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A 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 (IS-IS) intra-domain routing information exchange protocol.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc9194.

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1. Introduction

This document defines a YANG module for managing the reverse metric extension to IS-IS [RFC8500] [ISO-10589]. 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 metric?              isis:wide-metric
       +--rw flags
       |  +--rw whole-lan?           boolean
       |  +--rw allow-unreachable?   boolean
       +--rw exclude-te-metric?   boolean
       +--rw level-1
       |  +--rw metric?              isis:wide-metric
       |  +--rw flags
       |  |  +--rw whole-lan?           boolean
       |  |  +--rw allow-unreachable?   boolean
       |  +--rw exclude-te-metric?   boolean
       +--rw level-2
          +--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 [RFC8349] and [RFC9130].

This YANG module uses the same per-level hierarchical configuration structure as that defined in the augmented base module.

```
<CODE BEGINS> file "ietf-isis-reverse-metric@2022-10-19.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
      "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 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>";

description
  "This module defines the configuration and operational state
   for managing the IS-IS reverse metric functionality
   (RFC 8500).

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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 9194; see the
   RFC itself for full legal notices.";
reference
  "RFC 8500: IS-IS Routing with Reverse Metric";

revision 2022-10-19 {
  description
    "Initial revision.";
  reference
    "RFC 9194: A YANG Module for 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
      "RFC 8500: IS-IS Routing with Reverse Metric, Section 2";
  }
  container flags {
    description
      "The reverse metric flag values.";
    leaf whole-lan {
      type boolean;
      description
        "The 'Whole LAN' bit (W bit) (RFC 8500).  If true, then
         a Designated Intermediate System (DIS) processing this
         reverse metric will add the metric value to all the
         nodes it advertises in the pseudonode Link State
         Protocol Data Unit (LSP) for this interface.
         Otherwise, it will only increment the metric for the
         advertising node in the pseudonode LSP for this
         interface.";
      reference
        "RFC 8500: IS-IS Routing with Reverse Metric,
                   Section 2";
    }
    leaf allow-unreachable {
      type boolean;
      description
```

```
        "The 'Unreachable' bit (U bit) (RFC 8500).  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
        "RFC 8500: IS-IS Routing with Reverse Metric,
                   Section 2";
    }
  }
}

grouping reverse-metric-if-config-data {
  description
    "IS-IS reverse metric config 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 Traffic Engineering
       Metric sub-TLV in the Reverse Metric TLV.";

    reference
      "RFC 8500: IS-IS Routing with Reverse Metric, Section 2";
  }
}

grouping tlv16-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
      "RFC 8500: IS-IS Routing with Reverse Metric, 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 the 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
        "Enables 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 the routing protocol
           instance type is 'isis'.";
      }

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

      container reverse-metric {
        description
          "Announces a reverse metric to neighbors.  The
           configuration is hierarchical and follows the same
           behavior as that defined for per-level values in the
           augmented base module.

           Reverse metric operation is enabled by the configuration
           of a 'reverse-metric' metric value either at the top
           level or under a level-specific container node.  If a
           'reverse-metric' metric value is only specified under a
           level-specific container node, then operation is only
           enabled at the specified level.

           As the reverse metric is advertised in IS-IS Hello
           Protocol Data Units (IIH PDUs), level-specific
           configuration is only available for broadcast interface
           types.";
        uses reverse-metric-if-config-data {
          refine "flags/whole-lan" {
            default "false";
          }
          refine "flags/allow-unreachable" {
            default "false";
          }
        }
        container level-1 {
          when '../../isis:interface-type = "broadcast"';
          description
            "Announces a reverse metric to level-1 neighbors.";
          uses reverse-metric-if-config-data;
        }
        container level-2 {
          when '../../isis:interface-type = "broadcast"';
          description
            "Announces 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 the routing protocol
           instance type is 'isis'.";
      }

      description
        "The reverse metric state advertised by an adjacency.";
      container reverse-metric {
        description
          "IS-IS Reverse Metric TLV data.";
        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
Maintained by IANA? N
Namespace: urn:ietf:params:xml:ns:yang:ietf-isis-reverse-metric
Prefix: isis-rmetric
Reference: RFC 9194

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 Network Configuration Access Control Model (NACM) [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 -- as well as [RFC9130].

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 functionality provided in RFC 8500, 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-rmetric:reverse-metric/" +
"isis-rmetric:level-1/"

- /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-rmetric:reverse-metric/" +
"isis-rmetric:level-2/"

- /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 functionality provided in RFC 8500, 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

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              and R. Wilton, "Network Management Datastore Architecture
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              Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018,
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   [RFC8500] Shen, N., Amante, S., and M. Abrahamsson, "IS-IS Routing
              with Reverse Metric", RFC 8500, DOI 10.17487/RFC8500,
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              L. Lhotka, "YANG Data Model for the IS-IS Protocol",
              RFC 9130, DOI 10.17487/RFC9130, October 2022,
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              Bray, T., Paoli, J., Sperberg-McQueen, M., Maler, E., and
              F. Yergeau, "Extensible Markup Language (XML) 1.0 (Fifth
              Edition)", World Wide Web Consortium Recommendation REC-
              xml-20081126, November 2008,
              <https://www.w3.org/TR/2008/REC-xml-20081126>.

6. Informative References

   [RFC7951] Lhotka, L., "JSON Encoding of Data Modeled with YANG",
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Appendix A. Examples

A.1. Enablement Example Using XML YANG Instance Data

Below is an example of XML [W3C.REC-xml-20081126] YANG instance data [RFC8342] 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. Usage Example Using XML YANG Instance Data

Below is an example of XML YANG instance data [RFC8342] 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:metric>
                65535
              </isis-rmetric: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 the "ietf-isis-reverse-metric" Module

A.3. Usage Example Using JSON YANG Instance Data

Below is an example of JSON YANG instance data [RFC7951] 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": {
                          "metric": 65535,
                          "exclude-te-metric": true
                        }
                      }
                    }
                  ]
                }
              }
            }
          ]
        }
      }
    }
```

Figure 3: Example JSON Data for the Level-1-Only Reverse Metric

Author's Address

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