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A YANG Data Model for Layer 0 Types

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Abstract

This document defines a collection of common data types and groupings in YANG data modeling language. These derived common types and groupings are intended to be imported by modules that model Layer 0 Traffic Engineering (TE) configuration and state capabilities such as Wavelength Switched Optical Networks (WSONs) and Spectrum Switched optical Networks (SSONs).

The list of Internet-Draft Shadow Directories can be accessed at http://www.ietf.org/shadow.html

This Internet-Draft will expire on November 27, 2019.

Table of Contents

1. Introduction

YANG [RFC6020] and [RFC7950] is a data modeling language used to model configuration data, state data, Remote Procedure Calls, and notifications for network management protocols such as NETCONF [RFC6241]. The YANG language supports a small set of built-in data types and provides mechanisms to derive other types from the built-in types.

This document introduces a collection of common data types derived from the built-in YANG data types. The derived types and groupings are designed to be the common types applicable for modeling Traffic Engineering (TE) features for Layer 0 optical networks in model(s) defined outside of this document. Examples of Layer 0 optical networks are Wavelength Switched Optical Networks (WSONs) [RFC6163] and Spectrum Switched optical Networks (SSONs) [RFC7698].

[G.698.2] defines amplified multichannel Dense Wavelength Division Multiplexing (DWDM) applications with single channel optical interfaces. The YANG data model defined in this document refers to the standard application mode defined in [G.698.2].

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

1.2. Terminology

Refer to [RFC7446] and [RFC7581] for the key terms used in this document.

The terminology for describing YANG data models is found in [RFC7950].

1.3. Prefixes in Data Node Names

In this document, names of data nodes and other data model objects are prefixed using the standard prefix associated with the corresponding YANG imported modules, as shown in Table 1.

Prefix	YANG module	Reference
layer0-type	ietf-layer0-types	[RFCXXXX]

Table 1: Prefixes and corresponding YANG modules

Note: The RFC Editor will replace XXXX with the number assigned to the RFC once this draft becomes an RFC.

YANG module "ietf-layer0-types" (defined in Section 3) references [RFC6163], [RFC7205], and [RFC7698].

3. Overview

This document defines one YANG module for common Layer 0 TE types: ietf-layer0-types for WSON and SSON specific types.

3.1. TE Types Module Contents

The ietf-layer0-types module contains common Layer 0 TE types that are to be imported by layer 0 specific technology such as WSON and SSON.

The ietf-layer0-types module contains the following YANG reusable types and groupings:

Operational-mode:

A type that represents operational-model type as defined in [G.698.2].

Vendor-identifier:

A type that represents vendor identifier as defined in [RFC7581].

layer0-node-type:

A base YANG identity for supported node type as defined in [RFC6163].

wavelength-assignment:

A base YANG identity for allocated wavelength assignment type as defined in [RFC6163].

layer0-grid-type:

A base YANG identity for the node type as defined in [RFC6163] & [RFC7698].

term-type:

A base YANG identity for the supported termination type as defined in [G.709].

layer0-bandwidth-type:

A base YANG identity for the layer0 bandwidth type as defined in [G.709].

dwdm-ch-spc-type:

A base YANG identity for the DWDM channel spacing type as defined in [RFC6205].

cwdm-ch-spc-type:

A base YANG identity for the CWDM channel spacing type as defined in [RFC6205].

FEC-type:

A base YANG identity for the FEC type as defined in [G.709].

wson-path-bandwidth:

A YANG grouping that defines the WSON path bandwidth attributes as defined in [RFC6163].

wson-link-bandwidth:

A YANG grouping that defines WSON link bandwidth attributes as defined in [RFC6163].

wson-link-label:

A YANG grouping that defines the label for WSON links as defined In [RFC6205].

wson-path-label:

A YANG groupin that defines the label for WSON paths as defined

In [RFC6205].

layer0-label-restriction:

A YANG grouping that defines the layer 0 label restriction applicable for both WSON and SSON and per priority level as defined in [RFC3209].

wson-label-step:

A YANG grouping that defines label steps for WSON as defined in [TE-topo].

flexi-grid-node-attributes:

A YANG grouping that defines Flex-grid node attrtibutes as defined in [RFC7698].

flexi-grid-path-bandwidth:

A YANG grouping that defines flex-grid path bandwidth attributes as defined in [RFC7698].

flexi-grid-link-bandwidth:

A YANG grouping that defines flex-grid link bandwidth attributes As defined in [RFC7698].

flexi-grid-link-label:

A YANG grouping that defines flex-grid link label attributes as defined in [RFC7698].

flexi-grid-channel:

A YANG grouping that defines flex-grid channel as defined in [RFC7698].

flexi-grid-path-label:

A YANG grouping that defines flex-grid path label for both single channel and multiple carriers [RFC7698].

flexi-grid-label-restriction:

A YANG grouping that defines flex-grid label restrictions and per priority level as defined in [RFC3209].

flexi-grid-label-step:

A YANG grouping that defines flex-grid label steps as defined in [TE-topo].

