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A YANG Data Model for Layer 1 (ODU) Network Topology

[draft-zhang-ccamp-l1-topo-yang-03.txt](#)

Abstract

A transport network is a server-layer network designed to provide connectivity services for a client-layer network to carry the client traffic opaquely across the server-layer network resources. A transport network may be constructed from equipment utilizing any of a number of different transport technologies such as the evolving optical transport infrastructure (Synchronous Optical Networking (SONET) / Synchronous Digital Hierarchy (SDH) and Optical Transport Network (OTN)) or packet transport as epitomized by the MPLS Transport Profile (MPLS-TP).

This draft describes a YANG data model to manipulate the topologies of a layer 1 Optical Transport Network (OTN). It is independent of control plane protocols and captures topology related information pertaining to OTN and also enables manipulation (e.g., obtaining) of an OTN network.

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1. Introduction

A transport network is a server-layer network designed to provide connectivity services for a client-layer network to carry the client traffic opaquely across the server-layer network resources. A transport network may be constructed from equipment utilizing any of a number of different transport technologies such as the evolving optical transport infrastructure (Synchronous Optical Networking (SONET) / Synchronous Digital Hierarchy (SDH) and Optical Transport Network (OTN)) or packet transport as epitomized by the MPLS Transport Profile (MPLS-TP).

This document defines a data model of a layer one network topology, using YANG [[RFC6020](#)]. The model can be used by an application exposing to a management system. Moreover, it can also be used by an application in the following ways (but not limited to):

- o to obtain a whole view of the network topology information of its interest e.g., via a network element or maybe a controller or a network management system within the network ;

- o to receive notifications with regard to the information of the change of the network topology of its interest;

- o to enforce the establishment/update of a network topology with the characteristic specified in the data model, e.g., by a network controller or a client controller to manipulate the network provided by the provider for flexible control and management;

The YANG model defined in this draft is independent of control plane protocols and captures topology related information pertaining to an Optical Transport Networks (OTN)-electronic layer and also enables manipulation of an OTN network. Other network layers, such as fixed Dense Wavelength Switched Optical Network (WSON) and flexible optical networks (a.k.a., flexi-grid networks) are covered in [WSON-YANG] and [[Flexi-YANG](#)], respectively.

2. Conventions used in this document

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](#)].

3. Terminology and Notations

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in the YANG data tree

presented later in this draft is defined in [[ietf-netmod-rfc6087bis](#)]. They are provided below for reference.

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

[4. YANG Data Model for Layer 1 Topology](#)

[4.1. YANG Tree](#)

```
module: ietf-odu-topology
augment /nd:networks/nd:network/nd:network-types/tet:te-topology:
  +--rw l1-network!
augment /nd:networks/nd:network:
  +--rw name?    string
augment /nd:networks/nd:network/nd:node:
  +--rw name?    string
augment /nd:networks/nd:network/nd:node/lnk:termination-
point/tet:te/tet:config:
  +--rw client-facing?      empty
  +--rw tpn?                uint16
  +--rw tsg?                identityref
  +--rw protocol-type?      identityref
  +--rw fec-enabled?        boolean
  +--rw adaptation-type?    adaptation-type
  +--rw sink-adapt-active?  boolean
  +--rw source-adapt-active? boolean
  +--rw timeslots
    +--rw values*    uint8
augment /nd:networks/nd:network/nd:node/lnk:termination-
point/tet:te/tet:state:
  +--ro client-facing?      empty
  +--ro tpn?                uint16
  +--ro tsg?                identityref
  +--ro protocol-type?      identityref
```



```
    +--ro fec-enabled?          boolean
    +--ro adaptation-type?      adaptation-type
    +--ro sink-adapt-active?    boolean
    +--ro source-adapt-active?  boolean
    +--ro timeslots
      +--ro values*            uint8
augment /nd:networks/nd:network/lnk:link/tet:te/tet:config:
  +--rw odu-type?             identityref
  +--rw distance?             uint32
augment /nd:networks/nd:network/lnk:link/tet:te/tet:state:
  +--ro odu-type?             identityref
  +--ro distance?             uint32
augment /nd:networks/nd:network/nd:node/tet:te/tet:tunnel-termination-
point/tet:state:
  +--ro odu-Type?             identityref
augment /nd:networks/nd:network/lnk:link/tet:te/tet:config/tet:te-link-
attributes/tet:schedules/tet:schedule:
  +--rw odu-type?             identityref
  +--rw oduflex-bw?           uint32
augment /nd:networks/nd:network/lnk:link/tet:te/tet:state/tet:te-link-
attributes/tet:schedules/tet:schedule:
  +--ro odu-type?             identityref
  +--ro oduflex-bw?           uint32
```

4.1.1. Augmentation

As can be seen, from the tree shown in [Section 4,1](#), the YANG module presented augments from a more generic Traffic Engineered (TE) network topology model, i.e., the ietf-te-topology YANG module as specified in [[draft-ietf-teas-yang-te-topo-04](#)].

