

CCAMP Working Group  
Internet-Draft  
Intended status: Standards Track  
Expires: February 24, 2019

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**A YANG Data Model for Optical Transport Network Topology  
draft-ietf-ccamp-otn-topo-yang-05**

Abstract

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

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

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Table of Contents

- [1. Introduction](#) . . . . . [2](#)
- [2. Terminology and Notations](#) . . . . . [3](#)
- [3. YANG Data Model for OTN Topology](#) . . . . . [4](#)
  - [3.1. OTN Topology Data Model Overview](#) . . . . . [4](#)
  - [3.2. YANG Tree for OTN topology](#) . . . . . [5](#)
- [4. The YANG Code](#) . . . . . [21](#)
- [5. IANA Considerations](#) . . . . . [54](#)
- [6. Security Considerations](#) . . . . . [54](#)
- [7. Acknowledgements](#) . . . . . [55](#)
- [8. Contributors](#) . . . . . [55](#)
- [9. References](#) . . . . . [56](#)
  - [9.1. Normative References](#) . . . . . [56](#)
  - [9.2. Informative References](#) . . . . . [57](#)
- Authors' Addresses . . . . . [58](#)

**1. Introduction**

A transport network is a server-layer network designed to provide connectivity services for a client-layer network to carry the client traffic transparently across the server-layer network resources. A transport network can be constructed of equipments utilizing any of a



number of different transport technologies such as the Optical Transport Networks (OTN) or packet transport as provided by the MPLS-Transport Profile (MPLS-TP).

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

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

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

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

## 2. Terminology and Notations

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in the YANG data tree presented later in this document is defined in [[RFC8340](#)]. They are provided below for reference.

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



- o Symbols after data node names: "?" means an optional node, "!" means a presence container, and "\*" denotes a list and leaf-list.
- o Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- o Ellipsis ("...") stands for contents of subtrees that are not shown.
- o Some of the key terms used in this document are listed as follow.
- o TS: Tributary Slot.
- o TSG: Tributary Slot Granularity.
- o TPN: Tributary Port Number.

### **3. YANG Data Model for OTN Topology**

#### **3.1. OTN Topology Data Model Overview**

This document aims to describe the data model for OTN topology. As a classic Traffic-engineering (TE) technology, OTN provide TDM switching in transport network. Therefore the YANG module presented in this document augments from a more generic Traffic Engineered (TE) network topology data model, i.e., the [ietf-te-topology.yang](#), as specified in [[I-D.ietf-teas-yang-te-topo](#)]. In section 6 of [[I-D.ietf-teas-yang-te-topo](#)], the guideline for augmenting TE topology model was provided, and in this draft we respectively augment the OTN attributes, TE bandwidth and TE label.

The entities and TE attributes, such as node, termination points and links, are still applicable for describing an OTN topology and the model presented in this document only specifies with technology-specific attributes/information. In OTN attributes augmentation, mainly OTN-specific parameters are included such as Tributary Slot Granularity (TSG), payload type and so on.

For different order of ODU in OTN technology, the te-bandwidth is augmented to allow specifying the type of ODU container and the number a link can support per priority level. For example, for a ODU3 link, it may advertise 32\*ODU0, 16\*ODU1, 4\*ODU2 available, assuming only a single priority level is supported. If one of ODU2 resource is taken to establish a ODU path, then the availability of this ODU link is updated as 24\*ODU0, 12\*ODU1, 3\*ODU2 available. If there are equipment hardware limitations, then a subset of potential ODU type SHALL be advertised. For instance, an ODU3 link may only support 4\*ODU2.



The types of OTN label can be divided into the tributary ports and the tributary slots, represented by TPN or TS list respectively. In the TE-label augmentation, two optional label formats are available for label representation.

