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A YANG Data Model for Flexi-Grid Optical Networks
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Abstract

This document defines a YANG module for managing flexi-grid optical networks. The model defined in this document specifies a flexi-grid traffic engineering database that is used to describe the topology of a flexi-grid network. It is based on and augments existing YANG models that describe network and traffic engineering topologies.

About This Document

This note is to be removed before publishing as an RFC.

The latest revision of this draft can be found at https://ietf-ccamp-wg.github.io/draft-ietf-ccamp-flexigrid-yang/draft-ietf-ccamp-flexigrid-yang.html. Status information for this document may be found at https://datatracker.ietf.org/doc/draft-ietf-ccamp-flexigrid-yang/.

Discussion of this document takes place on the Common Control and Measurement Plane Working Group mailing list (mailto:ccamp@ietf.org), which is archived at https://mailarchive.ietf.org/arch/browse/ccamp/. Subscribe at https://www.ietf.org/mailman/listinfo/ccamp/.

Source for this draft and an issue tracker can be found at https://github.com/ietf-ccamp-wg/draft-ietf-ccamp-flexigrid-yang.

Status of This Memo

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

This Internet-Draft will expire on 6 August 2026.

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1. Introduction

The flexible grid (flexi-grid) optical network technology defined by the International Telecommunication Union Telecommunication Standardization Sector (ITU-T) and documented in Recommendation ITU-T_G.694.1 [ITU-T_G.694.1] and ITU-T_G.872 [ITU-T_G.872] provides an enhanced Dense Wavelength Division Multiplexing (DWDM) grid by defining a set of nominal central frequencies, slot widths, and the concept of the "frequency slot". This technology increases both transport network scalability and flexibility, allowing the optimization of bandwidth usage.

[RFC7698] provides a framework for GMPLS-Based control of flexi-grid DWDM networks while [RFC7699] defines generalized labels for the use of GMPLS in flexi-grid networks.

[RFC8363] provides extensions to the OSPF-TE protocol so as to support GMPLS control of flexi-grid networks.

This document presents a YANG data model [RFC7950] for flexi-grid objects in the dynamic optical network, including nodes, transponders and links, as well as how such links interconnect nodes. This model is independent of control plane protocols.

This document identifies the flexi-grid components, parameters, and their values. It characterizes the features and the performances of the flexi-grid elements. For this, it augments [RFC8795], and imports the generic Layer 0 types and use of "media-channel" defined in [I-D.ietf-ccamp-rfc9093-bis].

An application example in Section 4 is also provided to better understand the utility of this YANG model.

A partner document defines a second YANG module that described flexi-grid tunnels, i.e., the paths from source to destination through a number of intermediate nodes [I-D.ietf-ccamp-flexigrid-tunnel-yang].

Impairment-aware traffic engineering topology is described in [I-D.ietf-ccamp-optical-impairment-topology-yang].

The YANG data model defined in this document conforms to the Network Management Datastore Architecture (NMDA) [RFC8342].

2. Terminology

Refer to [RFC7698] and [RFC7699] for the key terms used in this document.

The following terms are defined in [RFC7950] and are not redefined here:

* client
* server
* augment
* data model
* data node

The following terms are defined in [RFC6241] and are not redefined here:

* configuration data
* state data

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

3. Tree Diagram

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams is defined in [RFC8340].

3.1. 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. It uses prefixes from [I-D.ietf-ccamp-rfc9093-bis], [RFC8345], and [RFC8795].

Prefix	YANG module	Reference
l0-types	ietf-layer0-types	[RFCYYYY]
flexgt	ietf-flexi-grid-topology	RFC XXXX
nw	ietf-network	[RFC8345]
nt	ietf-network-topology	[RFC8345]
tet	ietf-te-topology	[RFC8795]

Table 1: Prefixes and corresponding YANG modules

RFC Editor Note: Please replace XXXX with the RFC number assigned to this document. Please replace YYYY with the RFC numbers assigned to [I-D.ietf-ccamp-rfc9093-bis]. Please remove this note.

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. Figure 1 shows a simple topology.

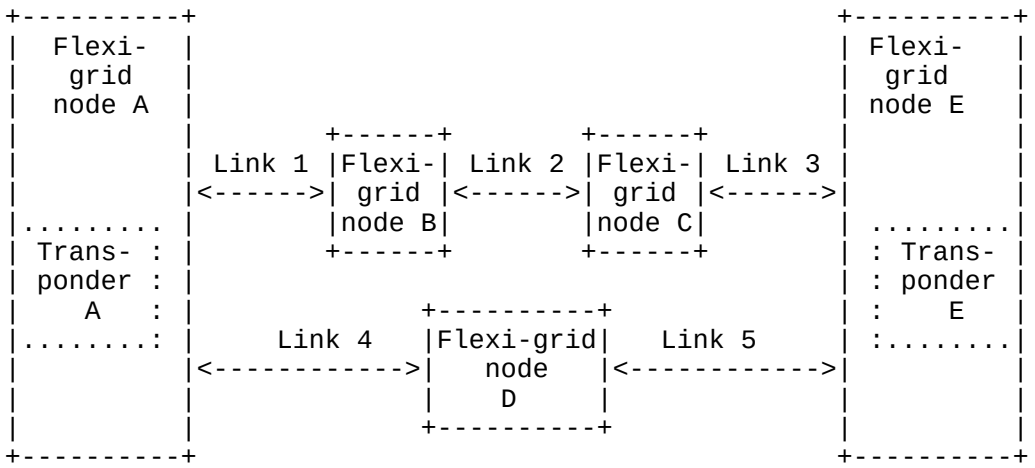

Figure 1: Topology Example

In order to configure a flexi-grid network to interconnect transponders A and E, first of all we have to populate the flexi-grid topology YANG model with all elements in the network:

* We define the transponders within nodes A and E as tunnel termination points (TTPs) and provide their internal local link connectivity towards the node interfaces. We also provide the identifiers, addresses and interfaces of nodes A and B.

