             A YANG Data Model for Layer-2 Network Topologies
                draft-dong-i2rs-l2-network-topology-01

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

   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). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   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."

   This Internet-Draft will expire on September 4, 2015.

Table of Contents

1. Introduction

   [I-D.medved-i2rs-topology-im] specifies the generic network topology
   information model, and approaches to extend the generic network
   topology information model to specific type of network topologies.
   It also provides the extensions made for Layer-3 unicast IGP, IS-IS
   and OSPF topologies. [I-D.clemm-i2rs-yang-network-topo] defines the
   Yang [RFC6020] [RFC6021] data models for generic network topology, L3
   unicast IGP, IS-IS, OSPF and TED which are derived from the
   information model defined in [I-D.medved-i2rs-topology-im].

   Besides the information collected through "live" layer-3 IGP,
   [I-D.amante-i2rs-topology-use-cases] also specifies the collection of
   network information which is not visible within the Layer 3 IGP's
   LSDB. Such information can be links, nodes, or properties of those
   links or nodes in lower layers of the network. The requirements on
   the topology data model in [I-D.medved-i2rs-topology-requirements]
   also include the physical properties associated with the ports/
   interfaces, and information associated with the network element's
   immediately adjacent neighbors.

   This document defines the Yang data model for layer-2 network
   topologies by extending the generic network topology data model
   defined in [I-D.clemm-i2rs-yang-network-topo].

2. Layer-2 Topology Model

   In order to represent a layer-2 network topology, the generic network
   topology model needs to be extended to contain layer-2 specific
   information. Module "l2-topology" applies the generic network
   topology model to layer-2 network topologies, and augments the

generic network topology with information specific to layer-2
networks.

The relationship between the l2-topology model and the generic
network topology model is shown in the figure below:
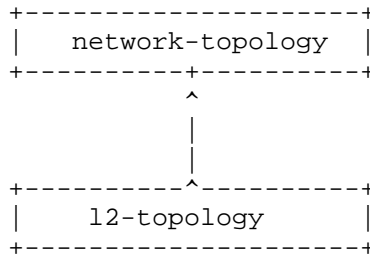
```
                   +--------------------+
                   |  network-topology  |
                   +---------+----------+
                             ^
                             |
                             |
                   +---------^----------+
                   |    l2-topology     |
                   +--------------------+
```
            Figure 1. L2-topology and generic network-topology

For layer-2 network topology, there are some layer-2 specific
parameters and capabilities to be added to the generic network
topology model, such as properties of layer-2 links or nodes,
descriptions, layer-2 addresses, encapsulations, etc. Part of the
Information collected through LLDP could be included in the layer-2
network topology.

The structure of "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: l2-topology
augment /nt:network/nt:network-types:
   +--rw l2-network!
augment /nt:network:
   +--rw l2-network-attributes
      +--rw name?   string
      +--rw flag*   flag-type
augment /nt:network/nt:node:
   +--rw l2-node-attributes
      +--rw name?                 string
      +--rw description?          string
      +--rw chassis-id?           yang:mac-address
      +--rw management-address*   inet:ip-prefix
      +--rw management-vid?       vlan
      +--rw nick-name?            nickname {TRILL}?
      +--rw flag*                 flag-type
augment /nt:network/ntopo:link:
   +--rw l2-link-attributes
      +--rw name?   string
      +--rw rate?   decimal64
      +--rw flag*   flag-type
augment /nt:network/nt:node/ntopo:termination-point:
   +--rw l2-termination-point-attributes
      +--rw description?          string
      +--rw mac-address?          yang:mac-address
      +--rw port-vlan-id?         vlan
      +--rw ppvid
      |  +--rw ppvid?        vlan
      |  +--rw ppvid-flags?  bits
      +--rw vlan-name* [vlan-id]
      |  +--rw vlan-id      vlan
      |  +--rw vlan-name?   string
      +--rw encapsulation?        identityref
      +--rw maximum-frame-size?   uint32
      +--rw link-aggregation
      |  +--rw aggregation-status?  bits
      |  +--rw aggregated-port-id?  string
      +--ro tp-state?             enumeration
```

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

o 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 network module in
   [I-D.clemm-i2rs-yang-network-topo].

o Additional network attributes are introduced in a grouping "l2-
   network-attributes", which augments the "network" list of the
   network module in [I-D.clemm-i2rs-yang-network-topo]. The
   attributes include an Layer-2 network name and a set of flags.
   Each type of flag is represented by a separate identity.

o Additional data objects for nodes are introduced by augmenting the
   "node" list of the generic network module. New objects include a
   series of layer-2 node parameters, as well as a set of flags.

o Additional data objects for termination points are introduced by
   augmenting the "termination-point" list of the generic network-
   topology module. New objects include a series of port properties
   and parameters.

o Links are augmented as well with a set of parameters, allowing to
   associate a link with an L2 name, the link rate and another set of
   flags.

3. Layer-2 Topology Yang Module

```
module l2-topology {
    yang-version 1;
    namespace "urn:TBD:params:xml:ns:yang:nt:l2-topology";
    // replace with IANA namespace when assigned
    prefix "l2t";

    import network {
        prefix "nt";
    }

    import network-topology {
        prefix "ntopo";
    }

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

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

    organization "TBD";
    contact "I-D Editor: jie.dong@huawei.com";

