

PIM Working Group
Internet Draft
Intended status: Standards Track
Expires: April 10, 2019

H. Zhao
Ericsson
X. Liu
Jabil
Y. Liu
Huawei
M. Sivakumar
Juniper
A. Peter
Individual

October 11, 2018

A Yang Data Model for IGMP and MLD Snooping
draft-ietf-pim-igmp-mld-snooping-yang-05.txt

Abstract

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

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/lid-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>

Internet-Draft IGMP & MLD Snooping Yang Module October 11, 2018

This Internet-Draft will expire on April 10, 2019.

Copyright Notice

Copyright (c) 2018 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](http://trustee.ietf.org/license-info) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction.....	3
1.1.	Terminology.....	3
1.2.	Tree Diagrams.....	3
2.	Design of Data Model.....	3
2.1.	Overview.....	4
2.2.	IGMP Snooping Instances.....	4
2.3.	MLD Snooping Instances.....	6
2.4.	IGMP and MLD Snooping Instances Reference.....	8
2.5.	IGMP and MLD Snooping RPC.....	9
3.	IGMP and MLD Snooping YANG Module.....	9
4.	Security Considerations.....	32
5.	IANA Considerations.....	33
6.	Normative References.....	34
Appendix A.	Data Tree Example.....	36
	Authors' Addresses.....	42

Internet-Draft IGMP & MLD Snooping Yang Module October 11, 2018

[1.](#) Introduction

This document defines a YANG [[RFC6020](#)] data model for the management of Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping 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 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](#)].

The terminology for describing YANG data models is found in [[RFC6020](#)].

[1.2.](#) Tree Diagrams

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams is as follows:

- o Brackets "[" and "]" enclose list keys.
- o Abbreviations before data node names: "rw" means configuration (read-write), and "ro" means state data (read-only).

- o Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.
- o Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- o Ellipsis ("...") stands for contents of subtrees that are not shown.

[2. Design of Data Model](#)

The model covers Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches [[RFC4541](#)].

Zhao & Liu, etc

Expires April 10, 2019

[Page 3]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

The goal of this document is to define a data model that provides a common user interface to IGMP and MLD Snooping. This document provides freedom for vendors to adapt this data model to their product implementations.

[2.1. Overview](#)

The IGMP and MLD Snooping YANG module defined in this document has all the common building blocks for the IGMP and MLD Snooping protocol.

The YANG module includes IGMP and MLD Snooping instance definition, instance reference in the scenario of BRIDGE and L2VPN. The module also includes the RPC methods for clearing IGMP and MLD Snooping group tables.

This YANG module follows the Guidelines for YANG Module Authors (NMDA) [[draft-dsdt-nmda-guidelines-01](#)]. This NMDA ("Network Management Datastore Architecture") architecture provides an architectural framework for datastores as they are used by network management protocols such as NETCONF [[RFC6241](#)], RESTCONF [[RFC8040](#)] and the YANG [[RFC7950](#)] data modeling language.

[2.2. IGMP Snooping Instances](#)

The YANG module defines igmp-snooping-instance which could be referenced in the BRIDGE or L2VPN scenario to enable IGMP Snooping.

All the IGMP Snooping related attributes have been defined in the igmp-snooping-instance. The read-write attribute means configurable data. The read-only attribute means state data. The key attribute of the igmp-snooping-instance is name.

One igmp-snooping-instance could be referenced in one BRIDGE instance or L2VPN instance. One igmp-snooping-instance corresponds to one BRIDGE instance or L2VPN instance.

The value of type in igmp-snooping-instance is bridge or l2vpn. When it is bridge, the igmp-snooping-instance will be referenced in the BRIDGE scenario. When it is l2vpn, the igmp-snooping-instance will be referenced in the L2VPN scenario.

The value of bridge-mrouter-interface, l2vpn-mrouter-interface-ac, l2vpn-mrouter-interface-pw are filled by snooping device dynamically. They are different from static-bridge-mrouter-interface, static-l2vpn-mrouter-interface-ac, and static-l2vpn-mrouter-interface-pw which are configured statically.

The attributes under the statistics are read-only. They show the statistics of IGMP and MLD Snooping related packets.

```
module: ietf-igmp-ml-d-snooping
  +--rw igmp-snooping-instances
  |   +--rw igmp-snooping-instance* [name]
  |   |   +--rw name                               string
  |   |   +--rw type?                             enumeration
  |   |   +--rw enable?                           boolean
  |   |   +--rw forwarding-mode?                  enumeration
  |   |   +--rw explicit-tracking?                boolean
  |   |   |   {explicit-tracking}?
  |   |   +--rw exclude-lite?                     boolean
  |   |   |   {exclude-lite}?
  |   |   +--rw send-query?                       boolean
  |   |   +--rw immediate-leave?                  empty
  |   |   |   {immediate-leave}?
  |   |   +--rw last-member-query-interval?      uint16
  |   |   +--rw query-interval?                  uint16
  |   |   +--rw query-max-response-time?        uint16
  |   |   +--rw require-router-alert?           boolean
```

```

|         {require-router-alert}?
| +--rw robustness-variable?          uint8
| +--rw version?                      uint8
| +--rw static-bridge-mrouter-interface*  if:interface-ref
|         {static-mrouter-interface}?
| +--rw static-l2vpn-mrouter-interface-ac*  if:interface-ref
|         {static-mrouter-interface}?
| +--rw static-l2vpn-mrouter-interface-pw*
|         l2vpn-instance-pw-ref {static-mrouter-interface}?
| +--rw querier-source?                inet:ipv4-address
| +--rw static-l2-multicast-group* [group source-addr]
|         {static-l2-multicast-group}?
|         +--rw group                  inet:ipv4-address
|         +--rw source-addr            source-ipv4-addr-type
|         +--rw bridge-outgoing-interface*  if:interface-ref
|         +--rw l2vpn-outgoing-ac*        l2vpn-instance-ac-ref
|         +--rw l2vpn-outgoing-pw*       l2vpn-instance-pw-ref
| +--ro entries-count?                uint32
| +--ro bridge-mrouter-interface*      if:interface-ref
| +--ro l2vpn-mrouter-interface-ac*    if:interface-ref
| +--ro l2vpn-mrouter-interface-pw*
|         l2vpn-instance-pw-ref
| +--ro group* [address]
|         +--ro address                inet:ipv4-address
|         +--ro mac-address?          yang:phys-address
|         +--ro expire?               uint32
|         +--ro up-time?              uint32
|         +--ro last-reporter?        inet:ipv4-address
|         +--ro source* [address]
|             +--ro address            inet:ipv4-address

