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A Yang Data Model for IGMP/MLD Proxy  
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## Abstract

This document defines a YANG data model that can be used to configure and manage Internet Group Management Protocol (IGMP) or Multicast Listener Discovery (MLD) proxy devices. The YANG module in this document conforms to Network Management Datastore Architecture (NMDA).

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## [1. Introduction](#)

This document defines a YANG [[RFC7950](#)] data model for the management of Internet Group Management Protocol (IGMP) or Multicast Listener Discovery (MLD) Proxy [[RFC4605](#)] devices.

The YANG module in this document conforms to the Network Management Datastore Architecture defined in [[RFC8342](#)]. The "Network Management Datastore Architecture" (NMDA) adds the ability to inspect the current operational values for configuration, allowing clients to use identical paths for retrieving the configured values and the operational values.

### [1.1. Terminology](#)

The terminology for describing YANG data models is found in [[RFC6020](#)] and [[RFC7950](#)], including:

- \* augment
- \* data model
- \* data node
- \* identity
- \* module

The following abbreviations are used in this document and defined model:

IGMP: Internet Group Management Protocol [[RFC3376](#)].

MLD: Multicast Listener Discovery [[RFC3810](#)].

PIM: Protocol Independent Multicast [[RFC7761](#)].

## [1.2](#). Conventions Used in This Document

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.

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## [1.3](#). Tree Diagrams

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

## [1.4](#). Prefixes in Data Node Names

In this document, names of data nodes, and other data model objects are often used without a prefix, as long as it is clear from the context in which YANG module each name is defined. Otherwise, names are prefixed using the standard prefix associated with the corresponding YANG module, as shown in Table 1.

Prefix	YANG module	Reference
inet	ietf-inet-types	<a href="#">[RFC6991]</a>
if	ietf-interfaces	<a href="#">[RFC8343]</a>
rt	ietf-routing	<a href="#">[RFC8349]</a>
rt-types	ietf-routing-types	<a href="#">[RFC8294]</a>
pim-base	ietf-pim-base	<a href="#">[draft-ietf-pim-yang]</a>



configuration is not needlessly complicated. Therefore, this model declares a number of features representing capabilities that not all deployed devices support.

The extensive use of feature declarations should also substantially simplify the capability negotiation process for a vendor's IGMP / MLD Proxy implementations.

### [2.3](#). Position of Address Family in Hierarchy

IGMP Proxy only supports IPv4, while MLD Proxy only supports IPv6. The data model defined in this document can be used for both IPv4 and IPv6 address families.

This document defines IGMP Proxy and MLD Proxy as separate schema branches in the structure. The benefits are:

- \* The model can support IGMP Proxy (IPv4), MLD Proxy (IPv6), or both optionally and independently. Such flexibility cannot be achieved cleanly with a combined branch.

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- \* The structure is consistent with other YANG data models such as [\[RFC8652\]](#), which uses separate branches for IPv4 and IPv6.

- \* Having separate branches for IGMP Proxy and MLD Proxy allows minor differences in their behavior to be modelled more simply and cleanly. The two branches can better support different features and node types.

## [3](#). Module Structure

This model augments the core routing data model specified in [\[RFC8349\]](#).

```
+--rw routing
  +--rw router-id?
  +--rw control-plane-protocols
    |   +--rw control-plane-protocol* [type name]
    |   |   +--rw type
    |   |   +--rw name
    |   |   +--rw igmp-proxy <= Augmented by this Model
```

...  
| +--rw mld-proxy <= Augmented by this Model

The "igmp-proxy" container instantiates IGMP Proxy. The "mld-proxy" container instantiates MLD Proxy.

The YANG data model defined in this document conforms to the Network Management Datastore Architecture (NMDA) [[RFC8342](#)]. The operational state data is combined with the associated configuration data in the same hierarchy [[RFC8407](#)].

### [3.1](#). IGMP Proxy Configuration and Operational State

The YANG module augments /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol to add the igmp-proxy container.

All the IGMP Proxy related attributes are defined in the igmp-proxy container. The read-write attributes represent configurable data. The read-only attributes represent state data.

The igmp-version represents version of IGMP protocol, and default value is 2. If the value of enable is true, it means IGMP Proxy is enabled.

The interface list under igmp-proxy contains upstream interfaces for IGMP proxy. There is also a constraint to make sure the upstream interface for IGMP proxy should not be configured PIM.

