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IS-IS YANG Model Augmentations for Additional Features - Version 1

Abstract

This document defines YANG data modules augmenting the IETF IS-IS YANG model to provide support for IS-IS Minimum Remaining Lifetime as defined in RFC 7987, IS-IS Application-Specific Link Attributes as defined in RFC 8919, and IS-IS Flexible Algorithm.

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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 YANG data modules augmenting the IETF IS-IS YANG model [[RFC9130](#)], which itself augments [[RFC8349](#)], to provide support for configuration and operational state for the following IS-IS features:

RFC7987: IS-IS Minimum Remaining Lifetime [[RFC7987](#)].

RFC8919: IS-IS Application-Specific Link Attributes [[RFC8919](#)].

RFC9350: IGP Flexible Algorithm [[RFC9350](#)].

RFC8491: Signaling Maximum SID Depth (MSD) Using IS-IS [[RFC8491](#)].

The augmentations defined in this document requires support for the IS-IS base model [[RFC9130](#)] which defines basic IS-IS configuration and state. The IS-IS YANG model augments the ietf-routing YANG model defined in [[RFC8349](#)].

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and

"OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

1.2. Tree diagram

Tree diagrams used in this document follow the notation defined in [[RFC8340](#)].

2. YANG Module for IS-IS Minimum Remaining Lifetime

This document defines a YANG module for IS-IS Minimum Remaining Lifetime as defined in [[RFC7987](#)]. It is an augmentation of the IS-IS base model.

```
module: ietf-isis-remaining-lifetime
```

```
notifications:
```

```
  +---n corrupt-remaining-lifetime
```

```
    +--ro routing-protocol-name?  -> /rt:routing
                                   /control-plane-protocols
                                   /control-plane-protocol/name
```

```
    +--ro isis-level?             level
```

```
    +--ro lsp-id?                 isis:lsp-id
```

```

<CODE BEGINS> file "ietf-isis-remaining-lifetime@2023-03-06.yang"

module ietf-isis-remaining-lifetime {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-isis-remaining-lifetime";

  prefix isis-remaining-lifetime;

  import ietf-isis {
    prefix "isis";
    reference
      "RFC 9130: YANG Data Model for the IS-IS Protocol";
  }

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

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

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

  description
    "This YANG module defines the configuration and operational
    state for IS-IS Minimum Remaining Lifetime feature as defined
    in RFC 7987.

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    authors of the code.  All rights reserved.

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    (http://trustee.ietf.org/license-info).

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

  reference "RFC XXXX";

  revision 2023-03-06 {
    description

```

```
    "Initial version";
reference
    "RFC XXXX: A YANG Data Model for IS-IS Minimum Remaining Lifetime.
}

notification corrupt-remaining-lifetime {
    uses isis:notification-instance-hdr;
    leaf lsp-id {
        type isis:lsp-id;
        description "LSP ID";
    }
    description
        "This notification is sent when the system
        detects corrupted lifetime of an LSP.";
    reference "RFC 7987: IS-IS Minimum Remaining Lifetime";
}
}
```