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

```
   revision "2015-03-03" {
       description "Initial revision";
       reference "draft-dong-i2rs-l2-network-topology-01";
   }

/*
 * Typedefs
 */

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

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

typedef flag-type {
    type identityref {
        base "flag-identity";
    }
}


/*
 * Features
 */

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

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

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

   identity pbb {
       base encapsulation-type;
       description
```

```
              "pbb encapsulation";
      }

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

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

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


   /*
    * Groupings
    */


      grouping l2-network-type {
          container l2-network {
              presence "indicates L2 Network";
          }
      }

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

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

      grouping l2-node-attributes {
```

```
        container l2-node-attributes {
            leaf name {
                description "Node name";
                type string;
            }
            leaf description {
                description "Node description";
                type string;
            }
            leaf chassis-id {
                description "System MAC address";
                type yang:mac-address;
            }
            leaf-list management-address {
                description "System management address";
                type inet:ip-prefix;
            }

            leaf management-vid {
                description "System management VID";
                type vlan;
            }

            leaf nick-name {
                if-feature TRILL;
                description "Nickname of RBridge";
                type nickname;
            }

            leaf-list flag {
                description "Node operational flags";
                type flag-type;
            }
          }
        } // grouping l2-node-attributes

    grouping l2-link-attributes {
        container l2-link-attributes {
            leaf name {
                description "Link name";
                type string;
            }
            leaf rate {
                description "Link rate";
                type decimal64 {
                    fraction-digits 2;
                }
            }
```

```
            leaf-list flag {
                description "Link flags";
                type flag-type;
            }

        }
    } // grouping l2-link-attributes

    grouping l2-termination-point-attributes {
        container l2-termination-point-attributes {
            leaf description {
                description "Port description";
                type string;
            }
            leaf mac-address {
                description "Interface MAC address";
                type yang:mac-address;
            }
            leaf port-vlan-id {
                description "Port VLAN ID";
                type vlan;
            }

            container ppvid {
                description "Port and protocol VLAN ID";
                leaf ppvid {
                    type vlan;
                }
                leaf ppvid-flags {
                    type bits {
                        bit port-protocol-vlan-supported {
                            position 1;
                        }
                        bit port-protocol-vlan-enabled {
                            position 2;
                        }
                    }
                }
            }

            list vlan-name {
                key "vlan-id";
                description "Interface configured VLANs";
                leaf vlan-id {
                    type vlan;
                }
                leaf vlan-name {
                    type string;
```

```
            }
        }

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

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

        container link-aggregation {
            leaf aggregation-status {
                description "Link aggregation capabilities and status";
                type bits {
                    bit aggregation-capability {
                        position 0;
                    }
                    bit aggregation-status {
                        position 1;
                    }
                }
            }
            leaf aggregated-port-id {
                type string;
            }
        }

        leaf tp-state {
            config false;
            type enumeration {
                enum "forwarding" {
                    value 0;
                    description
                      "the termination point is in forwarding state";
                }
                enum "blocking" {
                    value 1;
                      description
                        "the termination point is in blocking state";
                }
                enum "others" {
                    value 2;
                      description
```

```
                                "the termination point is in other state";
                    }
                }
            }
        }
    } // grouping l2-termination-point-attributes


    /*
     * Data nodes
     */

    augment "/nt:network/nt:network-types" {
        uses l2-network-type;
    }

    augment "/nt:network" {
        when "nt:network-types/l2-network";
        uses l2-network-attributes;
    }

    augment "/nt:network/nt:node" {
        when "../nt:network-types/l2-network";
        uses l2-node-attributes;
    }

    augment "/nt:network/ntopo:link" {
        when "/nt:network/nt:network-types/l2-network";
        uses l2-link-attributes;
    }

    augment "/nt:network/nt:node/ntopo:termination-point" {
        when "/nt:network/nt:network-types/l2-network";
        uses l2-termination-point-attributes;
    }

    /*
     * Notifications: to be added
     */

} // module l2-topology
```

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. References

6.1. Normative References

   [I-D.clemm-i2rs-yang-network-topo]
             Clemm, A., Medved, J., Varga, R., Tkacik, T., Bahadur, N.,
             and H. Ananthakrishnan, "A Data Model for Network
             Topologies", draft-clemm-i2rs-yang-network-topo-02 (work
             in progress), December 2014.

   [I-D.medved-i2rs-topology-im]
             Medved, J., Bahadur, N., Clemm, A., and H.
             Ananthakrishnan, "An Information Model for Network
             Topologies", draft-medved-i2rs-topology-im-01 (work in
             progress), October 2013.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
             Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC6020] Bjorklund, M., "YANG - A Data Modeling Language for the
             Network Configuration Protocol (NETCONF)", RFC 6020,
             October 2010.

   [RFC6021] Schoenwaelder, J., "Common YANG Data Types", RFC 6021,
             October 2010.

6.2. Informative References

   [I-D.amante-i2rs-topology-use-cases]
             Medved, J., Previdi, S., Lopez, V., and S. Amante,
             "Topology API Use Cases", draft-amante-i2rs-topology-use-
             cases-01 (work in progress), October 2013.

   [I-D.medved-i2rs-topology-requirements]
               Medved, J., Previdi, S., Gredler, H., Nadeau, T., and S.
               Amante, "Topology API Requirements", draft-medved-i2rs-
               topology-requirements-00 (work in progress), February
               2013.

Authors' Addresses

   Jie Dong
   Huawei Technologies
   Huawei Campus, No. 156 Beiqing Rd.
   Beijing 100095
   China

   Email: jie.dong@huawei.com

   Xiugang Wei
   Huawei Technologies
   Huawei Campus, No. 156 Beiqing Rd.
   Beijing 100095
   China

   Email: weixiugang@huawei.com