Note the model in this draft uses the YANG model named ietf-transport-types.yang defined in [[draft-sharma-ccamp-otn-service-model-00](#)].

4.1.2. The node and link list

The module presented in this draft contains all the nodes and links information pertaining to a layer one network. As specified in the ietf-network YANG module, a node is identified by the node-id, which is unique within the network. Within the nodes, all the interfaces pertaining to this node and their potential capabilities/constraints SHOULD be present.

Similarly, a link is identified by the link-id, which is unique within a node. It includes the association with nodes as well as

interfaces. Moreover, it includes information that is of interest to the client, for purposes, such as path computation, monitoring etc.

Since for an optical transport network, its client interface attributes has technology-specific attributes that need to be captured to give the client all the necessary information for its use. For full control purpose, this attributes and information are also captured and listed in this YANG module.

4.2. YANG Code

```
<CODE BEGINS> file " ietf-odu-topology@2016-07-07.yang"

module ietf-odu-topology {
  yang-version 1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-odu-topology";
  prefix "l1topo";

  import ietf-network {
    prefix "nd";
  }

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

  import ietf-te-topology {
    prefix "tet";
  }

  import ietf-transport-types {
    prefix "tran-types";
  }

  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";
  contact
    "
    WG List: <mailto:ccamp@ietf.org>

    ID-draft editor:
    Xian ZHANG (zhang.xian@huawei.com);
    Anurag Sharma (AnSharma@infinera.com);
    ";
```



```
description
  "This module defines a protocol independent Layer 1/ODU
  topology data model.";

revision 2016-07-07 {
  description
    "Initial version.";
  reference
    "draft-zhang-ccamp-l1-topo-yang-01.txt";
}

/*
typedef
*/

typedef adaptation-type {
  type enumeration {
    enum CBR {
      description "Constant Bit Rate.";
    }
    enum ATMvp {
      description "ATM VP.";
    }
    enum GFP {
      description "Generic Framing Procedure.";
    }
    enum NULL {
      description "NULL";
    }
    enum PRBS {
      description "Pseudo Random Binary Sequence";
    }
    enum RSn {
      description "TBD";
    }
  }
}

description
  "Defines a type representing the adaptation type
  on the termination point.";
}

/*
Groupings
*/
```



```
grouping l1-network-type {
  container l1-network {
    presence "indicates a L1 network, i.e., Optical
      Transport Network (OTN).";
    description "l1 network type";
  }
  description "l1-network-type";
}

grouping l1-network-attributes {
  leaf name {
    type string;
    description "the network name";
  }
  description "name attribute for l1 network";
}

grouping l1-node-attributes {
  description "l1-node-attributes";
  leaf name {
    type string;
    description "a name for this node.";
  }
}

grouping l1-link-attributes {
  description "l1 link attributes";

  leaf odu-type {
    type identityref{
      base tran-types:tributary-protocol-type;
    }
    description "the ODU type supported by this link";
  }

  leaf distance {
    type uint32;
    description "distance in the unit of kilometers";
  }
}

grouping ttp-odu-attributes {
  description "ttp ODU attributes";

  leaf odu-Type {
    type identityref{
      base tran-types:tributary-protocol-type;
```



```
    }
    description "the ODU type supported by this ttp";
  }
}

grouping sch-odu-attributes {
  description "additional odu attributes for scheduled link";

  leaf odu-type {
    type identityref {
      base tran-types:tributary-protocol-type;
    }
    description "the ODU type scedhuled";
  }

  leaf oduflex-bw {
    type uint32;
    description "banwidth for ODUFlex type";
  }
}

grouping l1-tp-attributes {
  description "l1-tp-attributes";

  leaf client-facing {
    type empty;
    description
      "if present, it means this tp is a client-facing tp";
  }

  leaf tpn {
    type uint16 {
      range "0..4095";
    }
    description
      "Tributary Port Number. Applicable in case of mux services.";
    reference
      "RFC7139: GMPLS Signaling Extensions for Control of Evolving
      G.709 Optical Transport Networks.";
  }

  leaf tsg {
    type identityref {
      base tran-types:tributary-slot-granularity;
    }
    description "Tributary slot granularity.";
    reference
```



```
"G.709/Y.1331, February 2012: Interfaces for the Optical
Transport Network (OTN)";
}

leaf protocol-type {
  type identityref {
    base tran-types:tributary-protocol-type;
  }
  description "Protocol type for the Termination Point.";
}

leaf fec-enabled {
  type boolean;
  description
    "This attribute is optional and indicates whether Forward
    Error Correction (FEC) is enabled or not for the
    Termination Point.";
}

leaf adaptation-type {
  type adaptation-type;
  description
    "This attribute indicates the type of the supported
    adaptation function at the termination point.";
  reference