```

```

|         +--ro bridge-outgoing-interface*  if:interface-ref
|         +--ro l2vpn-outgoing-ac*          l2vpn-instance-ac-ref
|         +--ro l2vpn-outgoing-pw*         l2vpn-instance-pw-ref
|         +--ro up-time?                   uint32
|         +--ro expire?                    uint32
|         +--ro host-count?                uint32
|         |           {explicit-tracking}?
|         +--ro last-reporter?              inet:ipv4-address
|         +--ro host* [host-address] {explicit-tracking}?
|             +--ro host-address            inet:ipv4-address
|             +--ro host-filter-mode?      enumeration
| +--ro interfaces
|     +--ro interface* [name]
|         +--ro name                        if:interface-ref

```

```

|         +---ro statistics
|         |
|         |   +---ro received
|         |   |
|         |   |   +---ro query?                yang:counter64
|         |   |   +---ro membership-report-v1?  yang:counter64
|         |   |   +---ro membership-report-v2?  yang:counter64
|         |   |   +---ro membership-report-v3?  yang:counter64
|         |   |   +---ro leave?                yang:counter64
|         |   |   +---ro non-member-leave?      yang:counter64
|         |   |   +---ro pim?                  yang:counter64
|         |   +---ro sent
|         |   |
|         |   |   +---ro query?                yang:counter64
|         |   |   +---ro membership-report-v1?  yang:counter64
|         |   |   +---ro membership-report-v2?  yang:counter64
|         |   |   +---ro membership-report-v3?  yang:counter64
|         |   |   +---ro leave?                yang:counter64
|         |   |   +---ro non-member-leave?      yang:counter64
|         |   |   +---ro pim?                  yang:counter64

```

[2.3.](#) MLD Snooping Instances

The YANG module defines mld-snooping-instance which could be referenced in the BRIDGE or L2VPN scenario to enable MLD Snooping.

The mld-snooping-instance is the same as IGMP snooping except changing IPV4 addresses to IPV6 addresses.

```

module: ietf-igmp-mld-snooping
  +---rw mld-snooping-instances
  |   +---rw mld-snooping-instance* [name]
  |   |   +---rw name                string
  |   |   +---rw type?              enumeration
  |   |   +---rw enable?            boolean
  |   |   +---rw forwarding-mode?   enumeration
  |   |   +---rw explicit-tracking?  boolean

```

```

|   {explicit-tracking}?
+---rw exclude-lite?    boolean
|   {exclude-lite}?
+---rw send-query?      boolean
+---rw immediate-leave? empty
|   {immediate-leave}?
+---rw last-member-query-interval?  uint16

```

```

+--rw query-interval?                               uint16
+--rw query-max-response-time?                       uint16
+--rw require-router-alert?                           boolean
|   {require-router-alert}?
+--rw robustness-variable?                           uint8
+--rw version?                                         uint8
+--rw static-bridge-mrouter-interface*                if:interface-ref
|   {static-mrouter-interface}?
+--rw static-l2vpn-mrouter-interface-ac*             if:interface-ref
|   {static-mrouter-interface}?
+--rw static-l2vpn-mrouter-interface-pw*
|   l2vpn-instance-pw-ref {static-mrouter-interface}?
+--rw querier-source?                                inet:ipv6-address
+--rw static-l2-multicast-group* [group source-addr]
|   {static-l2-multicast-group}?
|   +--rw group                                       inet:ipv6-address
|   +--rw source-addr                                 source-ipv6-addr-type
|   +--rw bridge-outgoing-interface*                 if:interface-ref
|   +--rw l2vpn-outgoing-ac*                         l2vpn-instance-ac-ref
|   +--rw l2vpn-outgoing-pw*                         l2vpn-instance-pw-ref
+--ro entries-count?                                  uint32
+--ro bridge-mrouter-interface*                       if:interface-ref
+--ro l2vpn-mrouter-interface-ac*                     if:interface-ref
+--ro l2vpn-mrouter-interface-pw*
|   l2vpn-instance-pw-ref
+--ro group* [address]
|   +--ro address                                     inet:ipv6-address
|   +--ro mac-address?                               yang:phys-address
|   +--ro expire?                                     uint32
|   +--ro up-time?                                    uint32
|   +--ro last-reporter?                             inet:ipv6-address
|   +--ro source* [address]
|       +--ro address                                 inet:ipv6-address
|       +--ro bridge-outgoing-interface*             if:interface-ref
|       +--ro l2vpn-outgoing-ac*                     l2vpn-instance-ac-ref
|       +--ro l2vpn-outgoing-pw*                     l2vpn-instance-pw-ref
|       +--ro up-time?                                uint32
|       +--ro expire?                                 uint32
|       +--ro host-count?                             uint32
|       |   {explicit-tracking}?
|       +--ro last-reporter?                         inet:ipv6-address
|       +--ro host* [host-address] {explicit-tracking}?
|           +--ro host-address                       inet:ipv6-address
|           +--ro host-filter-mode?                  enumeration

```



```

+--ro interfaces
  +--ro interface* [name]
    +--ro name          if:interface-ref
    +--ro statistics
      +--ro received
        | +--ro query?      yang:counter64
        | +--ro report-v1?  yang:counter64
        | +--ro report-v2?  yang:counter64
        | +--ro done?       yang:counter64
        | +--ro pim?        yang:counter64
      +--ro sent
        +--ro query?      yang:counter64
        +--ro report-v1?  yang:counter64
        +--ro report-v2?  yang:counter64
        +--ro done?       yang:counter64
        +--ro pim?        yang:counter64

```

[2.4.](#) IGMP and MLD Snooping Instances Reference

The `igmp-snooping-instance` could be referenced in the scenario of BRIDGE or L2VPN to configure the IGMP Snooping.

For the BRIDGE scenario this model augments `/dot1q:bridges/dot1q:bridge` to reference `igmp-snooping-instance`. It means IGMP Snooping is enabled in the whole bridge.

It also augments `/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-vlan/dot1q:vlan` to reference `igmp-snooping-instance`. It means IGMP Snooping is enabled in the certain VLAN of the bridge.

```

augment /dot1q:bridges/dot1q:bridge:
  +--rw igmp-snooping-instance?  igmp-snooping-instance-ref
  +--rw mld-snooping-instance?    mld-snooping-instance-ref

```

```

augment /dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-vlan/dot1q:
  +--rw igmp-snooping-instance?  igmp-snooping-instance-ref
  +--rw mld-snooping-instance?    mld-snooping-instance-ref

```

For the L2VPN scenario this model augments `/ni:network-instances/ni:network-instance/ni:ni-type/l2vpn:l2vpn` to reference `igmp-snooping-instance`. It means IGMP Snooping is enabled in the specified l2vpn instance.

```

augment /ni:network-instances/ni:network-instance/ni:ni-type/l2vpn:l2vpn:
  +--rw igmp-snooping-instance?  igmp-snooping-instance-ref
  +--rw mld-snooping-instance?    mld-snooping-instance-ref

```

Internet-Draft IGMP & MLD Snooping Yang Module October 11, 2018

The mld-snooping-instance could be referenced in concurrence with igmp-snooping-instance to configure the MLD Snooping.