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

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

### 3.2. YANG Tree for OTN topology

The following OTN specific attributes have been augmented to TE topology models.

```

module: ietf-otn-topology
  augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
    +-rw otn-topology!
  augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes:
    +-rw tsg?          identityref
    +-rw distance?    uint32
  augment /nw:networks/nw:network/nw:node/nt:termination-point/tet:te:
    +-rw supported-payload-types* [index]
    | +-rw index          uint16
    | +-rw payload-type?  string
    +-rw client-facing?   boolean

```

The technology specific TE bandwidth for OTN topology can be specified using the following augment statements:

```

augment /nw:networks/nw:network/nw:node/nt:termination-point/tet:te
  /tet:interface-switching-capability/tet:max-lsp-bandwidth
  /tet:te-bandwidth/tet:technology:
  +--:(otn)
    +-rw odu-type?  identityref
  augment /nw:networks/nw:network/nw:node/tet:te/tet:te-node-attributes
    /tet:connectivity-matrices/tet:path-constraints
    /tet:te-bandwidth/tet:technology:
    +--:(otn)
      +-rw odulist* [odu-type]
        +-rw odu-type  identityref
        +-rw number?   uint16
  augment /nw:networks/nw:network/nw:node/tet:te/tet:te-node-attributes

```





```

    /tet:connectivity-matrices/tet:connectivity-matrix
    /tet:path-constraints/tet:te-bandwidth/tet:technology:
+--:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type    identityref
    +--rw number?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:information-source-entry/tet:connectivity-matrices
  /tet:path-constraints/tet:te-bandwidth/tet:technology:
+--:(otn)
  +--ro odulist* [odu-type]
    +--ro odu-type    identityref
    +--ro number?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:information-source-entry/tet:connectivity-matrices
  /tet:connectivity-matrix/tet:path-constraints
  /tet:te-bandwidth/tet:technology:
+--:(otn)
  +--ro odulist* [odu-type]
    +--ro odu-type    identityref
    +--ro number?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:tunnel-termination-point/tet:client-layer-adaptation
  /tet:switching-capability/tet:te-bandwidth/tet:technology:
+--:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type    identityref
    +--rw number?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:tunnel-termination-point/tet:local-link-connectivities
  /tet:path-constraints/tet:te-bandwidth/tet:technology:
+--:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type    identityref
    +--rw number?    uint16
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:tunnel-termination-point/tet:local-link-connectivities
  /tet:local-link-connectivity/tet:path-constraints
  /tet:te-bandwidth/tet:technology:
+--:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type    identityref
    +--rw number?    uint16
augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
  /tet:interface-switching-capability/tet:max-lsp-bandwidth
  /tet:te-bandwidth/tet:technology:
+--:(otn)
  +--rw odu-type?    identityref

```



```
augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
  /tet:max-link-bandwidth/tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--rw odulist* [odu-type]
      +--rw odu-type   identityref
      +--rw number?   uint16
augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
  /tet:max-resv-link-bandwidth/tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--rw odulist* [odu-type]
      +--rw odu-type   identityref
      +--rw number?   uint16
augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
  /tet:unreserved-bandwidth/tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--rw odulist* [odu-type]
      +--rw odu-type   identityref
      +--rw number?   uint16
augment /nw:networks/nw:network/nt:link/tet:te
  /tet:information-source-entry
  /tet:interface-switching-capability/tet:max-lsp-bandwidth
  /tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--ro odu-type?   identityref
augment /nw:networks/nw:network/nt:link/tet:te
  /tet:information-source-entry/tet:max-link-bandwidth
  /tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--ro odulist* [odu-type]
      +--ro odu-type   identityref
      +--ro number?   uint16
augment /nw:networks/nw:network/nt:link/tet:te
  /tet:information-source-entry
  /tet:max-resv-link-bandwidth/tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--ro odulist* [odu-type]
      +--ro odu-type   identityref
      +--ro number?   uint16
augment /nw:networks/nw:network/nt:link/tet:te
  /tet:information-source-entry/tet:unreserved-bandwidth
  /tet:te-bandwidth/tet:technology:
  +--:(otn)
    +--ro odulist* [odu-type]
      +--ro odu-type   identityref
      +--ro number?   uint16
augment /nw:networks/tet:te/tet:templates/tet:link-template
  /tet:te-link-attributes/tet:interface-switching-capability
  /tet:max-lsp-bandwidth/tet:te-bandwidth/tet:technology:
```



```

+---:(otn)
  +--rw odu-type?  identityref
augment /nw:networks/tet:te/tet:templates/tet:link-template
  /tet:te-link-attributes/tet:max-link-bandwidth
  /tet:te-bandwidth/tet:technology:

```

```

+---:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type  identityref
    +--rw number?   uint16
augment /nw:networks/tet:te/tet:templates/tet:link-template
  /tet:te-link-attributes/tet:max-resv-link-bandwidth
  /tet:te-bandwidth/tet:technology:

```

```

+---:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type  identityref
    +--rw number?   uint16
augment /nw:networks/tet:te/tet:templates/tet:link-template
  /tet:te-link-attributes/tet:unreserved-bandwidth
  /tet:te-bandwidth/tet:technology:

```

```

+---:(otn)
  +--rw odulist* [odu-type]
    +--rw odu-type  identityref
    +--rw number?   uint16

```

The technology specific TE label for this OTN topology can be specified using the following augment statements:

```

augment /nw:networks/nw:network/nw:node/tet:te
  /tet:te-node-attributes/tet:connectivity-matrices
  /tet:label-restrictions/tet:label-restriction:

```

```

+--rw range-type?  identityref
+--rw tsg?         identityref
+--rw priority?    uint8

```

```

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:

```

```

+---:(otn)
  +--rw (otn-label-type)?
    +---:(tributary-port)
      | +--rw tpn?  uint16
    +---:(tributary-slot)
      +--rw ts?    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-end/tet:te-label
  /tet:technology:

```

```

+---:(otn)
  +--rw (otn-label-type)?
    +---:(tributary-port)

```



```

    | +--rw tpn?    uint16
    +--:(tributary-slot)
      +--rw ts?    uint16
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--ro tpn?      uint16
  +--ro tsg?      identityref
  +--ro ts-list?  string
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 range-type?   identityref
    +--rw tsg?          identityref
    +--rw priority?     uint8
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:
    +--:(otn)
        +--rw (otn-label-type)?
            +--:(tributary-port)
                | +--rw tpn?   uint16
            +--:(tributary-slot)
                +--rw ts?     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/tet:label-end
        /tet:te-label/tet:technology:
    +--:(otn)
        +--rw (otn-label-type)?
            +--:(tributary-port)
                | +--rw tpn?   uint16
            +--:(tributary-slot)
                +--rw ts?     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 range-type?   identityref
    +--rw tsg?          identityref
    +--rw priority?     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:
    +--:(otn)
        +--rw (otn-label-type)?
            +--:(tributary-port)
                | +--rw tpn?   uint16
            +--:(tributary-slot)
                +--rw ts?     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/tet:label-end
        /tet:te-label/tet:technology:
    +--:(otn)
        +--rw (otn-label-type)?
            +--:(tributary-port)

```



```

    | +--rw tpn?    uint16
    +--:(tributary-slot)
      +--rw ts?    uint16
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--rw tpn?      uint16
  +--rw tsg?      identityref
  +--rw ts-list?  string
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:
+--:(otn)
  +--ro tpn?      uint16
  +--ro tsg?      identityref
  +--ro ts-list?  string

```



```

augment /nw:networks/nw:network/nw:node/tet:te
  /tet:information-source-entry/tet:connectivity-matrices
  /tet:label-restrictions/tet:label-restriction:
  +--ro range-type?   identityref
  +--ro tsg?          identityref
  +--ro priority?     uint8
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:
  +--:(otn)
    +--ro (otn-label-type)?
      +--:(tributary-port)
        | +--ro tpn?   uint16
      +--:(tributary-slot)
        +--ro ts?    uint16
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:
  +--:(otn)
    +--ro (otn-label-type)?
      +--:(tributary-port)
        | +--ro tpn?   uint16
      +--:(tributary-slot)
        +--ro ts?    uint16
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:
  +--:(otn)
    +--ro tpn?      uint16
    +--ro tsg?      identityref
    +--ro ts-list?  string
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:
  +--:(otn)
    +--ro tpn?      uint16
    +--ro tsg?      identityref
    +--ro ts-list?  string
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:

```



```

+---:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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:
+---:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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:
+---:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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 range-type?  identityref
  +--ro tsg?          identityref
  +--ro priority?    uint8
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:
+---:(otn)
  +--ro (otn-label-type)?
    +---:(tributary-port)
      | +--ro tpn?    uint16
    +---:(tributary-slot)
      +--ro ts?      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/tet:label-end/tet:te-label
  /tet:technology:
+---:(otn)
  +--ro (otn-label-type)?

