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YANG data model for Flexi-Grid media-channels
draft-ietf-ccamp-flexigrid-media-channel-yang-02.txt

1. Introduction

Transport networks are evolving from current DWDM systems towards elastic optical networks, based on flexi-grid transmission and switching technologies \[RFC7698\]. Such technology aims at increasing both transport network scalability and flexibility, allowing the optimization of bandwidth usage.

Abstract

This document defines a YANG model for managing flexi-grid optical media channels, complementing the information provided by the flexi-grid topology model. It is also grounded on other defined YANG abstract models.

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1. Introduction

Transport networks are evolving from current DWDM systems towards elastic optical networks, based on flexi-grid transmission and switching technologies [RFC7698]. Such technology aims at increasing both transport network scalability and flexibility, allowing the optimization of bandwidth usage.
While [I-D.draft-ietf-ccamp-flexigrid-yang] focuses on flexi-grid objects such as nodes, transponders and links, this document presents a YANG [RFC7950] model for the flexi-grid media-channel. This YANG module defines the whole path from a source transponder or node to the destination through a number of intermediate nodes in the flexi-grid network.

This document identifies the flexi-grid media-channel components, parameters and their values, characterizes the features and the performances of the flexi-grid elements. An application example is provided towards the end of the document to better understand their utility.

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 [RFC2119].

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying RFC-2119 significance.

In this document, the characters ">>" preceding an indented line(s) indicates a compliance requirement statement using the key words listed above. This convention aids reviewers in quickly identifying or finding the explicit compliance requirements of this RFC.

3. Flexi-grid media-channel overview

The present model defines a flexi-grid media-channel mainly composed of:
- source address
- source flexi-grid port
- source flexi-grid transponder
- destination address
- destination flexi-grid port
- destination flexi-grid transponder
- A list of links that defines the path
- Other optical attributes

Each path can be a media-channel (only defined by source and destination node) or a network media-channel (additionally needs source and destination transponders). Therefore, all the attributes are optional to support both situations.
This is achieved by a combination of the traffic engineering tunnel attributes explained in [I-D.draft-ietf-teas-yang-te] and augments when necessary. For instance, source address, source flexi-grid transponder, destination address and destination flexi-grid transponder attributes are directly taken from tunnel, whereas other attributes such as source flexi-grid port, destination flexi-grid port are defined, as they are specific for flexi-grid.

4. Example of use

In order to explain how this model is used, we provide the following example. An optical network usually has multiple transponders, switches (nodes) and links between them. Figure 1 shows a simple topology, where two physical paths interconnect two optical transponders.

![Topology Diagram]

After the nodes, links and transponders have been defined using [I-D.draft-ietf-ccamp-flexigrid-yang], we can configure the media-channel from the information we have stored in the flexi-grid topology, by querying which elements are available, and planning the resources that have to be provided on each situation. Note that every element in the flexi-grid topology has a reference, and this is the way in which they are called in the media-channel.
1. Depending on the case, it is possible to define either the source and destination node ports, or the source and destination node and transponder. In our case, we would define a network media channel, with source transponder A and source node B, and destination transponder E and destination node C. Thus, we are going to follow path x.

2. Then, for each link in the path x, we indicate which channel we are going to use, providing information about the slots, and what nodes are connected.

3. Finally, the flexi-grid topology has to be updated with each element usage status each time a media channel is created or torn down.

5. Media Channel YANG Model

5.1. YANG Model - Tree

module: ietf-flexi-grid-media-channel
augment /te:te/te:tunnels/te:tunnel:
  +++-rw src-client-signal? identityref
  +++-rw dst-client-signal? identityref
  +++-rw fec-type? identityref
  +++-rw termination-type? identityref
  +++-rw bit-stuffing? boolean
augment /te:te/te:globals/te:named-path-constraints/
  te:named-path-constraint/te:te-bandwidth/te:technology:
    +++-:(flexi-grid)
    +++-rw bandwidth-type? identityref
augment /te:te/te:tunnels/te:tunnel/te:te-bandwidth/te:technology:
    +++-:(flexi-grid)
    +++-rw bandwidth-type? identityref
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:te-bandwidth/te:technology:
    +++-:(flexi-grid)
    +++-rw bandwidth-type? identityref
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
  te:p2p-secondary-path/te:te-bandwidth/te:technology:
    +++-:(flexi-grid)
    +++-rw bandwidth-type? identityref
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:explicit-route-objects-always/
te:route-object-exclude-always/te:type/te:label/te:label-hop/
te:te-label/te:technology:
  +--(flexi-grid)
    +--rw (single-or-super-channel)?
      +--:(single)
        |  +--rw flex-n?              int16
        |  +--rw flex-m?              uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:explicit-route-objects-always/
te:route-object-include-exclude/te:type/te:label/te:label-hop/
te:te-label/te:technology:
  +--(flexi-grid)
    +--rw (single-or-super-channel)?
      +--:(single)
        |  +--rw flex-n?              int16
        |  +--rw flex-m?              uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-in-segment/te:label-restrictions/
te:label-restriction:
  +--rw grid-type?   identityref
  +--rw priority?    uint8
  +--rw flexi-grid
    +--rw nominal-central-frequency-granularity? identityref
    +--rw slot-width-granularity? identityref
    +--rw min-slot-width-factor?        uint16
    +--rw max-slot-width-factor?        uint16
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-in-segment/te:label-restrictions/
te:label-restriction/te:label-start/te:te-label/te:technology:
  +--(flexi-grid)
    +--rw flex-n?   int16
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-in-segment/te:label-restrictions/
te:label-restriction/te:label-end/te:te-label/te:technology:
  +--(flexi-grid)
    +--rw flex-n?   int16
augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-out-segment/te:label-restrictions/
te:label-restriction:
  +--rw grid-type?   identityref
  +--rw priority?    uint8
  +--rw flexi-grid
    +--rw nominal-central-frequency-granularity?   identityref
    +--rw slot-width-granularity?                   identityref
    +--rw min-slot-width-factor?                   uint16
    +--rw max-slot-width-factor?                   uint16

augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-out-segment/te:label-restrictions/
te:label-restriction/te:label-start/te:te-label/te:technology:
  +--:(flexi-grid)
    +--rw flex-n?   int16

augment /te:te/te:globals/te:named-path-constraints/
te:named-path-constraint/te:path-out-segment/te:label-restrictions/
te:label-restriction/te:label-end/te:te-label/te:technology:
  +--:(flexi-grid)
    +--rw flex-n?   int16

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
te:p2p-primary-path/te:optimizations/te:algorithm/te:metric/
te:optimization-metric/te:explicit-route-exclude-objects/
te:route-object-exclude-object/te:type/te:label/te:label-hop/
te:te-label/te:technology:
  +--:(flexi-grid)
    +--rw (single-or-super-channel)?
      +--:(single)
        |  +--rw flex-n?   int16
        |  +--rw flex-m?   uint16
      +--:(super)
        +--rw subcarrier-flex-n* [flex-n]
          +--rw flex-n   int16
          +--rw flex-m?  uint16

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
te:p2p-primary-path/te:optimizations/te:algorithm/te:metric/
te:optimization-metric/te:explicit-route-include-objects/
te:route-object-include-object/te:type/te:label/te:label-hop/
te:te-label/te:technology:
  +--:(flexi-grid)
    +--rw (single-or-super-channel)?
      +--:(single)
        |  +--rw flex-n?   int16
        |  +--rw flex-m?   uint16
      +--:(super)
        +--rw subcarrier-flex-n* [flex-n]
          +--rw flex-n   int16
          +--rw flex-m?  uint16