[2.5.](#) IGMP and MLD Snooping RPC

IGMP and MLD Snooping RPC clears the specified IGMP and MLD Snooping group tables.

```
rpcs:
  +---x clear-igmp-snooping-groups {rpc-clear-groups}?
  |   +---w input
  |       +---w name?      string
  |       +---w group?     inet:ipv4-address
  |       +---w source?    inet:ipv4-address
  +---x clear-mld-snooping-groups {rpc-clear-groups}?
      +---w input
          +---w name?      string
          +---w group?     inet:ipv6-address
          +---w source?    inet:ipv6-address
```

[3.](#) IGMP and MLD Snooping YANG Module

```
<CODE BEGINS> file ietf-igmp-mld-snooping@2018-10-11.yang
module ietf-igmp-mld-snooping {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-igmp-mld-snooping";
  // replace with IANA namespace when assigned
  prefix ims;

  import ietf-inet-types {
    prefix "inet";
  }

  import ietf-yang-types {
    prefix "yang";
  }

  import ietf-interfaces {
    prefix "if";
  }
```

```
import ietf-l2vpn {  
    prefix "l2vpn";  
}
```

```
import ietf-network-instance {  
    prefix "ni";
```

Zhao & Liu, etc

Expires April 10, 2019

[Page 9]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

```
}
```

```
import ieee802-dot1q-bridge {  
    prefix "dot1q";  
}
```

```
organization  
    "IETF PIM Working Group";
```

```
contact
```

```
    "WG Web:  <http://tools.ietf.org/wg/pim/>
```

```
    WG List:  <mailto:pim@ietf.org>
```

```
    Editors:  Hongji Zhao  
              <mailto:hongji.zhao@ericsson.com>
```

```
              Xufeng Liu  
              <mailto:xufeng.liu.ietf@gmail.com>
```

```
              Yisong Liu  
              <mailto:liuyisong@huawei.com>
```

```
              Anish Peter  
              <mailto:anish.ietf@gmail.com>
```

```
              Mahesh Sivakumar  
              <mailto:sivakumar.mahesh@gmail.com>
```

```
    ";
```

```
description
```

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

```
    Copyright (c) 2018 IETF Trust and the persons identified as  
    authors of the code.  All rights reserved.
```

Redistribution and use in source and binary forms, with or without modification, is permitted pursuant to, and subject to the license terms contained in, the Simplified BSD License set forth in [Section 4.c](#) of the IETF Trust's Legal Provisions Relating to IETF Documents (<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.";

```
revision 2018-10-11 {  
  description  
    "Initial revision.";
```

Zhao & Liu, etc

Expires April 10, 2019

[Page 10]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

```
  reference  
    "RFC XXXX: A YANG Data Model for IGMP and MLD Snooping";  
}
```

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

```
feature immediate-leave {  
  description  
    "Support configuration of immediate-leave."  
}
```

```
feature join-group {  
  description  
    "Support configuration of join-group."  
}
```

```
feature require-router-alert {  
  description  
    "Support configuration of require-router-alert."  
}
```

```
feature static-l2-multicast-group {  
  description  
    "Support configuration of L2 multicast static-group."  
}
```

```
feature static-mrouter-interface {
```

```

    description
        "Support configuration of mrouter interface.";
}

feature rpc-clear-groups {
    description
        "Support clearing statistics by RPC for IGMP & MLD snooping.";
}

feature explicit-tracking {
    description
        "Support configuration of per instance explicit-tracking.";
}

feature exclude-lite {
    description
        "Support configuration of per instance exclude-lite.";
}

/*
 * Typedefs

```

```

 */
typedef igmp-snooping-instance-ref {
    type leafref {
        path "/igmp-snooping-instances/igmp-snooping-instance/name";
    }
    description
        "This type is used by data models that need to reference
        IGMP snooping instance.";
}

typedef mld-snooping-instance-ref {
    type leafref {
        path "/mld-snooping-instances/mld-snooping-instance/name";
    }
    description
        "This type is used by data models that need to reference
        MLD snooping instance.";
}

typedef l2vpn-instance-ac-ref {
    type leafref {
        path "/ni:network-instances/ni:network-instance"+
        "/l2vpn:endpoint/l2vpn:name";
    }
}

```

```

    }
    description "l2vpn-instance-ac-ref";
}

typedef l2vpn-instance-pw-ref {
    type leafref {
        path "/ni:network-instances/ni:network-instance"+
            "/l2vpn:endpoint/l2vpn:name";
    }
    description "l2vpn-instance-pw-ref";
}

typedef source-ipv4-addr-type {
    type union {
        type enumeration {
            enum '*' {
                description
                "Any source address.";
            }
        }
        type inet:ipv4-address;
    }
    description
    "Multicast source IPV4 address type.";
} // source-ipv4-addr-type

typedef source-ipv6-addr-type {
    type union {

```

```

    type enumeration {
        enum '*' {
            description
            "Any source address.";
        }
    }
    type inet:ipv6-address;
}
description
    "Multicast source IPV6 address type.";
} // source-ipv6-addr-type

/*
 * Groupings
 */

```

```

grouping instance-config-attributes-igmp-snooping {
    description "IGMP snooping configuration for each"+
        "BRIDGE or L2VPN instance.";

    uses instance-config-attributes-igmp-mld-snooping;

    leaf querier-source {
        type inet:ipv4-address;
        description "Use the IGMP snooping querier to support IGMP
            snooping in a VLAN where PIM and IGMP are not configured.
            The IPV4 address is used as source address in messages.";
    }

    list static-l2-multicast-group {
        if-feature static-l2-multicast-group;
        key "group source-addr";
        description
            "A static multicast route, (*,G) or (S,G).";

        leaf group {
            type inet:ipv4-address;
            description
                "Multicast group IPV4 address";
        }

        leaf source-addr {
            type source-ipv4-addr-type;
            description
                "Multicast source IPV4 address.";
        }

        leaf-list bridge-outgoing-interface {
            when "../.. /type = 'bridge'";
            type if:interface-ref;
        }
    }

```

```

        description "Outgoing interface in BRIDGE forwarding";
    }

    leaf-list l2vpn-outgoing-ac {
        when "../.. /type = 'l2vpn'";
        type l2vpn-instance-ac-ref;
        description "Outgoing AC in L2VPN forwarding";
    }

```

```

    leaf-list l2vpn-outgoing-pw {
        when "../..type = 'l2vpn'";
        type l2vpn-instance-pw-ref;
        description "Outgoing PW in L2VPN forwarding";
    }
} // static-l2-multicast-group
} // instance-config-attributes-igmp-snooping

grouping instance-config-attributes-igmp-mld-snooping {
    description
        "IGMP and MLD snooping configuration of each VLAN.";

    leaf enable {
        type boolean;
        default false;
        description
            "Set the value to true to enable IGMP & MLD snooping.";
    }

    leaf forwarding-mode {
        type enumeration {
            enum "mac" {
                description
                    "MAC-based lookup mode";
            }
            enum "ip" {
                description
                    "IP-based lookup mode";
            }
        }
        default "ip";
        description "The default forwarding mode is ip";
    }

    leaf explicit-tracking {
        if-feature explicit-tracking;
        type boolean;
        default false;
        description "Tracks IGMP & MLD snooping v3 membership reports
            from individual hosts. It contributes to saving network
            resources and shortening leave latency.";
    }
}