<CODE ENDS>

3. YANG Module for IS-IS Application-Specific Link Attributes

This document defines a YANG module for IS-IS Application-Specific Link Attributes [[RFC8919](#)]. It is an augmentation of the IS-IS base model.

```

module: ietf-isis-link-attr
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/isis:isis:
  +--rw isis-link-attr-op
    +--rw (link-attr-op-mode)
      +--:(legacy)
        | +--rw legacy?          empty
      +--:(transition)
        | +--rw transition?      empty
      +--:(app-specific)
        +--rw app-specific?      empty
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/isis:isis/isis:interfaces
  /isis:interface:
  +--rw isis-asla
    +--rw interface-asla* [app-id]
      +--rw app-id                uint16
      +--rw unidirectional-link-delay?  uint32
      +--rw metric-type?            uint8
      +--rw metric?                uint32

augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/isis:isis/isis:database
  /isis:levels/isis:lsp/isis:extended-is-neighbor
  /isis:neighbor/isis:instances/isis:instance:
  +--ro application-specific-link-attributes-sub-tlvs
    +--ro asla-sub-tlvs* []
      +--ro l-flag?          boolean
      +--ro sabm-length?     uint8
      +--ro r-flag?          boolean
      +--ro udabm-length?    uint8
      +--ro sabm
        | +--ro sabm-bits*  identityref
      +--ro udabm
      +--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/isis:isis/isis:database
  /isis:levels/isis:lsp/isis:mt-is-neighbor/isis:neighbor
  /isis:instances/isis:instance:
  +--ro application-specific-link-attributes-sub-tlvs
    +--ro asla-sub-tlvs* []
      +--ro l-flag?          boolean
      +--ro sabm-length?     uint8
      +--ro r-flag?          boolean
      +--ro udabm-length?    uint8

```

```

+--ro sabm
| +--ro sabm-bits*   identityref
+--ro udabm
+--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/isis:isis/isis:database
    /isis:levels/isis:lsp:
+--ro application-specific-srlg-tlv
    +--ro as-srlg-tlvs* []
        +--ro neighbor-system-id?   isis:system-id
        +--ro pseudo-node-id?       uint8
        +--ro l-flag?                boolean
        +--ro sabm-length?           uint8
        +--ro r-flag?                boolean
        +--ro udabm-length?          uint8
        +--ro sabm
            | +--ro sabm-bits*   identityref
        +--ro udabm
        +--ro length-of-sub-tlvs?    uint8
        +--ro link-id-sub-tlvs
            | +--ro link-local-remote-ids
            | | +--ro link-local-id?    union
            | | +--ro link-remote-id?   union
            | +--ro ipv4-interface-addr
            | | +--ro ipv4-int-addr?    inet:ipv4-address
            | +--ro ipv4-neighbor-addr
            | | +--ro ipv4-neighbor-addr?  inet:ipv4-address
            | +--ro ipv6-interface-addr
            | | +--ro ipv6-int-addr?    inet:ipv6-address
            | +--ro ipv6-neighbor-addr
            |   +--ro ipv6-neighbor-addr?  inet:ipv6-address
        +--ro srlgs
            +--ro srlg*    uint32

```

<CODE BEGINS> file "ietf-isis-link-attr@2023-03-06.yang"

```
module ietf-isis-link-attr {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-isis-link-attr";

  prefix isis-link-attr;

  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-isis {
    prefix "isis";
    reference
      "RFC 9130: YANG Data Model for the IS-IS Protocol";
  }

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

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

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

  description
    "This YANG module defines the configuration and operational
    state for IS-IS application specific link attributes feature as
    defined in RFC 8919.

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

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```

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The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED', 'MAY', and 'OPTIONAL' in this document are to be interpreted as described in BCP 14 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

reference "RFC XXXX";

```
revision 2023-03-06 {
  description
    "Initial version";
  reference
    "RFC XXXX: A YANG Data Model for IS-IS Application-Specific Link
    Attributes.";
}
```

```
identity sabm-bit {
  description
    "Base identity for sabm bits.";
  reference "RFC 8919: IS-IS Application-Specific Link Attributes";
}
```

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

```
identity sr-policy-bit {
  base sabm-bit;
  description
    "S bit, Segment Routing Policy.";
}
```

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

```

grouping application-identifier-bit-mask {
  description
    "Identification of the set of applications associated with link
    attribute advertisements";

  leaf l-flag {
    type boolean;
    description
      "Legacy Flag. When set, all of the applications
      specified in the bit mask MUST use the legacy
      advertisements.";
  }
  leaf sabm-length {
    type uint8;
    description
      "Standard Application Identifier Bit Mask Length in
      octets.";
  }
  leaf r-flag {
    type boolean;
    default false;
    description
      "Reserved.";
  }
  leaf udabm-length {
    type uint8;
    description
      "User Defined Application Identifier Bit Mask Length
      in octets.";
  }
  container sabm {
    leaf-list sabm-bits {
      type identityref {
        base sabm-bit;
      }
    }
    description
      "SABM bits list. This list will contain
      identities for the bits which are set in the
      SABA bits.";
  }
  description
    "Standard Application Identifier Bit Mask.";
}
container udabm {
  description
    "User Defined Application Identifier Bit Mask.
    This container is to be augmented by user defined
    applications.";
}

```

