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A YANG Data Model for Layer-2 Network Topologies
draft-ietf-i2rs-yang-l2-network-topology-02

Abstract

This document defines a YANG data model for Layer 2 network topologies.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

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1. Introduction

[I-D.ietf-i2rs-yang-network-topo] defines the Yang [RFC6020] [RFC6991] [I-D.ietf-netmod-rfc6020bis]data models of the abstract (generic) network and network topology. Such models can be augmented with technology-specific details to build more specific topology models.

This document defines the Yang data model for Layer 2 network topologies by augmenting the generic network and network topology data models with L2 specific topology attributes.

2. Layer 2 Topology Model

The Layer 2 network topology model is designed to be generic and applicable to Layer 2 networks built with different L2 technologies.

The Layer 2 topology model applies the generic network and network topology models to Layer 2 network topologies, and augments the generic models with information specific in Layer 2 networks. The relationship between the Layer 2 topology model and the generic network and network topology model is shown in the figure below:

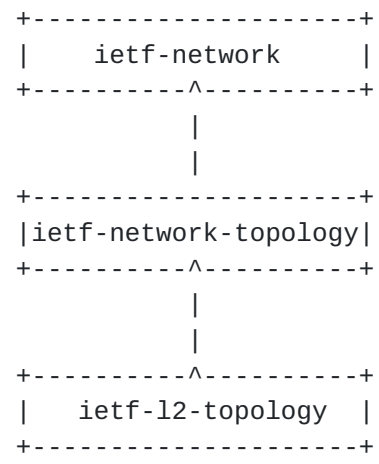

Figure 1. L2-topology model structure

In order to represent a Layer 2 network topology, the generic network and topology models are augmented with Layer-2 specific information, such as the identifiers, descriptions, attributes and states of the Layer-2 networks, nodes, links and termination points. Some of the information may be collected via Link Layer Discovery Protocl (LLDP) or other Layer-2 protocols, and some of them may be locally configured.

