

PIM Working Group
Internet Draft
Intended status: Standards Track
Expires: July 07, 2019

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January 8, 2019

A Yang Data Model for IGMP and MLD Snooping
draft-ietf-pim-igmp-mld-snooping-yang-07.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).

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[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](#)].

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The goal of this document is to define a data model that provides a common user interface to IGMP and MLD Snooping.

[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 conforms to Network Management Datastore Architecture (NMDA) [[RFC8342](#)]. This NMDA 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 augments `/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol`.

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.

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 scenario 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 interfaces show the statistics of IGMP Snooping related packets.

```
module: ietf-igmp-mls-snooping
  augment /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:
    +--rw igmp-snooping-instance {feature-igmp-snooping}?
      | +--rw scenario?                               snooping-scenario-type
      | +--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 static-bridge-mrouter-interface*       if:interface-ref {static-mrou
interface}?
      | +--rw static-l2vpn-mrouter-interface-ac*     if:interface-ref {static-mrou
interface}?
      | +--rw static-l2vpn-mrouter-interface-pw*     pw:pseudowire-ref {static-mro
interface}?
```

```

|   +--rw version?                               uint8
|   +--rw querier-source?                         inet:ipv4-address
|   +--rw static-l2-multicast-group* [group source-addr] {static-l2-multicas
group}}?
|   |   +--rw group                               rt-types:ipv4-multicast-group-addr
|   |   +--rw source-addr                         rt-types:ipv4-multicast-source-addr
|   |   +--rw bridge-outgoing-interface*         if:interface-ref
|   |   +--rw l2vpn-outgoing-ac*                 if:interface-ref
|   |   +--rw l2vpn-outgoing-pw*                 pw:pseudowire-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*           pw:pseudowire-ref
|   +--ro group* [address]
|   |   +--ro address                             rt-types:ipv4-multicast-group-address
|   |   +--ro mac-address?                       yang:phys-address
|   |   +--ro expire?                            rt-types:timer-value-seconds16
|   |   +--ro up-time                            uint32
|   |   +--ro last-reporter?                     inet:ipv4-address
|   |   +--ro source* [address]
|   |   |   +--ro address                         rt-types:ipv4-multicast-source-addr
|   |   |   +--ro bridge-outgoing-interface*     if:interface-ref
|   |   |   +--ro l2vpn-outgoing-ac*             if:interface-ref
|   |   |   +--ro l2vpn-outgoing-pw*             pw:pseudowire-ref
|   |   |   +--ro up-time                        uint32
|   |   |   +--ro expire?                       rt-types:timer-value-seconds16
|   |   |   +--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           filter-mode-type

```

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```

|   +--ro interfaces
|   |   +--ro interface* [name]
|   |   |   +--ro name                         if:interface-ref
|   |   +--ro statistics
|   |   |   +--ro received
|   |   |   |   +--ro num-query?               yang:counter64
|   |   |   |   +--ro num-membership-report-v1? yang:counter64
|   |   |   |   +--ro num-membership-report-v2? yang:counter64
|   |   |   |   +--ro num-membership-report-v3? yang:counter64
|   |   |   |   +--ro num-leave?               yang:counter64
|   |   |   |   +--ro num-non-member-leave?    yang:counter64
|   |   |   |   +--ro num-pim-hello?           yang:counter64
|   |   |   +--ro sent
|   |   |   |   +--ro num-query?               yang:counter64

```

	+++ro num-membership-report-v1?	yang:counter64
	+++ro num-membership-report-v2?	yang:counter64
	+++ro num-membership-report-v3?	yang:counter64
	+++ro num-leave?	yang:counter64
	+++ro num-non-member-leave?	yang:counter64
	+++ro num-pim-hello?	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
  augment /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:
    +--rw igmp-snooping-instance {feature-igmp-snooping}?
    | ...
    +--rw mld-snooping-instance {feature-mld-snooping}?
      +--rw scenario?                               snooping-scenario-type
      +--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 static-bridge-mrouter-interface*          if:interface-ref {static-mrou
interface}?

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```

      +--rw static-l2vpn-mrouter-interface-ac*        if:interface-ref {static-mrou
interface}?
      +--rw static-l2vpn-mrouter-interface-pw*        pw:pseudowire-ref {static-mro
interface}?
      +--rw version?                                  uint8
      +--rw querier-source?                           inet:ipv6-address
      +--rw static-l2-multicast-group* [group source-addr] {static-l2-multicas

