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OTN Tunnel YANG Model

Abstract

This document describes the YANG data model for tunnels in OTN TE networks. The model can be used to do the configuration in order to establish the tunnel in OTN network. This work is independent with the control plane protocols.

Status of This Memo

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Table of Contents

- 1. [Introduction](#)
 - 1.1. [Terminology and Notations](#)
 - 1.2. [Tree Diagram](#)
 - 1.3. [Prefix in Data Node Names](#)
- 2. [OTN Tunnel Model Description](#)
 - 2.1. [Overview of OTN Tunnel Model](#)
 - 2.2. [Bandwidth Augmentation](#)
 - 2.3. [Label Augmentation](#)
- 3. [OTN Tunnel YANG Tree](#)
- 4. [OTN Tunnel YANG Code](#)
- 5. [Security Considerations](#)
- 6. [IANA Considerations](#)
- 7. [Acknowledgements](#)
- 8. [Contributors](#)
- 9. [References](#)
 - 9.1. [Normative References](#)
 - 9.2. [Informative References](#)
- [Authors' Addresses](#)

1. Introduction

OTN transport networks, specified in [[ITU-Tg709](#)], can carry various types of client signals. In many cases, the client signal is carried over an OTN tunnel across connected domains in a multi-domain network.

This document provides YANG model for creating OTN tunnel. The model augments the generic TE Tunnel model specified in [[I-D.ietf-teas-yang-te](#)].

1.1. Terminology and Notations

Refer to [[I-D.ietf-ccamp-otn-topo-yang](#)] for the OTN specific terms 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](#)].

1.2. Tree Diagram

A simplified graphical representation of the data model is used in Section 3 of this document. The meaning of the symbols in these diagrams is defined in [[RFC8340](#)].

1.3. Prefix 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 the following table.

Prefix	YANG module	Reference
l1-types	ietf-layer1-types	[RFCYYYY]
otntnl	ietf-otn-tunnel	[RFCXXXX]
te	ietf-te	[RFCZZZZ]

Table 1: Prefixes and Corresponding YANG Modules

RFC Editor Note: Please replace XXXX with the number assigned to the RFC once this draft becomes an RFC. Please replace YYYY with the RFC numbers assigned to [[I-D.ietf-ccamp-layer1-types](#)]. Please replace ZZZZ with the RFC numbers assigned to [[I-D.ietf-teas-yang-te](#)].

2. OTN Tunnel Model Description

2.1. Overview of OTN Tunnel Model

This document aims to describe the data model for OTN tunnel. The OTN tunnel model is using TE tunnel [[I-D.ietf-teas-yang-te](#)] as a basic model and augments it with OTN-specific parameters, including the bandwidth information and label information. Figure 1 shows the augmentation relationship.

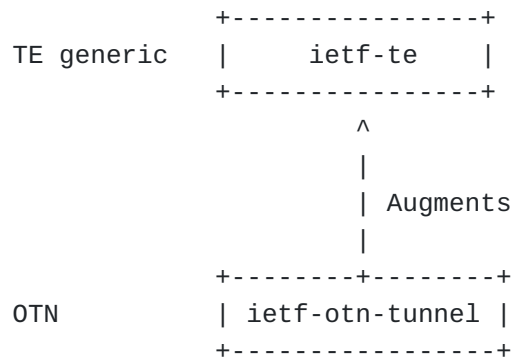


Figure 1 - Relationship between OTN and TE tunnel models

It is also worth noting that the OTN tunnel provisioning is usually based on the OTN topology. Therefore the OTN tunnel model is usually used together with OTN topology model specified in [[I-D.ietf-ccamp-otn-topo-yang](#)]. The OTN tunnel model also imports a few type modules, including ietf-layer1-types, ietf-te-types and ietf-inet-types. The OTN-specific attributes in [[RFC7139](#)], including the Tributary Slot (TS) and Tributary Port Number (TPN), can be used to represent the bandwidth and label information. These attributes have been specified in [[I-D.ietf-ccamp-layer1-types](#)] and used in this document for augmentation of the generic TE tunnel model.

More scenarios and model applications can be found in [[I-D.ietf-ccamp-transport-nbi-app-statement](#)] and [[I-D.ietf-teas-actn-yang](#)].

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

2.2. Bandwidth Augmentation

The model augments all the occurrences of the te-bandwidth container with the OTN technology specific attributes using the otn-link-bandwidth and otn-path-bandwidth groupings defined in [[I-D.ietf-ccamp-layer1-types](#)].

2.3. Label Augmentation

The model augments all the occurrences of the label-restriction list with OTN technology specific attributes using the otn-label-range-info grouping defined in [[I-D.ietf-ccamp-layer1-types](#)].

Moreover, the model augments all the occurrences of the te-label container with the OTN technology specific attributes using the otn-label-start-end, otn-label-hop and otn-label-step groupings defined in [[I-D.ietf-ccamp-layer1-types](#)].