The structure of "ietf-l2-topology" data model is depicted in the following diagram. Brackets enclose list keys, "rw" means configuration data, "ro" means operational state data, "?" designates optional nodes, "*" designates nodes that can have multiple instances.

```
module: ietf-l2-topology
augment /nw:networks/nw:network/nw:network-types:
   +--rw l2-network!
augment /nw:networks/nw:network:
   +--rw l2-network-attributes
      +--rw name?   string
      +--rw flag*   flag-type
augment /nw:networks/nw:network/nw:node:
   +--rw l2-node-attributes
      +--rw name?                 string
      +--rw description?          string
      +--rw management-address*   inet:ip-address
      +--rw management-vid?       vlan {VLAN}?
      +--rw nick-name*            trill-nickname {TRILL}?
      +--rw flag*                 flag-type
augment /nw:networks/nw:network/nt:link:
   +--rw l2-link-attributes
      +--rw name?    string
      +--rw flag*    flag-type
```

```
      +--rw rate?    decimal64
      +--rw delay?   uint32
      +--rw srlg*    uint32
augment /nw:networks/nw:network/nw:node/nt:termination-point:
   +--rw l2-termination-point-attributes
      +--rw description?          string
      +--rw maximum-frame-size?   uint32
      +--rw (l2-termination-point-type)?
      |  +--:(ethernet)
      |  |  +--rw mac-address?          yang:mac-address
      |  |  +--rw eth-encapsulation?    identityref
      |  |  +--rw port-vlan-id?         vlan {VLAN}?
      |  |  +--rw vlan-id-name* [vlan-id] {VLAN}?
      |  |     +--rw vlan-id      vlan
      |  |     +--rw vlan-name?   string
      |  +--:(legacy)
      |     +--rw encapsulation?        identityref
      +--ro tp-state?             enumeration
notifications:
   +---n l2-node-event
   |  +--ro event-type?           l2-network-event-type
   |  +--ro network-ref?          -> /nw:networks/network/network-id
   |  +--ro node-ref?             -> /nw:networks/network[nw:network-id =
current()/../network-ref]/node/node-id
   |  +--ro l2-network!
   |  +--ro l2-node-attributes
   |     +--ro name?                 string
   |     +--ro description?          string
   |     +--ro management-address*   inet:ip-address
   |     +--ro management-vid?       vlan {VLAN}?
   |     +--ro nick-name*            trill-nickname {TRILL}?
   |     +--ro flag*                 flag-type
   +---n l2-link-event
   |  +--ro event-type?           l2-network-event-type
   |  +--ro network-ref?          -> /nw:networks/network/network-id
   |  +--ro link-ref?             -> /nw:networks/network[nw:network-id =
current()/../network-ref]/nt:link/link-id
   |  +--ro l2-network!
   |  +--ro l2-link-attributes
   |     +--ro name?    string
   |     +--ro flag*    flag-type
   |     +--ro rate?    decimal64
   |     +--ro delay?   uint32
   |     +--ro srlg*    uint32
   +---n l2-termination-point-event
      +--ro event-type?                       l2-network-event-type
      +--ro network-ref?                      -> /nw:networks/network/network-
id
```

```
      +--ro node-ref?                          -> /nw:networks/
network[nw:network-id = current()/../network-ref]/node/node-id
      +--ro tp-ref?                            -> /nw:networks/
network[nw:network-id = current()/../network-ref]/node[nw:node-id =
current()/../node-ref]/nt:termination-point/tp-id
      +--ro l2-network!
```

```
      +--ro l2-termination-point-attributes
         +--ro description?          string
         +--ro maximum-frame-size?   uint32
         +--ro (l2-termination-point-type)?
         |  +--:(ethernet)
         |  |  +--ro mac-address?          yang:mac-address
         |  |  +--ro eth-encapsulation?    identityref
         |  |  +--ro port-vlan-id?         vlan {VLAN}?
         |  |  +--ro vlan-id-name* [vlan-id] {VLAN}?
         |  |     +--ro vlan-id      vlan
         |  |     +--ro vlan-name?   string
         |  +--:(legacy)
         |     +--ro encapsulation?        identityref
         +--ro tp-state?             enumeration
```

The L2-topology module augments the generic ietf-network and ietf-network-topology modules as follows:

- A new network type "l2-network-type" is introduced. This is represented by a container object, and is inserted under the "network-types" container of the generic ietf-network module in [I-D.ietf-i2rs-yang-network-topo].

- Additional network attributes are introduced in a grouping "l2-network-attributes", which augments the "network" list of the ietf-network module. The attributes include Layer-2 network name and a set of flags. Each type of flag is represented by a separate identity.

- Additional data objects for Layer-2 nodes are introduced by augmenting the "node" list of the generic ietf-network module. New objects include Layer-2 node identifier, description, management address, and a set of flags.

- Additional data objects for Layer-2 termination points are introduced by augmenting the "termination-point" list of the ietf-network-topology module defined in [I-D.ietf-i2rs-yang-network-topo]. New objects include Layer-2 termination point descriptions, Layer-2 termination point type specific attributes and Layer-2 termination point states.

- Links in the ietf-network-topology module are augmented as well with a set of Layer-2 parameters, allowing to associate a link with a name, a set of Layer-2 link attributes and flags.

- The optional L2 technology specific attributes are introduced in this module as Layer-2 features.

