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A YANG Data Model for Optical Transport Network Topology
draft-ietf-ccamp-otn-topo-yang-02

Abstract

A transport network is a server-layer network designed to provide connectivity services for a client-layer network to carry the client traffic transparently across the server-layer network resources. A transport network can be constructed from equipments utilizing any of a number of different transport technologies such as the evolving Optical Transport Networks (OTN) or packet transport as provided by the MPLS-Transport Profile (MPLS-TP).

This document describes a YANG data model to describe the topologies of an Optical Transport Network (OTN). It is independent of control plane protocols and captures topological and resource related information pertaining to OTN. This model enables clients, which interact with a transport domain controller via a REST interface, for OTN topology related operations such as obtaining the relevant topology resource information.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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Table of Contents

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 transparently across the server-layer network resources. A transport network can be constructed of equipments utilizing any of a number of different transport technologies such as the Optical

Transport Networks (OTN) or packet transport as provided by the MPLS-Transport Profile (MPLS-TP).

This document defines a data model of an OTN network topology, using YANG [RFC7950]. The model can be used by an application exposing to a transport controller via a REST interface. Furthermore, it can be used by an application for the following purposes (but not limited to):

- To obtain a whole view of the network topology information of its interest;
- To receive notifications with regard to the information change of the OTN topology;
- To enforce the establishment and update of a network topology with the characteristic specified in the data model, e.g., by a client controller;

The YANG model defined in this document is independent of control plane protocols and captures topology related information pertaining to an Optical Transport Networks (OTN)-electrical layer, as the scope specified by [RFC7062] and [RFC7138]. Furthermore, it is not a stand-alone model, but augmenting from the TE topology YANG model defined in [I-D.ietf-teas-yang-te-topo]. Following TE topology YANG model, the YANG model defined in this document is interface independent. The applicability of models to interfaces is described in [I-D.zhang-teas-actn-yang].

Optical network technologies, including fixed Dense Wavelength Switched Optical Network (WSON) and flexible optical networks (a.k.a., flexi-grid networks), are covered in [I-D.ietf-ccamp-wson-yang] and [I-D.vergara-ccamp-flexigrid-yang], respectively.

2. 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 document is defined in [I-D.ietf-netmod-yang-tree-diagrams]. They are provided below for reference.

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

- Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.
- Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- Ellipsis ("...") stands for contents of subtrees that are not shown.

3. YANG Data Model for OTN Topology

3.1. the YANG Tree

```
module: ietf-otn-topology
  augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
    +--rw otn-topology!
  augment /nw:networks/nw:network/nt:link/tet:te
  /tet:te-link-attributes:
    +--rw available-odu-info* [priority]
    |  +--rw priority    uint8
    |  +--rw odulist* [odu-type]
    |  |  +--rw odu-type     identityref
    |  |  +--rw number?      uint16
    |  |  +--rw tpn-range?   string
    |  +--rw ts-range?   string
    +--rw tsg?                  identityref
    +--rw distance?             uint32
  augment /nw:networks/nw:network/nw:node/nt:termination-point
  /tet:te:
    +--rw supported-payload-types* [index]
       +--rw index           uint16
       +--rw payload-type?   string
```

3.2. Explanation of the OTN Topology Data Model

As can be seen, from the data tree shown in Section 3.1, the YANG module presented in this document augments from a more generic Traffic Engineered (TE) network topology data model, i.e., the ietf-te-topology.yang as specified in [I-D.ietf-teas-yang-te-topo]. The entities and their attributes, such as node, termination points and links, are still applicable for describing an OTN topology and the model presented in this document only specifies with technology-specific attributes/information. For example, if the data plane complies with ITU-T G.709 (2012) standards, the switching-capability

and encoding attributes MUST be filled as OTN-TDM and G.709 ODUk(Digital Path) respectively.

Note the model in this document re-uses some attributes defined in ietf-transport-types.yang, which is specified in [I-D.ietf-ccamp-otn-tunnel-model].

One of the main augmentations in this model is that it allows to specify the type of ODU container and the number a link can support per priority level. For example, for a ODU3 link, it may advertise 32*ODU0, 16*ODU1, 4*ODU2 available, assuming only a single priority level is supported. If one of ODU2 resource is taken to establish a ODU path, then the availability of this ODU link is updated as 24*ODU0, 12*ODU1, 3*ODU2 available. If there are equipment hardware limitations, then a subset of potential ODU type SHALL be advertised. For instance, an ODU3 link may only support 4*ODU2.