3. OTN Tunnel YANG Tree

module: ietf-otn-tunnel

augment /te:te/te:globals/te:named-path-constraints
/te:named-path-constraint/te:te-bandwidth/te:technology:

+--:(otn)

+--rw otn

+--rw odu-type? identityref

+--rw (oduflex-type)?

+--:(generic)

| +--rw nominal-bit-rate uint64

+--:(cbr)

| +--rw client-type identityref

+--:(gfp-n-k)

| +--rw gfp-n uint8

| +--rw gfp-k? gfp-k

+--:(flexe-client)

| +--rw flexe-client flexe-client-rate

+--:(flexe-aware)

| +--rw flexe-aware-n uint16

+--:(packet)

+--rw opuflex-payload-rate uint64

augment /te:te/te:tunnels/te:tunnel/te:te-bandwidth/te:technology:

+--:(otn)

+--rw otn

+--rw odu-type? identityref

+--rw (oduflex-type)?

+--:(generic)

| +--rw nominal-bit-rate uint64

+--:(cbr)

| +--rw client-type identityref

+--:(gfp-n-k)

| +--rw gfp-n uint8

| +--rw gfp-k? gfp-k

+--:(flexe-client)

| +--rw flexe-client flexe-client-rate

+--:(flexe-aware)

| +--rw flexe-aware-n uint16

+--:(packet)

+--rw opuflex-payload-rate uint64

augment /te:te/te:tunnels/te:tunnel/te:primary-paths

/te:primary-path/te:te-bandwidth/te:technology:

+--:(otn)

+--rw otn

+--rw odu-type? identityref

+--rw (oduflex-type)?

+--:(generic)

| +--rw nominal-bit-rate uint64

+--:(cbr)

```

        | +--rw client-type          identityref
    +--:(gfp-n-k)
        | +--rw gfp-n                uint8
        | +--rw gfp-k?              gfp-k
    +--:(flexe-client)
        | +--rw flexe-client          flexe-client-rate
    +--:(flexe-aware)
        | +--rw flexe-aware-n        uint16
    +--:(packet)
        +--rw opuflex-payload-rate   uint64
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:computed-paths-properties
    /te:computed-path-properties/te:path-properties
    /te:te-bandwidth/te:technology:
+--:(otn)
    +--ro otn
        +--ro odu-type?              identityref
        +--ro (oduflex-type)?
            +--:(generic)
                | +--ro nominal-bit-rate   uint64
            +--:(cbr)
                | +--ro client-type          identityref
            +--:(gfp-n-k)
                | +--ro gfp-n                uint8
                | +--ro gfp-k?              gfp-k
            +--:(flexe-client)
                | +--ro flexe-client          flexe-client-rate
            +--:(flexe-aware)
                | +--ro flexe-aware-n        uint16
            +--:(packet)
                +--ro opuflex-payload-rate   uint64
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path/te:te-bandwidth
    /te:technology:
+--:(otn)
    +--rw otn
        +--rw odu-type?              identityref
        +--rw (oduflex-type)?
            +--:(generic)
                | +--rw nominal-bit-rate   uint64
            +--:(cbr)
                | +--rw client-type          identityref
            +--:(gfp-n-k)
                | +--rw gfp-n                uint8
                | +--rw gfp-k?              gfp-k
            +--:(flexe-client)
                | +--rw flexe-client          flexe-client-rate
            +--:(flexe-aware)
                | +--rw flexe-aware-n        uint16
            +--:(packet)
                +--rw opuflex-payload-rate   uint64

```

```

        +---:(packet)
            +---rw opuflex-payload-rate      uint64
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
        /te:primary-path/te:primary-reverse-path
        /te:computed-paths-properties/te:computed-path-properties
        /te:path-properties/te:te-bandwidth/te:technology:
+---:(otn)
    +---ro otn
        +---ro odu-type?                    identityref
        +---ro (oduflex-type)?
            +---:(generic)
                | +---ro nominal-bit-rate      uint64
            +---:(cbr)
                | +---ro client-type            identityref
            +---:(gfp-n-k)
                | +---ro gfp-n                  uint8
                | +---ro gfp-k?                 gfp-k
            +---:(flexe-client)
                | +---ro flexe-client            flexe-client-rate
            +---:(flexe-aware)
                | +---ro flexe-aware-n          uint16
            +---:(packet)
                +---ro opuflex-payload-rate      uint64
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:te-bandwidth/te:technology:
+---:(otn)
    +---rw otn
        +---rw odu-type?                    identityref
        +---rw (oduflex-type)?
            +---:(generic)
                | +---rw nominal-bit-rate      uint64
            +---:(cbr)
                | +---rw client-type            identityref
            +---:(gfp-n-k)
                | +---rw gfp-n                  uint8
                | +---rw gfp-k?                 gfp-k
            +---:(flexe-client)
                | +---rw flexe-client            flexe-client-rate
            +---:(flexe-aware)
                | +---rw flexe-aware-n          uint16
            +---:(packet)
                +---rw opuflex-payload-rate      uint64
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:computed-paths-properties
        /te:computed-path-properties/te:path-properties
        /te:te-bandwidth/te:technology:
+---:(otn)
    +---ro otn
        +---ro odu-type?                    identityref