3. Layer-2 Topology Yang Module

```
<CODE BEGINS> file "ietf-l2-topology@2015-12-22.yang"
module ietf-l2-topology {
    yang-version 1.1;
    namespace "urn:ietf:params:xml:ns:yang:ietf-l2-topology";
    prefix "l2t";

    import ietf-network {
      prefix "nw";
    }

    import ietf-network-topology {
      prefix "nt";
    }

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

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

    organization
      "IETF I2RS (Interface to the Routing System) Working Group";
    contact
      "WG Web:    <http://tools.ietf.org/wg/i2rs/>
       WG List:   <mailto:i2rs@ietf.org>
       WG Chair:  Susan Hares
                  <mailto:shares@ndzh.com>

       WG Chair:  Jeffrey Haas
                  <mailto:jhaas@pfrc.org>

       Editor:    Jie Dong
                  <mailto:jie.dong@huawei.com>

       Editor:    Xiugang Wei
                  <mailto:weixiugang@huawei.com>";

    description
      "This module defines a basic model for
       the layer-2 topology of a network";

    revision "2015-12-22" {
      description "Initial revision";
      reference "draft-ietf-i2rs-l2-network-topology-02";
```

```
       }

      /*
       * Typedefs
       */

       typedef vlan {
         type uint16 {
           range "0..4095";
         }
         description "VLAN ID";
       }

       typedef trill-nickname {
         type uint16;
         description "TRILL Nickname";
       }

       typedef flag-type {
         type identityref {
           base "flag-identity";
         }
         description "Base type for flags";
       }

       typedef l2-network-event-type {
         type enumeration {
           enum "add" {
             value 0;
             description "An L2 node or link or termination-point
             has been added";
           }
           enum "remove" {
             value 1;
             description "An L2 node or link or termination-point
             has been removed";
           }
           enum "update" {
             value 2;
             description "An L2 node or link or termination-point
             has been updated";
           }
         }
         description "l2 network event type for notifications";
       } // l2-topology-event-type
```

```
      /*
      * Features
      */

      feature VLAN {
        description
          "Indicates that the system supports the
           vlan functions";
      }

      feature QinQ {
        description
          "Indicates that the system supports the
           qinq functions";
      }

      feature PBB {
        description
         "Indicates that the device supports the
          provider-backbone-bridging functions";
      }

      feature VPLS {
        description
          "Indicates that the device supports the
           VPLS functions";
        reference "RFC 4761, RFC 4762";
      }

      feature TRILL {
        description
          "Indicates that the device supports the
           TRILL functions";
        reference "RFC 6325";
      }

      feature VXLAN {
        description
          "Indicates that the device supports the
           VXLAN functions";
        reference "RFC 7348";
      }

     /*
      * Identities
      */
```

```
identity flag-identity {
  description "Base type for flags";
}

identity encapsulation-type {
  description
    "Base identity from which specific encapsulation
     types are derived.";
}

identity eth-encapsulation-type {
  base encapsulation-type;
  description
    "Base identity from which specific ethernet
     encapsulation types are derived.";

}

identity ethernet {
  base eth-encapsulation-type;
  description
    "native ethernet encapsulation";
}

identity vlan {
  base eth-encapsulation-type;
  description
    "vlan encapsulation";
}

identity qinq {
  base eth-encapsulation-type;
  description
    "qinq encapsulation";
}

identity pbb {
  base eth-encapsulation-type;
  description
    "pbb encapsulation";
}

identity trill {
  base eth-encapsulation-type;
  description
    "trill encapsulation";
}
```

```
       identity vpls {
         base eth-encapsulation-type;
         description
           "vpls encapsulation";
       }

       identity vxlan {
         base eth-encapsulation-type;
         description
           "vxlan encapsulation";
       }

       identity frame-relay {
         base encapsulation-type;
         description
           "Frame Relay encapsulation";
       }

       identity ppp {
         base encapsulation-type;
         description
           "PPP encapsulation";
       }

       identity hdlc {
         base encapsulation-type;
         description
           "HDLC encapsulation";
       }

       identity atm {
         base encapsulation-type;
         description
           "Base identity from which specific ATM
            encapsulation types are derived.";

       }

       identity pwe3 {
         base encapsulation-type;
         description
           "Base identity from which specific pw
            encapsulation types are derived.";
       }


      /*
       * Groupings
```

```
       */


       grouping l2-network-type {
         description "Identify the topology type to be L2.";
         container l2-network {