* We do the same for the nodes B, C and D, providing their identifiers, addresses and interfaces, as well as the internal connectivity matrix between interfaces.

* Then, we also define the links 1 to 5 that interconnect nodes, indicating which flexi-grid labels are available.

* Other information, such as the slot frequency and granularity are also provided.

5. YANG Data Model for Flexi-Grid Topology

5.1. Flexi-Grid Topology Data Model Overview

This document describes the data model for flexi-grid topology. As a classic traffic engineering (TE) technology, flexi-grid provides WDM switching in transport network. Therefore the YANG module presented in this document augments from a more generic TE network topology data model, i.e., the ietf-te-topology, as specified in [RFC8795], following the guidelines provided in section 6 of [RFC8795].

Common types, identities, and groupings defined in [I-D.ietf-ccamp-rfc9093-bis] are reused in this document.

The figure below shows the augmentation relationship between YANG models.

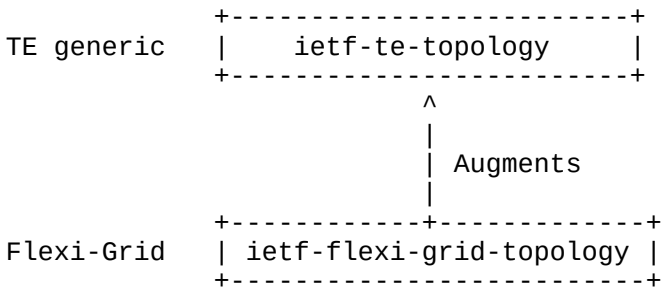

Figure 2: Relationship between Flexi-Grid and TE topology models

The entities and TE attributes, such as node, termination points and links, are still applicable for describing a flexi-grid topology and the model presented in this document only specifies the technology-specific attributes/information.

The flexi-grid specific attributes and label format is defined in [RFC7699], including the grid type, nominal central frequency granularity, slot width granularity, n and m parameters. A collection of common data types have also been specified in [I-D.ietf-ccamp-rfc9093-bis], and used in this document for augmentation of the generic TE topology model.

The YANG module ietf-flexi-grid-topology defined in this document conforms to the Network Management Datastore Architecture (NMDA) defined in [RFC8342].

5.2. Augmentations for Flexi-Grid Topology and Node

There are a few characteristics augmenting to the generic TE topology.

Following the guidelines in [RFC8795], a flexi-grid-topology network-type is specified as the indicator of flexi-grid in the topology as shown in Figure 3.

```
augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
  +--rw flexi-grid-topology!
```

Figure 3: Flexi-Grid Topology Augmentation

A flexi-grid-node presence container is specified, augmenting the generic TE node attributes, to indicate that the TE node is a Flexi-Grid node as shown in Figure 4.

```
augment /nw:networks/nw:network/nw:node/tet:te
        /tet:te-node-attributes:
  +--rw flexi-grid-node!
```

Figure 4: Flex-Grid Node Augmentation

It is assumed that all the flexi-grid nodes are reconfigurable.

5.3. Bandwidth Augmentation

No bandwidth augmentations are needed for this YANG module.

As described in Section 4.2 of [RFC7699], there is some overlap between bandwidth and label in Layer 0.

The flexi-grid label resource information described in Section 5.4, is sufficient to also describe the spectrum resources within a flexi-grid network. Therefore, the model does not define any augmentation for the te-bandwidth containers defined in [RFC8795].

5.4. Label Augmentation

The model augments all the occurrences of the label-restriction list in [RFC8795] with flexi-grid technology specific attributes using the flexi-grid-label-range-info grouping defined in [I-D.ietf-ccamp-rfc9093-bis].

Moreover, following the guidelines in [RFC8795], the model augments all the occurrences of the te-label container with the flexi-grid technology specific attributes using the flexi-grid-label-start-end, flexi-grid-label-hop and flexi-grid-label-step groupings defined in [I-D.ietf-ccamp-rfc9093-bis].