```

```

    +--ro (oduflex-type)?
      +--:(generic)
        | +--ro nominal-bit-rate          uint64
      +--:(cbr)
        | +--ro client-type                identityref
      +--:(gfp-n-k)
        | +--ro gfp-n                      uint8
        | +--ro gfp-k?                     gfp-k
      +--:(flexe-client)
        | +--ro flexe-client               flexe-client-rate
      +--:(flexe-aware)
        | +--ro flexe-aware-n              uint16
      +--:(packet)
        +--ro opuflex-payload-rate         uint64
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
      /te:secondary-reverse-path/te:te-bandwidth/te:technology:
+--:(otn)
  +--rw otn
    +--rw odu-type?                      identityref
    +--rw (oduflex-type)?
      +--:(generic)
        | +--rw nominal-bit-rate          uint64
      +--:(cbr)
        | +--rw client-type                identityref
      +--:(gfp-n-k)
        | +--rw gfp-n                      uint8
        | +--rw gfp-k?                     gfp-k
      +--:(flexe-client)
        | +--rw flexe-client               flexe-client-rate
      +--:(flexe-aware)
        | +--rw flexe-aware-n              uint16
      +--:(packet)
        +--rw opuflex-payload-rate         uint64
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
      /te:secondary-reverse-path/te:computed-paths-properties
      /te:computed-path-properties/te:path-properties
      /te:te-bandwidth/te:technology:
+--:(otn)
  +--ro otn
    +--ro odu-type?                      identityref
    +--ro (oduflex-type)?
      +--:(generic)
        | +--ro nominal-bit-rate          uint64
      +--:(cbr)
        | +--ro client-type                identityref
      +--:(gfp-n-k)
        | +--ro gfp-n                      uint8
        | +--ro gfp-k?                     gfp-k
      +--:(flexe-client)

```

```

        | +--ro flexe-client          flexe-client-rate
        +--:(flexe-aware)
        | +--ro flexe-aware-n        uint16
        +--:(packet)
        +--ro opuflex-payload-rate   uint64
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-in-segment
        /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
+--rw range-type?      otn-label-range-type
+--rw tsg?             identityref
+--rw odu-type-list*   identityref
+--rw priority?        uint8
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-out-segment
        /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
+--rw range-type?      otn-label-range-type
+--rw tsg?             identityref
+--rw odu-type-list*   identityref
+--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
        /te:primary-path/te:path-in-segment/te:label-restrictions
        /te:label-restriction:
+--rw otn-label-range
+--rw range-type?      otn-label-range-type
+--rw tsg?             identityref
+--rw odu-type-list*   identityref
+--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
        /te:primary-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
+--rw range-type?      otn-label-range-type
+--rw tsg?             identityref
+--rw odu-type-list*   identityref
+--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
        /te:primary-path/te:primary-reverse-path
        /te:path-in-segment/te:label-restrictions
        /te:label-restriction:
+--rw otn-label-range
+--rw range-type?      otn-label-range-type
+--rw tsg?             identityref
+--rw odu-type-list*   identityref
+--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
        /te:primary-path/te:primary-reverse-path
        /te:path-out-segment/te:label-restrictions

```

```

        /te:label-restriction:
+--rw otn-label-range
  +--rw range-type?      otn-label-range-type
  +--rw tsg?             identityref
  +--rw odu-type-list*   identityref
  +--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
  /te:secondary-path/te:path-in-segment
  /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
  +--rw range-type?      otn-label-range-type
  +--rw tsg?             identityref
  +--rw odu-type-list*   identityref
  +--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
  /te:secondary-path/te:path-out-segment
  /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
  +--rw range-type?      otn-label-range-type
  +--rw tsg?             identityref
  +--rw odu-type-list*   identityref
  +--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path/te:path-in-segment
  /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
  +--rw range-type?      otn-label-range-type
  +--rw tsg?             identityref
  +--rw odu-type-list*   identityref
  +--rw priority?        uint8
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path/te:path-out-segment
  /te:label-restrictions/te:label-restriction:
+--rw otn-label-range
  +--rw range-type?      otn-label-range-type
  +--rw tsg?             identityref
  +--rw odu-type-list*   identityref
  +--rw priority?        uint8
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint
  /te:explicit-route-objects-always
  /te:route-object-exclude-always/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?          otn-tpn
    +--rw tsg?          identityref
    +--rw ts-list?      string
augment /te:te/te:globals/te:named-path-constraints

```

```

        /te:named-path-constraint
        /te:explicit-route-objects-always
        /te:route-object-include-exclude/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?      otn-tpn
    +--rw tsg?      identityref
    +--rw ts-list?   string
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment
  /te:label-restrictions/te:label-restriction
  /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    |   +--rw ts?       otn-ts
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    |   +--rw ts?       otn-ts
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment
  /te:label-restrictions/te:label-restriction/te:label-step
  /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    |   +--rw ts?       otn-ts
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-out-segment
  /te:label-restrictions/te:label-restriction
  /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?

