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 RFC 5329, OSPF Two-Part Metric as defined in RFC 8042, OSPF Graceful Link Shutdown as defined in RFC 8379 and OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement as defined in RFC 8510.

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YANG [RFC6020] [RFC7950] is a data definition language used to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [RFC6241]. YANG is proving relevant beyond its initial confines, as bindings to other interfaces (e.g., ReST) and encodings other than XML (e.g., JSON) are being defined. Furthermore, YANG data models can be used as the basis for implementation of other interfaces, such as CLI and programmatic APIs.

This document defines YANG data modules augmenting the IETF OSPF YANG model [I-D.ietf-ospf-yang], which itself augments [RFC8349], to provide support for configuration and operational state for the following OSPF features:

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

**RFC8042**: OSPF Two-Part Metric [RFC8042].

**RFC8379**: OSPF Graceful Link Shutdown [RFC8379].

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

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

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. YANG Module for Traffic Engineering 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:body:
   +-ro ospfv3-intra-area-te
     +-ro router-address-tlv
       +-ro router-address? inet:ipv6-address

   +-ro link-tlv
     +-ro link-type              ospf:router-link-type
       +-ro local-if-ipv6-addrs
         +-ro local-if-ipv6-addr* inet:ipv6-address
       +-ro remote-if-ipv6-addrs
         +-ro remote-if-ipv6-addr* inet:ipv6-address
       +-ro te-metric?            uint32
       +-ro max-bandwidth?        rt-types:bandwidth-ieee-float32
       +-ro max-reservable-bandwidth? rt-types:bandwidth-ieee-float32
       +-ro unreserved-bandwidths
         +-ro unreserved-bandwidth* rt-types:bandwidth-ieee-float32
           +-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
module ietf-ospfv3-te {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-ospfv3-te";

  prefix ospfv3-te;

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

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

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

  import ietf-routing {
    prefix "rt";
  }

  import ietf-ospf {
    prefix "ospf";
  }

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

  contact "WG Web: <http://tools.ietf.org/wg/lsr>
    WG List: <mailto:lsr@ietf.org>
    Author: Yingzhen Qu <mailto:yqu@futurewei.com>
    Author: Acee Lindem <mailto:acee@cisco.com>";

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

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

reference "RFC XXXX";

revision 2019-08-13 {
  description
    "Initial version";
  reference
    "RFC XXXX: A YANG Data Model for OSPFv3 TE.";
}

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

grouping ospfv3-intra-area-te {
  description "Grouping for OSPFv3 intra-area-te-lsa.";
  container ospfv3-intra-area-te {
    container router-address-tlv {
      description "The router IPv6 address tlv advertises a reachable IPv6 address.";
      leaf router-address {
        type inet:ipv6-address;
        description
          "Router IPv6 address.";
      }
    }
    container link-tlv {
      description "Describes a singel link, and it is constructed of a set of Sub-TLVs.";
      leaf link-type {
        type ospf:router-link-type;
        mandatory true;
        description "Link type.";
      }
    }
  }
}
container local-if-ipv6-addrs {
    description "All local interface IPv6 addresses.";
    leaf-list local-if-ipv6-addr {
        type inet:ipv6-address;
        description "List of local interface IPv6 addresses.";
    }
}

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

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

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

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

container unreserved-bandwidths {
    description "All unreserved bandwidths.";
    list unreserved-bandwidth {
        leaf priority {
            type uint8 {
                range "0 .. 7";
            }
            description "Priority from 0 to 7.";
        }
        leaf unreserved-bandwidth {
            type rt-types:bandwidth-ieee-float32;
            description "Unreserved bandwidth.";
        }
        description "List of unreserved bandwidths for different
priorities.
};
}

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

container neighbor-id {
  description "Neighbor link 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 Intrea-Area-TE-LSA.";
uses ospfv3-intra-area-te;
)
)
<CODE ENDS>

3. YANG Module for OSPF Two-Part Metric

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

module: ietf-ospf-two-part-metric  
augment /rt:routing/rt:control-plane-protocols  
   /rt:control-plane-protocol/ospf:ospf:/ospf:areas/ospf:area  
      /ospf:interfaces/ospf:interface:  
         +--rw two-part-metric  
         +--rw enable?  
         +--rw int-input-cost?  
         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: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?  
                           +--ro mt-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:body/ospf:opaque/ospf:te-opaque/ospf:link-tlv:  
                                          +--ro network-to-router-te-metric?  
                                          +--ro network-to-router-te-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:body/ospf:tev3:intra-area-te/ospf:tev3:link-tlv:  
                                                         +--ro network-to-router-te-metric?  
                                                         +--ro network-to-router-te-metric?  