```

    }
}

grouping application-specific-link-attributes-sub-tlv {
    description
        "Grouping for specification of the applications and
        application-specific attribute values.";

    container application-specific-link-attributes-sub-tlvs {
        list asla-sub-tlvs {
            uses application-identifier-bit-mask;
            uses isis:unknown-tlvs;
            description
                "List of application specific link attributes sub-tlvs.";
        }
        description
            "Application specific link attributes sub-tlv.";
    }
}

grouping application-specific-srlg-tlv {
    description
        "Grouping of a TLV to advertise application-specific
        SRLGs for a given link.";
    container application-specific-srlg-tlv {
        list as-srlg-tlvs {
            leaf neighbor-system-id {
                type isis:system-id;
                description
                    "Neighbor System-ID.";
            }
            leaf pseudo-node-id {
                type uint8;
                description
                    "Pseudo-node ID.";
            }
        }
        uses application-identifier-bit-mask;
        leaf length-of-sub-tlvs {
            type uint8;
            description
                "Length of sub-tlvs.";
        }
    }

    container link-id-sub-tlvs {
        description
            "Link Identifier sub-TLVs.";
        container link-local-remote-ids {
            description
                "Link local/remote identifier sub-tlv.";
        }
    }
}

```

```

leaf link-local-id {
    type union {
        type inet:ipv4-address;
        type uint32;
    }
    description
        "Local identifier of the link.
        It could be an IPv4 address or a local identifier.";
}
leaf link-remote-id {
    type union {
        type inet:ipv4-address;
        type uint32;
    }
    description
        "Remote identifier of the link.
        It could be an IPv4 address or a remotely learned
        identifier.";
}
}
container ipv4-interface-addr {
    leaf ipv4-int-addr {
        type inet:ipv4-address;
        description
            "IPv4 address for the interface.";
    }
    description
        "IPv4 interface address sub-tlv.";
}
container ipv4-neighbor-addr {
    leaf ipv4-neighbor-addr {
        type inet:ipv4-address;
        description
            "IPv4 address for a neighboring router
            on this link.";
    }
    description
        "IPv4 neighbor address sub-tlv.";
}
container ipv6-interface-addr {
    leaf ipv6-int-addr {
        type inet:ipv6-address;
        description
            "IPv6 address for the interface.";
    }
    description
        "IPv6 interface address sub-tlv.";
}
container ipv6-neighbor-addr {

```

```

        leaf ipv6-neighbor-addr {
            type inet:ipv6-address;
            description
                "IPv6 address for a neighboring router
                on this link.";
        }
        description
            "IPv6 neighbor address sub-tlv.";
    }
}

container srlgs {
    description "List of SRLGs.";
    leaf-list srlg {
        type uint32;
        description
            "SRLG value of the link.";
    }
}

description
    "List of application specific SRLG tlvs.";
}
description
    "Application specific SRLG tlv.";
}
}

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis" {
    when "/rt:routing/rt:control-plane-protocols/"+
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
        description
            "This augment ISIS routing protocol when used";
    }
    description
        "This augments ISIS protocol configuration
        with application specific link attributes.";

    container isis-link-attr-op {
        choice link-attr-op-mode {
            mandatory "true";
            leaf legacy {
                type empty;
                description
                    "Only send legacy advertisements.";
            }
            leaf transition {

```