```

```

leaf exclude-lite {

```



```

    if-feature exclude-lite;
    type boolean;
    default false;
    description
        "lightweight IGMPv3 and MLDv2 protocols, which simplify the
        standard versions of IGMPv3 and MLDv2.";
    reference "RFC5790";
}

leaf send-query {
    type boolean;
    default false;
    description "Enable quick response for topo changes.
        To support IGMP snooping in a VLAN where PIM and IGMP are
        not configured. It cooperates with param querier-source. ";
}

leaf immediate-leave {
    if-feature immediate-leave;
    type empty;
    description
        "When immediate leave is enabled, the IGMP software assumes
        that no more than one host is present on each VLAN port.";
}

leaf last-member-query-interval {
    type uint16 {
        range "1..65535";
    }
    units seconds;
    default 1;
    description
        "Last Member Query Interval, which may be tuned to modify
        the leave latency of the network.";
    reference "RFC3376. Sec. 8.8.";
}

leaf query-interval {
    type uint16;
    units seconds;
    default 125;
    description
        "The Query Interval is the interval between General Queries
        sent by the Querier.";
    reference "RFC3376. Sec. 4.1.7, 8.2, 8.14.2.";
}

leaf query-max-response-time {
    type uint16;

```

```
    units seconds;
    default 10;
    description
        "Query maximum response time specifies the maximum time
        allowed before sending a responding report.";
    reference "RFC3376. Sec. 4.1.1, 8.3, 8.14.3.";
}

leaf require-router-alert {
    if-feature require-router-alert;
    type boolean;
    default false;
    description
        "When the value is true, router alert should exist
        in the IP head of IGMP or MLD packet.";
}

leaf robustness-variable {
    type uint8 {
        range "1..7";
    }
    default 2;
    description
        "Querier's Robustness Variable allows tuning for the
        expected packet loss on a network.";
    reference "RFC3376. Sec. 4.1.6, 8.1, 8.14.1.";
}

leaf version {
    type uint8 {
        range "1..3";
    }
    default 2;
    description "IGMP and MLD snooping version.";
}

leaf-list static-bridge-mrouter-interface {
    when "../type = 'bridge'";
    if-feature static-mrouter-interface;
    type if:interface-ref;
    description "static mrouter interface in BRIDGE forwarding";
}

leaf-list static-l2vpn-mrouter-interface-ac {
    when "../type = 'l2vpn'";
    if-feature static-mrouter-interface;
    type if:interface-ref;
```

```
    description "static mrouter interface whose type is interface
        in L2VPN forwarding";
}
```

```
leaf-list static-l2vpn-mrouter-interface-pw {
    when "../type = 'l2vpn'";
    if-feature static-mrouter-interface;
    type l2vpn-instance-pw-ref;
    description "static mrouter interface whose type is PW
        in L2VPN forwarding";
}
} // instance-config-attributes-igmp-mld-snooping

grouping instance-config-attributes-ml-d-snooping {
    description "MLD snooping configuration of each VLAN.";

    uses instance-config-attributes-igmp-ml-d-snooping;

    leaf querier-source {
        type inet:ipv6-address;
        description
            "Use the MLD snooping querier to support MLD snooping where
            PIM and MLD are not configured. The IPV6 address is used as
            the source address in messages.";
    }

    list static-l2-multicast-group {
        if-feature static-l2-multicast-group;
        key "group source-addr";
        description
            "A static multicast route, (*,G) or (S,G).";

        leaf group {
            type inet:ipv6-address;
            description
                "Multicast group IPV6 address";
        }

        leaf source-addr {
            type source-ipv6-addr-type;
            description
                "Multicast source IPV6 address.";
        }
    }
}
```

```

leaf-list bridge-outgoing-interface {
  when "../.. /type = 'bridge'";
  type if:interface-ref;
  description "Outgoing interface in BRIDGE forwarding";
}

leaf-list l2vpn-outgoing-ac {
  when "../.. /type = 'l2vpn'";
  type l2vpn-instance-ac-ref;
  description "Outgoing AC in L2VPN forwarding";
}

```

```

leaf-list l2vpn-outgoing-pw {
  when "../.. /type = 'l2vpn'";
  type l2vpn-instance-pw-ref;
  description "Outgoing PW in L2VPN forwarding";
}
} // static-l2-multicast-group
} // instance-config-attributes-mld-snooping

grouping instance-state-group-attributes-igmp-mld-snooping {
  description
    "Attributes for both IGMP and MLD snooping groups.";

  leaf mac-address {
    type yang:phys-address;
    description "Destination MAC address for L2 multicast.";
  }

  leaf expire {
    type uint32;
    units seconds;
    description
      "The time left before multicast group timeout.";
  }

  leaf up-time {
    type uint32;
    units seconds;
    description
      "The time elapsed since L2 multicast record created.";
  }
} // instance-state-group-attributes-igmp-mld-snooping

```

```

grouping instance-state-attributes-igmp-snooping {
  description
    "State attributes for IGMP snooping for each instance.";

  uses instance-state-attributes-igmp-mld-snooping;

  list group {

    key "address";

    config false;

    description "IGMP snooping information";

    leaf address {
      type inet:ipv4-address;
      description

```

```

    "Multicast group IPV4 address";
  }

  uses instance-state-group-attributes-igmp-mld-snooping;

  leaf last-reporter {
    type inet:ipv4-address;
    description
      "Address of the last host which has sent report to join
       the multicast group.";
  }

  list source {
    key "address";
    description "Source IPV4 address for multicast stream";
    leaf address {
      type inet:ipv4-address;
      description "Source IPV4 address for multicast stream";
    }

    uses instance-state-source-attributes-igmp-mld-snooping;

    leaf last-reporter {
      type inet:ipv4-address;
      description
        "Address of the last host which has sent report

```

```

    to join the multicast group.";
}

list host {
    if-feature explicit-tracking;
    key "host-address";
    description
        "List of multicast membership hosts
        of the specific multicast source-group.";

    leaf host-address {
        type inet:ipv4-address;
        description
            "Multicast membership host address.";
    }
    leaf host-filter-mode {
        type enumeration {
            enum "include" {
                description
                    "In include mode";
            }
            enum "exclude" {
                description
                    "In exclude mode.";
            }
        }
    }
}

```

```

    }
    description
        "Filter mode for a multicast membership
        host may be either include or exclude.";
    }
} // list host

} // list source
} // list group
} // instance-state-attributes-igmp-snooping

grouping instance-state-attributes-igmp-ml-d-snooping {

    description
        "State attributes for IGMP & MLD snooping instance.";

    leaf entries-count {
        type uint32;
        config false;
    }
}