2. IETF-Layer0-Types YANG Module

```
<CODE BEGINS> file ietf-layer0-types@2019-05-15.yang
module ietf-layer0-types {
  namespace "urn:ietf:params:xml:ns:yang:ietf-layer0-types";
  prefix "layer0-types";

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

     Editor: Aihua Guo
       <mailto:aguo@futurewei.com>

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       <mailto:younglee.tx@gmail.com>

     Editor: Italo Busi
       <mailto:Italo.Busi@huawei.com>

     Editor: Dieter Beller
       <mailto:Dieter.Beller@nokia.com>";

  description
    "This module defines Optical Layer 0 types. This module
     provides groupings that can be applicable to Layer 0
     Fixed Optical Networks (e.g., CWDM (Coarse Wavelength
     Division Multiplexing) and DWDM (Dense Wavelength Division
     Multiplexing)) and Flexi-grid Optical Networks.

     Copyright (c) 2018 IETF Trust and the persons identified
     as authors of the code.  All rights reserved.

     Redistribution and use in source and binary forms, with
     or without modification, is permitted pursuant to, and
     subject to the license terms contained in, the Simplified
     BSD License set forth in Section 4.c of the IETF Trust's
     Legal Provisions Relating to IETF Documents
     (http://trustee.ietf.org/license-info).";
```

```
  revision "2019-05-15" {
    description
      "Initial Version";
    reference
      "RFC XXXX: A YANG Data Model for WSON (Wavelength Switched
       Optical Networks)";
  }

  typedef operational-mode {
    type string;
    description
      "Vendor-specific mode that guarantees interoperability.";
    reference "ITU-T G.698.2 (11/2018)";
  }

  typedef standard-mode {
    type string;
    description
      "ITU-T G.698.2 standard mode that guarantees interoperability.
       It must be an string with the following format:
       B-DScW-ytz(v) where all these attributes are conformant
       to the ITU-T recomendation";
    reference "ITU-T G.698.2 (11/2018)";
  }

  typedef vendor-identifier {
    type string;
    description
      "vendor identifier that uses vendor-specific mode";
    reference
      "RFC7581: Routing and Wavelength Assignment Information
       Encoding for Wavelength Switched Optical Networks";
  }

  typedef frequency-thz {
    type decimal64 {
      fraction-digits 5;
    }
    units THz;
    description
      "The DWDM frequency in THz, e.g., 193.12500";
    reference
      "RFC6205:Generalized Labels for Lambda-Switch-Capable (LSC)
         Label Switching Routers";
  }

  typedef frequency-ghz {
    type decimal64 {
      fraction-digits 5;
```

```
    }
    units GHz;
    description
      "The DWDM frequency in GHz, e.g., 193125.00";
    reference
      "RFC6205: Generalized Labels for Lambda-Switch-Capable (LSC)
        Label Switching Routers";
  }

  identity layer0-node-type {
    description
      "layer0 node type.";
    reference
      "RFC6163: Framework for GMPLS and Path Computation Element
       (PCE) Control of Wavelength Switched Optical Networks
       (WSONs)";
  }

  identity flexi-grid-node {
    base layer0-node-type;
    description
      "flexi Grid node";
  }

  identity wson-node-foadm {
    base layer0-node-type;
    description
      "Fixed OADM (Optical Add-Drop Multiplexer) node";
  }

  identity wson-node-roadm {
    base layer0-node-type;
    description
      "ROADM (Reconfigurable Optical Add-Drop Multiplexer)
       or OXC (Optical Cross Connect) node";
  }

  identity wson-node-ila {
    base layer0-node-type;
    description
      "ILA (In-Line Amplifier) node";
  }

  identity wavelength-assignment {
    description
      "Wavelength selection base";
    reference
      "RFC6163: Framework for GMPLS and Path Computation Element
        (PCE) Control of Wavelength Switched Optical Networks
```

```
        (WSONs)";
  }

  identity unspecified-wavelength-assignment {
    base wavelength-assignment;
    description
      "No method specified";
  }

  identity first-fit-wavelength-asignment {
    base wavelength-assignment;
    description
      "All the available wavelengths are numbered,
       and this WA (Wavelength Assignment) method chooses
       the available wavelength with the lowest index";
  }

  identity random-wavelength-asignment {
    base wavelength-assignment;
    description
      "This WA method chooses an available
       wavelength randomly";
  }

  identity least-loaded-wavelength-asignment {
    base wavelength-assignment;
    description
      "This WA method selects the wavelength that
       has the largest residual capacity on the most loaded
       link along the route (in multi-fiber networks)";
  }

  identity layer0-grid-type {
    description
      "Layer0 grid type.";
    reference
      "RFC7698: Framework and Requirements for GMPLS-Based Control
         of Flexi-Grid Dense Wavelength Division Multiplexing (DWDM)
         Networks &
       RFC6163: Framework for GMPLS and Path Computation Element
         (PCE) Control of Wavelength Switched Optical Networks
         (WSONs)";
  }

  identity flexi-grid-dwdm {
    base layer0-grid-type;
    description
      "flexi grid";
  }
```

```