6. YANG Model (Tree Structure) for Flexi-Grid Topology

module: ietf-flexi-grid-topology

```
  augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
    +--rw flexi-grid-topology!
  augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes:
    +--rw flexi-grid-node!
  augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes/tet:connectivity-matrices
            /tet:label-restrictions/tet:label-restriction:
    +--rw flexi-grid-label-range!
       +--rw grid-type?    identityref
       +--rw priority?     uint8
       +--rw flexi-grid
          +--rw slot-width-granularity?   identityref
          +--rw min-slot-width-factor?    uint16
          +--rw max-slot-width-factor?    uint16
  augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes/tet:connectivity-matrices
            /tet:connectivity-matrix/tet:from/tet:label-restrictions
            /tet:label-restriction:
    +--rw flexi-grid-label-range!
       +--rw grid-type?    identityref
       +--rw priority?     uint8
       +--rw flexi-grid
          +--rw slot-width-granularity?   identityref
          +--rw min-slot-width-factor?    uint16
          +--rw max-slot-width-factor?    uint16
```

```
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:te-node-attributes/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:to/tet:label-restrictions
          /tet:label-restriction:
  +--rw flexi-grid-label-range!
     +--rw grid-type?    identityref
     +--rw priority?     uint8
     +--rw flexi-grid
        +--rw slot-width-granularity?   identityref
        +--rw min-slot-width-factor?    uint16
        +--rw max-slot-width-factor?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:label-restrictions/tet:label-restriction:
  +--ro flexi-grid-label-range!
     +--ro grid-type?    identityref
     +--ro priority?     uint8
     +--ro flexi-grid
        +--ro slot-width-granularity?   identityref
        +--ro min-slot-width-factor?    uint16
        +--ro max-slot-width-factor?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:from/tet:label-restrictions
          /tet:label-restriction:
  +--ro flexi-grid-label-range!
     +--ro grid-type?    identityref
     +--ro priority?     uint8
     +--ro flexi-grid
        +--ro slot-width-granularity?   identityref
        +--ro min-slot-width-factor?    uint16
        +--ro max-slot-width-factor?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:to/tet:label-restrictions
          /tet:label-restriction:
  +--ro flexi-grid-label-range!
     +--ro grid-type?    identityref
     +--ro priority?     uint8
     +--ro flexi-grid
        +--ro slot-width-granularity?   identityref
        +--ro min-slot-width-factor?    uint16
        +--ro max-slot-width-factor?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:tunnel-termination-point
          /tet:local-link-connectivities/tet:label-restrictions
          /tet:label-restriction:
  +--rw flexi-grid-label-range!
```

```
          +--rw grid-type?    identityref
          +--rw priority?     uint8
          +--rw flexi-grid
             +--rw slot-width-granularity?   identityref
             +--rw min-slot-width-factor?    uint16
             +--rw max-slot-width-factor?    uint16
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity/tet:label-restrictions
               /tet:label-restriction:
       +--rw flexi-grid-label-range!
          +--rw grid-type?    identityref
          +--rw priority?     uint8
          +--rw flexi-grid
             +--rw slot-width-granularity?   identityref
             +--rw min-slot-width-factor?    uint16
             +--rw max-slot-width-factor?    uint16
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction:
       +--rw flexi-grid-label-range!
          +--rw grid-type?    identityref
          +--rw priority?     uint8
          +--rw flexi-grid
             +--rw slot-width-granularity?   identityref
             +--rw min-slot-width-factor?    uint16
             +--rw max-slot-width-factor?    uint16
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry/tet:label-restrictions
               /tet:label-restriction:
       +--ro flexi-grid-label-range!
          +--ro grid-type?    identityref
          +--ro priority?     uint8
          +--ro flexi-grid
             +--ro slot-width-granularity?   identityref
             +--ro min-slot-width-factor?    uint16
             +--ro max-slot-width-factor?    uint16
     augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction:
       +--rw flexi-grid-label-range!
          +--rw grid-type?    identityref
          +--rw priority?     uint8
          +--rw flexi-grid
             +--rw slot-width-granularity?   identityref
             +--rw min-slot-width-factor?    uint16
             +--rw max-slot-width-factor?    uint16
```

```
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-start/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-end/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--rw flexi-grid-channel-spacing?   identityref
          +--rw flexi-ncfg?                   identityref
          +--rw flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:underlay/tet:primary-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:underlay/tet:backup-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
```

```
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:optimizations/tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
            +--:(single)
            |  +--rw flexi-n?              flexi-n
            |  +--rw flexi-m?              flexi-m
            o--:(super)
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:optimizations/tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
            +--:(single)
            |  +--rw flexi-n?              flexi-n
            |  +--rw flexi-m?              flexi-m
            o--:(super)
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
```

```
                  +--rw flexi-n    flexi-n
                  +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:path-properties/tet:path-route-objects
               /tet:path-route-object/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:from/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:from/tet:label-restrictions
               /tet:label-restriction/tet:label-end/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:from/tet:label-restrictions
               /tet:label-restriction/tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--rw flexi-grid-channel-spacing?   identityref
          +--rw flexi-ncfg?                   identityref
          +--rw flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
```

```
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to/tet:label-restrictions
               /tet:label-restriction/tet:label-end/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to/tet:label-restrictions
               /tet:label-restriction/tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--rw flexi-grid-channel-spacing?   identityref
          +--rw flexi-ncfg?                   identityref
          +--rw flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay/tet:primary-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay/tet:backup-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
```

```
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations/tet:algorithm
               /tet:metric/tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations/tet:algorithm
               /tet:metric/tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
```

```