```





```

    +---:(tributary-port)
    | +-ro tpn?   uint16
    +---:(tributary-slot)
    +-ro ts?     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 range-type?  identityref
  +-ro tsg?         identityref
  +-ro priority?   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:
+---:(otn)
  +-ro (otn-label-type)?
  +---:(tributary-port)
  | +-ro tpn?   uint16
  +---:(tributary-slot)
  +-ro ts?     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/tet:label-end/tet:te-label
  /tet:technology:
+---:(otn)
  +-ro (otn-label-type)?
  +---:(tributary-port)
  | +-ro tpn?   uint16
  +---:(tributary-slot)
  +-ro ts?     uint16
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:
+---:(otn)
  +-ro tpn?      uint16
  +-ro tsg?     identityref
  +-ro ts-list?  string
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:
+---:(otn)

```



```

    +--ro tpn?          uint16
    +--ro tsg?          identityref
    +--ro ts-list?     string
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:
+--:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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:
+--:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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:
+--:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
augment /nw:networks/nw:network/nw:node/tet:te
  /tet:tunnel-termination-point/tet:local-link-connectivities
  /tet:label-restrictions/tet:label-restriction:
  +--rw range-type?  identityref
  +--rw tsg?          identityref
  +--rw priority?    uint8
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:
+--:(otn)
  +--rw (otn-label-type)?
    +--:(tributary-port)
      | +--rw tpn?    uint16

```



```

    +---:(tributary-slot)
        +--rw ts?    uint16
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:
+---:(otn)
    +--rw (otn-label-type)?
        +---:(tributary-port)
            | +--rw tpn?    uint16
        +---:(tributary-slot)
            +--rw ts?    uint16
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:
+---:(otn)
    +--rw tpn?        uint16
    +--rw tsg?        identityref
    +--rw ts-list?    string
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:
+---:(otn)
    +--rw tpn?        uint16
    +--rw tsg?        identityref
    +--rw ts-list?    string
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:
+---:(otn)
    +--rw tpn?        uint16
    +--rw tsg?        identityref
    +--rw ts-list?    string
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:
+---:(otn)
    +--rw tpn?        uint16
    +--rw tsg?        identityref
    +--rw ts-list?    string

```



```

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:
+--:(otn)
  +--ro tpn?          uint16
  +--ro tsg?          identityref
  +--ro ts-list?     string
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 range-type?   identityref
+--rw tsg?           identityref
+--rw priority?     uint8
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:
+--:(otn)
  +--rw (otn-label-type)?
  +--:(tributary-port)
  | +--rw tpn?      uint16
  +--:(tributary-slot)
  +--rw ts?        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/tet:label-end/tet:te-label
  /tet:technology:
+--:(otn)
  +--rw (otn-label-type)?
  +--:(tributary-port)
  | +--rw tpn?      uint16
  +--:(tributary-slot)
  +--rw ts?        uint16
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:
+--:(otn)
  +--rw tpn?          uint16
  +--rw tsg?          identityref
  +--rw ts-list?     string
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:
+--:(otn)
  +-rw tpn?          uint16
  +-rw tsg?          identityref
  +-rw ts-list?     string
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:
+--:(otn)
  +-rw tpn?          uint16
  +-rw tsg?          identityref
  +-rw ts-list?     string
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:
+--:(otn)
  +-rw tpn?          uint16
  +-rw tsg?          identityref
  +-rw ts-list?     string
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:
+--:(otn)
  +-ro tpn?          uint16
  +-ro tsg?          identityref
  +-ro ts-list?     string
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:
+--:(otn)
  +-rw tpn?          uint16
  +-rw tsg?          identityref
  +-rw ts-list?     string
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:
+---:(otn)
  +-rw tpn?      uint16
  +-rw tsg?      identityref
  +-rw ts-list?  string
augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes
  /tet:label-restrictions/tet:label-restriction:
  +-rw range-type?  identityref
  +-rw tsg?          identityref
  +-rw priority?    uint8
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:
+---:(otn)
  +-rw (otn-label-type)?
  +---:(tributary-port)
  | +-rw tpn?  uint16
  +---:(tributary-slot)
  +-rw ts?    uint16
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:
+---:(otn)
  +-rw (otn-label-type)?
  +---:(tributary-port)
  | +-rw tpn?  uint16
  +---:(tributary-slot)
  +-rw ts?    uint16
augment /nw:networks/nw:network/nt:link/tet:te
  /tet:information-source-entry/tet:label-restrictions
  /tet:label-restriction:
  +-ro range-type?  identityref
  +-ro tsg?          identityref
  +-ro priority?    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:
+---:(otn)
  +-ro (otn-label-type)?
  +---:(tributary-port)
  | +-ro tpn?  uint16
  +---:(tributary-slot)
  +-ro ts?    uint16
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:

```



```

+---:(otn)
  +--ro (otn-label-type)?
    +---:(tributary-port)
      | +--ro tpn?   uint16
    +---:(tributary-slot)
      +--ro ts?     uint16
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:
+---:(otn)
  +--rw tpn?       uint16
  +--rw tsg?       identityref
  +--rw ts-list?   string
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:
+---:(otn)
  +--rw tpn?       uint16
  +--rw tsg?       identityref
  +--rw ts-list?   string
augment /nw:networks/tet:te/tet:templates/tet:link-template
  /tet:te-link-attributes/tet:label-restrictions
  /tet:label-restriction:
  +--rw range-type? identityref
  +--rw tsg?         identityref
  +--rw priority?   uint8
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:
+---:(otn)
  +--rw (otn-label-type)?
    +---:(tributary-port)
      | +--rw tpn?   uint16
    +---:(tributary-slot)
      +--rw ts?     uint16
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:
+---:(otn)
  +--rw (otn-label-type)?
    +---:(tributary-port)
      | +--rw tpn?   uint16
    +---:(tributary-slot)
      +--rw ts?     uint16

```



#### **4. The YANG Code**

```
<CODE BEGINS> file "ietf-otn-topology.yang"

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

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

  import ietf-network {
    prefix "nw";
    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
      "I-D.ietf-teas-yang-te-topo: YANG Data Model for
      Traffic Engineering (TE) Topologies";
  }

  import ietf-otn-types {
    prefix "otn-types";
    reference
      "I-D.ietf-teas-yang-te: A YANG Data Model for Traffic
      Engineering Tunnels and Interfaces";
  }

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

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

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description

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

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```
revision 2018-08-23 {
  description
    "Initial Revision";
  reference
    "RFC XXXX: A YANG Data Model for Optical Transport Network Topology";
  // RFC Ed.: replace XXXX with actual RFC number, update date
  // information and remove this note
}

/*
 * Groupings
 */
```



```
grouping otn-link-attributes {
  description "link attributes for OTN";

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

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

/*
 * Data nodes
 */
```



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

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

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

/*
 * Augment TE bandwidth
 */

/* Augment maximum LSP bandwidth of link terminationpoint (LTP) */
augment "/nw:networks/nw:network/nw:node/nt:termination-point/"
  + "tet:te/"
  + "tet:interface-switching-capability/tet:max-lsp-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
  when "../..../..../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE bandwidth";
  }
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-path-bandwidth;
  }
}
```



```
/* Augment bandwidth path constraints of connectivity-matrices */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:te-node-attributes/tet:connectivity-matrices/"
  + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment bandwidth path constraints of connectivity-matrix */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:te-node-attributes/tet:connectivity-matrices/"
  + "tet:connectivity-matrix/"
  + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment bandwidth path constraints of connectivity-matrices information-
source */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:information-source-entry/tet:connectivity-matrices/"
  + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment bandwidth path constraints of connectivity-matrix information-
source */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:information-source-entry/tet:connectivity-matrices/"
```



```
+ "tet:connectivity-matrix/"  
+ "tet:path-constraints/tet:te-bandwidth/tet:technology" {
```

```

when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment client bandwidth of tunnel termination point (TTP) */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:tunnel-termination-point/"
  + "tet:client-layer-adaptation/tet:switching-capability/"
  + "tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment bandwidth path constraints of local-link-connectivities */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:tunnel-termination-point/"
  + "tet:local-link-connectivities/tet:path-constraints/"
  + "tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE bandwidth";
}
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-link-bandwidth;
}
}

/* Augment bandwidth path constraints of local-link-connectivity (LLC) */
augment "/nw:networks/nw:network/nw:node/tet:te/"
  + "tet:tunnel-termination-point/"
  + "tet:local-link-connectivities/"
  + "tet:local-link-connectivity/tet:path-constraints/"
  + "tet:te-bandwidth/tet:technology" {
when "../../../../../../../nw:network-types/tet:te-topology/"
  + "otntopo:otn-topology" {

```



```
        description "Augment OTN TE bandwidth";
    }
    description "OTN bandwidth.";
    case otn {
        uses otn-types:otn-link-bandwidth;
    }
}