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
te:p2p-primary-path/te:explicit-route-objects-always/ 
te:route-object-exclude-always/te:type/te:label/te:label-hop/ 
te:te-label/te:technology: 
  +--:(flexi-grid) 
    ++--rw (single-or-super-channel)? 
    +--:(single) 
      |  ++--rw flex-n?   int16 
      |  ++--rw flex-m?   uint16 
    +--:(super) 
      ++--rw subcarrier-flex-n* [flex-n] 
        ++--rw flex-n   int16 
        ++--rw flex-m?   uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
te:p2p-primary-path/te:explicit-route-objects-always/ 
te:route-object-include-exclude/te:type/te:label/te:label-hop/ 
te:te-label/te:technology: 
  +--:(flexi-grid) 
    ++--rw (single-or-super-channel)? 
    +--:(single) 
      |  ++--rw flex-n?   int16 
      |  ++--rw flex-m?   uint16 
    +--:(super) 
      ++--rw subcarrier-flex-n* [flex-n] 
        ++--rw flex-n   int16 
        ++--rw flex-m?   uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
te:p2p-primary-path/te:path-in-segment/te:label-restrictions/ 
te:label-restriction: 
  ++--rw grid-type?   identityref 
  ++--rw priority?    uint8 
  ++--rw flexi-grid 
    ++--rw nominal-central-frequency-granularity? identityref 
    ++--rw slot-width-granularity? identityref 
    ++--rw min-slot-width-factor? uint16 
    ++--rw max-slot-width-factor? uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
te:p2p-primary-path/te:path-in-segment/te:label-restrictions/ 
te:label-restriction/te:label-start/te:te-label/te:technology: 
  +--:(flexi-grid) 
    ++--rw flex-n?   int16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
te:p2p-primary-path/te:path-in-segment/te:label-restrictions/ 
te:label-restriction/te:label-end/te:te-label/te:technology: 
  +--:(flexi-grid) 
    ++--rw flex-n?   int16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
  te:p2p-primary-path/te:path-out-segment/te:label-restrictions/ 
  te:label-restriction: 
  +--rw grid-type?  identityref 
  +--rw priority?  uint8 
  +--rw flexi-grid 
    +--rw nominal-central-frequency-granularity?  identityref 
    +--rw slot-width-granularity?  identityref 
    +--rw min-slot-width-factor?  uint16 
    +--rw max-slot-width-factor?  uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
  te:p2p-primary-path/te:path-out-segment/te:label-restrictions/ 
  te:label-restriction/te:label-start/te:te-label/te:technology: 
  +--:(flexi-grid) 
    +--rw flex-n?  int16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
  te:p2p-primary-path/te:path-out-segment/te:label-restrictions/ 
  te:label-restriction/te:label-end/te:te-label/te:technology: 
  +--:(flexi-grid) 
    +--rw flex-n?  int16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
  te:p2p-primary-path/te:computed-paths-properties/ 
  te:computed-path-properties/te:path-route-objects/te:path-computed-route-object/te:type/ 
  te:label/te:label-hop/te:te-label/te:technology: 
  +--:(flexi-grid) 
    +--ro (single-or-super-channel)? 
      +--:(single) 
        |  +--ro flex-n?  int16 
        |  +--ro flex-m?  uint16 
      +--:(super) 
        +--ro subcarrier-flex-n* [flex-n] 
          +--ro flex-n  int16 
          +--ro flex-m?  uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/ 
  te:p2p-primary-path/te:lsp/te:lsp/te:lsp-record-route-information/ 
  te:lsp-record-route-information/te:type/te:label/te:label-hop/ 
  te:te-label/te:technology: 
  +--:(flexi-grid) 
    +--ro (single-or-super-channel)? 
      +--:(single) 
        |  +--ro flex-n?  int16 
        |  +--ro flex-m?  uint16 
      +--:(super) 
        +--ro subcarrier-flex-n* [flex-n] 
          +--ro flex-n  int16 
          +--ro flex-m?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:lsps/te:lsp/te:path-properties/
  te:path-route-objects/te:path-computed-route-object/te:type/
  te:type/te:label-hop/te:te-label/te:technology:
  +--:(flexi-grid)
    +--ro (single-or-super-channel)?
      +--:(single)
        |  +--ro flex-n?    int16
        |  +--ro flex-m?    uint16
        +--:(super)
          +--ro subcarrier-flex-n* [flex-n]
            +--ro flex-n    int16
            +--ro flex-m?   uint16
  augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
    te:p2p-primary-path/te:p2p-primary-reverse-path/te:optimizations/
    te:explicit-route-exclude-objects/te:route-object-exclude-object/
    te:type/te:label-hop/te:te-label/te:technology:
    +--:(flexi-grid)
      +--rw (single-or-super-channel)?
        +--:(single)
          |  +--rw flex-n?    int16
          |  +--rw flex-m?    uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
  augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
    te:p2p-primary-path/te:p2p-primary-reverse-path/te:optimizations/
    te:explicit-route-exclude-objects/te:route-object-exclude-object/
    te:type/te:label-hop/te:te-label/te:technology:
    +--:(flexi-grid)
      +--rw (single-or-super-channel)?
        +--:(single)
          |  +--rw flex-n?    int16
          |  +--rw flex-m?    uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
  augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
    te:p2p-primary-path/te:p2p-primary-reverse-path/te:optimizations/
    te:explicit-route-include-objects/te:route-object-include-object/
    te:type/te:label-hop/te:te-label/te:technology:
    +--:(flexi-grid)
      +--rw (single-or-super-channel)?
        +--:(single)
          |  +--rw flex-n?    int16
          |  +--rw flex-m?    uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
  augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
    te:p2p-primary-path/te:p2p-primary-reverse-path/te:optimizations/
    te:explicit-route-exclude-objects/te:route-object-exclude-always/
    te:type/te:label-hop/te:te-label/te:technology:
    +--:(flexi-grid)
      +--rw (single-or-super-channel)?
        +--:(single)
          |  +--rw flex-n?    int16
          |  +--rw flex-m?    uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
  augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
    te:p2p-primary-path/te:p2p-primary-reverse-path/
    te:type/te:label-hop/te:te-label/te:technology:
    +--:(flexi-grid)
      +--rw (single-or-super-channel)?
        +--:(single)
          |  +--rw flex-n?    int16
          |  +--rw flex-m?    uint16
        +--:(super)
          +--rw subcarrier-flex-n* [flex-n]
            +--rw flex-n    int16
            +--rw flex-m?   uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/
  te:explicit-route-objects-always/te:route-object-include-exclude/
  te:type/te:label/te:label-hop/te:te-label/te:technology:
  +++:(flexi-grid)
  +--rw (single-or-super-channel)?
  +--:(single)
  |  +--rw flex-n?  int16
  |  +--rw flex-m?  uint16
  +--:(super)
  +--rw subcarrier-flex-n* [flex-n]
  +--rw flex-n  int16
  +--rw flex-m?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-in-segment/
  te:label-restrictions/te:label-restriction:
  +--rw grid-type?  identityref
  +--rw priority?  uint8
  +--rw flexi-grid
  +--rw nominal-central-frequency-granularity?  identityref
  +--rw slot-width-granularity?  identityref
  +--rw min-slot-width-factor?  uint16
  +--rw max-slot-width-factor?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-in-segment/
  te:label-restrictions/te:label-restriction/te:label-start/
  te:te-label/te:technology:
  +++:(flexi-grid)
  +--rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-in-segment/
  te:label-restrictions/te:label-restriction/te:label-end/te:te-label/
  te:technology:
  +++:(flexi-grid)
  +--rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-out-segment/
  te:label-restrictions/te:label-restriction:
  +--rw grid-type?  identityref
  +--rw priority?  uint8
  +--rw flexi-grid
  +--rw nominal-central-frequency-granularity?  identityref
  +--rw slot-width-granularity?  identityref
  +--rw min-slot-width-factor?  uint16
  +--rw max-slot-width-factor?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-out-segment/
  te:label-restrictions/te:label-restriction/te:label-start/
  te:te-label/te:technology:
  +++:(flexi-grid)
  +--rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:path-out-segment/
  te:label-restrictions/te:label-restriction/te:label-end/te:te-label/
  te:technology:
  +=-(flexi-grid)
  ++-rw flex-n? int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/
  te:computed-paths-properties/te:computed-path-properties/
  te:path-properties/te:path-route-objects/
  te:path-computed-route-object/te:type/te:label/te:label-hop/
  te:te-label/te:technology:
  +=-(flexi-grid)
  +++-ro (single-or-super-channel)?
  +++-:(single)
    |  +++-ro flex-n? int16
    |  +++-ro flex-m? uint16
  +++-:(super)
    +++-ro subcarrier-flex-n* [flex-n]
      +++-ro flex-n int16
      +++-ro flex-m? uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:lsps/te:lsp/
  te:lsp-record-route-information/te:lsp-record-route-information/
  te:type/te:label/te:label-hop/te:te-label/te:technology:
  +=-(flexi-grid)
  +++-ro (single-or-super-channel)?
  +++-:(single)
    |  +++-ro flex-n? int16
    |  +++-ro flex-m? uint16
  +++-:(super)
    +++-ro subcarrier-flex-n* [flex-n]
      +++-ro flex-n int16
      +++-ro flex-m? uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
  te:p2p-primary-path/te:p2p-primary-reverse-path/te:lsps/te:lsp/
  te:path-properties/te:path-route-objects/
  te:path-computed-route-object/te:type/te:label/te:label-hop/
  te:te-label/te:technology:
  +=-(flexi-grid)
  +++-ro (single-or-super-channel)?
  +++-:(single)
    |  +++-ro flex-n? int16
    |  +++-ro flex-m? uint16
  +++-:(super)
    +++-ro subcarrier-flex-n* [flex-n]
      +++-ro flex-n int16
      +++-ro flex-m? uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/ 
  te:optimization-metric/te:explicit-route-exclude-objects/ 
  te:route-object-exclude-object/te:type/te:label/te:label-hop/ 
  te:te-label/te:technology: 
  +++:(flexi-grid) 
  +++-rw (single-or-super-channel)? 
  +++-:(single) 
  | +++-rw flex-n? int16 
  | +++-rw flex-m? uint16 
  +++-:(super) 
  +++-rw subcarrier-flex-n* [flex-n] 
  | +++-rw flex-n int16 
  | +++-rw flex-m? uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/ 
  te:optimization-metric/te:explicit-route-include-objects/ 
  te:route-object-include-object/te:type/te:label/te:label-hop/ 
  te:te-label/te:technology: 
  +++-(flexi-grid) 
  +++-rw (single-or-super-channel)? 
  +++-:(single) 
  | +++-rw flex-n? int16 
  | +++-rw flex-m? uint16 
  +++-:(super) 
  +++-rw subcarrier-flex-n* [flex-n] 
  | +++-rw flex-n int16 
  | +++-rw flex-m? uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/ 
  te:p2p-secondary-path/te:explicit-route-objects-always/ 
  te:route-object-exclude-always/te:type/te:label/te:label-hop/ 
  te:te-label/te:technology: 
  +++:(flexi-grid) 
  +++-rw (single-or-super-channel)? 
  +++-:(single) 
  | +++-rw flex-n? int16 
  | +++-rw flex-m? uint16 
  +++-:(super) 
  +++-rw subcarrier-flex-n* [flex-n] 
  | +++-rw flex-n int16 
  | +++-rw flex-m? uint16 

augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/ 
  te:p2p-secondary-path/te:explicit-route-objects-always/ 
  te:te-label/te:technology: 
  +++-(flexi-grid) 
  +++-rw (single-or-super-channel)? 
  +++-:(single) 
  | +++-rw flex-n? int16 
  | +++-rw flex-m? uint16 
  +++-:(super) 
  +++-rw subcarrier-flex-n* [flex-n] 
  | +++-rw flex-n int16 
  | +++-rw flex-m? uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-in-segment/te:label-restrictions/
te:label-restriction:
  +-rw grid-type? identityref
  +-rw priority?  uint8
  +-rw flexi-grid
    +-rw nominal-central-frequency-granularity? identityref
    +-rw slot-width-granularity? identityref
    +-rw min-slot-width-factor?  uint16
    +-rw max-slot-width-factor?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-in-segment/te:label-restrictions/
te:label-restriction/te:label-start/te:te-label/te:technology:
  +-:(flexi-grid)
    +-rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-in-segment/te:label-restrictions/
te:label-restriction/te:label-end/te:te-label/te:technology:
  +-:(flexi-grid)
    +-rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-out-segment/te:label-restrictions/
te:label-restriction:
  +-rw grid-type? identityref
  +-rw priority?  uint8
  +-rw flexi-grid
    +-rw nominal-central-frequency-granularity? identityref
    +-rw slot-width-granularity? identityref
    +-rw min-slot-width-factor?  uint16
    +-rw max-slot-width-factor?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-out-segment/te:label-restrictions/
te:label-restriction/te:label-start/te:te-label/te:technology:
  +-:(flexi-grid)
    +-rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-out-segment/te:label-restrictions/
te:label-restriction/te:label-end/te:te-label/te:technology:
  +-:(flexi-grid)
    +-rw flex-n?  int16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:path-computed-route-object/te:type/
te:label/te:label-hop/te:te-label/te:technology:
  +-:(flexi-grid)
    +-ro (single-or-super-channel)?
      +-:(single)
      |  +-ro flex-n?  int16
      |  +-ro flex-m?  uint16
      +-:(super)
      |  +-ro subcarrier-flex-n* [flex-n]
        +-ro flex-n  int16
        +-ro flex-m? uint16
augment /te:te/te:tunnels/te:p2p-secondary-paths/
te:type/te:label/te:label-hop/te:te-label/te:technology:
  +--:(flexi-grid)
    +--ro (single-or-super-channel)?
      +--:(single)
        |    +--ro flex-n? int16
        |    +--ro flex-m? uint16
      +--:(super)
        +--ro subcarrier-flex-n* [flex-n]
          +--ro flex-n int16
          +--ro flex-m? uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
te:p2p-secondary-path/te:lsp/te:path-properties/
te:path-route-objects/te:path-computed-route-object/te:type/
te:label/te:label-hop/te:te-label/te:technology:
  +--:(flexi-grid)
    +--ro (single-or-super-channel)?
      +--:(single)
        |    +--ro flex-n? int16
        |    +--ro flex-m? uint16
      +--:(super)
        +--ro subcarrier-flex-n* [flex-n]
          +--ro flex-n int16
          +--ro flex-m? uint16
augment /te:te/te:lsp/te:lsp-record-route-information/
te:lsp-record-route-information/te:type/te:label/te:label-hop/
te:te-label/te:technology:
  +--:(flexi-grid)
    +--ro (single-or-super-channel)?
      +--:(single)
        |    +--ro flex-n? int16
        |    +--ro flex-m? uint16
      +--:(super)
        +--ro subcarrier-flex-n* [flex-n]
          +--ro flex-n int16
          +--ro flex-m? uint16
augment /te:tunnels-rpc/te:input/te:tunnel-info/tepc:path-request:
  +-- src-client-signal? identityref
  +-- dst-client-signal? identityref
  +-- fec-type? identityref
  +-- termination-type? identityref
  +-- bit-stuffing? boolean
  +-- wavelength-assignment? identityref
5.2. YANG Model - Code