```

```

group}?
|   +--rw group                               rt-types:ipv6-multicast-group-addr
|   +--rw source-addr                         rt-types:ipv6-multicast-source-add
|   +--rw bridge-outgoing-interface*         if:interface-ref
|   +--rw l2vpn-outgoing-ac*                 if:interface-ref
|   +--rw l2vpn-outgoing-pw*                 pw:pseudowire-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*            pw:pseudowire-ref
+--ro group* [address]
|   +--ro address                            rt-types:ipv6-multicast-group-address
|   +--ro mac-address?                       yang:phys-address
|   +--ro expire?                            rt-types:timer-value-seconds16
|   +--ro up-time                            uint32
|   +--ro last-reporter?                     inet:ipv6-address
|   +--ro source* [address]
|       +--ro address                        rt-types:ipv6-multicast-source-
|       +--ro bridge-outgoing-interface*    if:interface-ref
|       +--ro l2vpn-outgoing-ac*            if:interface-ref
|       +--ro l2vpn-outgoing-pw*            pw:pseudowire-ref
|       +--ro up-time                        uint32
|       +--ro expire?                       rt-types:timer-value-seconds16
|       +--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          filter-mode-type
+--ro interfaces
    +--ro interface* [name]
        +--ro name                          if:interface-ref
        +--ro statistics
            +--ro received
                |   +--ro num-query?          yang:counter64
                |   +--ro num-report-v1?      yang:counter64
                |   +--ro num-report-v2?      yang:counter64
                |   +--ro num-done?           yang:counter64
                |   +--ro num-pim-hello?      yang:counter64
            +--ro sent
                +--ro num-query?              yang:counter64
                +--ro num-report-v1?          yang:counter64
                +--ro num-report-v2?          yang:counter64
                +--ro num-done?               yang:counter64
                +--ro num-pim-hello?          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
```

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.

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```
rpcs:
  +---x clear-igmp-snooping-groups {rpc-clear-groups}?
  |   +---w input
  |       +---w name?      igmp-mld-snooping-instance-ref
  |       |               {feature-igmp-snooping}?
  |       +---w group?     rt-types:ipv4-multicast-group-address
  |       +---w source?    rt-types:ipv4-multicast-source-address
  +---x clear-mld-snooping-groups {rpc-clear-groups}?
      +---w input
          +---w name?      igmp-mld-snooping-instance-ref
          |               {feature-mld-snooping}?
          +---w group?     rt-types:ipv6-multicast-group-address
          +---w source?    rt-types:ipv6-multicast-source-address
```

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

```
<CODE BEGINS> file ietf-igmp-mld-snooping@2019-01-08.yang
module ietf-igmp-mld-snooping {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-igmp-mld-snooping";

  prefix ims;

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

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

  import ietf-interfaces {
    prefix "if";
  }

  import ietf-routing {
    prefix "rt";
  }

  import ietf-routing-types {
    prefix "rt-types";
  }
```

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

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

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```
import ietf-pseudowires {
  prefix "pw";
}

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
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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) Snooping devices."
```

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revision 2019-01-08 {
 description

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

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

```
feature feature-igmp-snooping {
  description
    "Support IGMP snooping protocol.";
  reference
    "RFC 4541, Section 1";
}
```

```
feature feature-ml-d-snooping {
  description
    "Support MLD snooping protocol.";
  reference
    "RFC 4541, Section 1";
}
```

```
feature immediate-leave {
  description
    "Support configuration of immediate-leave.";
  reference
    "RFC 2236, Section 10";
}
```

```

feature require-router-alert {
    description
        "Support configuration of require-router-alert.";
    reference
        "RFC 3376, Section 5.2";
}

feature static-l2-multicast-group {
    description
        "Support configuration of L2 multicast static-group.";
    reference
        "RFC 4541, Section 2.1";
}

feature static-mrouter-interface {
    description
        "Support configuration of mrouter interface.";
    reference
        "RFC 4541, Section 2.1";
}

```

```

feature rpc-clear-groups {
    description
        "Support clearing statistics by RPC for IGMP & MLD snooping.";
    reference
        "RFC 4541, Section 2.1";
}

feature explicit-tracking {
    description
        "Support configuration of per instance explicit-tracking.";
    reference
        "RFC 3376, Appendix B";
}

feature exclude-lite {
    description
        "Support configuration of per instance exclude-lite.";
    reference
        "RFC 5790, Section 3";
}

/* identities */