```

        type empty;
        description
            "Send both application-specific and legacy advertisements.";
    }
    leaf app-specific{
        type empty;
        description
            "Only send application-specific advertisements.";
    }
    description
        "Link attributes mode";
}

description
    "Link attributes operation mode.";
}
}

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:interfaces/isis:interface" {
when "/rt:routing/rt:control-plane-protocols/"+
    "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used.";
}
description
    "This augments ISIS interface configuration
    with application specific link attributes.";

container isis-asla {
    list interface-asla {
        key app-id;

        leaf app-id {
            type uint16 {
                range "0 .. 1023";
            }
            description
                "Application ID.
                0 - RSVP TE. 1 - Segment Routing Policy.
                2 - Loop-Free Alternate.";
        }

        leaf unidirectional-link-delay {
            type uint32 {
                range "0 .. 16777215";
            }
            description

```

```

        "This 24-bit field carries the average link delay in
        microseconds.";
    }

    leaf metric-type {
        type uint8;
        description
            "IGP metric type.";
    }

    leaf metric {
        type uint32 {
            range "1 .. 16777215";
        }
        description
            "metric value.";
    }

    description
        "ASLA interface configuration.";
}
description
    "Application specific link attributes configuration.";
}
}

/* TLV 22 */
augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
    "/isis:extended-is-neighbor/isis:neighbor"+
    "/isis:instances/isis:instance" {
    when "/rt:routing/rt:control-plane-protocols/" +
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
        description
            "This augment ISIS routing protocol when used";
    }
    description
        "This augments ISIS protocol LSDB TLV22.";

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

/* TLV 223 */
augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
    "/isis:mt-is-neighbor/isis:neighbor"+
    "/isis:instances/isis:instance" {

```

```

when "/rt:routing/rt:control-plane-protocols/"+
    "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used";
    }
description
    "This augments ISIS protocol LSDB TLV223.";

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

/* application-specific SRLG TLV 238 */
augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp" {
when "/rt:routing/rt:control-plane-protocols/"+
    "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used";
    }
description
    "This augments ISIS protocol LSDB.";

    uses application-specific-srlg-tlv;
}
}

<CODE ENDS>

```

4. YANG Module for IS-IS Flexible Algorithm

This document defines a YANG module for IS-IS Flexible Algorithm [[RFC9350](#)]. It is an augmentation of the IS-IS base model.

```

module: ietf-isis-flex-algo
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis:
    +--rw isis-flex-algo
        +--rw flex-algo* [algo-number]
            +--rw algo-number          uint8
            +--rw advertise-definition? boolean
            +--rw admin-groups {te-types:extended-admin-groups,
                                te-types:named-extended-admin-groups}?
            | +--rw exclude-admin-groups* -> /te:te/globals
                                                    /named-admin-groups
                                                    /named-admin-group/name
            | +--rw include-any-admin-groups* -> /te:te/globals
                                                    /named-admin-groups
                                                    /named-admin-group/name
            | +--rw include-all-admin-groups* -> /te:te/globals
                                                    /named-admin-groups
                                                    /named-admin-group/name
            +--rw exclude-srlgs* -> /te:te/globals
                                                    /named-srlgs/named-srlg/name
                                                    {te-types:named-srlg-groups}?
            +--rw fast-reroute?          boolean
            +--rw metric-type?           identityref
            +--rw microloop-avoidance?   boolean
            +--rw prefix-metric!
            +--rw priority?              uint8
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:router-capabilities:
    +--ro fad-tlvs
        +--ro fad-tlv* []
            +--ro flex-algo?              uint8
            +--ro metric-type?            identityref
            +--ro calc-type?              uint8
            +--ro priority?               uint8
            +--ro fa-ex-ag-sub-tlv
            | +--ro extended-admin-groups* uint64
            +--ro fa-in-any-ag-sub-tlv
            | +--ro extended-admin-groups* uint64
            +--ro fa-in-all-ag-sub-tlv
            | +--ro extended-admin-groups* uint64
            +--ro fad-flags-sub-tlv
            | +--ro fad-flags*            identityref
            +--ro fa-ex-srlg-sub-tlv
            | +--ro srlgs*                uint32
            +--ro unknown-tlvs
                +--ro unknown-tlv* []
                    +--ro type?            uint16
                    +--ro length?          uint16

```