/* Augment maximum LSP bandwidth of TE link */
augment "/nw:networks/nw:network/nt:link/tet:te/"
    + "tet:te-link-attributes/"
    + "tet:interface-switching-capability/tet:max-lsp-bandwidth/"
    + "tet:te-bandwidth/tet:technology" {
    when "../../../nw:network-types/tet:te-topology/"
        + "otntopo:otn-topology" {
        description "OTN TE bandwidth.";
    }
    description "OTN bandwidth.";
    case otn {
        uses otn-types:otn-path-bandwidth;
    }
}

/* Augment maximum bandwidth of TE link */
augment "/nw:networks/nw:network/nt:link/tet:te/"
    + "tet:te-link-attributes/"
    + "tet:max-link-bandwidth/"
    + "tet:te-bandwidth/tet:technology" {
    when "../../../nw:network-types/tet:te-topology/"
        + "otntopo:otn-topology" {
        description "OTN TE bandwidth.";
    }
    description "OTN bandwidth.";
    case otn {
        uses otn-types:otn-link-bandwidth;
    }
}

/* Augment maximum reservable bandwidth of TE link */
augment "/nw:networks/nw:network/nt:link/tet:te/"
    + "tet:te-link-attributes/"
    + "tet:max-resv-link-bandwidth/"
    + "tet:te-bandwidth/tet:technology" {
    when "../../../nw:network-types/tet:te-topology/"
        + "otntopo:otn-topology" {
        description "OTN TE bandwidth.";
    }
    description "OTN bandwidth.";
}
```



```
    case otn {
      uses otn-types:otn-link-bandwidth;
    }
  }

/* Augment unreserved bandwidth of TE Link */
augment "/nw:networks/nw:network/nt:link/tet:te/"
  + "tet:te-link-attributes/"
  + "tet:unreserved-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
  when "../..../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-link-bandwidth;
  }
}

/* Augment maximum LSP bandwidth of TE link information-source */
augment "/nw:networks/nw:network/nt:link/tet:te/"
  + "tet:information-source-entry/"
  + "tet:interface-switching-capability/"
  + "tet:max-lsp-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
  when "../..../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-path-bandwidth;
  }
}

/* Augment maximum bandwidth of TE link information-source */
augment "/nw:networks/nw:network/nt:link/tet:te/"
  + "tet:information-source-entry/"
  + "tet:max-link-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
  when "../..../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-link-bandwidth;
  }
}
```



```
    }

    /* Augment maximum reservable bandwidth of TE link information-source */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
      + "tet:information-source-entry/"
      + "tet:max-resv-link-bandwidth/"
      + "tet:te-bandwidth/tet:technology" {
    when "../../../nw:network-types/tet:te-topology/"
      + "otntopo:otn-topology" {
      description "OTN TE bandwidth.";
    }
    description "OTN bandwidth.";
    case otn {
      uses otn-types:otn-link-bandwidth;
    }
  }

  /* Augment unreserved bandwidth of TE link information-source */
  augment "/nw:networks/nw:network/nt:link/tet:te/"
    + "tet:information-source-entry/"
    + "tet:unreserved-bandwidth/"
    + "tet:te-bandwidth/tet:technology" {
  when "../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-link-bandwidth;
  }
}

/* Augment maximum LSP bandwidth of TE link template */
augment "/nw:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes/"
  + "tet:interface-switching-capability/"
  + "tet:max-lsp-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
/*
  when "../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
*/
description "OTN bandwidth.";
case otn {
  uses otn-types:otn-path-bandwidth;
}
}
```





```
    }

    /* Augment maximum bandwidth of TE link template */
    augment "/nw:networks/tet:te/tet:templates/"
      + "tet:link-template/tet:te-link-attributes/"
      + "tet:max-link-bandwidth/"
      + "tet:te-bandwidth/tet:technology" {
/*
  when "../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
*/
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-link-bandwidth;
  }
}

/* Augment maximum reservable bandwidth of TE link template */
augment "/nw:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes/"
  + "tet:max-resv-link-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
/*
  when "../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
*/
  description "OTN bandwidth.";
  case otn {
    uses otn-types:otn-link-bandwidth;
  }
}

/* Augment unreserved bandwidth of TE link template */
augment "/nw:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes/"
  + "tet:unreserved-bandwidth/"
  + "tet:te-bandwidth/tet:technology" {
/*
  when "../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "OTN TE bandwidth.";
  }
*/
  description "OTN bandwidth.";
```



