

CCAMP Working Group
Internet-Draft
Intended status: Standards Track
Expires: October 14, 2021

H. Zheng
I. Busi
Huawei Technologies
S. Belotti
Nokia
V. Lopez
Telefonica
Y. Xu
CAICT
April 12, 2021

OTN Tunnel YANG Model
draft-ietf-ccamp-otn-tunnel-model-13

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

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on October 14, 2021.

Copyright Notice

Copyright (c) 2021 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents

(<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	2
2.	Terminology and Notations	2
3.	OTN Tunnel Model Description	3
3.1.	Overview of OTN Tunnel Model	3
3.2.	Bandwidth Augmentation	4
3.3.	Label Augmentation	4
4.	OTN Tunnel YANG Tree	4
5.	OTN Tunnel YANG Code	15
6.	Security Considerations	31
7.	IANA Considerations	32
8.	Acknowledgements	32
9.	Contributors	32
10.	References	33
10.1.	Normative References	33
10.2.	Informative References	34
	Authors' Addresses	35

[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 [\[I-D.ietf-teas-yang-te\]](#).

[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 draft 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 More OTN specific terms can be found in [[I-D.ietf-ccamp-otn-topo-yang](#)].

[3.](#) OTN Tunnel Model Description

[3.1.](#) 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.

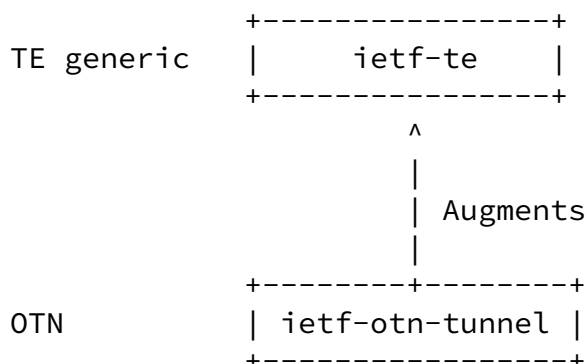


Figure 1 - Relationship between OTN and TE tunnel models

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

Zheng, et al.

Expires October 14, 2021

[Page 3]

Internet-Draft

OTN Tunnel YANG Model

April 2021

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](#)].

[3.2.](#) 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](#)].

[3.3.](#) 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](#)].

4. 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:p2p-primary-paths
  /te:p2p-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:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-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
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
  /te:p2p-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: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-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-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:
+---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-in-segment
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    +--rw otn-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 (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    +--rw otn-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:
+--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
    /te:label-start/te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    +--rw otn-ts?          otn-ts
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:path-out-segment

```



```

        /te:te-label/te:technology:
+--:(otn)
  +--rw (range-type)?
    +--:(trib-port)
      | +--rw otn-tpn?    otn-tpn
    +--:(trib-slot)
      +--rw otn-ts?     otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:optimizations/te:algorithm
  /te:metric/te:optimization-metric
  /te:explicit-route-exclude-objects
  /te:route-object-exclude-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?        identityref
  +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:optimizations/te:algorithm
  /te:metric/te:optimization-metric
  /te:explicit-route-include-objects
  /te:route-object-include-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?        identityref
  +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:explicit-route-objects-always
  /te:route-object-exclude-always/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?        identityref
  +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:explicit-route-objects-always
  /te:route-object-include-exclude/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?        identityref
  +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-in-segment
  /te:label-restrictions/te:label-restriction:
+--rw 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:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    |   +--rw otn-ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    |   +--rw otn-ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction:
+--rw 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:p2p-primary-paths
    /te:p2p-primary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?
    +---:(trib-port)
    |   +--rw otn-tpn?      otn-tpn
    +---:(trib-slot)
    |   +--rw otn-ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
    +--rw (range-type)?

```