  identity wson-grid-dwdm {
    base layer0-grid-type;
    description
      "DWDM grid";
  }

  identity wson-grid-cwdm {
    base layer0-grid-type;
    description
      "CWDM grid";
  }

  identity term-type {
    description
      "Termination type.";
  }

  identity term-phys {
    base term-type;
    description
      "Physical Layer Termination";
    reference
   "G.709: Interfaces for the Optical Transport Network (OTN)";
  }

  identity term-otu {
    base term-type;
    description
      "OTU (Optical Transport Unit) Termination";
  }

  identity term-odu {
    base term-type;
    description
      "ODU (Optical Data Unit) Termination";
  }

  identity term-opu {
    base term-type;
    description
      "OPU (Optical Payload Unit) Termination";
  }

  identity term-section {
    base term-type;
    description
      "Section Layer Termination";
  }
```

```
  identity layer0-bandwidth-type {
    description
      "Bandwidth type carried by a single wavelength channel";
    reference
   "G.709: Interfaces for the Optical Transport Network (OTN)";
  }

  identity bw-otu1 {
    base layer0-bandwidth-type;
    description
      "OTU1 (2.66G)";
  }

  identity bw-otu1e {
    base layer0-bandwidth-type;
    description
      "OTU1e (11.04G)";
  }

  identity bw-otu1f {
    base layer0-bandwidth-type;
    description
      "OTU1f (11.27G)";
  }

  identity bw-otu2 {
    base layer0-bandwidth-type;
    description
      "OTU2 (10.70G)";
  }

  identity bw-otu2e {
    base layer0-bandwidth-type;
    description
      "OTU2e (11.09G)";
  }

  identity bw-otu2f {
    base layer0-bandwidth-type;
    description
      "OTU2f (11.31G)";
  }

  identity bw-otu3 {
    base layer0-bandwidth-type;
    description
      "OTU3 (43.01G)";
  }
```

```
  identity bw-otu3e1 {
    base layer0-bandwidth-type;
    description
      "OTU3e1 (44.57G)";
  }

  identity bw-otu3e2 {
    base layer0-bandwidth-type;
    description
      "OTU3e2 (44.58G)";
  }

  identity bw-otu4 {
    base layer0-bandwidth-type;
    description
      "OTU4 (111.80G)";
  }

  identity bw-otucn {
    base layer0-bandwidth-type;
    description
      "OTUCn (beyond 100G)";
  }

  identity dwdm-ch-spc-type {
    description
      "DWDM channel spacing type";
    reference
      "RFC6205: Generalized Labels for Lambda-Switch-Capable (LSC)
         Label Switching Routers";
  }

  identity dwdm-100ghz {
    base dwdm-ch-spc-type;
    description
      "100GHz channel spacing";
    reference
      "ITU-T Recommendation G.694.1: Spectral grids for WDM applications:
      DWDM frequency grid";
  }

  identity dwdm-50ghz {
    base dwdm-ch-spc-type;
    description
      "50GHz channel spacing";
    reference
      "ITU-T Recommendation G.694.1: Spectral grids for WDM applications:
      DWDM frequency grid";
```

```
  }

  identity dwdm-25ghz {
    base dwdm-ch-spc-type;
    description
      "25GHz channel spacing";
    reference
      "ITU-T Recommendation G.694.1: Spectral grids for WDM applications:
      DWDM frequency grid";
  }

  identity dwdm-12p5ghz {
    base dwdm-ch-spc-type;
    description
      "12.5GHz channel spacing";
    reference
      "ITU-T Recommendation G.694.1: Spectral grids for WDM applications:
      DWDM frequency grid";
  }

  identity  flexi-ch-spc-type {
    description
      "flexi-grid channel spacing type";
    reference
      "RFC7581: Routing and Wavelength Assignment Information
       Encoding for Wavelength Switched Optical Networks";
  }

  identity flexi-ch-spc-6p25ghz {
    base flexi-ch-spc-type;
    description
      "6.25GHz channel spacing";
  }

  identity  flexi-slot-width-granularity {
    description
      "flexi-grid slot width granularity";
    reference
      "RFC7581: Routing and Wavelength Assignment Information
       Encoding for Wavelength Switched Optical Networks";
  }

  identity flexi-swg-12p5ghz {
    base flexi-slot-width-granularity;
    description
      "12.5GHz slot width granularity";
  }

  identity cwdm-ch-spc-type {
```

```
    description
      "CWDM channel spacing type";
    reference
      "RFC6205: Generalized Labels for Lambda-Switch-Capable (LSC)
         Label Switching Routers";
  }

  identity cwdm-20nm {
    base cwdm-ch-spc-type;
    description
      "20nm channel spacing";
  }

  identity fec-type {
    description
      "FEC (Forward Error Correction) type";
    reference
   "G.709: Interfaces for the Optical Transport Network (OTN)";
  }

  identity g-fec {
    base fec-type;
    description
      "G-FEC (Generic-FEC)";
  }
  identity e-fec {
    base fec-type;
    description
      "E-FEC (Enhanced-FEC)";
  }
  identity no-fec {
    base fec-type;
    description
      "No FEC";
  }

  /* Groupings. */
  grouping wson-path-bandwidth {
    description "WSON (Wavelength Switched Optical Network)
                 path bandwidth attributes";
    reference
      "RFC6163";
    leaf bandwidth-type {
      type identityref {
        base layer0-bandwidth-type;
      }
      description "WSON bandwidth type";
    }
  }
```

```
  grouping wson-link-bandwidth {
    description "WSON link bandwidth attributes";
    reference
      "RFC6163";
