on sub-TLVs";
        }
        leaf link-local-address {
            type inet:ipv6-address;
            description
                "IPv6 Link Local address";
        }
        list sub-tlvs {
            description "IPv6 Link Local TLV Sub-TLVs";
            uses unknown-sub-tlv;
        }
    }
}
description "IPv6 Link-Local TLV Grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3.8";
}

grouping ipv4-link-local-tlv {
    container ipv4-link-local-tlv {
        description "IPv4 Link-Local LSA TLV";
        leaf ipv4-link-local-tlv-length {
            type uint16;
            description
                "IPv4 Link-Local TLV Length - Variable dependent
                on sub-TLVs";
        }
        leaf link-local-address {
            type inet:ipv4-address;

```

```

        description
            "IPv4 Link Local address";
    }
    list sub-tlvs {
        description "IPv4 Link Local TLV Sub-TLVs";
        uses unknown-sub-tlv;
    }
}
description "IPv4 Link-Local TLV Grouping";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 3.9";
}

grouping ospfv3-e-lsa-area {
    description "Area scope OSPFv3 Extended LSAs.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4";

    container e-router {
        when "../ospf:header/ospf:type = "
            + "'ospfv3-e-lsa:ospfv3-e-router-lsa'" {
            description "Only valid for OSPFv3 Extended-Router LSAs";
        }
        description "OSPFv3 Extended Router LSA";
        reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
            Extensibility, Section 4.1";
        uses ospf:ospf-router-lsa-bits;
        uses ospf:ospfv3-lsa-options;

        list e-router-tlvs {
            description "E-Router LSA TLVs";
            container unknown-tlv {
                uses ospf:tlv;
                description "Unknown E-Router TLV";
            }
            container link-tlv {
                description "E-Router LSA TLV";
                leaf link-tlv-length {
                    type uint16;
                    description
                        "Link TLV Length - Variable dependent on sub-TLVs";
                }
                leaf interface-id {
                    type uint32;
                    description "Interface ID for link";
                }
                leaf neighbor-interface-id {
                    type uint32;
                    description "Neighbor's Interface ID for link";
                }
            }
        }
    }
}

```

```

    }
    leaf neighbor-router-id {
        type rt-types:router-id;
        description "Neighbor's Router ID for link";
    }
    leaf type {
        type ospf:router-link-type;
        description "Link type: 1 - Point-to-Point Link
                    2 - Transit Network Link
                    3 - Stub Network Link Link
                    4 - Virtual Link";
    }
    leaf metric {
        type uint16;
        description "Link Metric";
    }
    list sub-tlvs {
        description "Link TLV Sub-TLVs";
        uses unknown-sub-tlv;
    }
}
}
}

container e-network {
    when "../../ospf:header/ospf:type = "
        + "'ospfv3-e-lsa:ospfv3-e-network-lsa'" {
        description
            "Only applies to E-Network LSAs.";
    }
    description "Extended Network LSA";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.2";
    uses ospf:ospfv3-lsa-options;
    list e-network-tlvs {
        description "E-Network LSA TLVs";
        container unknown--tlv {
            uses ospf:tlv;
            description "Unknown E-Network TLV";
        }
        container attached-router-tlv {
            description "Attached Router TLV";
            leaf attached-router-tlv-length {
                type uint16;
                description
                    "Attached Router TLV Length - Variable dependent
                    on sub-TLVs";
            }
        }
        leaf-list Adjacent-neighbor-router-id {

```

```

        type rt-types:router-id;
        description "Adjacent Neighbor's Router ID";
    }
    list sub-tlvs {
        description "Attached Router TLV Sub-TLVs";
        uses unknown-sub-tlv;
    }
}
}
}