                  +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:path-properties
               /tet:path-route-objects/tet:path-route-object/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-start/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-end/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--ro flexi-grid-channel-spacing?   identityref
          +--ro flexi-ncfg?                   identityref
          +--ro flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:underlay/tet:primary-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
```

```
            |  +--ro flexi-m?             flexi-m
            o--:(super)
            |  o--ro subcarrier-flexi-n* [flexi-n]
            |     +--ro flexi-n    flexi-n
            |     +--ro flexi-m?   flexi-m
            +--:(multi)
               +--ro frequency-slots
                  +--ro frequency-slot* [flexi-n]
                     +--ro flexi-n    flexi-n
                     +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:underlay/tet:backup-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?             flexi-n
             |  +--ro flexi-m?             flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:optimizations/tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?             flexi-n
             |  +--ro flexi-m?             flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
```

```
                  +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:optimizations/tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:path-properties/tet:path-route-objects
               /tet:path-route-object/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:from/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--ro flexi-n?   flexi-n
```

```
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:from/tet:label-restrictions
          /tet:label-restriction/tet:label-end/tet:te-label
          /tet:technology:
  +--:(flexi-grid)
     +--ro flexi-n?   flexi-n
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:from/tet:label-restrictions
          /tet:label-restriction/tet:label-step/tet:technology:
  +--:(flexi-grid)
     o--ro flexi-grid-channel-spacing?   identityref
     +--ro flexi-ncfg?                   identityref
     +--ro flexi-n-step?                 uint8
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:to/tet:label-restrictions
          /tet:label-restriction/tet:label-start/tet:te-label
          /tet:technology:
  +--:(flexi-grid)
     +--ro flexi-n?   flexi-n
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:to/tet:label-restrictions
          /tet:label-restriction/tet:label-end/tet:te-label
          /tet:technology:
  +--:(flexi-grid)
     +--ro flexi-n?   flexi-n
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:to/tet:label-restrictions
          /tet:label-restriction/tet:label-step/tet:technology:
  +--:(flexi-grid)
     o--ro flexi-grid-channel-spacing?   identityref
     +--ro flexi-ncfg?                   identityref
     +--ro flexi-n-step?                 uint8
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:underlay/tet:primary-path
          /tet:path-element/tet:type/tet:label/tet:label-hop
          /tet:te-label/tet:technology:
  +--:(flexi-grid)
     +--ro (single-or-super-channel)?
        +--:(single)
        |  +--ro flexi-n?              flexi-n
        |  +--ro flexi-m?              flexi-m
        o--:(super)
```

```
            |  o--ro subcarrier-flexi-n* [flexi-n]
            |     +--ro flexi-n    flexi-n
            |     +--ro flexi-m?   flexi-m
            +--:(multi)
               +--ro frequency-slots
                  +--ro frequency-slot* [flexi-n]
                     +--ro flexi-n    flexi-n
                     +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay/tet:backup-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations/tet:algorithm
               /tet:metric/tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
                      +--ro flexi-n    flexi-n
                      +--ro flexi-m?   flexi-m
```

```
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:optimizations/tet:algorithm
          /tet:metric/tet:optimization-metric
          /tet:explicit-route-include-objects
          /tet:route-object-include-object/tet:type/tet:label
          /tet:label-hop/tet:te-label/tet:technology:
  +--:(flexi-grid)
     +--ro (single-or-super-channel)?
        +--:(single)
        |  +--ro flexi-n?             flexi-n
        |  +--ro flexi-m?             flexi-m
        o--:(super)
        |  o--ro subcarrier-flexi-n* [flexi-n]
        |     +--ro flexi-n    flexi-n
        |     +--ro flexi-m?   flexi-m
        +--:(multi)
           +--ro frequency-slots
              +--ro frequency-slot* [flexi-n]
                 +--ro flexi-n    flexi-n
                 +--ro flexi-m?   flexi-m
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry/tet:connectivity-matrices
          /tet:connectivity-matrix/tet:path-properties
          /tet:path-route-objects/tet:path-route-object/tet:type
          /tet:label/tet:label-hop/tet:te-label/tet:technology:
  +--:(flexi-grid)
     +--ro (single-or-super-channel)?
        +--:(single)
        |  +--ro flexi-n?             flexi-n
        |  +--ro flexi-m?             flexi-m
        o--:(super)
        |  o--ro subcarrier-flexi-n* [flexi-n]
        |     +--ro flexi-n    flexi-n
        |     +--ro flexi-m?   flexi-m
        +--:(multi)
           +--ro frequency-slots
              +--ro frequency-slot* [flexi-n]
                 +--ro flexi-n    flexi-n
                 +--ro flexi-m?   flexi-m
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:tunnel-termination-point
          /tet:local-link-connectivities/tet:label-restrictions
          /tet:label-restriction/tet:label-start/tet:te-label
          /tet:technology:
  +--:(flexi-grid)
     +--rw flexi-n?   flexi-n
augment /nw:networks/nw:network/nw:node/tet:te
```

```
            /tet:tunnel-termination-point
            /tet:local-link-connectivities/tet:label-restrictions
            /tet:label-restriction/tet:label-end/tet:te-label
            /tet:technology:
      +--:(flexi-grid)
         +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities/tet:label-restrictions
            /tet:label-restriction/tet:label-step/tet:technology:
      +--:(flexi-grid)
         o--rw flexi-grid-channel-spacing?   identityref
         +--rw flexi-ncfg?                   identityref
         +--rw flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities/tet:underlay
            /tet:primary-path/tet:path-element/tet:type/tet:label
            /tet:label-hop/tet:te-label/tet:technology:
      +--:(flexi-grid)
         +--rw (single-or-super-channel)?
            +--:(single)
            |  +--rw flexi-n?              flexi-n
            |  +--rw flexi-m?              flexi-m
            o--:(super)
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities/tet:underlay
            /tet:backup-path/tet:path-element/tet:type/tet:label
            /tet:label-hop/tet:te-label/tet:technology:
      +--:(flexi-grid)
         +--rw (single-or-super-channel)?
            +--:(single)
            |  +--rw flexi-n?              flexi-n
            |  +--rw flexi-m?              flexi-m
            o--:(super)
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
```

```
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:optimizations
               /tet:algorithm/tet:metric/tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:optimizations