<CODE BEGINS> file "ietf-flexi-grid-media-channel@2019-03-24.yang"

module ietf-flexi-grid-media-channel {
  yang-version 1.1;
  prefix "flexi-grid-media-channel";

  import ietf-te { prefix "te"; }
  import ietf-layer0-types { prefix "layer0-types"; }
  import ietf-te-path-computation { prefix "tepc"; }
  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>
    WG Chair: Daniele Ceccarelli
              <mailto:daniele.ceccarelli@ericsson.com>
    WG Chair: Fatai Zhang
              <mailto:zhangfatai@huawei.com>
    Editor: Jorge E. Lopez de Vergara <jorge.lopez_vergara@uam.es>
    Editor: Daniel Perdices <daniel.perdices@naudit.es>
    Editor: Victor Lopez <victor.lopezalvarez@telefonica.com>
    Editor: Young Lee <leeyoung@huawei.com>"
    description
      "This module defines a model for Flex-grid Media Channel Services.";

  revision "2019-03-24" {
    description
      "version 2";
    reference "version 2";
  }

/* Groupings. */

grouping flexi-grid-media-channel-attributes {
  description "Parameters for flexi-grid media channel.";

  leaf src-client-signal {
    type identityref {
      base otn-types:client-signal;
    }
    description "Client signal at the source endpoint of the media channel.";
  }

  leaf dst-client-signal {
    type identityref {
      base otn-types:client-signal;
    }
    description "Client signal at the destination endpoint of the media channel.";
  }

  leaf fec-type {
    type identityref {
      base layer0-types:fec-type;
    }
    description "FEC type.";
  }

  leaf termination-type {
    type identityref {
      base layer0-types:term-type;
    }
    description "Termination type.";
  }

  leaf bit-stuffing {
    type boolean;
    description "Bit stuffing enabled/disabled.";
  }
}

grouping flexi-grid-path-constraints {
    description
        "Global named path constraints configuration
        grouping for flexi-grid media channel";

    leaf wavelength-assignment {
        type identityref {
            base layer0-types:wavelength-assignment;
        }
        description "Wavelength Allocation Method";
    }
}

augment "/te:te/te:tunnels/te:tunnel" {
    description
        "Augment with additional parameters required for flexi-grid
        media channel.";
    uses flexi-grid-media-channel-attributes;
}