```

```

        +--:(trib-port)
        | +--rw tpn?    otn-tpn
        +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:path-out-segment
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw (range-type)?
+--:(trib-port)
| +--rw tpn?    otn-tpn
+--:(trib-slot)
+--rw ts?      otn-ts
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:path-out-segment
    /te:label-restrictions/te:label-restriction/te:label-step
    /te:technology:
+--:(otn)
+--rw otn
+--rw (range-type)?
+--:(trib-port)
| +--rw tpn?    otn-tpn
+--:(trib-slot)
+--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:optimizations/te:algorithm/te:metric
    /te:optimization-metric/te:explicit-route-exclude-objects
    /te:route-object-exclude-object/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw tpn?      otn-tpn
+--rw tsg?      identityref
+--rw ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:optimizations/te:algorithm/te:metric
    /te:optimization-metric/te:explicit-route-include-objects
    /te:route-object-include-object/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw tpn?      otn-tpn
+--rw tsg?      identityref
+--rw ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:explicit-route-objects-always
    /te:route-object-exclude-always/te:type/te:label

```

```

        /te:label-hop/te:te-label/te:technology:
+---:(otn)
    +--rw otn
        +--rw tpn?          otn-tpn
        +--rw tsg?          identityref
        +--rw ts-list?      string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:explicit-route-objects-always
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+---:(otn)
    +--rw otn
        +--rw tpn?          otn-tpn
        +--rw tsg?          identityref
        +--rw ts-list?      string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:path-in-segment/te:label-restrictions
    /te:label-restriction/te:label-start/te:te-label
    /te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
            +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:path-in-segment/te:label-restrictions
    /te:label-restriction/te:label-end/te:te-label
    /te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
            +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:path-in-segment/te:label-restrictions
    /te:label-restriction/te:label-step/te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
            +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:path-out-segment

```

```

        /te:label-restrictions/te:label-restriction
        /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:path-out-segment
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:path-out-segment
  /te:label-restrictions/te:label-restriction/te:label-step
  /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:computed-paths-properties
  /te:computed-path-properties/te:path-properties
  /te:path-route-objects/te:path-route-object/te:type
  /te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn
    +--ro tpn?          otn-tpn
    +--ro tsg?          identityref
    +--ro ts-list?      string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:primary-reverse-path/te:optimizations
  /te:algorithm/te:metric/te:optimization-metric
  /te:explicit-route-exclude-objects
  /te:route-object-exclude-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn

```

```

    +--rw tpn?          otn-tpn
    +--rw tsg?          identityref
    +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path/te:optimizations
    /te:algorithm/te:metric/te:optimization-metric
    /te:explicit-route-include-objects
    /te:route-object-include-object/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn
    +--rw tpn?          otn-tpn
    +--rw tsg?          identityref
    +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path
    /te:explicit-route-objects-always
    /te:route-object-exclude-always/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn
    +--rw tpn?          otn-tpn
    +--rw tsg?          identityref
    +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path
    /te:explicit-route-objects-always
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn
    +--rw tpn?          otn-tpn
    +--rw tsg?          identityref
    +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path
    /te:path-in-segment/te:label-restrictions
    /te:label-restriction/te:label-start/te:te-label
    /te:technology:
+--:(otn)
    +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    |   +--rw ts?       otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
    /te:primary-path/te:primary-reverse-path
    /te:path-in-segment/te:label-restrictions

```

```

        /te:label-restriction/te:label-end/te:te-label
        /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:primary-reverse-path
  /te:path-in-segment/te:label-restrictions
  /te:label-restriction/te:label-step/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction/te:label-start/te:te-label
  /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction/te:label-end/te:te-label
  /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?    otn-tpn
      +--:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction/te:label-step/te:technology:
+--:(otn)