    "G.874.1, January 2002: Optical transport network (OTN):
    Protocol-neutral management information model for the
    network element view.";
}

leaf sink-adapt-active {
  type boolean;
  description
    "This attribute allows for activation or deactivation of
    the sink adaptation function. The value of TRUE means active.";
  reference
    "G.874.1, January 2002: Optical transport network (OTN):
    Protocol-neutral management information model for the
    network element view ";
}

leaf source-adapt-active {
  type boolean;
  description
    "This attribute allows for activation or deactivation of
    the sink adaptation function. The value of TRUE
    means active.";
```



```
        reference
        "G.874.1, January 2002: Optical transport network (OTN):
        Protocol-neutral management information model for
        the network element view ";
    }

    container timeslots {
        description
        "A list of tributary timeslots used by the ODU
        Termination Point.";
        leaf-list values {
            type uint8;
            description
            "Tributary timeslot value.";
            reference
            "G.709/Y.1331, February 2012: Interfaces for the
            Optical Transport Network (OTN)";
        }
    }
}

/*
 * Data nodes
 */
augment "/nd:networks/nd:network/nd:network-types/tet:te-topology" {
    uses l1-network-type;
    description "augment network types to include L1 newtork";
}

augment "/nd:networks/nd:network" {
    when "nd:network-types/tet:te-topology/l1-network" {
        description "Augment only for L1 network";
    }
    uses l1-network-attributes;
    description "Augment network configuration";
}

augment "/nd:networks/nd:network/nd:node" {
    when "nd:network-types/tet:te-topology/l1-network" {
        description "Augment only for L1 network";
    }
    description "Augment node configuration";
    uses l1-node-attributes;
}

augment "/nd:networks/nd:network/nd:node/"
```



```
    +"lnk:termination-point/tet:te/tet:config" {
when "nd:network-types/tet:te-topology/l1-network" {
    description "Augment only for L1 network";
}
description "OTN TP attributes config in a ODU topology.";
uses l1-tp-attributes;
}

augment "/nd:networks/nd:network/nd:node" +
    "/lnk:termination-point/tet:te/tet:state" {
when "nd:network-types/tet:te-topology/l1-network" {
    description "Augment only for L1 network";
}
description "OTN TP attributes state in a ODU topology.";
uses l1-tp-attributes;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/tet:config" {
when "nd:network-types/tet:te-topology/l1-network" {
    description "Augment only for L1 network.";
}
description "Augment link configuration";

uses l1-link-attributes;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/tet:state" {
when "nd:network-types/tet:te-topology/l1-network" {
    description "Augment only for L1 network.";
}
description "Augment link state";

uses l1-link-attributes;
}

augment "/nd:networks/nd:network/nd:node/tet:te" +
    "/tet:tunnel-termination-point/tet:state"{
when "nd:network-types/tet:te-topology/l1-network" {
    description "Augment only for L1 network";
}
description "Augment ttp state";
uses ttp-odu-attributes;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/tet:config"
    +"/tet:te-link-attributes/tet:schedules/tet:schedule"{
when "nd:network-types/tet:te-topology/l1-network" {
```



```

        description "Augment only for L1 network.";
    }
    description "Augment link schedule config";

    uses sch-odu-attributes;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/tet:state"
+ "/tet:te-link-attributes/tet:schedules/tet:schedule"{
    when "nd:network-types/tet:te-topology/l1-network" {
        description "Augment link schedule state.";
    }
    description "Augment link schedule config";

    uses sch-odu-attributes;
}
}

<CODE ENDS>

```

5. Security Considerations

Since the data model defined in this draft is manipulated via, for example, the interface between an orchestrator and a transport network controller. The security concerns mentioned in [[draft-ietf-teas-yang-te-topo-04](#)] also applies to this draft.

The YANG module defined in this memo is designed to be accessed via the RESTCONF protocol defined in [[draft-ietf-netconf-restconf-13](#)] , or maybe via the NETCONF protocol [[RFC6241](#)].

There are a number of data nodes defined in the YANG module which 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., <POST>) to these data nodes without proper protection can have a negative effect on network operations.

[Editor's note: to List specific subtrees and data nodes and their sensitivity/vulnerability.]

6. Manageability Considerations

TBD.

7. IANA Considerations

TBD.

8. Acknowledgements

The initial YANG model specified in this draft is based on [draft-clemm-i2rs-yang-network-topo](#) but it is modified according to the features of the layer one networks.

We would like to thank the authors of the above mentioned draft for their helpful discussion during the creation of this draft.

9. References

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