```

```
identity scenario-type {
    description
        "Base identity for scenario type in IGMP & MLD snooping";
}
```

```
identity bridge {
    base scenario-type;
    description
        "This identity represents BRIDGE scenario.";
}
```

```
identity l2vpn {
    base scenario-type;
    description
        "This identity represents L2VPN scenario.";
}
```

```
identity filter-mode {
    description
        "Base identity for filter mode in IGMP & MLD snooping";
}
```

```
identity include {
    base filter-mode;
    description
        "This identity represents include mode.";
}
```

```
identity exclude {
```

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```
    base filter-mode;
    description
        "This identity represents exclude mode.";
}
```

```
identity igmp-snooping {
    base rt:control-plane-protocol;
    description
        "IGMP snooping protocol";
}
```

```
identity mld-snooping {
    base rt:control-plane-protocol;
    description
        "MLD snooping protocol";
}
```

```

/*
 * Typedefs
 */

typedef snooping-scenario-type {
    type identityref {
        base "scenario-type";
    }
    description "The IGMP & MLD snooping scenario type";
}

typedef filter-mode-type {
    type identityref {
        base "filter-mode";
    }
    description "The host filter mode";
}

typedef igmp-mld-snooping-instance-ref {
    type leafref {
        path "/rt:routing/rt:control-plane-protocols"+
            "/rt:control-plane-protocol/rt:name";
    }
    description
        "This type is used by data models which need to
        reference IGMP & MLD snooping instance.";
}

```

```

/*
 * Groupings
 */

```

```

    grouping instance-config-attributes-igmp-snooping {

```

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```

    description
        "IGMP snooping configuration for each BRIDGE or L2VPN instance.";

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

    leaf version {
        type uint8 {
            range "1..3";
        }
    }

```

```

    default 2;
    description "IGMP snooping version.";
}

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 rt-types:ipv4-multicast-group-address;
        description
            "Multicast group IPv4 address";
    }

    leaf source-addr {
        type rt-types:ipv4-multicast-source-address;
        description
            "Multicast source IPv4 address.";
    }

    leaf-list bridge-outgoing-interface {
        when 'derived-from-or-self(..../scenario,"ims:bridge")';
        type if:interface-ref;
        description "Outgoing interface in BRIDGE forwarding";
    }

    leaf-list l2vpn-outgoing-ac {
        when 'derived-from-or-self(..../scenario,"ims:l2vpn")';
        type if:interface-ref;
        description "Outgoing AC in L2VPN forwarding";
    }

    leaf-list l2vpn-outgoing-pw {

```

```

    when 'derived-from-or-self(..../scenario,"ims:l2vpn")';
    type pw:pseudowire-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
            "Track the 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
            "Track the Lightweight IGMPv3 and MLDv2 protocol report";
        reference "RFC5790";
    }
}

```

```
leaf send-query {
  type boolean;
  default false;
  description
    "Enable quick response for topology changes.
     To support IGMP snooping in a VLAN where PIM and IGMP are
     not configured. It cooperates with parameter 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..1023";
  }
  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;
```

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```
    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-list static-bridge-mrouter-interface {  
    when 'derived-from-or-self(..../scenario,"ims: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 'derived-from-or-self(..../scenario,"ims: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 'derived-from-or-self(..../scenario,"ims:l2vpn")';  
    if-feature static-mrouter-interface;  
    type pw:pseudowire-ref;  
    description  
        "static mrouter interface whose type is PW  
        in L2VPN forwarding";
```

```

    }
} // instance-config-attributes-igmp-mld-snooping

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

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

    leaf version {
        type uint8 {
            range "1..2";
        }
    }
}

```

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```

    default 2;
    description "MLD snooping version.";
}

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 rt-types:ipv6-multicast-group-address;
        description
            "Multicast group IPv6 address";
    }

    leaf source-addr {
        type rt-types:ipv6-multicast-source-address;
        description
            "Multicast source IPv6 address.";
    }

    leaf-list bridge-outgoing-interface {
        when 'derived-from-or-self(..../scenario,"ims:bridge")';
        type if:interface-ref;
    }
}

