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YANG Module for IS-IS Reverse Metric

Abstract

This document defines a YANG module for managing the reverse metric extension to the Intermediate System to Intermediate System intra-domain routing information exchange protocol (IS-IS).

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1. Introduction

This document defines a YANG module for managing the reverse metric extension to IS-IS [[RFC8500](#)], [[ISO10589](#)]. Please refer to [[RFC8500](#)] for the description and definition of the functionality managed by this module.

The YANG data model described in this document conforms to the Network Management Datastore Architecture defined in [[RFC8342](#)].

2. YANG Management

2.1. YANG Tree

The following is the YANG tree diagram ([[RFC8340](#)]) for the IS-IS reverse metric extension additions.

```

module: ietf-isis-reverse-metric
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis:
    +--rw reverse-metric
        +--rw enable-receive?    boolean
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:interfaces
    /isis:interface:
    +--rw reverse-metric
        +--rw reverse-metric
            | +--rw metric?          isis:wide-metric
            | +--rw flags
            | | +--rw whole-lan?      boolean
            | | +--rw allow-unreachable? boolean
            | +--rw exclude-te-metric? boolean
        +--rw level-1
            | +--rw reverse-metric
            | +--rw metric?          isis:wide-metric
            | +--rw flags
            | | +--rw whole-lan?      boolean
            | | +--rw allow-unreachable? boolean
            | +--rw exclude-te-metric? boolean
        +--rw level-2
            +--rw reverse-metric
                +--rw metric?          isis:wide-metric
                +--rw flags
                | +--rw whole-lan?      boolean
                | +--rw allow-unreachable? boolean
                +--rw exclude-te-metric? boolean
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/isis:isis/isis:interfaces
    /isis:interface/isis:adjacencies/isis:adjacency:
    +--ro reverse-metric
        +--ro metric?          isis:wide-metric
        +--ro flags
            | +--ro whole-lan?      boolean
            | +--ro allow-unreachable? boolean
        +--ro te-metric?    uint32

```

2.2. YANG Module

The following is the YANG module for managing the IS-IS reverse metric functionality defined in [\[RFC8500\]](#). It imports modules from the following RFCs: [\[RFC8349\]](#), [\[I-D.ietf-isis-yang-isis-cfg\]](#).

```

<CODE BEGINS> file "ietf-isis-reverse-metric@2021-12-11.yang"
module ietf-isis-reverse-metric {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric";
  prefix isis-rmetric;

  import ietf-routing {
    prefix rt;
    reference
      "RFC8349:
       A YANG Data Model for Routing Management (NMDA Version)";
  }
  import ietf-isis {
    prefix isis;
    reference
      "draft-ietf-isis-yang-isis-cfg-42:
       YANG Data Model for IS-IS Protocol";
  }

  organization
    "IETF LSR Working Group (LSR)";

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

     Author: Christian Hopps
             <mailto:chopps@chopps.org>";

  // RFC Ed.: replace XXXX with actual RFC number and
  // remove this note.

  description
    "This module defines the configuration and operational state for
     managing the IS-IS reverse metric functionality [RFC8500].

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     authors of the code. All rights reserved.

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     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.";

```

```

revision 2021-12-11 {
  description "Initial Revision";
  reference "RFC XXXX: YANG IS-IS Reverse Metric";
}

grouping reverse-metric-data {
  description "IS-IS reverse metric data.";
  leaf metric {
    type isis:wide-metric;
    description "The reverse metric value.";
    reference "RFC8500, Section 2";
  }
  container flags {
    description "The reverse metric flag values.";
    leaf whole-lan {
      type boolean;
      description
        "The 'whole LAN' or W-bit. If true then a DIS processing
        this reverse metric will add the metric value to all the
        nodes it advertises in the pseudo-node LSP for this
        interface. Otherwise, it will only increment the metric
        for the advertising node in the pseudo-node LSP for this
        interface.";
      reference "RFC8500, Section 2";
    }
    leaf allow-unreachable {
      type boolean;
      description
        "The 'allow-unreachable' or U-bit. If true it allows the
        neighbor to increment the overall metric up to 2^24-1
        rather than the lesser maximum of 2^24-2. If the metric
        is then set by the neighbor to 2^24-1, it will cause
        traffic to stop using, rather than avoid using, the
        interface.";
      reference "RFC8500, Section 2";
    }
  }
}

grouping reverse-metric-if-config-data {
  description "IS-IS reverse metric config data.";
  container reverse-metric {
    description "IS-IS reverse metric data.";
    uses reverse-metric-data;
    leaf exclude-te-metric {
      type boolean;
      default false;
      description
        "If true and there is a TE metric defined for this