/*
 * Data nodes
 */

/* Augment TE bandwidth
 */

/* Augment bandwidth of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
 + "te:named-path-constraint/"
 + "te:te-bandwidth/te:technology" {
    description "flexi-grid bandwidth.";
    case flexi-grid {
        uses layer0-types:flexi-grid-path-bandwidth;
    }
}

/* Augment bandwidth of tunnel */
augment "/te:te/te:tunnels/te:tunnel/
 + "te:te-bandwidth/te:technology" {
    description "flexi-grid bandwidth.";
    case flexi-grid {
        uses layer0-types:flexi-grid-path-bandwidth;
    }
}

/* Augment label hop of route-object-include-exclude of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
    + "te:named-path-constraint/te:explicit-route-objects-always/
    + "te:route-object-include-exclude/te:type/te:label/
    + "te:label-hop/te:te-label/te:technology"
    { description "flexi-grid label.";
        case flexi-grid {
            uses layer0-types:flexi-grid-path-label;
        }
    }
/* Augment label restrictions for the path-in-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
    + "te:named-path-constraint/te:path-in-segment/
    + "te:label-restrictions/
    + "te:label-restriction"
    { description "flexi-grid label.";
        uses layer0-types:flexi-grid-label-restriction;
    }
/* Augment label restrictions start for the path-in-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
    + "te:named-path-constraint/te:path-in-segment/
    + "te:label-restrictions/
    + "te:label-restriction/te:label-start/
    + "te:te-label/te:technology"
    { description "flexi-grid label.";
        case flexi-grid {
            uses layer0-types:flexi-grid-link-label;
        }
    }
/* Augment label restrictions end for the path-in-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
    + "te:named-path-constraint/te:path-in-segment/
    + "te:label-restrictions/
    + "te:label-restriction/te:label-end/
    + "te:te-label/te:technology"
    { description "flexi-grid label.";
        case flexi-grid {
            uses layer0-types:flexi-grid-link-label;
        }
    }
/* Augment label restrictions for the path-out-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
  + "te:named-path-constraint/te:path-out-segment/
    + "te:label-restrictions/
      + "te:label-restriction"
    { description "flexi-grid label.";
      uses layer0-types:flexi-grid-label-restriction;
    }
/* Augment label restrictions start for the path-out-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
  + "te:named-path-constraint/te:path-out-segment/
    + "te:label-restrictions/
      + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology"
    { description "flexi-grid label.";
      case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
      }
    }
/* Augment label restrictions end for the path-out-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/
  + "te:named-path-constraint/te:path-out-segment/
    + "te:label-restrictions/
      + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology"
    { description "flexi-grid label.";
      case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
      }
    }
/* Augment label hop of route-exclude of primary path */
augment "/te:te:te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
    + "te:optimizations/te:algorithm/te:metric/
      + "te:optimization-metric/te:explicit-route-exclude-objects/
        + "te:route-object-exclude-object/te:type/te:label/"
      + "te:label-hop/te:te-label/te:technology"
    { description "flexi-grid label.";
      case flexi-grid {
        uses layer0-types:flexi-grid-path-label;
      }
    }
/* Augment label hop of route-include of primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:optimizations/te:algorithm/te:metric/
  + "te:optimization-metric/te:explicit-route-include-objects/
  + "te:route-object-include-object/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}

/* Augment label hop of route-object-exclude-always of primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:explicit-route-objects-always/
  + "te:route-object-exclude-always/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}

/* Augment label hop of route-object-include-exclude of primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:explicit-route-objects-always/
  + "te:route-object-include-exclude/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}

/* Augment label restrictions for the path-in-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:path-in-segment/te:label-restrictions/
  + "te:label-restriction" {
  description "flexi-grid label.";
  uses layer0-types:flexi-grid-label-restriction;
}
/* Augment label restrictions start for the path-in-segment of primary path */
augment "+/\te/te/te:tunnels/te:tunnel/"
   + "te:p2p-primary-paths/te:p2p-primary-path/"
   + "te:path-in-segment/te:label-restrictions/"
   + "te:label-restriction/te:label-start/"
   + "te:te-label/te:technology" {
      description "flexi-grid label.";
      case flexi-grid {
         uses layer0-types:flexi-grid-link-label;
      }
   }
/* Augment label restrictions end for the path-in-segment of primary path */