```

```

    description "Outgoing interface in BRIDGE forwarding";
}

leaf-list l2vpn-outgoing-ac {
    when 'derived-from-or-self(..../scenario,"ims:l2vpn")';
    type if:interface-ref;
    description "Outgoing AC in L2VPN forwarding";
}

leaf-list l2vpn-outgoing-pw {
    when 'derived-from-or-self(..../scenario,"ims:l2vpn")';
    type pw:pseudowire-ref;
    description "Outgoing PW in L2VPN forwarding";
}
} // static-l2-multicast-group
} // instance-config-attributes-igmp-ml-d-snooping

```

```

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

```

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```

    "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 rt-types:timer-value-seconds16;
    units seconds;
    description
        "The time left before multicast group timeout.";
}

leaf up-time {
    type uint32;
    units seconds;
    mandatory true;
    description
        "The time elapsed since L2 multicast record created.";
}
} // instance-state-group-attributes-igmp-ml-d-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 rt-types:ipv4-multicast-group-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 rt-types:ipv4-multicast-source-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 filter-mode-type;
    mandatory true;
    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 'derived-from-or-self(..../scenario,"ims:bridge")';
  type if:interface-ref;
  config false;
  description "mrouter interface in BRIDGE forwarding";
}

leaf-list l2vpn-mrouter-interface-ac {

```

```

    when 'derived-from-or-self(..scenario,"ims:l2vpn")';
    type if:interface-ref;
    config false;
    description
        "mrouter interface whose type is interface
        in L2VPN forwarding";

}

leaf-list l2vpn-mrouter-interface-pw {
    when 'derived-from-or-self(..scenario,"ims:l2vpn")';
    type pw:pseudowire-ref;
    config false;
    description
        "mrouter interface whose type is PW in L2VPN forwarding";
}
} // instance-config-attributes-igmp-mld-snooping

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

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

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

        leaf address {
            type rt-types:ipv6-multicast-group-address;
            description
                "Multicast group IPv6 address";
        }

        uses instance-state-group-attributes-igmp-mld-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 rt-types:ipv6-multicast-source-address;
    description "Source IPv6 address for multicast stream";
}

uses instance-state-source-attributes-igmp-mld-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 filter-mode-type;
        mandatory true;
        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 'derived-from-or-self(..../../scenario,"ims:bridge")';

```

```
    type if:interface-ref;
    description "Outgoing interface in BRIDGE forwarding";
}

leaf-list l2vpn-outgoing-ac {
    when 'derived-from-or-self ../../../../scenario,"ims:l2vpn")';
    type if:interface-ref;
    description "Outgoing AC in L2VPN forwarding";
}

leaf-list l2vpn-outgoing-pw {
    when 'derived-from-or-self ../../../../scenario,"ims:l2vpn")';
    type pw:pseudowire-ref;
    description "Outgoing PW in L2VPN forwarding";
}

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

leaf expire {
    type rt-types:timer-value-seconds16;
    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-ml-d-snooping

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

    leaf num-query {
        type yang:counter64;
        description
            "The number of query messages.";
        reference
```

```
        "RFC 2236, Section 2.1";
    }
    leaf num-membership-report-v1 {
        type yang:counter64;
```

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```
        description
            "The number of membership report v1 messages.";
        reference
            "RFC 3376, Section 4";
    }
    leaf num-membership-report-v2 {
        type yang:counter64;
        description
            "The number of membership report v2 messages.";
        reference
            "RFC 3376, Section 4";
    }
    leaf num-membership-report-v3 {
        type yang:counter64;
        description
            "The number of membership report v3 messages.";
        reference
            "RFC 3376, Section 4";
    }
    leaf num-leave {
        type yang:counter64;
        description
            "The number of leave messages.";
        reference
            "RFC 3376, Section 4";
    }
    leaf num-non-member-leave {
        type yang:counter64;
        description
            "The number of non member leave messages.";
        reference
            "RFC 3376, Section 4";
    }
    leaf num-pim-hello {
        type yang:counter64;
        description
            "The number of PIM hello messages.";
        reference
            "RFC 7761, Section 4.9";
    }
} // igmp-snooping-statistics
```

```

grouping mld-snooping-statistics {
  description
    "The statistics attributes for MLD snooping.";

  leaf num-query {
    type yang:counter64;
    description
      "The number of Multicast Listener Query messages.";
    reference
      "RFC 3810, Section 5";