```

        +--ro value?      yang:hex-string
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:extended-ipv4-reachability
    /isis:prefixes:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
    +--ro flex-algo?      uint8
    +--ro metric?         uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:mt-extended-ipv4-reachability
    /isis:prefixes:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
    +--ro flex-algo?      uint8
    +--ro metric?         uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:ipv6-reachability/isis:prefixes:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
    +--ro flex-algo?      uint8
    +--ro metric?         uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:mt-ipv6-reachability
    /isis:prefixes:
+--ro fapm-sub-tlvs
+--ro fapm-sub-tlv* []
    +--ro flex-algo?      uint8
    +--ro metric?         uint32

notifications:
+---n flex-algo-not-supported
    +--ro routing-protocol-name?  -> /rt:routing
                                   /control-plane-protocols
                                   /control-plane-protocol/name
    +--ro isis-level?              level
    +--ro flex-algo-number?        uint8

```

<CODE BEGINS> file "ietf-isis-flex-algo@2023-03-06.yang"

```
module ietf-isis-flex-algo {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-isis-flex-algo";
  prefix isis-flex-algo;

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

  import ietf-te-types {
    prefix te-types;
    reference
      "RFC8776: Common YANG Data Types for Traffic Engineering.";
  }

  import ietf-isis {
    prefix "isis";
    reference
      "RFC 9130: YANG Data Model for the IS-IS Protocol";
  }

  import ietf-te {
    prefix "te";
  }

  import ietf-isis-link-attr {
    prefix "isis-link-attr";
  }

  organization
    "IETF LSR - Link State Routing Working Group";
  contact
    "WG Web:  <http://datatracker.ietf.org/wg/lsr>
    WG List:  <mailto:spring@ietf.org>

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

  description
```

"The YANG module defines the configuration and operational state for ISIS Flexible Algorithm as defined in RFC xxxx.

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

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

The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED', 'MAY', and 'OPTIONAL' in this document are to be interpreted as described in BCP 14 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

reference "RFC XXXX: YANG Data Model for ISIS Flexible Algorithm.";

```
revision 2023-03-06 {  
  description  
    "Initial Version";  
  reference "RFC XXXX: YANG Data Model for ISIS Flexible Algorithm.";  
}
```

```
/* Identities */
```

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

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

```
identity min-uni-delay {  
  base metric-type;  
  description
```

```

        "Min unidirectional link delay metric type.";
    reference
        "RFC 8570 - IS-IS Traffic Engineering (TE) Metric Extensions";
}

identity te-metric {
    base metric-type;
    description
        "Traffic engineering metric type.";
    reference
        "RFC 5305 - IS-IS Extensions for Traffic Engineering (TE)";
}

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

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

/* Identity augmentation */
identity flex-algo-bit {
    base isis-link-attr:sabm-bit;
    description
        "X bit, flexible algorithm.";
}

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

grouping fa-in-any-ag-sub-tlv {

```

```

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

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

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

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

```

```

    }
    description
        "The flex-algo exclude SRLG sub-tlv.";
    }
    description
        "The flex-algo exclude SRLG sub-tlv.";
}

grouping fad-tlvs {
    container fad-tlvs {
        list fad-tlv {
            leaf flex-algo {
                type uint8;
                description
                    "Flex-algo number, value between 128 and 255 inclusive.";
            }
            leaf metric-type {
                type identityref {
                    base metric-type;
                }
                description
                    "Type of metric to be used during the calculation.";
            }
            leaf calc-type {
                type uint8 {
                    range "0..127";
                }
                description
                    "IGP algorithm types, value from 0 to 127 as
                    defined under 'Interior Gateway Protocol (IGP)
                    Parameter' by IANA.";
            }
            leaf priority {
                type uint8;
                description
                    "Priority of the advertisement.";
            }
        }

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

        description
            "List of flex-algo definition TLVs.";
    }
    description

```