```

```

        interface then do not send the TE metric sub-TLV in the
        reverse metric TLV.";

        reference "RFC8500, Section 2";
    }
}

grouping tlv16-reverse-metric {
    description "IS-IS reverse metric TLV data.";
    container reverse-metric {
        description "IS-IS reverse metric TLV data.";
        uses reverse-metric-data;
        leaf te-metric {
            type uint32;
            description
                "The TE metric value from the sub-TLV if present.";
            reference "RFC8500, Section 2";
        }
    }
}

augment "/rt:routing/rt:control-plane-protocols/"
+ "rt:control-plane-protocol/"
+ "isis:isis" {
    when "derived-from-or-self(..../rt:type, 'isis:isis')" {
        description
            "This augment is only valid when routing protocol instance
            type is 'isis'.";
    }

    description
        "The reverse metric configuration for an IS-IS instance.";

    container reverse-metric {
        description "Global reverse metric configuration.";
        leaf enable-receive {
            type boolean;
            default false;
            description
                "Enable handling of reverse metric announcements from
                neighbors. By default, reverse metric handling is disabled
                and must be explicitly enabled through this
                configuration.";
        }
    }
}

augment "/rt:routing/rt:control-plane-protocols/"

```

```

+"rt:control-plane-protocol/"
+"isis:isis/isis:interfaces/isis:interface" {
when "derived-from-or-self(..../..../rt:type, 'isis:isis')" {
    description
        "This augment is only valid when routing protocol instance
        type is 'isis'.";
}

description
    "The reverse metric configuration for an interface.";

container reverse-metric {
    description "Announce a reverse metric to neighbors.";
    uses reverse-metric-if-config-data;
    container level-1 {
        description
            "Announce a reverse metric to level-1 neighbors.";
        uses reverse-metric-if-config-data;
    }
    container level-2 {
        description
            "Announce a reverse metric to level-2 neighbors.";
        uses reverse-metric-if-config-data;
    }
}
}
augment "/rt:routing/rt:control-plane-protocols/"
+"rt:control-plane-protocol/"
+"isis:isis/isis:interfaces/isis:interface/"
+"isis:adjacencies/isis:adjacency" {
when "derived-from-or-self(..../..../..../rt:type,
                            'isis:isis')" {
    description
        "This augment is only valid when routing protocol instance
        type is 'isis'.";
}

description
    "The reverse metric state advertised by an adjacency.";
uses tlv16-reverse-metric;
}
}
<CODE ENDS>

```

3. IANA Considerations

3.1. Updates to the IETF XML Registry

This document registers a URI in the "IETF XML Registry" [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registration has been made:

URI urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric

Registrant Contact The IESG.

XML N/A; the requested URI is an XML namespace.

3.2. Updates to the YANG Module Names Registry

This document registers one YANG module in the "YANG Module Names" registry [[RFC6020](#)]. Following the format in [[RFC6020](#)], the following registration has been made:

name ietf-isis-reverse-metric

namespace urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric

prefix isis-rmetric

reference RFC XXXX (RFC Ed.: replace XXX with actual RFC number and remove this note.)

4. Security Considerations

The YANG module specified in this document defines 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 preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

The YANG module defined in this document can enable, disable and modify the behavior of metrics used by routing. For the security implications regarding these types of changes consult [[RFC8500](#)] which defines the functionality.

There are a number of data nodes defined in this 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. These YANG nodes correspond directly to the RFC 8500 functionality and the security considerations of the functionality are described in RFC 8500.

These are the subtrees and data nodes:

Under `"/rt:routing/rt:control-plane-protocols/" +`
`"rt:control-plane-protocol/isis:isis"`

- `/isis-rmetric:reverse-metric/isis-rmetric:enable-receive`

Under `"/rt:routing/rt:control-plane-protocols/" +`
`"rt:control-plane-protocol/isis:isis/" +`
`"isis:interfaces/isis:interface/" +`
`"isis-rmetric:reverse-metric"`

- `/isis-rmetric:metric`
- `/isis-rmetric:flags/isis-rmetric:whole-lan`
- `/isis-rmetric:flags/isis-rmetric:allow-unreachable`
- `/isis-rmetric:exclude-te-metric`

Under `"/rt:routing/rt:control-plane-protocols/" +`
`"rt:control-plane-protocol/isis:isis/" +`
`"isis:interfaces/isis:interface/" +`
`"isis:level-1/isis-rmetric:reverse-metric"`

- `/isis-rmetric:metric`
- `/isis-rmetric:flags/isis-rmetric:whole-lan`
- `/isis-rmetric:flags/isis-rmetric:allow-unreachable`
- `/isis-rmetric:exclude-te-metric`

Under `"/rt:routing/rt:control-plane-protocols/" +`
`"rt:control-plane-protocol/isis:isis/" +`
`"isis:interfaces/isis:interface/" +`
`"isis:level-2/isis-rmetric:reverse-metric"`

- `/isis-rmetric:metric`
- `/isis-rmetric:flags/isis-rmetric:whole-lan`
- `/isis-rmetric:flags/isis-rmetric:allow-unreachable`
- `/isis-rmetric:exclude-te-metric`

Some of the readable data nodes in this 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. These YANG nodes correspond

directly to the RFC 8500 functionality and the security considerations of the functionality are described in RFC 8500. These are the subtrees and data nodes:

Under `"/rt:routing/rt:control-plane-protocols/" +`
`"rt:control-plane-protocol/isis:isis/" +`
`"isis:interfaces/isis:interface/" +`
`"isis:adjacencies/isis:adjacency/" +`
`"isis-rmetric:reverse-metric"`