```

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```

}
leaf num-report-v1 {
  type yang:counter64;
  description
    "The number of Version 1 Multicast Listener Report.";
  reference
    "RFC 3810, Section 5";
}
leaf num-report-v2 {
  type yang:counter64;
  description
    "The number of Version 2 Multicast Listener Report.";
  reference
    "RFC 3810, Section 5";
}
leaf num-done {
  type yang:counter64;
  description
    "The number of Version 1 Multicast Listener Done.";
  reference
    "RFC 3810, Section 5";
}
leaf num-pim-hello {
  type yang:counter64;
  description
    "The number of PIM hello messages.";
  reference
    "RFC 7761, Section 4.9";
}
} // mld-snooping-statistics

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;
        }
        container sent {
            description
                "Statistics of sent IGMP snooping packets.";

            uses igmp-snooping-statistics;
        }
    }
}

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

grouping mld-snooping-interface-statistics-attributes {

    description "Interface statistics attributes for MLD snooping";
}

```



```

    "IGMP & MLD snooping augmentation to control plane protocol
    configuration and state.";

/*
 * igmp-snooping-instance
 */

container igmp-snooping-instance {
    when 'derived-from-or-self(..../rt:type, "ims:igmp-snooping")' {
        description
            "This container is only valid for IGMP snooping protocol.";
    }
    if-feature feature-igmp-snooping;
    description
        "IGMP snooping instance to configure the igmp-snooping.";

    leaf scenario {
        type snooping-scenario-type;
        default bridge;
        description
            "The scenario 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

```

```
/*
```

```

 * mld-snooping-instance
 */

container mld-snooping-instance {
    when 'derived-from-or-self(..../rt:type, "ims:mld-snooping")' {
        description
            "This container is only valid for MLD snooping protocol.";
    }
    if-feature feature-mld-snooping;
    description
        "MLD snooping instance to configure the mld-snooping.";

    leaf scenario {

```

```

    type snooping-scenario-type;
    default bridge;
    description
        "The scenario 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
}

```

```

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

    leaf igmp-snooping-instance {
        type igmp-mld-snooping-instance-ref;

        description
            "Configure IGMP snooping instance under bridge view";
    }
    leaf mld-snooping-instance {
        type igmp-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
        "Reference IGMP & MLD snooping instance in BRIDGE scenario";
}

```

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```

leaf igmp-snooping-instance {
    type igmp-mld-snooping-instance-ref;

    description
        "Configure IGMP snooping instance under VLAN view";
}

```



```

    }

    leaf mld-snooping-instance {
        type igmp-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-mld-snooping-instance-ref;

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

        description
            "Configure MLD snooping instance in L2VPN scenario";
    }
}

```

```

/*  RPCs  */

```

```

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

    input {

        leaf name {
            if-feature feature-igmp-snooping;
            type igmp-mld-snooping-instance-ref;
            description

```

```

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

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

    leaf source {
        type rt-types:ipv4-multicast-source-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
        "Clear the specified MLD snooping cache tables.";

    input {
        leaf name {
            if-feature feature-mld-snooping;
            type igmp-mld-snooping-instance-ref;
            description
                "Name of the mld-snooping-instance";
        }

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

        leaf source {
            type rt-types:ipv6-multicast-source-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>

```

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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:

```
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/ims:igmp-snoop
instance
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/ims:mld-snoopi
instance
```

The subtrees under /dot1q:bridges/dot1q:bridge

```
/dot1q:bridges/dot1q:bridge/ims:igmp-snooping-instance
/dot1q:bridges/dot1q:bridge/ims:mld-snooping-instance
```

The subtrees under

```
/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-vlan/dot1q:vlan
```

```
/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-vlan/dot1q:vlan/ims:ig
snooping-instance
/dot1q:bridges/dot1q:bridge/dot1q:component/dot1q:bridge-vlan/dot1q:vlan/ims:ml
snooping-instance
```

The subtrees under `/ni:network-instances/ni:network-instance/ni:ni-type/l2vpn:l2vpn`

`/ni:network-instances/ni:network-instance/ni:ni-type/l2vpn:l2vpn/ims:igmp-snoop-instance`

`/ni:network-instances/ni:network-instance/ni:ni-type/l2vpn:l2vpn/ims:mld-snoop-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:

`/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/ims:igmp-snoop-instance`

`/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/ims:mld-snoop-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.

