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A YANG Data Model for Layer-2 Network Topologies  
draft-ietf-i2rs-yang-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](#)].

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## [1.](#) Introduction

[I-D.ietf-i2rs-yang-network-topo] defines the Yang [[RFC6020](#)] [[RFC6021](#)] 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:

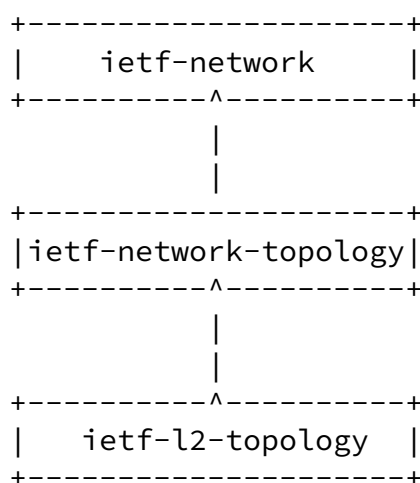


Figure 1. L2-topology model structure

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 Protocol (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:network/nw:network-types:
  +--rw l2-network!
augment /nw:network:
  +--rw l2-network-attributes
    +--rw name?   string
    +--rw flag*   flag-type

```

```

augment /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: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: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?         leafref
  | +--ro node-ref?           leafref
  | +--ro l2-network!
  | +--ro l2-node-attributes
  | | +--ro name?              string
  | | +--ro description?       string
  | | +--ro management-address*  inet:ip-prefix
  | | +--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?         leafref
|     +---ro link-ref?            leafref
|     +---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?              leafref
+---ro node-ref?                 leafref
+---ro tp-ref?                   leafref
+---ro l2-network!

```

```

+---ro l2-termination-point-attributes
+---ro description?              string
+---ro maximum-frame-size?       uint32
+---ro (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:

- 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 ietf-network module in [[I-D.ietf-i2rs-yang-network-topo](#)].

- o 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.
- o 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.
- o 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.
- o 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.
- o 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@2015-06-23.yang"
module ietf-l2-topology {
  yang-version 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 "TBD";
contact "I-D Editor: jie.dong@huawei.com";

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

revision "2015-06-23" {
  description "Initial revision";
  reference "draft-ietf-i2rs-l2-network-topology-01";
}

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

augment "/nw:network" {
  when "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:network/nw:node" {
  when "../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:network/nt:link" {
  when "/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:network/nw:node/nt:termination-point" {
  when "/nw:network/nw:network-types/l2-network" {
    description
      "Augmentation parameters apply only for networks
      with L2 topology";
  }
  description
```

```
    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

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#### [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.

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