```

```

+--rw otn
+--rw (range-type)?
+--:(trib-port)
| +--rw tpn?    otn-tpn
+--:(trib-slot)
+--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
/te:primary-path/te:primary-reverse-path
/te:computed-paths-properties/te:computed-path-properties
/te:path-properties/te:path-route-objects
/te:path-route-object/te:type/te:label/te:label-hop
/te:te-label/te:technology:
+--:(otn)
+--ro otn
+--ro tpn?    otn-tpn
+--ro tsg?    identityref
+--ro ts-list? string
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
/te:secondary-path/te:optimizations/te:algorithm
/te:metric/te:optimization-metric
/te:explicit-route-exclude-objects
/te:route-object-exclude-object/te:type/te:label
/te:label-hop/te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw tpn?    otn-tpn
+--rw tsg?    identityref
+--rw ts-list? string
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
/te:secondary-path/te:optimizations/te:algorithm
/te:metric/te:optimization-metric
/te:explicit-route-include-objects
/te:route-object-include-object/te:type/te:label
/te:label-hop/te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw tpn?    otn-tpn
+--rw tsg?    identityref
+--rw ts-list? string
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
/te:secondary-path/te:explicit-route-objects-always
/te:route-object-exclude-always/te:type/te:label
/te:label-hop/te:te-label/te:technology:
+--:(otn)
+--rw otn
+--rw tpn?    otn-tpn
+--rw tsg?    identityref
+--rw ts-list? string
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths

```

```

        /te:secondary-path/te:explicit-route-objects-always
        /te:route-object-include-exclude/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?      otn-tpn
    +--rw tsg?      identityref
    +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-in-segment
        /te:label-restrictions/te:label-restriction
        /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-in-segment
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-in-segment
        /te:label-restrictions/te:label-restriction/te:label-step
        /te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)
    |   +--rw tpn?      otn-tpn
    +--:(trib-slot)
    +--rw ts?        otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction
        /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
    +--:(trib-port)

```

```

        | +--rw tpn?    otn-tpn
        +---:(trib-slot)
        +--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+---:(otn)
+--rw otn
+--rw (range-type)?
+---:(trib-port)
| +--rw tpn?    otn-tpn
+---:(trib-slot)
+--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction/te:label-step
        /te:technology:
+---:(otn)
+--rw otn
+--rw (range-type)?
+---:(trib-port)
| +--rw tpn?    otn-tpn
+---:(trib-slot)
+--rw ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
        /te:secondary-path/te:computed-paths-properties
        /te:computed-path-properties/te:path-properties
        /te:path-route-objects/te:path-route-object/te:type
        /te:label/te:label-hop/te:te-label/te:technology:
+---:(otn)
+--ro otn
+--ro tpn?      otn-tpn
+--ro tsg?      identityref
+--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:optimizations/te:algorithm
        /te:metric/te:optimization-metric
        /te:explicit-route-exclude-objects
        /te:route-object-exclude-object/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+---:(otn)
+--rw otn
+--rw tpn?      otn-tpn
+--rw tsg?      identityref
+--rw ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:optimizations/te:algorithm
        /te:metric/te:optimization-metric

```

```

        /te:explicit-route-include-objects
        /te:route-object-include-object/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?      otn-tpn
    +--rw tsg?      identityref
    +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path
  /te:explicit-route-objects-always
  /te:route-object-exclude-always/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?      otn-tpn
    +--rw tsg?      identityref
    +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path
  /te:explicit-route-objects-always
  /te:route-object-include-exclude/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw tpn?      otn-tpn
    +--rw tsg?      identityref
    +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path/te:path-in-segment
  /te:label-restrictions/te:label-restriction
  /te:label-start/te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?  otn-tpn
      +--:(trib-slot)
        +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
  /te:secondary-reverse-path/te:path-in-segment
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw otn
    +--rw (range-type)?
      +--:(trib-port)
        | +--rw tpn?  otn-tpn
      +--:(trib-slot)

```

```

        +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:path-in-segment
        /te:label-restrictions/te:label-restriction/te:label-step
        /te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
                +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction
        /te:label-start/te:te-label/te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
                +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
                +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:path-out-segment
        /te:label-restrictions/te:label-restriction/te:label-step
        /te:technology:
+---:(otn)
    +--rw otn
        +--rw (range-type)?
            +---:(trib-port)
            |   +--rw tpn?    otn-tpn
            +---:(trib-slot)
                +--rw ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:secondary-reverse-paths
        /te:secondary-reverse-path/te:computed-paths-properties
        /te:computed-path-properties/te:path-properties
        /te:path-route-objects/te:path-route-object/te:type

```

```

        /te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn
    +--ro tpn?      otn-tpn
    +--ro tsg?      identityref
    +--ro ts-list?  string
augment /te:te/te:lsps/te:lsp/te:lsp-record-route-information
        /te:lsp-record-route-information/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn
    +--ro tpn?      otn-tpn
    +--ro tsg?      identityref
    +--ro ts-list?  string

```

4. OTN Tunnel YANG Code

```

<CODE BEGINS>file "ietf-otn-tunnel@2022-03-10.yang"
module ietf-otn-tunnel {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-otn-tunnel";
  prefix "otn-tnl";

  import ietf-te {
    prefix "te";
    revision-date "2021-02-20";
    reference
      "I-D.ietf-teas-yang-te-19: A YANG Data Model for Traffic
      Engineering Tunnels and Interfaces. ";
  }

  import ietf-layer1-types {
    prefix "l1-types";
    reference
      "I-D.ietf-ccamp-layer1-types:
      A YANG Data Model for Layer 1 Types. ";
  }

  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>

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

    Editor:   Sergio Belotti
              <mailto:sergio.belotti@nokia.com>

    Editor:   Victor Lopez
              <mailto:victor.lopezalvarez@telefonica.com>

    Editor:   Yunbin Xu
              <mailto:xuyunbin@caict.ac.cn>";

  description
    "This module defines a model for OTN Tunnel Services.

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

    Copyright (c) 2022 IETF Trust and the persons
    identified as authors of the code.  All rights reserved.