```

        "ISIS Flexible Algorithm Definition TLV.";
    }
    description
        "ISIS Flexible Algorithm Definition (FAD) TLV.";
}

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

/* Configurations */

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis" {
    when "/rt:routing/rt:control-plane-protocols/"+
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
        description
            "This augment ISIS routing protocol when used";
    }
    description
        "This augments ISIS protocol configuration
        with flexible algorithm.";

    container isis-flex-algo {
        list flex-algo {
            key "algo-number";

```

```

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

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

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

```

```

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

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

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

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

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

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

description
    "List of flex-algo configurations.";

```

```

    }
    description
        "Flexible Algorithm configuration.";
    }
}

/* Database */

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
        "/isis:router-capabilities" {
    when "/rt:routing/rt:control-plane-protocols/" +
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used";
    }

    description
        "This augments ISIS protocol LSDB router capability.";

    uses fad-tlvs;
}

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
        "/isis:extended-ipv4-reachability/isis:prefixes" {
    when "/rt:routing/rt:control-plane-protocols/" +
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used";
    }

    description
        "This augments ISIS protocol LSDB prefix.";
    uses fapm-sub-tlvs;
}

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
        "/isis:mt-extended-ipv4-reachability/isis:prefixes" {
    when "/rt:routing/rt:control-plane-protocols/" +
        "rt:control-plane-protocol/rt:type = 'isis:isis'" {
    description
        "This augment ISIS routing protocol when used";
    }

    description
        "This augments ISIS protocol LSDB prefix.";
    uses fapm-sub-tlvs;
}

```

```

}

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
        "/isis:ipv6-reachability/isis:prefixes" {
        when "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rt:type = 'isis:isis'" {
        description
            "This augment ISIS routing protocol when used";
        }

        description
            "This augments ISIS protocol LSDB prefix.";
        uses fapm-sub-tlvs;
    }

augment "/rt:routing/" +
    "rt:control-plane-protocols/rt:control-plane-protocol"+
    "/isis:isis/isis:database/isis:levels/isis:lsp"+
        "/isis:mt-ipv6-reachability/isis:prefixes" {
        when "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rt:type = 'isis:isis'" {
        description
            "This augment ISIS routing protocol when used";
        }

        description
            "This augments ISIS protocol LSDB prefix.";
        uses fapm-sub-tlvs;
    }

/* notification */

notification flex-algo-not-supported {
    uses isis:notification-instance-hdr;
    leaf flex-algo-number {
        type uint8 {
            range "128..255";
        }
        description
            "Flex-algo identifier which is not supported by the IS-IS
            instance.";
    }
    description
        "This notification is sent when an IS-IS instance does not
        support this flex-algo.";
}
}

```

<CODE ENDS>

5. YANG Module for IS-IS Maximum SID Depth

This document defines a module for Signaling Maximum SID Depth (MSD) using IS-IS [[RFC8491](#)]. It is an augmentation of the IS-IS base model.

The figure below describes the overall structure of the isis-msd YANG module:

```
module: ietf-isis-msd
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:router-capabilities:
+--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/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:extended-is-neighbor
    /isis:neighbor:
+--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/isis:isis/isis:database
    /isis:levels/isis:lsp/isis:mt-is-neighbor/isis:neighbor:
+--ro link-msd-sub-tlv
    +--ro link-msds* [msd-type]
        +--ro msd-type      identityref
        +--ro msd-value?    uint8
```

Figure 1

```

<CODE BEGINS> file "ietf-isis-msd@2023-03-06.yang"
module ietf-isis-msd {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-isis-msd";
  prefix isis-msd;

  import ietf-routing {
    prefix rt;
    reference
      "RFC 8349: A YANG Data Model for Routing
      Management (NMDA Version)";
  }
  import ietf-isis {
    prefix isis;
    reference
      "RFC 9130: YANG Data Model for the IS-IS Protocol";
  }
  import ietf-mpls-msd {
    prefix mpls-msd;
  }

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

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

    ";
  description
    "The YANG module augments the base ISIS 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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    authors of the code.  All rights reserved.

