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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 routeing information exchange protocol (IS-IS).

### **Status of This Memo**

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## [Author's Address](#)

## **1. Introduction**

This document defines a YANG module for managing the reverse metric extension to IS-IS [[RFC8500](#)], [[IS010589](#)]. 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 the following RFCs: [[RFC8349](#)], [[I-D.ietf-isis-yang-isis-cfg](#)].

This YANG module uses the same "Per-Level" hierarchical configuration structure as is defined in the augmented base module.

```

<CODE BEGINS> file "ietf-isis-reverse-metric@2022-01-01.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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(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 2022-01-01 {
    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.";
    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.";
    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. The configuration
         is hierarchical and follows the same behavior as defined
         for 'Per-Level' values in the augmented base module.

        Reverse metric operation is enabled by the configuration of
        a reverse-metric metric value at either 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 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
            "Announce a reverse metric to level-1 neighbors.";
        uses reverse-metric-if-config-data;
    }
    container level-2 {
        when '../isis:interface-type = "broadcast"';
        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.";
      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

**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 as well as [[I-D.ietf-isis-yang-isis-cfg](#)].

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-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 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 routeing 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>>.

- [RFC7951]** Lhotka, L., "JSON Encoding of Data Modeled with YANG", RFC 7951, DOI 10.17487/RFC7951, August 2016, <<https://www.rfc-editor.org/info/rfc7951>>.

**[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. Enablement Example using XML YANG Instance Data

Below is an example of XML 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 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 level-1 only reverse metric.

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