```

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

```
revision "2022-03-10" {
  description
    "Updated revision to align with the latest TE tunnel model.";
  reference
    "RFC XXXX: OTN Tunnel YANG Model";
  // RFC Ed.: replace XXXX with actual RFC number, update date
  // information and remove this note
}

/*
 * Data nodes
 */

/*
 * Augment TE bandwidth
 */

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:te-bandwidth/te:technology" {
  description
    "Augment TE bandwidth of the named path constraint.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:te-bandwidth/te:technology" {
  description
    "Augment TE bandwidth of the tunnel.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:te-bandwidth/te:technology" {
```

```

description
  "Augment TE bandwidth of the primary path.";
case otn {
  uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:computed-paths-properties/"
  + "te:computed-path-properties/te:path-properties/"
  + "te:te-bandwidth/te:technology" {
description
  "Augment TE bandwidth of primary path's computed path
  properties.";
case otn {
  uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:primary-reverse-path/"
  + "te:te-bandwidth/te:technology" {
description
  "Augment TE bandwidth of the primary reverse path.";
case otn {
  uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:primary-reverse-path/"
  + "te:computed-paths-properties/"
  + "te:computed-path-properties/te:path-properties/"
  + "te:te-bandwidth/te:technology" {
description
  "Augment TE bandwidth of the primary reverse path's computed
  path properties.";
case otn {
  uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-paths/te:secondary-path/"
  + "te:te-bandwidth/te:technology" {
description

```

```

    "Augment TE bandwidth of the secondary path.";
case otn {
    uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:computed-paths-properties/"
    + "te:computed-path-properties/te:path-properties/"
    + "te:te-bandwidth/te:technology" {
description
    "Augment TE bandwidth of the secondary path's computed path
    properties.";
case otn {
    uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/"
    + "te:secondary-reverse-path/"
    + "te:te-bandwidth/te:technology" {
description
    "Augment TE bandwidth of the secondary reverse path.";
case otn {
    uses l1-types:otn-path-bandwidth;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/"
    + "te:secondary-reverse-path/"
    + "te:computed-paths-properties/"
    + "te:computed-path-properties/te:path-properties/"
    + "te:te-bandwidth/te:technology" {
description
    "Augment TE bandwidth of the secondary reverse path's computed
    path properties.";
case otn {
    uses l1-types:otn-path-bandwidth;
}
}

/*
 * Augment TE label range information
 */

augment "/te:te/te:globals/te:named-path-constraints/"

```

```

    + "te:named-path-constraint/te:path-in-segment/"
    + "te:label-restrictions/te:label-restriction" {
description
    "Augment TE label range information for the ingress segment
    of the named path constraint.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:globals/te:named-path-constraints/"
    + "te:named-path-constraint/te:path-out-segment/"
    + "te:label-restrictions/"
    + "te:label-restriction" {
description
    "Augment TE label range information for the egress segment
    of the named path constraint.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction" {
description
    "Augment TE label range information for the ingress segment
    of the primay path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction" {
description
    "Augment TE label range information for the egress segment
    of the primay path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction" {
description
    "Augment TE label range information for the ingress segment
    of the primay reverse path.";
uses l1-types:otn-label-range-info;
}

```

```

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:primary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction" {
description
  "Augment TE label range information for the egress segment
  of the primay reverse path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-paths/te:secondary-path/"
  + "te:path-in-segment/te:label-restrictions/"
  + "te:label-restriction" {
description
  "Augment TE label range information for the ingress segment
  of the secondary path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-paths/te:secondary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction" {
description
  "Augment TE label range information for the egress segment
  of the secondary path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-reverse-paths/te:secondary-reverse-path/"
  + "te:path-in-segment/te:label-restrictions/"
  + "te:label-restriction" {
description
  "Augment TE label range information for the ingress segment
  of the secondary reverse path.";
uses l1-types:otn-label-range-info;
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-reverse-paths/te:secondary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction" {
description
  "Augment TE label range information for the egress segment
  of the secondary reverse path.";
uses l1-types:otn-label-range-info;
}