To configure a downstream interface for IGMP proxy, it is needed to enable IGMP on that interface. This is defined in the YANG Data Model

for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) [[RFC8652](#)].

```
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol:
    +--rw igmp-proxy {igmp-proxy}?
      +--rw interfaces
        +--rw interface* [interface-name]
          +--rw interface-name          if:interface-ref
          +--rw igmp-version?           uint8
          +--rw enable?                 boolean
          +--rw sender-source-address?  inet:ipv4-address
```

```

+--ro group* [group-address]
  +--ro group-address
  |       rt-types:ipv4-multicast-group-address
+--ro up-time?          uint32
+--ro filter-mode      enumeration
+--ro source* [source-address]
  +--ro source-address      inet:ipv4-address
  +--ro up-time?            uint32
  +--ro downstream-interface* [interface-name]
    +--ro interface-name    if:interface-ref

```

### [3.2.](#) MLD Proxy Configuration and Operational State

The YANG module augments `/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol` to add the `mld-proxy` container.

All the MLD Proxy related attributes are defined in the `mld-proxy` container. The read-write attributes represent configurable data. The read-only attributes represent state data.

The `mld-version` represents version of MLD protocol, and default value is [2](#). If the value of `enable` is true, it means MLD Proxy is enabled.

The interface list under `mld-proxy` contains upstream interfaces for MLD proxy. There is also a constraint to make sure the upstream interface for MLD proxy should not be configured PIM.

To configure a downstream interface for MLD proxy, enable MLD on that interface. This is defined in the YANG Data Model for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) [[RFC8652](#)].

```

augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol:
    +--rw mld-proxy {mld-proxy}?
      +--rw interfaces
        +--rw interface* [interface-name]

```

```

+--rw interface-name      if:interface-ref
+--rw mld-version?        uint8
+--rw enable?             boolean
+--rw sender-source-address? inet:ipv6-address
+--ro group* [group-address]
  +--ro group-address

```



```

|          rt-types:ipv6-multicast-group-address
+--ro up-time?          uint32
+--ro filter-mode       enumeration
+--ro source* [source-address]
    +--ro source-address      inet:ipv6-address
    +--ro up-time?           uint32
    +--ro downstream-interface* [interface-name]
        +--ro interface-name  if:interface-ref

```

#### 4. IGMP/MLD Proxy YANG Module

This module references [\[RFC4605\]](#), [\[RFC6991\]](#), [\[RFC8294\]](#), [\[RFC8343\]](#), [\[RFC8349\]](#) and [\[draft-ietf-pim-yang\]](#).

```

<CODE BEGINS> file ietf-igmp-mld-proxy@2021-04-21.yang
module ietf-igmp-mld-proxy {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-igmp-mld-proxy";
  // replace with IANA namespace when assigned
  prefix igmp-mld-proxy;

  import ietf-inet-types {
    prefix inet;
  }
  import ietf-interfaces {
    prefix if;
  }
  import ietf-routing {
    prefix rt;
  }
  import ietf-routing-types {
    prefix rt-types;
  }
  import ietf-pim-base {
    prefix pim-base;
  }

  organization
    "IETF PIM Working Group";

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

```

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";

#### description

"The module defines a collection of YANG definitions common for all Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Proxy devices.

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

```
revision 2021-04-21 {  
  description  
    "Initial revision.";  
  reference  
    "RFC XXXX: A YANG Data Model for IGMP and MLD Proxy";  
}
```

```
/*  
 * Features  
 */
```

```
feature igmp-proxy {  
  description  
    "Support IGMP Proxy protocol.";  
  reference
```

["RFC 4605"](#);

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```
}

feature mld-proxy {
  description
    "Support MLD Proxy protocol.";
  reference
    "RFC 4605";
}

/*
 * Identities
 */

identity igmp-proxy {
  base rt:control-plane-protocol;
  description
    "IGMP Proxy protocol";
}

identity mld-proxy {
  base rt:control-plane-protocol;
  description
    "MLD Proxy protocol";
}

/*
 * Groupings
 */

grouping per-interface-config-attributes {
  description "Config attributes under interface view";
  leaf enable {
    type boolean;
    default false;
    description
      "Set the value to true to enable IGMP/MLD proxy";
  }
} // per-interface-config-attributes

grouping state-group-attributes {
  description
    "State group attributes";
  leaf up-time {
```

```

    type uint32;
    units seconds;
    description
        "The elapsed time for (S,G) or (*,G).";
}
leaf filter-mode {
    type enumeration {
        enum "include" {

```