               /tet:algorithm/tet:metric/tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
```

```
            /tet:local-link-connectivities/tet:path-properties
            /tet:path-route-objects/tet:path-route-object/tet:type
            /tet:label/tet:label-hop/tet:te-label/tet:technology:
      +--:(flexi-grid)
         +--ro (single-or-super-channel)?
            +--:(single)
            |  +--ro flexi-n?             flexi-n
            |  +--ro flexi-m?             flexi-m
            o--:(super)
            |  o--ro subcarrier-flexi-n* [flexi-n]
            |     +--ro flexi-n    flexi-n
            |     +--ro flexi-m?   flexi-m
            +--:(multi)
               +--ro frequency-slots
                  +--ro frequency-slot* [flexi-n]
                     +--ro flexi-n    flexi-n
                     +--ro flexi-m?   flexi-m
   augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities
            /tet:local-link-connectivity/tet:label-restrictions
            /tet:label-restriction/tet:label-start/tet:te-label
            /tet:technology:
      +--:(flexi-grid)
         +--rw flexi-n?   flexi-n
   augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities
            /tet:local-link-connectivity/tet:label-restrictions
            /tet:label-restriction/tet:label-end/tet:te-label
            /tet:technology:
      +--:(flexi-grid)
         +--rw flexi-n?   flexi-n
   augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities
            /tet:local-link-connectivity/tet:label-restrictions
            /tet:label-restriction/tet:label-step/tet:technology:
      +--:(flexi-grid)
         o--rw flexi-grid-channel-spacing?   identityref
         +--rw flexi-ncfg?                   identityref
         +--rw flexi-n-step?                 uint8
   augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point
            /tet:local-link-connectivities
            /tet:local-link-connectivity/tet:underlay
            /tet:primary-path/tet:path-element/tet:type/tet:label
            /tet:label-hop/tet:te-label/tet:technology:
```

```
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?             flexi-n
             |  +--rw flexi-m?             flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity/tet:underlay/tet:backup-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?             flexi-n
             |  +--rw flexi-m?             flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity/tet:optimizations
               /tet:algorithm/tet:metric/tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?             flexi-n
             |  +--rw flexi-m?             flexi-m
             o--:(super)
```

```
            |  o--rw subcarrier-flexi-n* [flexi-n]
            |     +--rw flexi-n    flexi-n
            |     +--rw flexi-m?   flexi-m
            +--:(multi)
               +--rw frequency-slots
                  +--rw frequency-slot* [flexi-n]
                     +--rw flexi-n    flexi-n
                     +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity/tet:optimizations
               /tet:algorithm/tet:metric/tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type/tet:label
               /tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity/tet:path-properties
               /tet:path-route-objects/tet:path-route-object/tet:type
               /tet:label/tet:label-hop/tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--ro (single-or-super-channel)?
             +--:(single)
             |  +--ro flexi-n?              flexi-n
             |  +--ro flexi-m?              flexi-m
             o--:(super)
             |  o--ro subcarrier-flexi-n* [flexi-n]
             |     +--ro flexi-n    flexi-n
             |     +--ro flexi-m?   flexi-m
             +--:(multi)
                +--ro frequency-slots
                   +--ro frequency-slot* [flexi-n]
```

```
                  +--ro flexi-n    flexi-n
                  +--ro flexi-m?   flexi-m
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:underlay/tet:primary-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?             flexi-n
             |  +--rw flexi-m?             flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:underlay/tet:backup-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?             flexi-n
             |  +--rw flexi-m?             flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-end/tet:te-label
               /tet:technology:
```

```
       +--:(flexi-grid)
          +--rw flexi-n?   flexi-n
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--rw flexi-grid-channel-spacing?   identityref
          +--rw flexi-ncfg?                   identityref
          +--rw flexi-n-step?                 uint8
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--ro flexi-n?   flexi-n
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry/tet:label-restrictions
               /tet:label-restriction/tet:label-end/tet:te-label
               /tet:technology:
       +--:(flexi-grid)
          +--ro flexi-n?   flexi-n
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry/tet:label-restrictions
               /tet:label-restriction/tet:label-step/tet:technology:
       +--:(flexi-grid)
          o--ro flexi-grid-channel-spacing?   identityref
          +--ro flexi-ncfg?                   identityref
          +--ro flexi-n-step?                 uint8
     augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:underlay/tet:primary-path
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
       +--:(flexi-grid)
          +--rw (single-or-super-channel)?
             +--:(single)
             |  +--rw flexi-n?              flexi-n
             |  +--rw flexi-m?              flexi-m
             o--:(super)
             |  o--rw subcarrier-flexi-n* [flexi-n]
             |     +--rw flexi-n    flexi-n
             |     +--rw flexi-m?   flexi-m
             +--:(multi)
                +--rw frequency-slots
                   +--rw frequency-slot* [flexi-n]
                      +--rw flexi-n    flexi-n
                      +--rw flexi-m?   flexi-m
     augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:underlay/tet:backup-path
```

```
               /tet:path-element/tet:type/tet:label/tet:label-hop
               /tet:te-label/tet:technology:
         +--:(flexi-grid)
            +--rw (single-or-super-channel)?
               +--:(single)
               |  +--rw flexi-n?             flexi-n
               |  +--rw flexi-m?             flexi-m
               o--:(super)
               |  o--rw subcarrier-flexi-n* [flexi-n]
               |     +--rw flexi-n    flexi-n
               |     +--rw flexi-m?   flexi-m
               +--:(multi)
                  +--rw frequency-slots
                     +--rw frequency-slot* [flexi-n]
                        +--rw flexi-n    flexi-n
                        +--rw flexi-m?   flexi-m
      augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-start/tet:te-label
               /tet:technology:
         +--:(flexi-grid)
            +--rw flexi-n?   flexi-n
      augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-end/tet:te-label
               /tet:technology:
         +--:(flexi-grid)
            +--rw flexi-n?   flexi-n
      augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes/tet:label-restrictions
               /tet:label-restriction/tet:label-step/tet:technology:
         +--:(flexi-grid)
            o--rw flexi-grid-channel-spacing?   identityref
            +--rw flexi-ncfg?                   identityref
            +--rw flexi-n-step?                 uint8
```