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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

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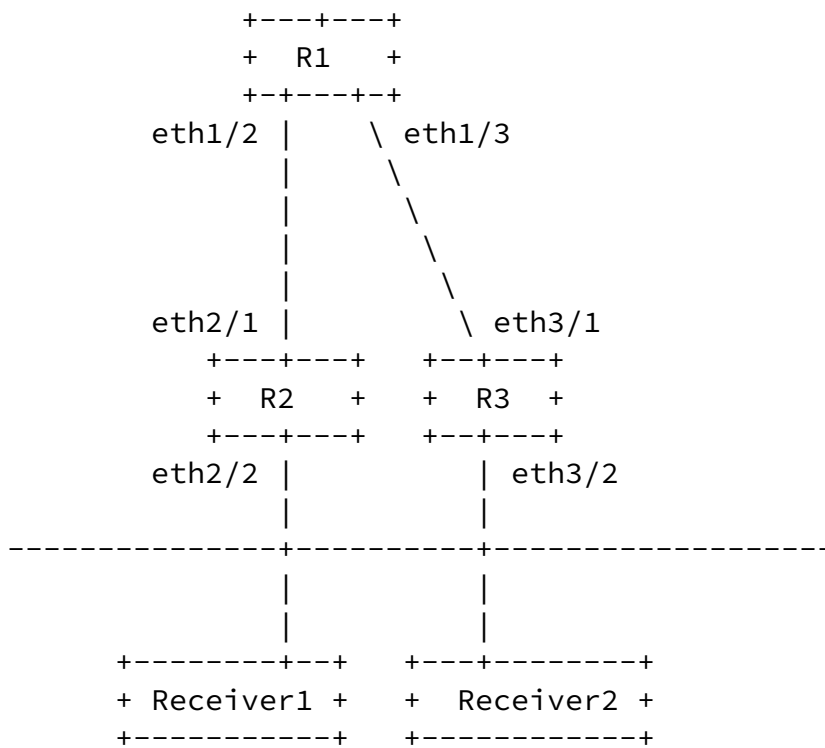
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[Appendix A](#). Data Tree Example

[A.1](#) Bridge scenario

This section contains an example for bridge scenario in the JSON encoding [[RFC7951](#)], containing both configuration and state data.

```
+-----+
+ Source +
+-----+
|
-----+-----
|eth1/1
```



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

```

{
  "ietf-interfaces:interfaces":{
    "interface":[
      {
        "name":"eth1/1",
        "type":"iana-if-type:ethernetCsmacd"
      }
    ]
  },
  "ietf-routing:routing":{
    "control-plane-protocols":{
      "control-plane-protocol":[
        {
          "type":"ietf-igmp-mld-snooping:igmp-snooping",

```

```

    "name":"bis1",
    "ietf-igmp-mld-snooping:igmp-snooping-instance":{
      "scenario":"ietf-igmp-mld-snooping:bridge",
      "enable":true
    }
  }
]
}

```



```

    "type": "ietf-igmp-mld-snooping:igmp-snooping",
    "name": "bis1",
    "ietf-igmp-mld-snooping:igmp-snooping-instance": {
      "scenario": "ietf-igmp-mld-snooping:bridge",
      "enable": true
    }
  }
]
},
"ieee802-dot1q-bridge:bridges": {
  "bridge": [
    {
      "name": "isp1",
      "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": "bis1"
              }
            ]
          }
        }
      ]
    }
  ]
}
]
}
]
}
}