```

```

        description
            "The number of L2 multicast entries in IGMP & MLD snooping";
    }

    leaf-list bridge-mrouter-interface {
        when "../type = 'bridge'";
        type if:interface-ref;
        config false;
        description "mrouter interface in BRIDGE forwarding";
    }

    leaf-list l2vpn-mrouter-interface-ac {
        when "../type = 'l2vpn'";
        type if:interface-ref;
        config false;
        description "mrouter interface whose type is interface
            in L2VPN forwarding";
    }

    leaf-list l2vpn-mrouter-interface-pw {
        when "../type = 'l2vpn'";
        type l2vpn-instance-pw-ref;
        config false;
        description "mrouter interface whose type is PW
            in L2VPN forwarding";
    }
} // instance-config-attributes-igmp-ml-d-snooping

grouping instance-state-attributes-ml-d-snooping {
    description
        "State attributes for MLD snooping of each VLAN.";

```

```

uses instance-state-attributes-igmp-ml-d-snooping;

list group {
    key "address";
    config false;
    description "MLD snooping statistics information";

    leaf address {
        type inet:ipv6-address;
        description
            "Multicast group IPV6 address";
    }
}

```

```

}

uses instance-state-group-attributes-igmp-ml-d-snooping;

leaf last-reporter {
    type inet:ipv6-address;
    description
        "Address of the last host which has sent report
        to join the multicast group.";
}

list source {
    key "address";
    description "Source IPV6 address for multicast stream";

    leaf address {
        type inet:ipv6-address;
        description "Source IPV6 address for multicast stream";
    }

    uses instance-state-source-attributes-igmp-ml-d-snooping;

    leaf last-reporter {
        type inet:ipv6-address;
        description
            "Address of the last host which has sent report
            to join the multicast group.";
    }

    list host {
        if-feature explicit-tracking;
        key "host-address";
        description
            "List of multicast membership hosts
            of the specific multicast source-group.";

        leaf host-address {
            type inet:ipv6-address;
            description

```

```

        "Multicast membership host address.";
    }
    leaf host-filter-mode {
        type enumeration {
            enum "include" {

```



```

        description
            "In include mode";
    }
    enum "exclude" {
        description
            "In exclude mode.";
    }
}
description
    "Filter mode for a multicast membership
    host may be either include or exclude.";
}
} // list host
} // list source
} // list group
} // instance-state-attributes-mld-snooping

grouping instance-state-source-attributes-igmp-mld-snooping {
    description
        "State attributes for IGMP & MLD snooping instance.";

    leaf-list bridge-outgoing-interface {
        when "../../type = 'bridge'";
        type if:interface-ref;
        description "Outgoing interface in BRIDGE forwarding";
    }

    leaf-list l2vpn-outgoing-ac {
        when "../../type = 'l2vpn'";
        type l2vpn-instance-ac-ref;
        description "Outgoing AC in L2VPN forwarding";
    }

    leaf-list l2vpn-outgoing-pw {
        when "../../type = 'l2vpn'";
        type l2vpn-instance-pw-ref;
        description "Outgoing PW in L2VPN forwarding";
    }

    leaf up-time {
        type uint32;
        units seconds;
        description "The time elapsed since L2 multicast
        record created";
    }
}

```

```
    leaf expire {
      type uint32;
      units seconds;
      description
        "The time left before multicast group timeout.";
    }

    leaf host-count {
      if-feature explicit-tracking;
      type uint32;
      description
        "The number of host addresses.";
    }
  } // instance-state-source-attributes-igmp-mld-snooping

grouping igmp-snooping-statistics-sent-received {
  description
    "The statistics attributes for IGMP snooping.";

  leaf query {
    type yang:counter64;
    description
      "The number of query messages.";
  }
  leaf membership-report-v1 {
    type yang:counter64;
    description
      "The number of membership report v1 messages.";
  }
  leaf membership-report-v2 {
    type yang:counter64;
    description
      "The number of membership report v2 messages.";
  }
  leaf membership-report-v3 {
    type yang:counter64;
    description
      "The number of membership report v3 messages.";
  }
  leaf leave {
    type yang:counter64;
    description
      "The number of leave messages.";
  }
  leaf non-member-leave {
    type yang:counter64;
    description
      "The number of non member leave messages.";
```

```
}  
leaf pim {  
    type yang:counter64;
```

Internet-Draft IGMP & MLD Snooping Yang Module October 11, 2018

```
        description  
            "The number of pim hello messages.";  
    }  
} // igmp-snooping-statistics-sent-received  
  
grouping mld-snooping-statistics-sent-received {  
    description  
        "The statistics attributes for MLD snooping."  
  
    leaf query {  
        type yang:counter64;  
        description  
            "The number of Multicast Listener Query messages."  
    }  
    leaf report-v1 {  
        type yang:counter64;  
        description  
            "The number of Version 1 Multicast Listener Report."  
    }  
    leaf report-v2 {  
        type yang:counter64;  
        description  
            "The number of Version 2 Multicast Listener Report."  
    }  
    leaf done {  
        type yang:counter64;  
        description  
            "The number of Version 1 Multicast Listener Done."  
    }  
    leaf pim {  
        type yang:counter64;  
        description  
            "The number of pim hello messages."  
    }  
} // mld-snooping-statistics-sent-received  
  
grouping interface-endpoint-attributes-igmp-snooping {  
    description "interface attributes for IGMP snooping";  
  
    list host {
```

```

if-feature explicit-tracking;

key "host-address";

config false;

description
  "List of multicast membership hosts"+
  "of the specific multicast source-group.";

```

Zhao & Liu, etc

Expires April 10, 2019

[Page 24]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

```

leaf host-address {
  type inet:ipv4-address;
  description
    "Multicast membership host address.";
}
leaf host-filter-mode {
  type enumeration {
    enum "include" {
      description
        "In include mode";
    }
    enum "exclude" {
      description
        "In exclude mode.";
    }
  }
  description
    "Filter mode for a multicast membership
    host may be either include or exclude.";
}
} // list host
} // interface-endpoint-attributes-igmp-snooping

grouping interface-endpoint-attributes-mlld-snooping {

  description "interface endpoint attributes MLD snooping";

  list host {

    if-feature explicit-tracking;

    key "host-address";

```

```

config false;

description
  "List of multicast membership hosts
  of the specific multicast source-group.";

leaf host-address {
  type inet:ipv6-address;
  description
    "Multicast membership host address.";
}
leaf host-filter-mode {
  type enumeration {
    enum "include" {
      description
        "In include mode";
    }
  }
}

```

Zhao & Liu, etc

Expires April 10, 2019

[Page 25]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

```

    enum "exclude" {
      description
        "In exclude mode.";
    }
  }
  description
    "Filter mode for a multicast membership
    host may be either include or exclude.";
}
} // list host
} // interface-endpoint-attributes-mld-snooping

grouping igmp-snooping-interface-statistics-attributes {

  description "Interface statistics attributes for IGMP snooping";

  container interfaces {
    config false;

    description
      "Interfaces associated with the IGMP snooping instance";

    list interface {
      key "name";

      description
        "Interfaces associated with the IGMP snooping instance";
    }
  }
}