```
    case otn {
      uses otn-types:otn-link-bandwidth;
    }
  }
}

/*
 * Augment TE label.
 */

/* Augment label restrictions of connectivity-matrices */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label restriction.";
  uses otn-types:otn-label-restriction;
}

/* Augment label restrictions start of connectivity-matrices */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

/* Augment label restrictions end of connectivity-matrices */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}
```



```

    }
  }

  /* Augment label hop of underlay primary path of connectivity-matrices */
  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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}

  /* Augment label hop of underlay backup path of connectivity-matrices */
  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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}

  /* Augment label hop of route-exclude of connectivity-matrices */
  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/"
    + "otntopo:otn-topology" {

```



```

    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}

```

/\* Augment label hop of route-include of connectivity-matrices (added) \*/

```

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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

/\* Augment label hop of path-route of connectivity-matrices \*/

```

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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

/\* Augment ingress label restrictions of connectivity-matrix \*/

```

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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
}
description "OTN label.";
uses otn-types:otn-label-restriction;
}

/* Augment egress label restrictions start of connectivity-matrix */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}

/* Augment egress label restrictions end of connectivity-matrix */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}

/* Augment label hop of underlay primary path of connectivity-matrix */
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label hop of underlay backup path of connectivity-matrix */
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label hop of route-exclude of connectivity-matrix */
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

```



```
}
```

```
/* Augment label hop of route-include of connectivity-matrix */
```

```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}
```

```
/* Augment label hop of path-route of connectivity-matrix */
```

```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}
```

```
/* Augment label restrictions of connectivity-matrices information-source */
```

```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
}
```



description "OTN label.";

Zheng, et al.

Expires February 24, 2019

[Page 37]

```
    uses otn-types:otn-label-restriction;
  }

  /* Augment label restrictions start of connectivity-matrices information-
source */
  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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

  /* Augment label restrictions end of connectivity-matrices information-source
*/
  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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

  /* Augment label hop of underlay primary path of connectivity-matrices
information-source */
  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/"
    + "otntopo:otn-topology" {
```

```
    description "Augment OTN TE label";  
  }  
  description "OTN label."  
  case otn {  
    uses otn-types:otn-path-label;
```

```

}
}

```

```

/* Augment label hop of underlay backup path of connectivity-matrices
information-source */

```

```

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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

```

/* Augment label hop of route-exclude of connectivity-matrices information-
source */

```

```

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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

```

/* Augment label hop of route-include of connectivity-matrices information-
source */

```

```

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/"
```

```
    + "otntopo:otn-topology" {
      description "Augment OTN TE label";
    }
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}
```

/\* Augment label hop of path-route of connectivity-matrices information-source \*/

```
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/"
    + "otntopo:otn-topology" {
      description "Augment OTN TE label";
    }
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}
```

/\* Augment ingress label restrictions of connectivity-matrix information-source \*/

```
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/"
    + "otntopo:otn-topology" {
      description "Augment OTN TE label";
    }
  description "OTN label.";
  uses otn-types:otn-label-restriction;
}
```

/\* Augment ingress label restrictions start of connectivity-matrix information-source \*/

```
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/"
  + "otntopo:otn-topology" {
```

```

        description "Augment OTN TE label";
    }
    description "OTN label.";
    case otn {
        uses otn-types:otn-link-label;
    }
}

/* Augment ingress label restrictions end of connectivity-matrix information-
source */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}

/* Augment egress label restrictions of connectivity-matrix information-
source */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
}
description "OTN label.";
uses otn-types:otn-label-restriction;
}

/* Augment egress label restrictions start of connectivity-matrix
information-source */
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/"  
+ "otntopo:otn-topology" {  
description "Augment OTN TE label";
```

```
    }
    description "OTN label.";
    case otn {
      uses otn-types:otn-link-label;
    }
  }
}
```

/\* Augment egress label restrictions end of connectivity-matrix information-source \*/

```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}
```

/\* Augment label hop of underlay primary path of connectivity-matrix information-source \*/

```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}
```

/\* Augment label hop of underlay backup path of connectivity-matrix information-source \*/

```
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

/\* Augment label hop of route-exclude of connectivity-matrix information-source \*/

```

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/"
  + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}
}

```

/\* Augment label hop of route-include of connectivity-matrix information-source \*/

```

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/"
  + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {

```

```
    uses otn-types:otn-path-label;  
}
```





```
/* Augment label restrictions end of local-link-connectivities */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}

/* Augment label hop of underlay primary path of local-link-connectivities */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label hop of underlay backup path of local-link-connectivities */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}
```





```

}

/* Augment label hop of route-exclude of local-link-connectivities */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label hop of route-include of local-link-connectivities */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label hop of path-route of local-link-connectivities */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label restrictions of local-link-connectivity (LLC) */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
uses otn-types:otn-label-restriction;
}

/* Augment label restrictions start of local-link-connectivity (LLC) */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}

/* Augment label restrictions end of local-link-connectivity (LLC) */
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}

/* Augment label hop of underlay primary path of local-link-connectivity
(LLC) */
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label hop of underlay backup path of local-link-connectivity (LLC)
*/
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/"
    + "otntopo:otn-topology" {
description "Augment OTN TE label";
}
description "OTN label.";
case otn {

```

```
    uses otn-types:otn-path-label;  
}
```

```

}

/* Augment label hop of route-exclude of local-link-connectivity (LLC) */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label hop of route-include of local-link-connectivity (LLC) */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label hop of path-route of local-link-connectivity (LLC) */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label hop of underlay primary path of TE link */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label hop of underlay backup path of TE link */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
    }
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

/* Augment label restrictions of TE link */

```



```
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
uses otn-types:otn-label-restriction;
}

/* Augment label restrictions start of TE link */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}

/* Augment label restrictions end of TE link */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
}
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}

/* Augment label restrictions of TE link information-source */
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/"
  + "otntopo:otn-topology" {
  description "Augment OTN TE label";
```



```

    }
    description "OTN label.";
    uses otn-types:otn-label-restriction;
}

/* Augment label restrictions start of TE link information-source */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

/* Augment label restrictions end of TE link information-source */
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/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

/* Augment label hop of underlay primary path of TE link template */
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" {
/*
  when "../..../..../..../..../..../..../..../..../"
    + "nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
}
*/
description "OTN label.";
case otn {

```



```
    uses otn-types:otn-path-label;
  }
}

/* Augment label hop of underlay backup path of TE link template */
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" {
/*
  when "../../../../../../../../../../../../../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
*/
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

/* Augment label restrictions of TE link template */
augment "/nw:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes/"
  + "tet:label-restrictions/tet:label-restriction" {
/*
  when "../../../../../../../../../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
*/
description "OTN label.";
uses otn-types:otn-label-restriction;
}

/* Augment label restrictions start of TE link template */
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" {
/*
  when "../../../../../../../../../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
*/
description "OTN label.";
case otn {
```





```
    uses otn-types:otn-link-label;
  }
}

/* Augment label restrictions end of TE link template */
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" {
/*
  when "../../../../../../../nw:network-types/tet:te-topology/"
    + "otntopo:otn-topology" {
    description "Augment OTN TE label";
  }
*/
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}
}
```

<CODE ENDS>

## 5. IANA Considerations

It is proposed that IANA should assign new URIs from the "IETF XML Registry" [[RFC3688](#)] as follows: URI: urn:ietf:params:xml:ns:yang:ietf-otn-topology Registrant Contact: The IESG XML: N/A; the requested URI is an XML namespace. This document registers a YANG module in the YANG Module Names registry [[RFC7950](#)]. name: ietf-otn-topology namespace: urn:ietf:params:xml:ns:yang:ietf-otn-topology prefix: otntopo reference: RFC XXXX

## 6. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [[RFC6241](#)] or RESTCONF [[RFC8040](#)]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [[RFC6242](#)]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [[RFC5246](#)].



The NETCONF access control model [[RFC6536](#)] 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.

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/.../tet:te-bandwidth/tet:technology
/nw:networks/nw:network/nw:node/tet:te/.../tet:label-restriction
/nw:networks/nw:network/nw:node/.../tet:te-label/tet:technology
Editors note: we are using simplified description by folding similar
branches to avoid repetition.
```

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes. These are the subtrees and data nodes and their sensitivity/vulnerability:

Editors note: Currently there is no such data nodes, temporarily kept for review.

## **7. Acknowledgements**

We would like to thank Igor Bryskin, Zhe Liu, Zheyu Fan and Daniele Ceccarelli for their comments and discussions.

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