           presence "indicates L2 Network";
           description
           "The presence of the container node indicates
            L2 Topology";
         }
       }

       grouping l2-network-attributes {
         description "L2 Topology scope attributes";
         container l2-network-attributes {
           description "Containing L2 network attributes";
           leaf name {
             type string;
             description "Name of the L2 network";
           }

           leaf-list flag {
             type flag-type;
             description "L2 network flags";
           }
         }
       }

       grouping l2-node-attributes {
         description "L2 node attributes";
         container l2-node-attributes {
           description "Containing L2 node attributes";
           leaf name {
             type string;
             description "Node name";
           }
           leaf description {
             type string;
             description "Node description";
           }
           leaf-list management-address {
             type inet:ip-address;
             description "System management address";
           }
           leaf management-vid {
             if-feature VLAN;
             type vlan;
```

```
            description "System management VID";
          }
          leaf-list nick-name {
            if-feature TRILL;
            type trill-nickname;
            description "Nickname of the RBridge";
          }
          leaf-list flag {
            type flag-type;
            description "Node operational flags";
          }
        }
      }  // grouping l2-node-attributes

      grouping l2-link-attributes {
        description "L2 link attributes";
        container l2-link-attributes {
          description "Containing L2 link attributes";
          leaf name {
            type string;
            description "Link name";
          }
          leaf-list flag {
            type flag-type;
            description "Link flags";
          }
          leaf rate {
            type decimal64 {
              fraction-digits 2;
            }
            description "Link rate";

          }
          leaf delay {
            type uint32;
            description "Link delay in microseconds";
          }
          leaf-list srlg {
            type uint32;
            description
              "List of Shared Risk Link Groups
               this link belongs to.";
          }
        }
      } // grouping l2-link-attributes

      grouping l2-termination-point-attributes {
        description "L2 termination point attributes";
```

```
          container l2-termination-point-attributes {
            description "Containing L2 TP attributes";
            leaf description {
              type string;
              description "Port description";
            }

            leaf maximum-frame-size {
              type uint32;
              description "Maximum frame size";
            }

            choice l2-termination-point-type {
              description
                "Indicates termination-point type
                 specific attributes";
              case ethernet {
                leaf mac-address {
                  type yang:mac-address;
                  description "Interface MAC address";
                }

                leaf eth-encapsulation {
                  type identityref {
                    base eth-encapsulation-type;
                  }
                  description
                    "Encapsulation type of this
                     ternimation point.";
                }

                leaf port-vlan-id {
                  if-feature VLAN;
                  type vlan;
                  description "Port VLAN ID";
                }

                list vlan-id-name {
                  if-feature VLAN;
                  key "vlan-id";
                  description "Interface configured VLANs";
                  leaf vlan-id {
                    type vlan;
                    description "VLAN ID";
                  }
                  leaf vlan-name {
                    type string;
                    description "VLAN Name";
```

```
                }
              }
            } //case ethernet

            case legacy {
              leaf encapsulation {
                type identityref {
                  base encapsulation-type;
                }
                description
                  "Encapsulation type of this termination point.";
              }
            } //case legacy

          } //choice termination-point-type

          leaf tp-state {
            type enumeration {
              enum in-use {
                value 0;
                description
                  "the termination point is in forwarding state";
              }
              enum blocking {
                value 1;
                description
                  "the termination point is in blocking state";
              }
              enum down {
                value 2;
                description
                  "the termination point is in down state";
              }
              enum others {
                value 3;
                description
                  "the termination point is in other state";