/* Augment label restrictions for the path-out-segment of primary path */
augment "+/\te/te/te:tunnels/te:tunnel/"
   + "te:p2p-primary-paths/te:p2p-primary-path/"
   + "te:path-out-segment/te:label-restrictions/"
   + "te:label-restriction" {
      description "flexi-grid label.";
      uses layer0-types:flexi-grid-label-restriction;
   }
/* Augment label restrictions start for the path-out-segment of primary path */
augment "+/\te/te/te:tunnels/te:tunnel/"
   + "te:p2p-primary-paths/te:p2p-primary-path/"
   + "te:path-out-segment/te:label-restrictions/"
   + "te:label-restriction/te:label-start/"
   + "te:te-label/te:technology" {
      description "flexi-grid label.";
      case flexi-grid {
         uses layer0-types:flexi-grid-link-label;
      }
   }
/* Augment label restrictions end for the path-out-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/
    + "te:path-out-segment/te:label-restrictions/
    + "te:label-restriction/te:label-end/
    + "te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
    }
}
/* Augment label hop of path-route of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/
    + "te:computed-paths-properties/
    + "te:computed-path-properties/te:path-properties/
    + "te:path-route-objects/te:path-computed-route-object/
    + "te:type/te:label/
    + "te:label-hop/te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-path-label;
    }
}
/* Augment label hop of record-route of primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/
    + "te:lsps/te:lsp/te:lsp-record-route-information/
    + "te:lsp-record-route-information/te:type/te:label/
    + "te:label-hop/te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-path-label;
    }
}
/* Augment label hop of path-route of primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/
    + "te:lsps/te:lsp/te:path-properties/
    + "te:path-route-objects/te:path-computed-route-object/
    + "te:type/te:label/
    + "te:label-hop/te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-path-label;
    }
}
/* Augment label hop of route-exclude of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:optimizations/te:algorithm/te:metric/
  + "te:optimization-metric/te:explicit-route-exclude-objects/
  + "te:route-object-exclude-object/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label."
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}

/* Augment label hop of route-include of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:optimizations/te:algorithm/te:metric/
  + "te:optimization-metric/te:explicit-route-include-objects/
  + "te:route-object-include-object/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label."
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}

/* Augment label hop of route-object-exclude-always of reverse
  primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:explicit-route-objects-always/
  + "te:route-object-exclude-always/
  + "te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label."
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}
/* Augment label hop of route-object-include-exclude of reverse primary path */
augment "te:te/te:tunnels/te:tunnel/
   + te:p2p-primary-paths/te:p2p-primary-path/
   + te:p2p-primary-reverse-path/
   + te:explicit-route-objects-always/
   + te:route-object-include-exclude/
   + te:type/te:label/
   + te:label-hop/te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
      uses layer0-types:flexi-grid-path-label;
    }
  }
/* Augment label restrictions for the path-in-segment of reverse primary path */
augment "te:te/te:tunnels/te:tunnel/
   + te:p2p-primary-paths/te:p2p-primary-path/
   + te:p2p-primary-reverse-path/
   + te:path-in-segment/te:label-restrictions/
   + te:label-restriction/
   + te:te-label/te:technology" {
    description "flexi-grid label.";
    uses layer0-types:flexi-grid-label-restriction;
  }
/* Augment label restrictions start for the path-in-segment of reverse primary path */
augment "te:te/te:tunnels/te:tunnel/
   + te:p2p-primary-paths/te:p2p-primary-path/
   + te:p2p-primary-reverse-path/
   + te:path-in-segment/te:label-restrictions/
   + te:label-restriction/te:label-start/
   + te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
      uses layer0-types:flexi-grid-link-label;
    }
  }
/* Augment label restrictions end for the path-in-segment of reverse primary path */
augment "te:te/te:tunnels/te:tunnel/
   + te:p2p-primary-paths/te:p2p-primary-path/
   + te:p2p-primary-reverse-path/
   + te:path-in-segment/te:label-restrictions/
   + te:label-restriction/te:label-end/
   + te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
      uses layer0-types:flexi-grid-link-label;
    }
  }
/* Augment label restrictions for the path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:path-out-segment/te:label-restrictions/
  + "te:label-restriction" {
    description "flexi-grid label."
    uses layer0-types:flexi-grid-label-restriction;
  }
/* Augment label restrictions start for the path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:path-out-segment/te:label-restrictions/
  + "te:label-restriction/te:label-start/
  + "te:te-label/te:technology" {
    description "flexi-grid label."
    case flexi-grid {
      uses layer0-types:flexi-grid-link-label;
    }
  }
/* Augment label restrictions end for the path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:path-out-segment/te:label-restrictions/
  + "te:label-restriction/te:label-end/
  + "te:te-label/te:technology" {
    description "flexi-grid label."
    case flexi-grid {
      uses layer0-types:flexi-grid-link-label;
    }
  }
/* Augment label hop of path-route of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:computed-paths-properties/
  + "te:path-computed-route-object/
  + "te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
    description "flexi-grid label."
    case flexi-grid {
      uses layer0-types:flexi-grid-path-label;
    }
  }
/* Augment label hop of record-route of reverse primary LSP */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:lsps/te:lsp/te:lsp-record-route-information/
  + "te:lsp-record-route-information/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
description "flexi-grid label.";
case flexi-grid {
  uses layer0-types:flexi-grid-path-label;
}
}

/* Augment label hop of path-route of reverse primary LSP */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-primary-paths/te:p2p-primary-path/
  + "te:p2p-primary-reverse-path/
  + "te:lsps/te:lsp/te:path-properties/
  + "te:path-route-objects/te:path-computed-route-object/
  + "te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
description "flexi-grid label.";
case flexi-grid {
  uses layer0-types:flexi-grid-path-label;
}
}