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    without modification, is permitted pursuant to, and subject to

```

the license terms contained in, the Revised BSD License set forth in Section 4.c of the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>).

This version of this YANG module is part of RFC XXXX (<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 Data Model for ISIS MSD";

revision 2023-03-06 {

description

"Initial Version";

reference

"RFC XXXX: YANG Data Model for ISIS MSD.";

}

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 mpls-msd:msd-base-type;

}

description

"MSD-Types";

}

leaf msd-value {

type uint8;

description

"MSD value, in the range of 0-255.";

}

description

"List of link MSDs";

}

description

"Link MSD sub-tlvs.";

}

}

```

/* Node MSD TLV */

augment "/rt:routing/"
+ "rt:control-plane-protocols/rt:control-plane-protocol"
+ "/isis:isis/isis:database/isis:levels/isis:lsp"
+ "/isis:router-capabilities" {
when "derived-from-or-self ../../../../rt:type, 'isis:isis')" {
description
    "This augment ISIS routing protocol when used";
}
description
    "This augments ISIS protocol LSDB router capability.";
container node-msd-tlv {
list node-msds {
key "msd-type";
leaf msd-type {
type identityref {
base mpls-msd: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 8491: Signaling Maximum SID Depth (MSD) Using IS-IS";
}
}

```

```

/* link MSD sub-tlv */

```

```

augment "/rt:routing/"
+ "rt:control-plane-protocols/rt:control-plane-protocol"
+ "/isis:isis/isis:database/isis:levels/isis:lsp"
+ "/isis:extended-is-neighbor/isis:neighbor" {
when "derived-from-or-self ../../../../rt:type, "
+ "'isis:isis')" {
description
    "This augment ISIS routing protocol when used";
}
}

```

```

    }
    description
        "This augments ISIS protocol LSDB neighbor with
        Link MSD sub-TLV.";
    uses link-msd-sub-tlv;
}

augment "/rt:routing/"
    + "rt:control-plane-protocols/rt:control-plane-protocol"
    + "/isis:isis/isis:database/isis:levels/isis:lsp"
    + "/isis:mt-is-neighbor/isis:neighbor" {
when "derived-from-or-self(..../..../..../rt:type,"
    + "'isis:isis')" {
    description
        "This augment ISIS routing protocol when used";
}
description
    "This augments ISIS protocol LSDB neighbor.";
uses link-msd-sub-tlv;
}
}
<CODE ENDS>

```

Figure 2

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 [RFC8446].

The NETCONF access control model [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 correspond to the following schema nodes:

```
/isis:isis/isis:interfaces/isis:interface/isis-link-attr -  
Modification of link attributes operation mode could result in  
traffic being redirected or DoS attack.
```

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. These correspond to the following schema nodes:

```
/isis:isis/isis:database/isis:levels/isis:lsp/isis:mt-is-  
neighbor/isis:neighbor/isis:instances/isis:instance/application-  
specific-link-attributes-sub-tlvs
```

```
/isis:isis/isis:database/isis:levels/isis:lsp/application-  
specific-srlg-tlv
```

```
/isis:router-capabilities/node-msd-tlv
```

```
/isis:isis/isis:database/isis:levels/isis:lsp//isis:extended-is-  
neighbor/isis:neighbor/link-msd-sub-tlv
```

/isis:isis/isis:database/isis:levels/isis:lsp//isis:mt-is-neighbor/isis:neighbor/link-msd-sub-tlv

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:

URI: urn:ietf:params:xml:ns:yang:ietf-isis-remaining-lifetime
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-isis-link-attr
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-isis-flex-algo
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-isis-msd
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-isis-remaining-lifetime
namespace: urn:ietf:params:xml:ns:yang:ietf-isis-remaining-lifetime
prefix: isis-remaining-lifetime
reference: RFC XXXX

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

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

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

8. Acknowledgements

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

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

9. References

9.1. Normative References

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