container e-inter-area-prefix {
    when "../../ospf:header/ospf:type = "
        + "'ospfv3-e-lsa:ospfv3-e-inter-area-prefix-lsa'" {
        description
            "Only applies to E-Inter-Area-Prefix LSAs.";
    }
    description "Extended Inter-Area Prefix LSA";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.3";
    list e-inter-prefix-tlvs {
        description "E-Inter-Area-Prefix LSA TLVs";
        container unknown--tlv {
            uses ospf:tlv;
            description "Unknown E-Inter-Area-Prefix TLV";
        }
        container inter-prefix-tlv {
            description "Unknown E-Inter-Area-Prefix LSA TLV";
            leaf inter-prefix-tlv-length {
                type uint16;
                description
                    "Inter-Area-Prefix TLV Length - Variable dependent
                    on sub-TLVs";
            }
            leaf metric {
                type rt-types:uint24;
                description "Inter-Area Prefix Metric";
            }
        }
        uses ospfv3-lsa-prefix;
        list sub-tlvs {
            description "Inter-Area Prefix TLV Sub-TLVs";
            uses unknown-sub-tlv;
        }
    }
}
}

container e-inter-area-router {
    when "../../ospf:header/ospf:type = "

```

```

    + "'ospfv3-e-lsa:ospfv3-e-inter-area-router-lsa'" {
description
    "Only applies to E-Inter-Area-Router LSAs.";
}
description "Extended Inter-Area Router LSA";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 4.4";
list e-inter-router-tlvs {
    description "E-Inter-Area-Router LSA TLVs";
    container unknown-tlv {
        uses ospf:tlv;
        description "Unknown E-Inter-Area-Router TLV";
    }
    container inter-router-tlv {
        description "Unknown E-Inter-Area-Router LSA TLV";
        leaf inter-router-tlv-length {
            type uint16;
            description
                "Inter-Area-Router TLV Length - Variable dependent
                on sub-TLVs";
        }
        uses ospf:ospf-router-lsa-bits;
        uses ospf:ospfv3-lsa-options;
        leaf metric {
            type rt-types:uint24;
            description "Inter-Area Router Metric";
        }
        leaf destination-router-id {
            type rt-types:router-id;
            description "Destination Router ID";
        }
    }
    list sub-tlvs {
        description "Inter-Area Router TLV Sub-TLVs";
        uses unknown-sub-tlv;
    }
}
}
}

container e-intra-area-prefix {
    when "../../ospf:header/ospf:type = "
        + "'ospfv3-e-lsa:ospfv3-e-intra-area-prefix-lsa'" {
description
    "Only applies to E-Intra-Area-Prefix LSAs.";
}
description "E-Intra-Area-Prefix LSA";
reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
    Extensibility, Section 4.8";
leaf referenced-ls-type {

```

```

        type uint16;
        description "Referenced Link State type";
    }
    leaf referenced-link-state-id {
        type uint32;
        description
            "Referenced Link State ID";
    }
    leaf referenced-adv-router {
        type rt-types:router-id;
        description
            "Referenced Advertising Router";
    }
    list e-intra-prefix-tlvs {
        description "E-Intra-Area-Prefix LSA TLVs";
        container unknown-tlv {
            uses ospf:tlv;
            description "Unknown E-Intra-Area-Prefix TLV";
        }
        uses intra-area-prefix-tlv;
    }
}

grouping ospfv3-e-lsa-as {
    description "AS scope OSPFv3 Extended LSAs.";
    container e-as-external {
        when "../..//ospf:header/ospf:type = "
            + "'ospfv3-e-lsa:ospfv3-e-as-external-lsa'" {
            description
                "Only applies to E-AS-external LSAs.";
        }
        list e-external-tlvs {
            description "E-External LSA TLVs";
            container unknown-tlv {
                uses ospf:tlv;
                description "Unknown E-External TLV";
            }
            uses external-prefix-tlv;
        }
        description "E-AS-External LSA.";
        reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
            Extensibility, Section 4.5";
    }
}

container e-nssa {
    when "../..//ospf:header/ospf:type = "
        + "'ospfv3-e-lsa:ospfv3-e-nssa-lsa'" {
        description

```