Figure 5

7. The YANG Code for Flexi-grid topology

```
<CODE BEGINS> file "ietf-flexi-grid-topology@2023-12-15.yang"
module ietf-flexi-grid-topology {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-flexi-grid-topology";
  prefix "flexgt";

  import ietf-network {
    prefix "nw";
```

```
      reference
        "RFC 8345: A YANG Data Model for Network Topologies";
    }

    import ietf-network-topology {
      prefix "nt";
      reference
        "RFC 8345: A YANG Data Model for Network Topologies";
    }

    import ietf-te-topology {
      prefix "tet";
      reference
        "RFC 8795: YANG Data Model for Traffic Engineering
         (TE) Topologies";
    }

    import ietf-layer0-types {
      prefix "l0-types";
      reference
        "RFC YYYY: A YANG Data Model for Layer 0 Types";
    }
    /* Note: The RFC Editor will replace YYYY with the number assigned
       to the RFC once draft-ietf-ccamp-rfc9093-bis becomes an RFC.*/

    organization
       "IETF CCAMP Working Group";
    contact
      "WG Web: <https://datatracker.ietf.org/wg/ccamp/>

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

       Editor: Jorge E. Lopez de Vergara
               <mailto:jorge.lopez_vergara@uam.es>

       Editor: Daniel Perdices
               <mailto:daniel.perdices@uam.es>

       Editor: Haomian Zheng
               <mailto:zhenghaomian@huawei.com>

       Editor: Daniel King
               <mailto:d.king@lancaster.ac.uk>

       Editor: Young Lee
               <mailto:younglee.tx@gmail.com>";

    description
```

```
       "This YANG module defines a topology model for flexi-grid
        optical networks. The model augments the technology-agnostic
        TE topology model with flexi-grid technology specific
        definitions, based on RFC 7698 and RFC 7699.

        The model fully conforms to the Network Management Datastore
        Architecture (NMDA).

        Copyright (c) 2023 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 Revised
        BSD License set forth in Section 4.c of the IETF Trust's
        Legal Provisions Relating to IETF Documents
        (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX; see
        the RFC itself for full legal notices.

        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 (RFC 2119) (RFC 8174) when, and only when,
        they appear in all capitals, as shown here.";
      reference
        "RFC 7698: Framework and Requirements for GMPLS-Based Control
          of Flexi-Grid Dense Wavelength Division Multiplexing
          (DWDM) Networks;
         RFC 7699: Generalized Labels for the Flexi-Grid in Lambda
          Switch Capable (LSC) Label Switching Routers.";

    revision 2023-12-15 {
      description
        "Initial Version";
      reference
        "RFC XXXX: A YANG Data Model for Flexi-Grid Optical Networks";
      // RFC Ed.: replace XXXX with actual RFC number, update date
      // information and remove this note
    }

    /*
     * Groupings
     */

    grouping label-range-info {
      description
```

```
        "Flexi-grid-specific label range related information with a
        presence container indicating whether the label range is a
        flexi-grid label range.";
      container flexi-grid-label-range {
        presence
          "Indicates the label range is a flexi-grid label range.

          This container MUST NOT be present if there are other
          presence containers or attributes indicating another type
          of label range.";
        description
          "Flexi-grid-specific label range related information.";
        uses l0-types:flexi-grid-label-range-info;
      }
    }

    /*
     * Data nodes
     */

    augment "/nw:networks/nw:network/nw:network-types"
          + "/tet:te-topology" {
      description
        "Augment network types to define flexi-grid topology type.";
      container flexi-grid-topology {
        presence
          "Its presence identifies the flexi-grid topology type.";
        description
          "Introduce new network type for flexi-grid topology.";
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te"
          + "/tet:te-node-attributes" {
      when "/nw:networks/nw:network/nw:network-types"
         + "/tet:te-topology/flexgt:flexi-grid-topology" {
        description
        "Augmentation parameters apply only for networks with
         flexi-grid topology type.";
      }
      description "Augment TE node attributes.";
      container flexi-grid-node {
        presence "The TE node is a flexi-grid node.";
        description
          "Introduce new TE node type for flexi-grid node.";
      }
    }
```

```
     /*
      * Augment TE label range information
      */

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:te-node-attributes/tet:connectivity-matrices/"
           + "tet:label-restrictions/tet:label-restriction" {
       when "../../../../../../nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label range information for the TE node
          connectivity matrices.";
       uses label-range-info;
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:te-node-attributes/tet:connectivity-matrices/"
           + "tet:connectivity-matrix/tet:from/"
           + "tet:label-restrictions/tet:label-restriction" {
       when "../../../../../../../../nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label range information for the source Link
          Termination Point (LTP) of the connectivity matrix entry.";
       uses label-range-info;
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:te-node-attributes/tet:connectivity-matrices/"
           + "tet:connectivity-matrix/tet:to/"
           + "tet:label-restrictions/tet:label-restriction" {
       when "../../../../../../../../nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label range information for the destination LTP
          of the connectivity matrix entry.";
```

```
      uses label-range-info;
    }
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/"
          + "tet:connectivity-matrices/tet:label-restrictions/"
          + "tet:label-restriction" {
      when "../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the TE node
         connectivity matrices information source.";
      uses label-range-info;
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:from/tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the source LTP
         of the connectivity matrix entry information source.";
      uses label-range-info;
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:to/tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the destination LTP
         of the connectivity matrix entry information source.";
      uses label-range-info;
```

```
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the Tunnel
        Termination Point (TTP) Local Link Connectivities.";
      uses label-range-info;
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the TTP
         Local Link Connectivity entry.";
      uses label-range-info;
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the TE link.";
      uses label-range-info;
    }
```

```
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range information for the TE link
         information source.";
      uses label-range-info;
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction" {
      description
        "Augment TE label range information for the TE link template.";
      uses label-range-info;
    }

    /*
     * Augment TE label
     */

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the TE node
         connectivity matrices.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
```

```
          + "tet:label-restrictions/"
          + "tet:label-restriction/tet:label-end/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the TE node
         connectivity matrices.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:label-restrictions/"
          + "tet:label-restriction/tet:label-step/"
          + "tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the TE node
         connectivity matrices.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:underlay/tet:primary-path/tet:path-element/"
          + "tet:type/tet:label/tet:label-hop/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
```

```
        description
          "Augment TE label hop for the underlay primary path of the
           TE node connectivity matrices.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:underlay/tet:backup-path/tet:path-element/"
            + "tet:type/tet:label/tet:label-hop/"
            + "tet:te-label/tet:technology" {
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the underlay backup path of the
           TE node connectivity matrices.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:optimizations/tet:algorithm/tet:metric/"
            + "tet:optimization-metric/"
            + "tet:explicit-route-exclude-objects/"
            + "tet:route-object-exclude-object/"
            + "tet:type/tet:label/tet:label-hop/"
            + "tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the explicit route objects excluded
           by the path computation of the TE node connectivity
           matrices.";
        case flexi-grid {
```

```
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/"
          + "tet:type/tet:label/tet:label-hop/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects included
         by the path computation of the TE node connectivity
         matrices.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/tet:label/tet:label-hop/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the computed path route objects
         of the TE node connectivity matrices.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }
```

```
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the source LTP
         of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the source LTP
         of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/"
          + "tet:technology" {
```

```
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range step for the source LTP
           of the connectivity matrix entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-step;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/tet:to/"
            + "tet:label-restrictions/tet:label-restriction/"
            + "tet:label-start/"
            + "tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range start for the destination LTP
           of the connectivity matrix entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/tet:to/"
            + "tet:label-restrictions/tet:label-restriction/"
            + "tet:label-end/"
            + "tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
```

```
        }
        description
          "Augment TE label range end for the destination LTP
           of the connectivity matrix entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/tet:to/"
            + "tet:label-restrictions/tet:label-restriction/"
            + "tet:label-step/"
            + "tet:technology" {
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range step for the destination LTP
           of the connectivity matrix entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-step;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:te-node-attributes/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:underlay/tet:primary-path/tet:path-element/"
            + "tet:type/tet:label/tet:label-hop/"
            + "tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the underlay primary path
           of the connectivity matrix entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
```

```
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:underlay/tet:backup-path/tet:path-element/"
          + "tet:type/tet:label/tet:label-hop/"
          + "tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay backup path
         of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:optimizations/"
          + "tet:algorithm/tet:metric/tet:optimization-metric/"
          + "tet:explicit-route-exclude-objects/"
          + "tet:route-object-exclude-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects excluded
         by the path computation of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
```

```
          + "tet:connectivity-matrix/tet:optimizations/"
          + "tet:algorithm/tet:metric/tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects included
         by the path computation of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the computed path route objects
         of the connectivity matrix entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/"
          + "tet:connectivity-matrices/tet:label-restrictions/"
          + "tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
```

```
          + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the TE node connectivity