/* Augment label hop of route-exclude of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-secondary-paths/te:p2p-secondary-path/
  + "te:optimizations/te:algorithm/te:metric/
  + "te:optimization-metric/te:explicit-route-exclude-objects/
  + "te:route-object-exclude-object/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
description "flexi-grid label.";
case flexi-grid {
  uses layer0-types:flexi-grid-path-label;
}
}

/* Augment label hop of route-include of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-secondary-paths/te:p2p-secondary-path/
  + "te:optimizations/te:algorithm/te:metric/
  + "te:optimization-metric/te:explicit-route-include-objects/
  + "te:route-object-include-object/te:type/te:label/
  + "te:label-hop/te:te-label/te:technology" {
description "flexi-grid label.";
case flexi-grid {
  uses layer0-types:flexi-grid-path-label;
}
/* Augment label hop of route-object-exclude-always of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
   + "te:p2p-secondary-paths/te:p2p-secondary-path/
   + "te:explicit-route-objects-always/
   + "te:route-object-exclude-always/te:type/te:label/
   + "te:label-hop/te:te-label/te:technology" {
   description "flexi-grid label.";
   case flexi-grid {
      uses layer0-types:flexi-grid-path-label;
   }
}

/* Augment label hop of route-object-include-exclude of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
   + "te:p2p-secondary-paths/te:p2p-secondary-path/
   + "te:explicit-route-objects-always/
   + "te:route-object-include-exclude/te:type/te:label/
   + "te:label-hop/te:te-label/te:technology" {
   description "flexi-grid label.";
   case flexi-grid {
      uses layer0-types:flexi-grid-path-label;
   }
}

/* Augment label restrictions for the path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
   + "te:p2p-secondary-paths/te:p2p-secondary-path/
   + "te:path-in-segment/te:label-restrictions/
   + "te:label-restriction" {
   description "flexi-grid label.";
   uses layer0-types:flexi-grid-label-restriction;
}

/* Augment label restrictions start for the path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
   + "te:p2p-secondary-paths/te:p2p-secondary-path/
   + "te:path-in-segment/te:label-restrictions/
   + "te:label-restriction/te:label-start/
   + "te:te-label/te:technology" {
   description "flexi-grid label.";
   case flexi-grid {
      uses layer0-types:flexi-grid-link-label;
   }
}
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/* Augment label restrictions end for the path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
    }
}

/* Augment label restrictions start for the path-out-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
    }
}

/* Augment label restrictions end for the path-out-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
    description "flexi-grid label.";
    case flexi-grid {
        uses layer0-types:flexi-grid-link-label;
    }
}
/* Augment label hop of path-route of secondary path */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-secondary-paths/te:p2p-secondary-path/
  + "te:computed-path-properties/"
  + "te:path-route-objects/"
  + "te:path-computed-route-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}
/* Augment label hop of record-route of secondary LSP */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-secondary-paths/te:p2p-secondary-path/
  + "te:lsp/te:lsp/te:lsp-record-route-information/"
  + "te:lsp-record-route-information/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}
/* Augment label hop of path-route of secondary LSP */
augment "/te:te/te:tunnels/te:tunnel/
  + "te:p2p-secondary-paths/te:p2p-secondary-path/
  + "te:lsp/te:lsp/te:path-properties/"
  + "te:path-route-objects/"
  + "te:path-computed-route-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}
/* Augment label hop of record-route of LSP */
augment "/te:te/te:lsp/stat"/
  + "te:lsp/te:lsp-record-route-information/"
  + "te:lsp-record-route-information/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "flexi-grid label.";
  case flexi-grid {
    uses layer0-types:flexi-grid-path-label;
  }
}
augment "/te:tunnels-rpc/te:input/te:tunnel-info/"
    + "tepc:path-request" {
        description
            "Augment with additional constraints flexi-grid
             media channel."
        uses flexi-grid-media-channel-attributes;
        uses flexi-grid-path-constraints;
    }
}

<CODE ENDS>

5.3. License

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modification, are permitted provided that the following conditions
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CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN
ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
POSSIBILITY OF SUCH DAMAGE.
6. 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 [RFC8341] 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.

A number of configuration data nodes defined in this document are writable/deletable (i.e., "config true"). These data nodes may be considered sensitive or vulnerable in some network environments.

There are a number of data nodes defined in this YANG module that 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., edit-config) to these data nodes without proper protection can have a negative effect on network operations.

7. IANA Considerations

The namespace used in the defined model has to register a URI in the IETF XML registry [RFC3688], as well as in the YANG Module Names registry [RFC6020].

8. References

8.1. Normative References


8.2. Informative References


9. Contributors

The model presented in this paper was contributed to by more people than can be listed on the author list. Additional contributors include:

- Zafar Ali, Cisco Systems
- Daniel Michaud Vallinoto, Universidad Autonoma de Madrid
10. Acknowledgments

The work presented in this Internet-Draft has been partially funded by the European Commission under the project H2020 METRO-HAUL (Metro High bandwidth, 5G Application-aware optical network, with edge storage, compute and low Latency), Grant Agreement number: 761727, and by the Spanish Ministry of Economy and Competitiveness under the project TRAFICA, MINECO/FEDER TEC2015-69417-C2-1-R.

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