```

```

leaf name {
    type if:interface-ref;
    description
        "The name of interface";

}

container statistics {
    description
        "The interface statistics for IGMP snooping";

    container received {
        description
            "Statistics of received IGMP snooping packets.";

        uses igmp-snooping-statistics-sent-received;
    }
    container sent {
        description
            "Statistics of sent IGMP snooping packets.";

        uses igmp-snooping-statistics-sent-received;
    }
}

```

```

    }
}
}
} //igmp-snooping-interface-statistics-attributes

grouping mld-snooping-interface-statistics-attributes {

    description "Interface statistics attributes for MLD snooping";

    container interfaces {
        config false;

        description
            "Interfaces associated with the MLD snooping instance";

        list interface {
            key "name";

            description
                "Interfaces associated with the MLD snooping instance";
        }
    }
}

```

```

    leaf name {
        type if:interface-ref;
        description
            "The name of interface";

    }

    container statistics {
        description
            "The interface statistics for MLD snooping";

        container received {
            description
                "Statistics of received MLD snooping packets.";

            uses mld-snooping-statistics-sent-received;
        }
        container sent {
            description
                "Statistics of sent MLD snooping packets.";

            uses mld-snooping-statistics-sent-received;
        }
    }
}
} //mld-snooping-interface-statistics-attributes

/*

```

```

    * igmp-snooping-instance
    */
    container igmp-snooping-instances {
        description
            "igmp-snooping-instance list";

        list igmp-snooping-instance {
            key "name";
            description
                "IGMP snooping instance to configure the igmp-snooping.";

            leaf name {

```

```

    type string;
    description
        "Name of the igmp-snooping-instance";
}

leaf type {
    type enumeration {
        enum "bridge" {
            description "BRIDGE";
        }
        enum "l2vpn" {
            description "L2VPN";
        }
    }
    description "The type indicates BRIDGE or L2VPN.";
}

uses instance-config-attributes-igmp-snooping;

uses instance-state-attributes-igmp-snooping;

uses igmp-snooping-interface-statistics-attributes;

} //igmp-snooping-instance
} //igmp-snooping-instances

```

```

/*
 * mld-snooping-instance
 */

container mld-snooping-instances {
    description
        "mld-snooping-instance list";

    list mld-snooping-instance {

```

```

    key "name";
    description
        "MLD snooping instance to configure the mld-snooping.";

    leaf name {
        type string;

```



```

        description
            "Name of the mld-snooping-instance";
    }

    leaf type {
        type enumeration {
            enum "bridge" {
                description "BRIDGE";
            }
            enum "l2vpn" {
                description "L2VPN";
            }
        }
        description "The type indicates BRIDGE or L2VPN.";
    }

    uses instance-config-attributes-mld-snooping;

    uses instance-state-attributes-mld-snooping;

    uses mld-snooping-interface-statistics-attributes;

} //mld-snooping-instance
} //mld-snooping-instances

/* augments */

augment "/dot1q:bridges/dot1q:bridge" {
    description
        "Reference IGMP & MLD snooping instance in BRIDGE scenario";

    leaf igmp-snooping-instance {
        type igmp-snooping-instance-ref;
        description
            "Configure IGMP snooping instance under bridge view";
    }
    leaf mld-snooping-instance {
        type mld-snooping-instance-ref;
        description
            "Configure MLD snooping instance under bridge view";
    }
}

```

```

augment "/dot1q:bridges/dot1q:bridge"+
  "/dot1q:component/dot1q:bridge-vlan/dot1q:vlan" {
    description
      "Refrence IGMP & MLD snooping instance in BRIDGE scenario";

    leaf igmp-snooping-instance {
      type igmp-snooping-instance-ref;
      description
        "Configure IGMP snooping instance under VLAN view";
    }

    leaf mld-snooping-instance {
      type mld-snooping-instance-ref;
      description
        "Configure MLD snooping instance under VLAN view";
    }
  }

augment "/ni:network-instances/ni:network-instance"+
  "/ni:ni-type/l2vpn:l2vpn" {

    description
      "Reference IGMP & MLD snooping instance in L2VPN scenario";

    leaf igmp-snooping-instance {
      type igmp-snooping-instance-ref;
      description
        "Configure IGMP snooping instance in L2VPN scenario";
    }
    leaf mld-snooping-instance {
      type mld-snooping-instance-ref;
      description
        "Configure MLD snooping instance in L2VPN scenario";
    }
  }
}

```

```

/*  RPCs  */

```

```

rpc clear-igmp-snooping-groups {
  if-feature rpc-clear-groups;
  description
    "Clears the specified IGMP snooping cache tables.";

  input {

    leaf name {

```

type string;

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

```
    description
      "Name of the igmp-snooping-instance";
  }

  leaf group {
    type inet:ipv4-address;
    description
      "Multicast group IPv4 address.
       If it is not specified, all IGMP snooping group tables
       are cleared.";
  }

  leaf source {
    type inet:ipv4-address;
    description
      "Multicast source IPv4 address.
       If it is not specified, all IGMP snooping source-group
       tables are cleared.";
  }
}
} // rpc clear-igmp-snooping-groups

rpc clear-mld-snooping-groups {
  if-feature rpc-clear-groups;
  description
    "Clears the specified MLD snooping cache tables.";

  input {
    leaf name {
      type string;
      description
        "Name of the mld-snooping-instance";
    }

    leaf group {
      type inet:ipv6-address;
      description
        "Multicast group IPv6 address.
         If it is not specified, all MLD snooping group tables are
         cleared.";
    }

    leaf source {
```

```

    type inet:ipv6-address;
    description
      "Multicast source IPv6 address.
       If it is not specified, all MLD snooping source-group
       tables are cleared.";
  }
}
} // rpc clear-mld-snooping-groups

```

```

}
<CODE ENDS>

```

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 [RFC5246].

The NETCONF access control model [RFC6536] 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:

```
/ims:igmp-snooping-instances/ims:igmp-snooping-instance
```

```
/ims:mld-snooping-instances/ims:mld-snooping-instance
```

Unauthorized access to any data node of these subtrees can adversely affect the IGMP & MLD Snooping 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:

/ims:igmp-snooping-instances/ims:igmp-snooping-instance

/ims:mld-snooping-instances/ims:mld-snooping-instance

Unauthorized access to any data node of these subtrees can disclose the operational state information of IGMP & MLD Snooping on this device.

Some of the RPC operations in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control access to these operations. The IGMP & MLD Snooping Yang module support the "clear-igmp-snooping-groups" and "clear-mld-snooping-groups" RPCs. If it meets unauthorized RPC operation invocation, the IGMP and MLD Snooping group tables will be cleared unexpectedly.