         matrices information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/"
          + "tet:connectivity-matrices/tet:label-restrictions/"
          + "tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      when "../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the TE node connectivity
         matrices information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/"
          + "tet:connectivity-matrices/tet:label-restrictions/"
          + "tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the TE node connectivity
         matrices information source.";
```

```
       case flexi-grid {
         uses l0-types:flexi-grid-label-step;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:information-source-entry/tet:connectivity-matrices/"
           + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
           + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
       when "../../../../../../../../../"
          + "nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label hop for the underlay primary path
          of the TE node connectivity matrices of the information
          source entry.";
       case flexi-grid {
         uses l0-types:flexi-grid-label-hop;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:information-source-entry/tet:connectivity-matrices/"
           + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
           + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
       when "../../../../../../../../../"
          + "nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label hop for the underlay backup path
          of the TE node connectivity matrices of the information
          source entry.";
       case flexi-grid {
         uses l0-types:flexi-grid-label-hop;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:information-source-entry/tet:connectivity-matrices/"
           + "tet:optimizations/tet:algorithm/tet:metric/"
```

```
          + "tet:optimization-metric/"
          + "tet:explicit-route-exclude-objects/"
          + "tet:route-object-exclude-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects excluded
         by the path computation of the TE node connectivity matrices
         information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects included
         by the path computation of the TE node connectivity matrices
         information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
```

```
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the computed path route objects
           of the TE node connectivity matrices information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:from/tet:label-restrictions/"
            + "tet:label-restriction/"
            + "tet:label-start/tet:te-label/tet:technology" {
        when "../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range start for the source LTP
           of the connectivity matrix entry information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }
      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:from/tet:label-restrictions/"
            + "tet:label-restriction/"
            + "tet:label-end/tet:te-label/tet:technology" {
        when "../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
```

```
        description
          "Augment TE label range end for the source LTP
           of the connectivity matrix entry information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:from/tet:label-restrictions/"
            + "tet:label-restriction/"
            + "tet:label-step/tet:technology" {
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range step for the source LTP
           of the connectivity matrix entry information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-step;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:to/tet:label-restrictions/tet:label-restriction/"
            + "tet:label-start/tet:te-label/tet:technology" {
        when "../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range start for the destination LTP
           of the connectivity matrix entry information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }
```

```
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:to/tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the destination LTP
         of the connectivity matrix entry information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:to/tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the destination LTP
         of the connectivity matrix entry information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
```

```
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay primary path
         of the connectivity matrix entry information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay backup path
         of the connectivity matrix entry information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-exclude-objects/"
          + "tet:route-object-exclude-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
```

```
          "Augment TE label hop for the explicit route objects excluded
           by the path computation of the connectivity matrix entry
           information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:optimizations/tet:algorithm/tet:metric/"
            + "tet:optimization-metric/"
            + "tet:explicit-route-include-objects/"
            + "tet:route-object-include-object/tet:type/"
            + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the explicit route objects included
           by the path computation of the connectivity matrix entry
           information source.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-hop;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:information-source-entry/tet:connectivity-matrices/"
            + "tet:connectivity-matrix/"
            + "tet:path-properties/tet:path-route-objects/"
            + "tet:path-route-object/tet:type/"
            + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
        when "../../../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label hop for the computed path route objects
           of the connectivity matrix entry information source.";
```

```
       case flexi-grid {
         uses l0-types:flexi-grid-label-hop;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-start/"
         + "tet:te-label/tet:technology" {
       when "../../../../../../../../"
          + "nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label range start for the TTP
          Local Link Connectivities.";
       case flexi-grid {
         uses l0-types:flexi-grid-label-start-end;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
           + "tet:tunnel-termination-point/"
           + "tet:local-link-connectivities/"
           + "tet:label-restrictions/tet:label-restriction/"
           + "tet:label-end/"
           + "tet:te-label/tet:technology"{
       when "../../../../../../../../"
          + "nw:network-types/tet:te-topology/"
          + "flexgt:flexi-grid-topology" {
         description
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
       }
       description
         "Augment TE label range end for the TTP
          Local Link Connectivities.";
       case flexi-grid {
         uses l0-types:flexi-grid-label-start-end;
       }
     }

     augment "/nw:networks/nw:network/nw:node/tet:te/"
```

```
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/"
          + "tet:technology"{
      when "../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the TTP
         Local Link Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay primary path
         of the TTP Local Link Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
```

```
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay backup path
         of the TTP Local Link Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-exclude-objects/"
          + "tet:route-object-exclude-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects excluded
         by the path computation of the TTP Local Link
         Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
```

```
           "Augmentation parameters apply only for networks with
            flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects included
         by the path computation of the TTP Local Link
         Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the computed path route objects
         of the TTP Local Link Connectivities.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the TTP
```

```
          Local Link Connectivity entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:tunnel-termination-point/"
            + "tet:local-link-connectivities/"
            + "tet:local-link-connectivity/"
            + "tet:label-restrictions/tet:label-restriction/"
            + "tet:label-end/tet:te-label/tet:technology" {
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range end for the TTP
           Local Link Connectivity entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-start-end;
        }
      }

      augment "/nw:networks/nw:network/nw:node/tet:te/"
            + "tet:tunnel-termination-point/"
            + "tet:local-link-connectivities/"
            + "tet:local-link-connectivity/"
            + "tet:label-restrictions/tet:label-restriction/"
            + "tet:label-step/tet:technology" {
        when "../../../../../../../../../"
           + "nw:network-types/tet:te-topology/"
           + "flexgt:flexi-grid-topology" {
          description
            "Augmentation parameters apply only for networks with
             flexi-grid topology type.";
        }
        description
          "Augment TE label range step for the TTP
           Local Link Connectivity entry.";
        case flexi-grid {
          uses l0-types:flexi-grid-label-step;
        }
      }
```

```
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay primary path
         of the TTP Local Link Connectivity entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay backup path
         of the TTP Local Link Connectivity entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
```

```
          + "tet:explicit-route-exclude-objects/"
          + "tet:route-object-exclude-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects excluded
         by the path computation of the TTP Local Link
         Connectivity entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the explicit route objects included
         by the path computation of the TTP Local Link
         Connectivity entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity/"
```

```
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the computed path route objects
         of the TTP Local Link Connectivity entry.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label hop for the underlay primary path
         of the TE link.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
```

```
        "Augment TE label hop for the underlay backup path
         of the TE link.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the TE link.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the TE link.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
```

```
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the TE link.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range start for the TE link
         information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range end for the TE link
         information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
```

```
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../nw:network-types/tet:te-topology/"
         + "flexgt:flexi-grid-topology" {
        description
          "Augmentation parameters apply only for networks with
           flexi-grid topology type.";
      }
      description
        "Augment TE label range step for the TE link
         information source.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      description
        "Augment TE label hop for the underlay primary path
         of the TE link template.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      description
        "Augment TE label hop for the underlay backup path
         of the TE link template.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-hop;
      }
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      description
        "Augment TE label range start for the TE link template.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
```

```
      }
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      description
        "Augment TE label range end for the TE link template.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-start-end;
      }
    }

    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      description
        "Augment TE label range step for the TE link template.";
      case flexi-grid {
        uses l0-types:flexi-grid-label-step;
      }
    }
  }
  <CODE ENDS>
```