```

    description
        "In include mode, reception of packets sent
        to the specified multicast address is requested
        only from those IP source addresses listed in the
        source-list parameter";
}
enum "exclude" {
    description
        "In exclude mode, reception of packets sent
        to the given multicast address is requested
        from all IP source addresses except those
        listed in the source-list parameter.";
}
}
mandatory true;
description
    "Filter mode for a multicast group,
    may be either include or exclude.";
}
} // state-group-attributes

/* augments */

augment "/rt:routing/rt:control-plane-protocols"+
    "/rt:control-plane-protocol" {
    when
        "derived-from-or-self(rt:type, 'igmp-mld-proxy:igmp-proxy')" {
        description
            "This augmentation is only valid for IGMP Proxy.";
        }
    description
        "IGMP Proxy augmentation to routing control plane protocol
        configuration and state.";
    container igmp-proxy {
        if-feature "igmp-proxy";

```

```

description "IGMP proxy";
container interfaces {
  description
    "Containing a list of upstream interfaces.";
  list interface {
    key "interface-name";
    description
      "List of upstream interfaces.";
    leaf interface-name {
      type if:interface-ref;
      must "not( current() = /rt:routing"+
        "/rt:control-plane-protocols/pim-base:pim"+
        "/pim-base:interfaces/pim-base:interface"+
        "/pim-base:name )" {
        description

```

```

    "The upstream interface for IGMP proxy
    should not be configured PIM.";
  }
  description "The upstream interface name.";
}
leaf igmp-version {
  type uint8 {
    range "1..3";
  }
  default 2;
  description "IGMP version.";
}
uses per-interface-config-attributes;
leaf sender-source-address {
  type inet:ipv4-address;
  description
    "The sender source address of
    IGMP membership report or leave.";
}
list group {
  key "group-address";
  config false;
  description
    "Multicast group membership information
    that joined on the interface.";
  leaf group-address {
    type rt-types:ipv4-multicast-group-address;
    description
      "Multicast group address.";
  }
}

```

```

    }
    uses state-group-attributes;
    list source {
        key "source-address";
        description
            "List of multicast source information
            of the multicast group.";
        leaf source-address {
            type inet:ipv4-address;
            description
                "Multicast source address";
        }
        leaf up-time {
            type uint32;
            units seconds;
            description
                "The elapsed time for (S,G) or (*,G).";
        }
        list downstream-interface {
            key "interface-name";
            description "The downstream interfaces list.";
            leaf interface-name {

```

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```

        type if:interface-ref;
        description
            "Downstream interfaces
            for each upstream-interface";
    }
}
} // list source
} // list group
} // interface
} // interfaces
}
}

augment "/rt:routing/rt:control-plane-protocols"+
    "/rt:control-plane-protocol" {
    when
        "derived-from-or-self(rt:type, 'igmp-mld-proxy:mld-proxy')" {
        description
            "This augmentation is only valid for MLD Proxy.";
        }
    description
        "MLD Proxy augmentation to routing control plane protocol

```

```

    configuration and state.";
container mld-proxy {
    if-feature "mld-proxy";
    description "MLD proxy";
    container interfaces {
        description
            "Containing a list of upstream interfaces.";
        list interface {
            key "interface-name";
            description
                "List of upstream interfaces.";
            leaf interface-name {
                type if:interface-ref;
                must "not( current() = /rt:routing"+
                    "/rt:control-plane-protocols/pim-base:pim"+
                    "/pim-base:interfaces/pim-base:interface"+
                    "/pim-base:name )" {
                    description
                        "The upstream interface for MLD proxy
                        should not be configured PIM.";
                }
            }
            description "The upstream interface name.";
        }
        leaf mld-version {
            type uint8 {
                range "1..2";
            }
            default 2;
            description "MLD version.";
        }
    }
}

```

```

    }
    uses per-interface-config-attributes;
    leaf sender-source-address {
        type inet:ipv6-address;
        description
            "The sender source address of
            MLD membership report or leave.";
    }
    list group {
        key "group-address";
        config false;
        description
            "Multicast group membership information
            that joined on the interface.";
        leaf group-address {

```

```

        type rt-types:ipv6-multicast-group-address;
        description
            "Multicast group address.";
    }
    uses state-group-attributes;
    list source {
        key "source-address";
        description
            "List of multicast source information
            of the multicast group.";
        leaf source-address {
            type inet:ipv6-address;
            description
                "Multicast source address";
        }
        leaf up-time {
            type uint32;
            units seconds;
            description
                "The elapsed time for (S,G) or (*,G).";
        }
        list downstream-interface {
            key "interface-name";
            description "The downstream interfaces list.";
            leaf interface-name {
                type if:interface-ref;
                description
                    "Downstream interfaces
                    for each upstream-interface";
            }
        }
    } // list source
} // list group
} // interface
} // interfaces
}

```

```

    }
}
<CODE ENDS>

```

## [5. 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.

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 are the subtrees and data nodes and their sensitivity/vulnerability:

Under /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:/

igmp-mld-proxy:igmp-proxy

igmp-mld-proxy:mld-proxy

Unauthorized access to any data node of these subtrees can adversely affect the IGMP / MLD Proxy subsystem of both the local device and the network. This may lead to network malfunctions, delivery of packets to inappropriate destinations, and other problems.