[5. IANA Considerations](#)

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

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

URI: urn:ietf:params:xml:ns:yang:ietf-igmp-mld-snooping

Registrant Contact: The IESG.

XML: N/A, the requested URI is an XML namespace.

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

name: ietf-igmp-mld-snooping

namespace: urn:ietf:params:xml:ns:yang:ietf-igmp-mld-snooping

prefix: ims

reference: RFC XXXX

[6](#). Normative References

- [P802.1Qcp/D2.2] IEEE Approved Draft Standard for Local and Metropolitan Area Networks, "Bridges and Bridged Networks Amendment: YANG Data Model", Mar 2018
- [RFC2236] Fenner, W., "Internet Group Management Protocol, Version 2", [RFC 2236](#), November 1997.
- [RFC2710] Deering, S., Fenner, W., and B. Haberman, "Multicast Listener Discovery (MLD) for IPv6", [RFC 2710](#), October 1999.
- [RFC3376] Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, "Internet Group Management Protocol, Version 3", [RFC 3376](#), October 2002.
- [RFC3810] Vida, R. and L. Costa, "Multicast Listener Discovery Version 2 (MLDv2) for IPv6", [RFC 3810](#), June 2004.
- [RFC4541] M. Christensen, K. Kimball, F. Solensky, "Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches", [RFC 4541](#), May

2006.

- [RFC4604] Holbrook, H., Cain, B., and B. Haberman, "Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast", [RFC 4604](#), August 2006.
- [RFC4607] Holbrook, H. and B. Cain, "Source-Specific Multicast for IP", [RFC 4607](#), August 2006.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", [RFC 6020](#), October 2010.
- [RFC6021] Schoenwaelder, J., Ed., "Common YANG Data Types", [RFC 6021](#), October 2010.
- [RFC6991] Schoenwaelder, J., Ed., "Common YANG Data Types", [RFC 6991](#), July 2013.
- [RFC8342] M. Bjorklund and J. Schoenwaelder, "Network Management Datastore Architecture (NMDA)", [RFC 8342](#), March 2018.
- [RFC8343] M. Bjorklund, "A YANG Data Model for Interface Management", [RFC 8343](#), March 2018.

Zhao & Liu, etc

Expires April 10, 2019

[Page 34]

Internet-Draft

IGMP & MLD Snooping Yang Module

October 11, 2018

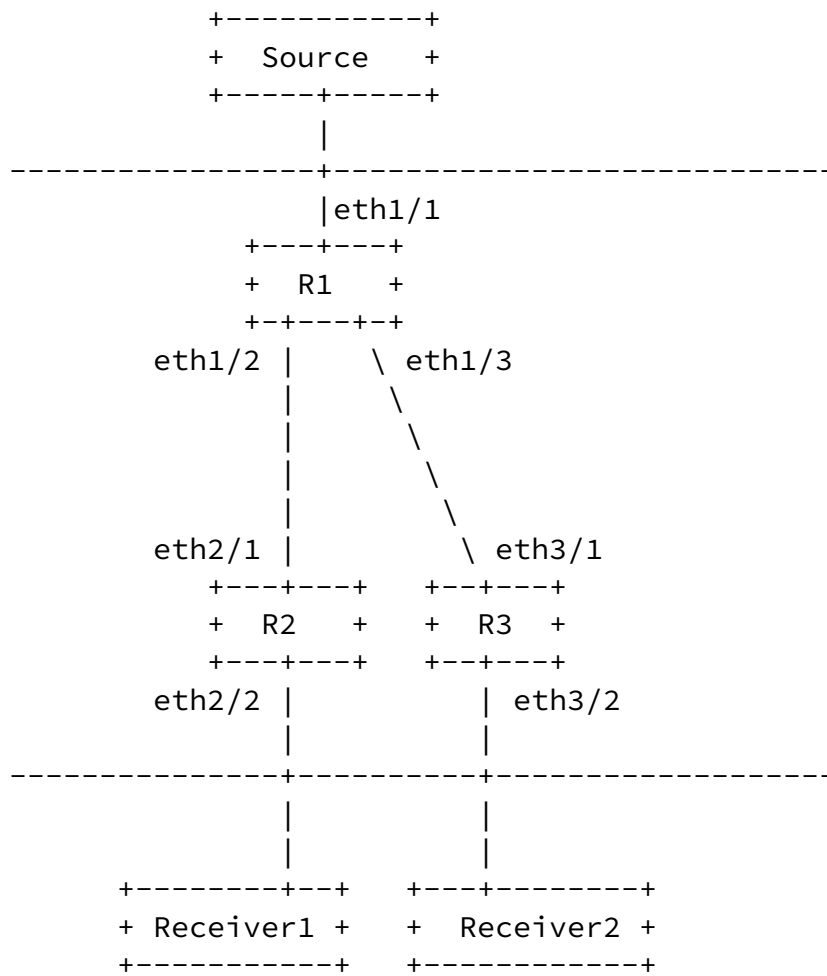
- [[draft-ietf-pim-igmp-mld-yang-06](#)] X. Liu, F. Guo, M. Sivakumar, P. McAllister, A. Peter, "A YANG data model for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD)", [draft-ietf-pim-igmp-mld-yang-06](#), Oct 20, 2017.
- [[draft-dsdt-nmda-guidelines-01](#)] M. Bjorklund, J. Schoenwaelder, P. Shafer, K. Watsen, R. Wilton, "Guidelines for YANG Module Authors (NMDA)", [draft-dsdt-nmda-guidelines-01](#), May 2017
- [[draft-bjorklund-netmod-rfc7223bis-00](#)] M. Bjorklund, "A YANG Data Model for Interface Management", [draft-bjorklund-netmod-rfc7223bis-00](#), August 21, 2017
- [[draft-bjorklund-netmod-rfc7277bis-00](#)] M. Bjorklund, "A YANG Data Model for IP Management", [draft-bjorklund-netmod-](#)

[rfc7277bis-00](#), August 21, 2017

- [[draft-ietf-netmod-revised-datastores-03](#)] M. Bjorklund, J. Schoenwaelder, P. Shafer, K. Watsen, R. Wilton, "Network Management Datastore Architecture", [draft-ietf-netmod-revised-datastores-03](#), July 3, 2017
- [[draft-ietf-bess-evpn-yang-02](#)] P. Brissette, A. Sajassi, H. Shah, Z. Li, H. Chen, K. Tiruveedhula, I. Hussain, J. Rabadan, "Yang Data Model for EVPN", [draft-ietf-bess-evpn-yang-02](#), March 13, 2017
- [[draft-ietf-bess-l2vpn-yang-08](#)] H. Shah, P. Brissette, I. Chen, I. Hussain, B. Wen, K. Tiruveedhula, "YANG Data Model for MPLS-based L2VPN", [draft-ietf-bess-l2vpn-yang-06.txt](#), February 17, 2018
- [[draft-ietf-rtgwg-ni-model-12](#)] L. Berger, C. Hopps, A. Lindem, X. Liu, "YANG Model for Network Instances", [draft-ietf-rtgwg-ni-model-12.txt](#), March 19, 2018