    leaf-list supported-bandwidth-list {
      type identityref {
        base layer0-bandwidth-type;
      }
      description "WSON bandwidth type";
    }
  }

  grouping wson-link-label {
    description
      "Generic label for WSON links";
    reference
      "RFC6205";
    choice grid-type {
      description
        "Label for DWDM or CWDM grid";
      case dwdm {
        leaf dwdm-n {
          type int16;
          description
           "N is used to determine the Nominal Central Frequency.
            The set of nominal central frequencies can be
            built using the following expression
            f = 193.1 THz + N x 0.00625 THz,
            where 193.1 THz is ITU-T 'anchor frequency'
            for transmission over the C band, N is a positive or
            negative integer including 0.";
          reference
            "RFC6205:Generalized Labels for Lambda-Switch-Capable
                 (LSC) Label Switching Routers";
        }
      }
      case cwdm {
        leaf cwdm-n {
          type int16;
          description
            "N is a two's-complement integer to take either a
                     positive, negative, or zero value. This value is
                     used to compute the channel wavelength as such
                     in G.694.2:
                     Wavelength (nm) = 1471 nm + N * 20 nm";
          reference
            "RFC6205:Generalized Labels for Lambda-Switch-Capable
                   (LSC) Label Switching Routers";
```

```
      }
    }
  }
}

grouping wson-path-label {
  description
    "Generic label for WSON paths";
  reference
    "RFC6205";
  choice grid-type {
    description
      "Label for DWDM or CWDM grid";
    case dwdm {
      choice single-or-super-channel {
        description "single or super channel";
        case single {
          leaf dwdm-n {
            type int16;
            description
             "N is used to determine the Nominal Central Frequency.
              The set of nominal central frequencies can be
              built using the following expression
               f = 193.1 THz + N x 0.00625 THz,
              where 193.1 THz is ITU-T 'anchor frequency'
              for transmission over the C band, N is a positive or
              negative integer including 0.";
           }
        }
        case super {
         leaf-list subcarrier-dwdm-n {
            type int16;
            description
              "List of subcarrier channels for super channel.
                       Each of the channels is represented by an
                       integer, n, a two's-complement integer to take
                       either a positive, negative, or zero value.
                       This value is used to compute the frequency as
                       such in G.694.1:
                       Frequency (THz) =
                         193.1 THz + n * channel spacing (THz)";
         }
        }
      }

    }
    case cwdm {
      leaf cwdm-n {
```

```
          type int16;
          description
            "Represented by an integer, n, a two's-complement
                  integer to take either a positive, negative, or
                  zero value. This value is used to compute the
                  channel wavelength as such in G.694.2:
                  Wavelength (nm) = 1471 nm + n * 20 nm";
          reference
            "RFC6205:Generalized Labels for Lambda-Switch-Capable
                  (LSC) Label Switching Routers";

        }
      }
    }
  }

  grouping layer0-label-restriction {
    description
      "layer0 label restriction.";
    reference
      "RFC3209";

    leaf grid-type {
      type identityref {
        base layer0-grid-type;
      }
      description "Grid type";
    }
    leaf priority {
      type uint8;
      description "priority";
    }
  }

  grouping wson-label-step {
    description "Label step information for WSON";
    reference
      "draft-ietf-teas-yang-te-topo-20";
    choice layer0-grid-type {
      description
        "Grid type: DWDM, CWDM, etc.";
      case dwdm {
        leaf wson-dwdm {
          type identityref {
            base dwdm-ch-spc-type;
          }
          description
            "Label-step is the channel-spacing (GHz), e.g.,
             100, 50, 25, or 12.5 GHz for DWDM";
```

```
          reference
            "RFC6205:Generalized Labels for Lambda-Switch-Capable
                  (LSC) Label Switching Routers";

        }
      }
      case cwdm {
        leaf wson-cwdm {
          type identityref {
            base cwdm-ch-spc-type;
          }
          description
            "label-step is the channel-spacing (nm), i.e., 20 nm
             for CWDM, which is the only value defined for CWDM";
          reference
            "RFC6205:Generalized Labels for Lambda-Switch-Capable
                  (LSC) Label Switching Routers";
        }
      }
    }
  }

  grouping flexi-grid-node-attributes {
    description "flexi-grid node attributes";
    reference
      "RFC7698";
    container flexi-grid-node {
      description "flexi-grid node attrtibutes";
      leaf node-type {
        type identityref {
          base layer0-node-type;
        }