3.3. The YANG Code

<CODE BEGINS> file "ietf-otn-topology@2017-10-30.yang"

```
module ietf-otn-topology {
  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-otn-topology";
  prefix "otntopo";

  import ietf-network {
    prefix "nw";
  }

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

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

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

  organization
    "IETF CCAMP Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/ccamp/>
```

```
        WG List: <mailto:ccamp@ietf.org>

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        Editor: Lei Wang
                <mailto:wangleiyj@chinamobile.com>

        Editor: Oscar Gonzalez de Dios
                <mailto:oscar.gonzalezdedios@telefonica.com>";

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

     revision 2017-10-30 {
       description
         "Revision 0.5";
       reference
         "draft-ietf-ccamp-otn-topo-yang-02.txt";
     }

    /*
     * Groupings
     */
     grouping otn-link-attributes {
       description "link attributes for OTN";

       list available-odu-info {
         key "priority";
         max-elements "8";
         description "List of ODU type and number on this link";
         leaf priority {
```

```
            type uint8 {
              range "0..7";
            }
            description "priority";
          }
          list odulist {
            key "odu-type";
            description
              "the list of available ODUs per priority level";
            leaf odu-type {
              type identityref {
                base otn-types:tributary-protocol-type;
              }
              description "the type of ODU";
            }
            leaf number {
              type uint16;
              description "the number of odu type supported";
            }
            leaf tpn-range {
              type string {
                pattern "([1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?"
                      + "(,[1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?)*)";
              }
              description
                "A list of available tributary port number range
                 between 1 and 9999.
                 For example 1-20,25,50-1000";
              reference "RFC 7139: GMPLS Signaling Extensions for Control
                         of Evolving G.709 Optical Transport Networks";
            }
          }
          leaf ts-range {
            type string {
              pattern "([1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?"
                    + "(,[1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?)*)";
            }
            description
              "A list of available tributary slot range
               between 1 and 9999.
               For example 1-20,25,50-1000";
            reference "RFC 7139: GMPLS Signaling Extensions for Control
                       of Evolving G.709 Optical Transport Networks";
          }
        }
        leaf tsg {
          type identityref {
            base otn-types:tributary-slot-granularity;
```

```
        }
        description "Tributary slot granularity.";
        reference
          "G.709/Y.1331, February 2016: Interfaces for the
           Optical Transport Network (OTN)";
      }
      leaf distance {
        type uint32;
        description "distance in the unit of kilometers";
      }
    }

    grouping otn-tp-attributes {
      description "tp attributes for OTN";
      list supported-payload-types {
        key "index";
        description
          "Supported payload types of a TP. The payload type is defined
           as the generalized PIDs in GMPLS.";
        leaf index {
          type uint16;
          description "payload type index";
        }
        leaf payload-type {
          type string;
          description "the payload type supported by this client tp";
          reference
            "http://www.iana.org/assignments/gmpls-sig-parameters
             /gmpls-sig-parameters.xhtml";
        }
      }
    }

   /*
    * Data nodes
    */
    augment "/nw:networks/nw:network/nw:network-types/"
          + "tet:te-topology" {
      container otn-topology {
        presence "indicates a topology type of Optical Transport
                  Network (OTN)-electrical layer.";
        description "otn topology type";
      }
      description "augment network types to include otn newtork";
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes" {
```

```
      when "../../../nw:network-types/tet:te-topology/"
         + "otntopo:otn-topology" {
        description "Augment only for otn network.";
      }
      description "Augment link configuration";
      uses otn-link-attributes;
    }

    augment "/nw:networks/nw:network/nw:node/nt:termination-point/"
          + "tet:te" {
      when "../../../nw:network-types/tet:te-topology/"
         + "otntopo:otn-topology" {
        description "Augment only for otn network";
      }
      description "OTN TP attributes config in ODU topology.";
      uses otn-tp-attributes;
    }
  }
```

<CODE ENDS>

4. IANA Considerations

TBD.

5. Manageability Considerations

TBD.

6. Security Considerations

The data following the model defined in this document is exchanged via, for example, the interface between an orchestrator and a transport network controller. The security concerns mentioned in [I-D.ietf-teas-yang-te-topo] for using ietf-te-topology.yang model also applies to this document.

The YANG module defined in this document can be accessed via the RESTCONF protocol defined in [RFC8040], 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.

Editors note: to list specific subtrees and data nodes and their sensitivity/vulnerability.

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