<CODE BEGINS> file "ietf-ospf-two-part-metric@2019-08-13.yang"  
module ietf-ospf-two-part-metric {  
   yang-version 1.1;  
   prefix ospf-two-metric;
import ietf-routing {
    prefix "rt";
}

import ietf-ospf {
    prefix "ospf";
}

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

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

contact
    "WG Web: <http://tools.ietf.org/wg/lsr>
    WG List: <mailto:lsr@ietf.org>
    Author: Yingzhen Qu
        <mailto:yqu@futurewei.com>
    Author: Acee Lindem
        <mailto:acee@cisco.com>";

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

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

reference "RFC XXXX";

revision 2019-08-13 {
    description
        "Initial version";
    reference
        "RFC XXXX: A YANG Data Model for OSPF.";
identity two-part-metric {
    base ospf:informational-capability;
    description
        "When set, the router is capable of supporting OSPF
two-part metrics.";
    reference
        "RFC 8042: OSPF Two-Part Metric";
}

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/"

description "Traffic Engineering Network-to-Router Sub-TLV.";

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.";
  }
}


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: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";
    }
}

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: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
   /ospfv3-e-lsa:e-router-tlvs:
     ++-ro graceful-link-shutdown-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:version/ospf:ospfv3/ospf:ospfv3
   /ospfv3-e-lsa:e-router-tlvs:
     ++-ro graceful-link-shutdown-sub-tlv!
<CODE BEGINS> file "ietf-ospf-graceful-link-shutdown@2019-08-13.yang"
module ietf-ospf-graceful-link-shutdown {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-ospf-graceful-link-shutdown";
  prefix ospf-grace-linkdown;

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

  import ietf-routing {
    prefix "rt";
  }
This YANG module defines the configuration and operational state for OSPF Graceful Link Shutdown feature as defined in RFC 8379.

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

```yaml
module: ietf-ospf-lls-local-id
  augment /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/ospf:
    +++rw lls-int-id
    +++rw enable?  boolean
```
module ietf-ospf-lls-local-id {
  yang-version 1.1;

  prefix ospf-lls-localid;

  import ietf-routing {
    prefix "rt";
  }

  import ietf-ospf {
    prefix "ospf";
  }

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

  contact
    "WG Web:  <http://tools.ietf.org/wg/lsr>
    WG List:  <mailto:lsr@ietf.org>
    Author:   Yingzhen Qu
              <mailto:yqu@futurewei.com>
    Author:   Acee Lindem
              <mailto:acee@cisco.com>";

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

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  reference "RFC XXXX";

  revision 2019-08-13 {
    description
"Initial version";
reference
"RFC XXXX: A YANG Data Model for OSPF.";
}

augment "/rt:routing/rt:control-plane-protocols"
+ "/rt:control-plane-protocol/ospf:ospf" {
  when "/../rt:type = 'ospf:ospfv2' or 
  + "/../rt:type = 'ospf:ospfv3'" {
    description
    "This augments the OSPF routing protocol when used.";
  } description
  "This augments the OSPF protocol configuration to support LLS extensions for interface 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.";
  }
}

6. 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.

7. 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:

Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

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

name: ietf-ospf-two-metric
prefix: ospf-two-metric
reference: RFC XXXX

name: ietf-ospf-grace-linkdown
prefix: ospf-grace-linkdown
reference: RFC XXXX

name: ietf-ospf-lls-localid
prefix: ospf-lls-localid
reference: RFC XXXX
8. Acknowledgements

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

9. References

9.1. Normative References


9.2. Informative References

[I-D.ietf-ospf-yang]

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