```

```

}

/*
 * Augment TE label.
 */

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the explicit route objects always
    excluded by the path computation with the named path
    constraint.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-include-exclude/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the explicit route objects included
    or excluded by the path computation with the named path
    constraint.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-in-segment/"
  + "te:label-restrictions/"
  + "te:label-restriction/te:label-start/"
  + "te:te-label/te:technology" {
  description
    "Augment TE label range start for the ingress segment
    of the named path constraint.";
  case otn {
    uses l1-types:otn-label-start-end;
  }
}

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-in-segment/"

```

```

    + "te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the ingress segment
    of the named path constraint.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:globals/te:named-path-constraints/"
    + "te:named-path-constraint/te:path-in-segment/"
    + "te:label-restrictions/te:label-restriction/"
    + "te:label-step/te:technology" {
description
    "Augment TE label range step for the ingress segment
    of the named path constraint.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:globals/te:named-path-constraints/"
    + "te:named-path-constraint/te:path-out-segment/"
    + "te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range start for the egress segment
    of the named path constraint.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:globals/te:named-path-constraints/"
    + "te:named-path-constraint/te:path-out-segment/"
    + "te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the egress segment
    of the named path constraint.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

```

```

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-out-segment/"
  + "te:label-restrictions/te:label-restriction/"
  + "te:label-step/te:technology" {
  description
    "Augment TE label range step for the egress segment
    of the named path constraint.";
  case otn {
    uses l1-types:otn-label-step;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-exclude-objects/"
  + "te:route-object-exclude-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the optimization of the explicit
    route objects excluded by the path computation of the primary
    path.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-include-objects/"
  + "te:route-object-include-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the optimization of the explicit
    route objects included by the path computation of the primary
    path.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the explicit route objects always

```

```

        excluded by the path computation of the primary path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:primary-paths/te:primary-path/"
+ "te:explicit-route-objects-always/"
+ "te:route-object-include-exclude/te:type/te:label/"
+ "te:label-hop/te:te-label/te:technology" {
    description
        "Augment TE label hop for the explicit route objects included
        or excluded by the path computation of the primary path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:primary-paths/te:primary-path/"
+ "te:path-in-segment/te:label-restrictions/"
+ "te:label-restriction/te:label-start/"
+ "te:te-label/te:technology" {
    description
        "Augment TE label range start for the ingress segment
        of the primay path.";
    case otn {
        uses l1-types:otn-label-start-end;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:primary-paths/te:primary-path/"
+ "te:path-in-segment/te:label-restrictions/"
+ "te:label-restriction/te:label-end/"
+ "te:te-label/te:technology" {
    description
        "Augment TE label range end for the ingress segment
        of the primay path.";
    case otn {
        uses l1-types:otn-label-start-end;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:primary-paths/te:primary-path/"
+ "te:path-in-segment/te:label-restrictions/"
+ "te:label-restriction/te:label-step/te:technology" {