        description "flexi-grid node type";
      }
    }
  }

  grouping flexi-grid-path-bandwidth {
    description "flexi-grid path bandwidth attributes";
    reference
      "RFC7698";
    leaf bandwidth-type {
      type identityref {
        base layer0-bandwidth-type;
      }
      description "flexi-grid bandwidth type";
    }
  }
```

```
  grouping flexi-grid-link-bandwidth {
    description "flexi-grid link bandwidth attributes";
    reference
      "RFC7698";
    leaf-list supported-bandwidth-list {
      type identityref {
        base layer0-bandwidth-type;
      }
      description "flexi-grid bandwidth type";
    }
  }

  grouping flexi-grid-link-label {
    description "flexi-grid link label.";
    reference
      "RFC7698";
    leaf flexi-n {
      type uint16;
      description
        "N is used to determine the Nominal Central Frequency.
         The set of nominal central frequencies can be
         built using the following expression
          f = 193.1 THz + N x 0.00625 THz,
         where 193.1 THz is ITU-T 'anchor frequency'
         for transmission over the C band, N is a positive or
         negative integer including 0.";
      reference
        "RFC7698: Framework and Requirements for GMPLS-Based
         Control of Flexi-Grid Dense Wavelength Division Multiplexing
         (DWDM) Networks";
    }
  }

  grouping flexi-grid-channel {
    description "flexi-grid channel grouping.";
    reference
      "RFC7698";
    uses flexi-grid-link-label;

    leaf flexi-m {
      type uint16 {
          range "1..max";
        }
      description
        "M is used to determine the slot width. A slot width is
         constrained to be M x SWG (that is, M x 12.5 GHz),
         where M is an integer greater than or equal to 1.";
      reference
        "RFC7698: Framework and Requirements for GMPLS-Based
```

```
          Control of Flexi-Grid Dense Wavelength Division Multiplexing
          (DWDM) Networks";
    }
  }
  grouping flexi-grid-path-label {
    description "flexi-grid path label.";
    reference
      "RFC7698";
      choice single-or-super-channel {
       description "single of super channel";
        case single {
          uses flexi-grid-channel;
       }
        case super {
         list subcarrier-flexi-n {
         key flexi-n;
         uses flexi-grid-channel;
         description
            "List of subcarrier channels for flexi-grid
             super channel.";
         }
        }
      }
  }

  grouping flexi-grid-label-restriction {
    description
      "flexi Grid-specific label restriction";
    reference
      "RFC7698 & RFC3209";
    uses layer0-label-restriction;

    container flexi-grid {
      description "flexi-grid definition";
      leaf nominal-central-frequency-granularity {
        type identityref {
          base flexi-ch-spc-type;
        }
        default flexi-ch-spc-6p25ghz;
        description
          "It is the spacing between allowed nominal central
           frequencies. Default is 6.25 GHz";
        reference
          "RFC7698: Framework and Requirements for GMPLS-Based
           Control of Flexi-Grid Dense Wavelength Division Multiplexing
           (DWDM) Networks";

      }
```

```
      leaf slot-width-granularity {
        type identityref {
          base flexi-slot-width-granularity;
        }
        default flexi-swg-12p5ghz;
        description
          "Minimum space between slot widths. Default is
                12.5 GHz";
        reference
          "RFC7698: Framework and Requirements for GMPLS-Based
           Control of Flexi-Grid Dense Wavelength Division Multiplexing
           (DWDM) Networks";

      }

      leaf min-slot-width-factor {
        type uint16 {
          range "1..max";
        }
        default 1;
        description
          "Minimum slot width is calculated by:
                 Minimum slot width (GHz) =
                     min-slot-width-factor * slot-width-granularity";
        reference
          "RFC8363: GMPLS OSPF-TE Extensions in Support of Flexi-Grid
           Dense Wavelength Division Multiplexing (DWDM) Networks";

      }

      leaf max-slot-width-factor {
        type uint16 {
          range "1..max";
        }
        description
          "Maximum slot width is calculated by:
                 Maximum slot width (GHz) =
                     max-slot-width-factor * slot-width-granularity";
        reference
          "RFC8363: GMPLS OSPF-TE Extensions in Support of Flexi-Grid
           Dense Wavelength Division Multiplexing (DWDM) Networks";
      }

    }
  }

  grouping flexi-grid-label-step {
    description "Label step information for flexi grid";
    reference
```

```
      "draft-ietf-teas-yang-te-topo-20";
    leaf flexi {
      type identityref {
        base flexi-ch-spc-type;
      }
        default flexi-ch-spc-6p25ghz;
      description
        "Label-step is the nominal central frequency
         granularity (GHz), e.g., 6.25 GHz";
      reference
        "RFC7698: Framework and Requirements for GMPLS-Based
         Control of Flexi-Grid Dense Wavelength Division Multiplexing
         (DWDM) Networks";
    }
  }
}

<CODE ENDS>
```

3. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF access control model [RFC6536] provides the means to restrict access for particular NETCONF users to a preconfigured subset of all available NETCONF protocol operations and content. The NETCONF Protocol over Secure Shell (SSH) [RFC6242] describes a method for invoking and running NETCONF within a Secure Shell (SSH) session as an SSH subsystem. The Network Configuration Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

The YANG module in this document defines optical layer0 type definitions (i.e., typedef, identity and grouping statements) in YANG data modeling language to be imported and used by other layer 0 specific modules. When imported and used, the resultant schema will have data nodes that can be writable, or readable. The access to

such data nodes may be onsidered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations.

The security considerations spelled out in the YANG 1.1 specification [RFC7950] apply for this document as well.

4. IANA Considerations

This document registers the following namespace URIs in the IETF XML registry [RFC3688]. Following the format in [RFC3688], registration is requested to be made as follows:

```
---------------------------------------------------------------------
   URI: urn:ietf:params:xml:ns:yang: ietf-layer0-types
   Registrant Contact: The IESG.
   XML: N/A, the requested URI is an XML namespace.
---------------------------------------------------------------------
```

This document registers the following YANG module in the YANG Module Names registry [RFC7950] & [RFC6020]:

```
---------------------------------------------------------------------
   name:         ietf-layer0-types
   namespace:    urn:ietf:params:xml:ns:yang: ietf-layer0-types
   prefix:       layer0-types
   reference:    RFC XXXX (TDB)
---------------------------------------------------------------------
```

5. References

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