Figure 6

8. 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 Transport Layer Security (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 SSH [RFC6242] describes a method for invoking and running NETCONF within a 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. These are the subtrees and data nodes and their sensitivity/vulnerability:

```
/nw:networks/nw:network/nw:network-types/tet:te-topology
/nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
/nw:networks/nw:network/nw:node/nt:termination-point/tet:te
/nw:networks/nw:network/nw:node/tet:te/tet:te-node-attributes
/te-connectivity-matrices/te-connectivity-matrix/tet:path-
constraints/tet:te-bandwidth/tet:technology
/nw:networks/nw:network/nw:node/tet:te
/tet:tunnel-termination-point/tet:local-link-connectivities
/tet:label-restrictions/tet:label-restriction
```

9. IANA Considerations

IANA is requested to assigned a new URI from the "IETF XML Registry" [RFC3688] as follows:

```
URI: urn:ietf:params:xml:ns:yang:ietf-flexi-grid-topology
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.
```

IANA is requested to assign a new YANG module name in the "YANG Module Names" registry [RFC6020] as follows:

```
Name: ietf-flexi-grid-topology
Namespace: urn:ietf:params:xml:ns:yang:ietf-flexi-grid-topology
Prefix: flexgt
Reference: RFC XXXX
```

10. References

10.1. Normative References

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