```

```

description
  "Augment TE label range step for the ingress segment
  of the primay path.";
case otn {
  uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-start/"
  + "te:te-label/te:technology" {
description
  "Augment TE label range start for the egress segment
  of the primay path.";
case otn {
  uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
description
  "Augment TE label range end for the egress segment
  of the primay path.";
case otn {
  uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-step/te:technology" {
description
  "Augment TE label range end for the egress segment
  of the primay path.";
case otn {
  uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:primary-paths/te:primary-path/"
  + "te:computed-paths-properties/"

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    + "te:computed-path-properties/te:path-properties/"
    + "te:path-route-objects/te:path-route-object/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the route object of the computed
    primary path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-exclude-objects/"
    + "te:route-object-exclude-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit
    route objects excluded by the path computation of the primary
    reverse path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-include-objects/"
    + "te:route-object-include-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit
    route objects included by the path computation of the primary
    reverse path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:explicit-route-objects-always/"
    + "te:route-object-exclude-always/"

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    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the explicit route objects always
    excluded by the path computation of the primary reverse
    path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:explicit-route-objects-always/"
    + "te:route-object-include-exclude/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the explicit route objects included
    or excluded by the path computation of the primary reverse
    path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range start for the ingress segment
    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the ingress segment

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    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-step/te:technology" {
description
    "Augment TE label range step for the ingress segment
    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range start for the egress segment
    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the egress segment
    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"

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    + "te:primary-reverse-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-step/te:technology" {
description
    "Augment TE label range step for the egress segment
    of the primay reverse path.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:primary-paths/te:primary-path/"
    + "te:primary-reverse-path/"
    + "te:computed-paths-properties/te:computed-path-properties/"
    + "te:path-properties/te:path-route-objects/"
    + "te:path-route-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the route object of the computed
    primary reverse path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-exclude-objects/"
    + "te:route-object-exclude-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit
    route objects excluded by the path computation of the
    secondary path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-include-objects/"
    + "te:route-object-include-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit

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        route objects included by the path computation of the
        secondary path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:secondary-paths/te:secondary-path/"
+ "te:explicit-route-objects-always/"
+ "te:route-object-exclude-always/te:type/te:label/"
+ "te:label-hop/te:te-label/te:technology" {
    description
        "Augment TE label hop for the explicit route objects always
        excluded by the path computation of the secondary path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:secondary-paths/te:secondary-path/"
+ "te:explicit-route-objects-always/"
+ "te:route-object-include-exclude/te:type/te:label/"
+ "te:label-hop/te:te-label/te:technology" {
    description
        "Augment TE label hop for the explicit route objects included
        or excluded by the path computation of the secondary path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:secondary-paths/te:secondary-path/"
+ "te:path-in-segment/te:label-restrictions/"
+ "te:label-restriction/te:label-start/"
+ "te:te-label/te:technology" {
    description
        "Augment TE label range start for the ingress segment
        of the secondary path.";
    case otn {
        uses l1-types:otn-label-start-end;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
+ "te:secondary-paths/te:secondary-path/"
+ "te:path-in-segment/te:label-restrictions/"

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        + "te:label-restriction/te:label-end/"
        + "te:te-label/te:technology" {
description
    "Augment TE label range end for the ingress segment
    of the secondary path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-step/te:technology" {
description
    "Augment TE label range step for the ingress segment
    of the secondary path.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range start for the egress segment
    of the secondary path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the egress segment
    of the secondary path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"

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    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-step/te:technology" {
description
    "Augment TE label range step for the egress segment
    of the secondary path.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-paths/te:secondary-path/"
    + "te:computed-paths-properties/"
    + "te:computed-path-properties/"
    + "te:path-properties/te:path-route-objects/"
    + "te:path-route-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the route object of the computed
    secondary path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-exclude-objects/"
    + "te:route-object-exclude-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit
    route objects excluded by the path computation of the
    secondary reverse path.";
case otn {
    uses l1-types:otn-label-hop;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:optimizations/te:algorithm/te:metric/"
    + "te:optimization-metric/te:explicit-route-include-objects/"
    + "te:route-object-include-object/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description
    "Augment TE label hop for the optimization of the explicit
    route objects included by the path computation of the

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        secondary reverse path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:explicit-route-objects-always/"
    + "te:route-object-exclude-always/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
    description
        "Augment TE label hop for the explicit route objects always
        excluded by the path computation of the secondary reverse
        path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:explicit-route-objects-always/"
    + "te:route-object-include-exclude/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
    description
        "Augment TE label hop for the explicit route objects included
        or excluded by the path computation of the secondary reverse
        path.";
    case otn {
        uses l1-types:otn-label-hop;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
    description
        "Augment TE label range start for the ingress segment
        of the secondary reverse path.";
    case otn {
        uses l1-types:otn-label-start-end;
    }
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"

```

```

    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the ingress segment
    of the secondary reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-step/te:technology" {
description
    "Augment TE label range step for the ingress segment
    of the secondary reverse path.";
case otn {
    uses l1-types:otn-label-step;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range start for the egress segment
    of the secondary reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

augment "/te:te/te:tunnels/te:tunnel/"
    + "te:secondary-reverse-paths/te:secondary-reverse-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description
    "Augment TE label range end for the egress segment
    of the secondary reverse path.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

```

```

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-reverse-paths/te:secondary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-step/te:technology" {
  description
    "Augment TE label range step for the egress segment
    of the secondary reverse path.";
  case otn {
    uses l1-types:otn-label-step;
  }
}

augment "/te:te/te:tunnels/te:tunnel/"
  + "te:secondary-reverse-paths/te:secondary-reverse-path/"
  + "te:computed-paths-properties/"
  + "te:computed-path-properties/"
  + "te:path-properties/te:path-route-objects/"
  + "te:path-route-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the route object of the computed
    secondary reverse path.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

augment "/te:te/te:lsp/"
  + "te:lsp/te:lsp-record-route-information/"
  + "te:lsp-record-route-information/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description
    "Augment TE label hop for the record route of the LSP.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}
}

```

<CODE ENDS>

5. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [[RFC6241](#)] or RESTCONF [[RFC8040](#)]. The lowest NETCONF

layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [[RFC6242](#)]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [[RFC8446](#)].

The NETCONF access control model [[RFC8341](#)] provides the means to restrict access for particular NETCONF 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. Considerations in Section 10 of [[I-D.ietf-teas-yang-te](#)] are also applicable to their subtrees in the module defined in this document.

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. Considerations in Section 10 of [[I-D.ietf-teas-yang-te](#)] are also applicable to their subtrees in the module defined in this document.

6. 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-tunnel
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.

This document registers following YANG modules in the YANG Module Names registry [[RFC7950](#)].

name:	ietf-otn-tunnel
namespace:	urn:ietf:params:xml:ns:yang:ietf-otn-tunnel
prefix:	otn-tnl
reference:	RFC XXXX

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

7. Acknowledgements

TBD.

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