- `/isis-rmetric:metric`
- `/isis-rmetric:flags/isis-rmetric:whole-lan`
- `/isis-rmetric:flags/isis-rmetric:allow-unreachable`
- `/isis-rmetric:te-metric`

5. Normative References

- [ISO10589] International Organization for Standardization, "Intermediate System to Intermediate System intra-domain routing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode network service (ISO 8473)", ISO Standard 10589:2002, 2002.
- [RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.
- [RFC8341] Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.
- [RFC8342] Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture (NMDA)", RFC 8342, DOI 10.17487/RFC8342, March 2018, <<https://www.rfc-editor.org/info/rfc8342>>.
- [RFC8349] Lhotka, L., Lindem, A., and Y. Qu, "A YANG Data Model for Routing Management (NMDA Version)", RFC 8349, DOI

10.17487/RFC8349, March 2018, <<https://www.rfc-editor.org/info/rfc8349>>.

[RFC8500] Shen, N., Amante, S., and M. Abrahamsson, "IS-IS Routing with Reverse Metric", RFC 8500, DOI 10.17487/RFC8500, February 2019, <<https://www.rfc-editor.org/info/rfc8500>>.

[I-D.ietf-isis-yang-isis-cfg] Litkowski, S., Yeung, D., Lindem, A., Zhang, J., and L. Lhotka, "YANG Data Model for IS-IS Protocol", Work in Progress, Internet-Draft, draft-ietf-isis-yang-isis-cfg-42, 15 October 2019, <<https://datatracker.ietf.org/doc/html/draft-ietf-isis-yang-isis-cfg-42>>.

6. Informative References

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.

[RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.

[RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017, <<https://www.rfc-editor.org/info/rfc8040>>.

[RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.

[RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

Appendix A. Examples

A.1. Example Enable XML

Below is an example of XML instance data to enable reverse metric processing.

```

<rt:routing
  xmlns:rt="urn:ietf:params:xml:ns:yang:ietf-routing"
  xmlns:isis="urn:ietf:params:xml:ns:yang:ietf-isis"
  xmlns:isis-rmetric=
    "urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric">
<rt:control-plane-protocols>
  <rt:control-plane-protocol>
    <rt:type>isis:isis</rt:type>
    <rt:name>default</rt:name>
    <isis:isis>
      <isis:area-address>00</isis:area-address>
      <isis-rmetric:reverse-metric>
        <isis-rmetric:enable-receive>true</isis-rmetric:enable-receive>
      </isis-rmetric:reverse-metric>
    </isis:isis>
  </rt:control-plane-protocol>
</rt:control-plane-protocols>
</rt:routing>

```

Figure 1: Example XML data to enable reverse metric processing.

A.2. Example Use XML

Below is an example of XML instance data for the ietf-isis-reverse-metric module.

```

<if:interfaces
  xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces"
  xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">
  <if:interface>
    <if:name>eth0</if:name>
    <if:type>ianaift:ethernetCsmacd</if:type>
  </if:interface>
</if:interfaces>
<rt:routing
  xmlns:rt="urn:ietf:params:xml:ns:yang:ietf-routing"
  xmlns:isis="urn:ietf:params:xml:ns:yang:ietf-isis"
  xmlns:isis-rmetric=
    "urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric">
<rt:control-plane-protocols>
  <rt:control-plane-protocol>
    <rt:type>isis:isis</rt:type>
    <rt:name>default</rt:name>
    <isis:isis>
      <isis:area-address>00</isis:area-address>
      <isis:interfaces>
        <isis:interface>
          <isis:name>eth0</isis:name>
          <isis-rmetric:reverse-metric>
            <isis-rmetric:reverse-metric>
              <isis-rmetric:metric>
                65535
              </isis-rmetric:metric>
            </isis-rmetric:reverse-metric>
          </isis-rmetric:reverse-metric>
        </isis:interface>
      </isis:interfaces>
    </isis:isis>
  </rt:control-plane-protocol>
</rt:control-plane-protocols>
</rt:routing>

```

Figure 2: Example XML data for ietf-isis-reverse-metric module.

A.3. Example JSON

Below is an example of JSON instance data for the ietf-isis-reverse-metric module.

```

{
  "ietf-interfaces:interfaces": {
    "interface": [
      {
        "name": "eth0",
        "type": "iana-if-type:ethernetCsmacd"
      }
    ]
  },
  "ietf-routing:routing": {
    "control-plane-protocols": {
      "control-plane-protocol": [
        {
          "type": "ietf-isis:isis",
          "name": "default",
          "ietf-isis:isis": {
            "area-address": [
              "00"
            ],
            "interfaces": {
              "interface": [
                {
                  "name": "eth0",
                  "ietf-isis-reverse-metric:reverse-metric": {
                    "level-1": {
                      "reverse-metric": {
                        "metric": 65535,
                        "exclude-te-metric": true
                      }
                    }
                  }
                }
              ]
            }
          }
        }
      ]
    }
  }
}

```

Figure 3: Example JSON data for level-1 only reverse metric.

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