```

        "Only applies to E-NSSA LSAs.";
    }
    list e-external-tlvs {
        description "E-NSSA LSA TLVs";
        container unknown-tlv {
            uses ospf:tlv;
            description "Unknown E-External TLV";
        }
        uses external-prefix-tlv;
    }
    description "E-NSSA LSA.";
    reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Section 4.6";
}
}

grouping ospfv3-e-lsa-link {
    description "Link scope OSPFv3 Extended LSAs.";
    container e-link {
        when "../ospf:header/ospf:type = "
            + "'ospfv3-e-lsa:ospfv3-e-link-lsa'" {
            description
                "Only applies to Extended Link LSAs.";
        }
        description "E-Link LSA";
        reference "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
            Extensibility, Section 4.7";
        leaf rtr-priority {
            type uint8;
            description "Router Priority for the interface.";
        }
        uses ospf:ospfv3-lsa-options;
        list e-link-tlvs {
            description "E-Link LSA TLVs";
            container unknown-tlv {
                uses ospf:tlv;
                description "Unknown E-Link TLV";
            }
            uses intra-area-prefix-tlv;
            uses ipv6-link-local-tlv;
            uses ipv4-link-local-tlv;
        }
    }
}

/* Configuration */
augment "/rt:routing/rt:control-plane-protocols"
    + "/rt:control-plane-protocol/ospf:ospf" {
    when "../rt:type = 'ospf:ospfv3'" {

```

```

        description
            "This augments the OSPFv3 routing protocol when used.";
    }
    description
        "This augments the OSPFv3 protocol configuration
        with extended LSA support.";
    leaf extended-lsa-support {
        type boolean;
        default false;
        description
            "Enable OSPFv3 Extended LSA Support for the OSPFv3
            domain";
        reference
            "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
            Extensibility, Appendix B - ExtendedLSASupport";
    }
}

augment "/rt:routing/rt:control-plane-protocols/"
+ "rt:control-plane-protocol/ospf:ospf/ospf:areas/ospf:area" {
    when "../../../rt:type = 'ospf:ospfv3'" {
        description
            "This augments the OSPFv3 area configuration
            when used.";
    }
    description
        "This augments the OSPFv3 protocol area
        configuration with extended LSA support.";
    leaf extended-lsa-support {
        type boolean;
        must "derived-from(..//ospf:area-type, 'stub-nssa-area') or "
            + "(current() = 'true') or "
            + "(../../extended-lsa-support = 'false')";
        description
            "For regular areas, i.e., areas where AS-scoped LSAs
            disabling AreaExtendedLSASupport for a regular
            OSPFv3 area (not a Stub or NSSA area) when
            ExtendedLSASupport is enabled is contradictory and
            is prohibited.";
    }
    description
        "Enable OSPFv3 Extended LSA Support for the OSPFv3
        area. If not specified, Extended LSA support status
        is inherited from the instance level configuration.";
    reference
        "RFC 8362 - OSPFv3 Link State Advertisement (LSA)
        Extensibility, Appendix B - AreaExtendedLSASupport";
}
}

```

```

/*
 * Link State Database (LSDB) Augmentations
 */
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" {
when "../../../../../../../../../../../"
+ "rt:type = 'ospf:ospfv3'" {
description
"This augmentation is only valid for OSPFv3.";
}
description
"OSPFv3 Link-Scoped Extended LSAs";

uses ospfv3-e-lsa-link;
}

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 Area-Scoped Extended LSAs";

uses ospfv3-e-lsa-area;
}

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

```

```
}  
description  
    "OSPFv3 AS-Scoped Extended LSAs";  
  
    uses ospfv3-e-lsa-as;  
}  
}  
<CODE ENDS>
```

Figure 2

5. 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 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 `ietf-ospfv3-extended-lsa.yang` module 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. There are the subtrees and data nodes and their sensitivity/vulnerability:

```
/ospf:ospf/extended-lsa-support
/ospf:ospf/ospf:areas/ospf:area/extended-lsa-support - For OSPFv3
Extended LSAs, the ability to disable OSPFv3 Extended LSA support
result in a denial of service.
```

Some of the readable data nodes in the `ietf-ospfv3-extended-lsa.yang` module 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 and information beyond the scope of OSPF router. 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.

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-ospfv3-extended-lsa
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
```

Figure 3

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

```
name: ietf-ospfv3-extended-lsa
namespace: urn:ietf:params:xml:ns:yang:ietf-ospfv3-extended-lsa
prefix: ospfv3-e-lsa
reference: RFC XXXX
```

Figure 4

7. Acknowledgements

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