              }
            }
            config false;
            description "State of the termination point";
          }
        }
      } // grouping l2-termination-point-attributes

   /*** grouping of network/node/link/tp leaf-refs ***/

     grouping network-ref {
```

```
      description
        "Grouping for an absolute reference to a network topology
        instance.";
      leaf network-ref {
        type leafref {
          path "/nw:networks/nw:network/nw:network-id";
        }
        description
          "An absolute reference to a network topology instance.";
      }
    }

    grouping link-ref {
      description
        "Grouping for an absolute reference to a link instance.";
        uses network-ref;
        leaf link-ref {
          type leafref {
            path "/nw:networks/nw:network"
              +"[nw:network-id = current()/../network-ref]"
              +"/nt:link/nt:link-id";
          }
        description
          "An absolute reference to a link instance.";
      }
    }

    grouping node-ref {
      description
        "Grouping for an absolute reference to a node instance.";
      uses network-ref;
      leaf node-ref {
        type leafref {
          path "/nw:networks/nw:network"
            +"[nw:network-id = current()/../network-ref]"
            +"/nw:node/nw:node-id";
        }
        description
          "An absolute reference to a node instance.";
      }
    }

    grouping tp-ref {
      description
        "Grouping for an absolute reference to a termination point.";
      uses node-ref;
      leaf tp-ref {
        type leafref {
```

```
          path "/nw:networks/nw:network"
            +"[nw:network-id = current()/../network-ref]"
            +"/nw:node[nw:node-id = current()/../node-ref]"
            +"/nt:termination-point/nt:tp-id";
        }
        description
          "Grouping for an absolute reference to a TP.";
      }
    }


     /*
      * Data nodes
      */


      augment "/nw:networks/nw:network/nw:network-types" {
        description
          "Introduce new network type for L2 topology";
        uses l2-network-type;
      }

      augment "/nw:networks/nw:network" {
        when "/nw:networks/nw:network/nw:network-types/l2-network" {
          description
            "Augmentation parameters apply only for networks
             with L2 topology";
        }
        description
          "Configuration parameters for the L2 network
           as a whole";
        uses l2-network-attributes;
      }

      augment "/nw:networks/nw:network/nw:node" {
        when "/nw:networks/nw:network/nw:network-types/l2-network" {
          description
            "Augmentation parameters apply only for networks
             with L2 topology";
        }
        description
          "Configuration parameters for L2 at the node
           level";
        uses l2-node-attributes;
      }

      augment "/nw:networks/nw:network/nt:link" {
        when "/nw:networks/nw:network/nw:network-types/l2-network" {
```

```
          description
            "Augmentation parameters apply only for networks
             with L2 topology";
        }
        description "Augment L2 topology link information";
        uses l2-link-attributes;
      }

      augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
        when "/nw:networks/nw:network/nw:network-types/l2-network" {
          description
            "Augmentation parameters apply only for networks
             with L2 topology";
        }
        description
          "Augment L2 topology termination point configuration";
        uses l2-termination-point-attributes;
      }

     /*
      * Notifications
      */

      notification l2-node-event {
        description "Notification event for L2 node";
        leaf event-type {
          type l2-network-event-type;
          description "Event type";
        }
        uses node-ref;
        uses l2-network-type;
        uses l2-node-attributes;
      }

      notification l2-link-event {
        description "Notification event for L2 link";
        leaf event-type {
          type l2-network-event-type;
          description "Event type";
        }
        uses link-ref;
        uses l2-network-type;
        uses l2-link-attributes;
      }

      notification l2-termination-point-event {
        description "Notification event for L2 termination point";
        leaf event-type {
```

```
          type l2-network-event-type;
          description "Event type";
        }
        uses tp-ref;
        uses l2-network-type;
        uses l2-termination-point-attributes;
      }

  }  // module l2-topology
  <CODE ENDS>
```

4. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

5. Security Considerations

The transport protocol used for sending the topology data MUST support authentication and SHOULD support encryption. The data-model by itself does not create any security implications.

6. Acknowledgements

The authors would like to acknowledge the comments and suggestions received from Susan Hares, Alia Atlas, Juergen Schoenwaelder, Mach Chen, Alexander Clemm and Sriganesh Kini.

7. References

7.1. Normative References

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