```

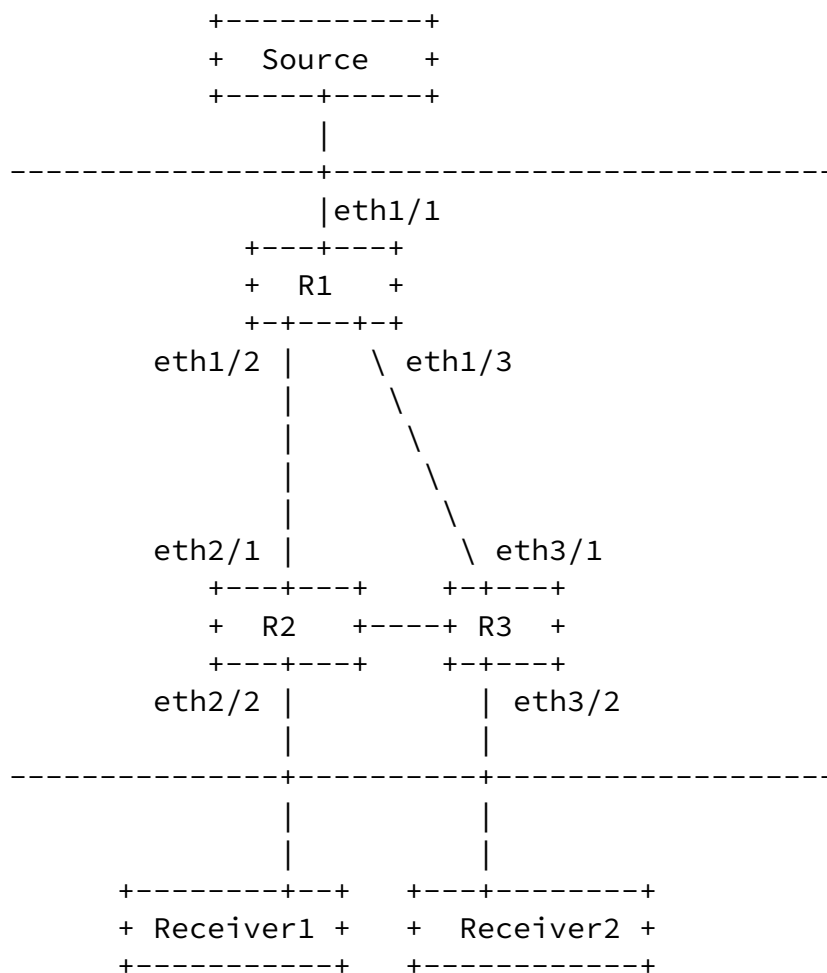
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A.2 L2VPN scenario

This section contains an example for L2VPN scenario in the JSON encoding [[RFC7951](#)], containing both configuration and state data.



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

```

{
  "ietf-interfaces:interfaces":{
    "interface":[
      {
        "name":"eth1/1",
        "type":"iana-if-type:ethernetCsmacd"
      }
    ]
  }
}

```

```

},
"ietf-pseudowires:pseudowires": {
  "pseudowire": [
    {
      "name": "pw2"
    },
    {
      "name": "pw3"
    }
  ]
}

```

```

    }
  ]
},
"ietf-network-instance:network-instances": {
  "network-instance": [
    {
      "name": "vpls1",
      "ietf-igmp-mlld-snooping:igmp-snooping-instance": "vis1",
      "ietf-l2vpn:type": "ietf-l2vpn:vpls-instance-type",
      "ietf-l2vpn:signaling-type": "ietf-l2vpn:ldp-signaling",
      "ietf-l2vpn:endpoint": [
        {
          "name": "acs",
          "ac": [
            {
              "name": "eth1/1"
            }
          ]
        },
        {
          "name": "pws",
          "pw": [
            {
              "name": "pw2"
            },
            {
              "name": "pw3"
            }
          ]
        }
      ]
    }
  ]
}
},
"ietf-routing:routing": {
  "control-plane-protocols": {
    "control-plane-protocol": [

```

```

    {
      "type": "ietf-igmp-mld-snooping:igmp-snooping",
      "name": "vis1",
      "ietf-igmp-mld-snooping:igmp-snooping-instance": {
        "scenario": "ietf-igmp-mld-snooping:l2vpn",
        "enable": true
      }
    }
  ]
}
}
}

```

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

```

{
  "ietf-interfaces:interfaces":{
    "interface":[
      {
        "name":"eth1/1",
        "type":"iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2018-05-23T12:34:56-05:00"
        }
      }
    ]
  },
  "ietf-pseudowires:pseudowires": {
    "pseudowire": [
      {
        "name": "pw2"
      },
      {
        "name": "pw3"
      }
    ]
  },
  "ietf-network-instance:network-instances": {
    "network-instance": [
      {
        "name": "vpls1",
        "ietf-igmp-mld-snooping:igmp-snooping-instance": "vis1",

```

```
]
}
]
},
"ietf-routing:routing": {
  "control-plane-protocols": {
    "control-plane-protocol": [
      {
        "type": "ietf-igmp-mld-snooping:igmp-snooping",
        "name": "vis1",
        "ietf-igmp-mld-snooping:igmp-snooping-instance": {
          "scenario": "ietf-igmp-mld-snooping:l2vpn",
          "enable": true
        }
      }
    ]
  }
}
}
```

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