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 are the subtrees and data nodes and their sensitivity/vulnerability:

Under /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:/

igmp-mld-proxy:igmp-proxy

igmp-mld-proxy:mld-proxy

operational state information of IGMP / MLD Proxy on this device. The group/source information may expose multicast group memberships.

## [6. IANA Considerations](#)

RFC Ed.: In this section, replace all occurrences of 'XXXX' with the actual RFC number (and remove this note).

### [6.1. XML Registry](#)

This document registers the following namespace URIs in the IETF XML registry [[RFC3688](#)]:

```
-----  
URI: urn:ietf:params:xml:ns:yang:ietf-igmp-mld-proxy  
Registrant Contact: The IETF.  
XML: N/A, the requested URI is an XML namespace.  
-----
```

### [6.2. YANG Module Names Registry](#)

This document registers the following YANG modules in the YANG Module Names registry [[RFC7950](#)]:

```
-----  
name:          ietf-igmp-mld-proxy  
namespace:     urn:ietf:params:xml:ns:yang:ietf-igmp-mld-proxy  
prefix:        igmp-mld-proxy  
reference:     RFC XXXX  
-----
```

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## 7.1. Normative References

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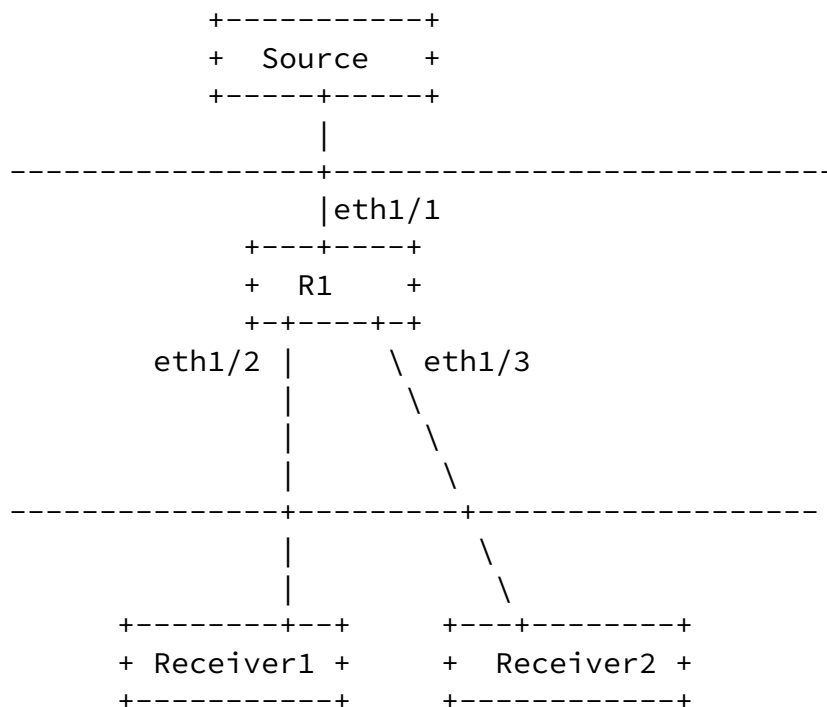
IGMP/MLD Proxy Yang Module

August 30, 2021

## Appendix. Data Tree Example

This section contains an example for IGMP Proxy in the JSON encoding [\[RFC7951\]](#), containing both configuration and state data. In the example IGMP Proxy is enabled on interface eth1/1.

It is also needed to enable IGMP on eth1/2 and eth1/3. The configuration details are omitted here because this document is focused on IGMP/MLD Proxy.



The configuration data for R1 in the above figure could be as follows:

```
{
```









China Mobile  
China  
Email: liuyisong@chinamobile.com

Mani Panchanathan  
Cisco  
India  
Email: mapancha@cisco.com

Mahesh Sivakumar  
Juniper Networks  
1133 Innovation Way  
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