[Appendix A](#). Data Tree Example

This section contains an example of an instance data tree in the JSON encoding [[RFC7951](#)], containing both configuration and state data.



as follows:

```
{
  "ietf-igmp-mld-snooping:igmp-snooping-instances": {
    "igmp-snooping-instance": [
      {
        "name": "ins101",
        "type": "bridge",
        "enable": true
      }
    ]
  },
  "ietf-igmp-mld-snooping:mld-snooping-instances": {
    "mld-snooping-instance": [
      {
        "name": "ins102",
        "type": "bridge",
        "enable": true
      }
    ]
  },
  "ieee802-dot1q-bridge:bridges": {
    "bridge": [
      {
        "name": "isp",
        "address": "00-23-ef-a5-77-12",
        "bridge-type": "ieee802-dot1q-bridge:customer-vlan-bridge",
        "component": [
          {
            "name": "comp1",
            "type": "ieee802-dot1q-bridge:c-vlan-component",
            "bridge-vlan": {
              "vlan": [
                {
                  "vid": 101,
                  "ietf-igmp-mld-snooping:igmp-snooping-instance": "ins101"
                },
                {
                  "vid": 102,
                  "ietf-igmp-mld-snooping:mld-snooping-instance": "ins102"
                }
              ]
            }
          }
        ]
      }
    ]
  }
}
```

Internet-Draft IGMP & MLD Snooping Yang Module October 11, 2018

The corresponding operational state data for R1 could be as follows:

```
{
  "ietf-interfaces:interfaces": {
    "interface": [
      {
        "name": "1/1",
        "type": "iana-if-type:ethernetCsmacd",
        "admin-status": "up",
        "if-index": 214748,
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2018-05-23T12:34:56-05:00"
        }
      },
      {
        "name": "1/2",
        "type": "iana-if-type:ethernetCsmacd",
        "admin-status": "up",
        "if-index": 214749,
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2018-05-23T12:35:06-05:02"
        }
      }
    ]
  },
  "ietf-igmp-mlld-snooping:igmp-snooping-instances": {
    "igmp-snooping-instance": [
      {
        "name": "ins101",
        "type": "bridge",
        "enable": true,
        "forwarding-mode": "ip",
        "explicit-tracking": false,
        "exclude-lite": false,
        "send-query": true,
        "immediate-leave": [null],
        "last-member-query-interval": 1,
        "query-interval": 125,
        "query-max-response-time": 10,
        "require-router-alert": false,
        "robustness-variable": 2,
        "entries-count": 1,

```

```

"bridge-mrouter-interface": ["1/1"],
"group": [
  {
    "address": "223.0.0.1",
    "mac-address": "01:00:5e:00:00:01",
    "expire": 120,

```

```

    "up-time": 180,
    "last-reporter": "100.0.0.1",
    "source": [
      {
        "address": "192.168.0.1",
        "bridge-outgoing-interface": ["1/2"],
        "up-time": 180,
        "expire": 120,
        "last-reporter": "100.0.0.1"
      }
    ]
  },
],
"interfaces": {
  "interface": [
    {
      "name": "1/1",
      "statistics": {
        "received": {
          "query": 5,
          "membership-report-v1": 0,
          "membership-report-v2": 0,
          "membership-report-v3": 0,
          "leave": 0,
          "non-member-leave": 0,
          "pim": 11
        },
        "sent": {
          "query": 0,
          "membership-report-v1": 0,
          "membership-report-v2": 3,
          "membership-report-v3": 0,
          "leave": 0,
          "non-member-leave": 0,
          "pim": 0
        }
      }
    }
  ]
}

```

```

    },
    {
      "name": "1/2",
      "statistics": {
        "received": {
          "query": 0,
          "membership-report-v1": 0,
          "membership-report-v2": 3,
          "membership-report-v3": 0,
          "leave": 0,
          "non-member-leave": 0,
          "pim": 0
        },
        "sent": {

```

```

      "query": 5,
      "membership-report-v1": 0,
      "membership-report-v2": 0,
      "membership-report-v3": 0,
      "leave": 0,
      "non-member-leave": 0,
      "pim": 11
    }
  }
}
]
}
}
],
"ietf-igmp-ml-d-snooping:mld-snooping-instances": {
  "mld-snooping-instance": [
    {
      "name": "ins102",
      "type": "bridge",
      "enable": true,
      "forwarding-mode": "ip",
      "explicit-tracking": false,
      "exclude-lite": false,
      "send-query": true,
      "immediate-leave": [null],
      "last-member-query-interval": 1,
      "query-interval": 125,
      "query-max-response-time": 10,
      "require-router-alert": false,

```

```

"robustness-variable": 2,
"entries-count": 1,
"bridge-mrouter-interface": ["1/1"],
"group": [
  {
    "address": "FF0E::1",
    "mac-address": "01:00:5e:00:00:01",
    "expire": 120,
    "up-time": 180,
    "last-reporter": "2001::1",
    "source": [
      {
        "address": "3001::1",
        "bridge-outgoing-interface": ["1/2"],
        "up-time": 180,
        "expire": 120,
        "last-reporter": "2001::1"
      }
    ]
  }
],

```

```

"interfaces": {
  "interface": [
    {
      "name": "1/1",
      "statistics": {
        "received": {
          "query": 7,
          "report-v1": 0,
          "report-v2": 0,
          "done": 0,
          "pim": 15
        },
        "sent": {
          "query": 0,
          "report-v1": 0,
          "report-v2": 3,
          "done": 0,
          "pim": 0
        }
      }
    },
    {
      "name": "1/2",

```

```

    "statistics": {
    "received": {
        "query": 0,
        "report-v1": 0,
        "report-v2": 3,
        "done": 0,
        "pim": 0
    },
    "sent": {
        "query": 7,
        "report-v1": 0,
        "report-v2": 0,
        "done": 0,
        "pim": 15
    }
    }
    }
    ]
    }
    ]
    }
}

```

Authors' Addresses

Hongji Zhao
 Ericsson (China) Communications Company Ltd.
 Ericsson Tower, No. 5 Lize East Street,
 Chaoyang District Beijing 100102, P.R. China

Email: hongji.zhao@ericsson.com

Xufeng Liu
 Jabil
 8281 Greensboro Drive, Suite 200
 McLean VA 22102
 USA

EMail: Xufeng.liu.ietf@gmail.com

Yisong Liu
Huawei Technologies
Huawei Bld., No.156 Beiqing Rd.
Beijing 100095
China

Email: liuyisong@huawei.com

Anish Peter
Individual

EMail: anish.ietf@gmail.com

Mahesh Sivakumar
Cisco Systems
510 McCarthy Boulevard
Milpitas, California
USA

EMail: sivakumar.mahesh@gmail.com