```
+++:(trib-port)
|  +-rw otn-tpn?   otn-tpn
```

```
+++:(trib-slot)
  +-rw otn-ts?   otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:computed-paths-properties
  /te:computed-path-properties/te:path-properties
  /te:path-route-objects/te:path-computed-route-object
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+++:(otn)
  +-ro otn-tpn?   otn-tpn
  +-ro tsg?       identityref
  +-ro ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:lsps/te:lsp
  /te:lsp-record-route-information
  /te:lsp-record-route-information/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+++:(otn)
  +-ro otn-tpn?   otn-tpn
  +-ro tsg?       identityref
  +-ro ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:lsps/te:lsp/te:path-properties
  /te:path-route-objects/te:path-computed-route-object
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+++:(otn)
  +-ro otn-tpn?   otn-tpn
  +-ro tsg?       identityref
  +-ro ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:optimizations/te:algorithm/te:metric
  /te:optimization-metric/te:explicit-route-exclude-objects
  /te:route-object-exclude-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+++:(otn)
  +-rw otn-tpn?   otn-tpn
  +-rw tsg?       identityref
  +-rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
```

```

    /te:p2p-primary-path/te:p2p-primary-reverse-path
    /te:optimizations/te:algorithm/te:metric
    /te:optimization-metric/te:explicit-route-include-objects
    /te:route-object-include-object/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?       identityref
  +--rw ts-list?   string

```

```

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:explicit-route-objects-always
  /te:route-object-exclude-always/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?       identityref
  +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:explicit-route-objects-always
  /te:route-object-include-exclude/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn
  +--rw tsg?       identityref
  +--rw ts-list?   string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-in-segment/te:label-restrictions
  /te:label-restriction:
  +--rw 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:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-in-segment/te:label-restrictions
  /te:label-restriction/te:label-start/te:te-label
  /te:technology:
+--:(otn)

```

```

    +--rw (range-type)?
      +--:(trib-port)
        | +--rw otn-tpn?    otn-tpn
      +--:(trib-slot)
        +--rw otn-ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-in-segment/te:label-restrictions
  /te:label-restriction/te:label-end/te:te-label
  /te:technology:
+--:(otn)
  +--rw (range-type)?
    +--:(trib-port)
      | +--rw otn-tpn?    otn-tpn
    +--:(trib-slot)
      +--rw otn-ts?    otn-ts

```

```

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction:
  +--rw 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:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction/te:label-start/te:te-label
  /te:technology:
+--:(otn)
  +--rw (range-type)?
    +--:(trib-port)
      | +--rw otn-tpn?    otn-tpn
    +--:(trib-slot)
      +--rw otn-ts?    otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:path-out-segment/te:label-restrictions
  /te:label-restriction/te:label-end/te:te-label
  /te:technology:
+--:(otn)

```

```

    +--rw (range-type)?
      +--:(trib-port)
        | +--rw otn-tpn?    otn-tpn
      +--:(trib-slot)
        +--rw otn-ts?      otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path
  /te:computed-paths-properties/te:computed-path-properties
  /te:path-properties/te:path-route-objects
  /te:path-computed-route-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?    otn-tpn
  +--ro tsg?        identityref
  +--ro ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path/te:lsp
  /te:lsp/te:lsp-record-route-information
  /te:lsp-record-route-information/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?    otn-tpn
  +--ro tsg?        identityref

```

```

    +--ro ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-primary-reverse-path/te:lsp
  /te:lsp/te:path-properties/te:path-route-objects
  /te:path-computed-route-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?    otn-tpn
  +--ro tsg?        identityref
  +--ro ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
  /te:p2p-secondary-path/te:optimizations/te:algorithm
  /te:metric/te:optimization-metric
  /te:explicit-route-exclude-objects
  /te:route-object-exclude-object/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw otn-tpn?    otn-tpn

```

```

    +--rw tsg?          identityref
    +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:optimizations/te:algorithm
    /te:metric/te:optimization-metric
    /te:explicit-route-include-objects
    /te:route-object-include-object/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn-tpn?    otn-tpn
    +--rw tsg?        identityref
    +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:explicit-route-objects-always
    /te:route-object-exclude-always/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn-tpn?    otn-tpn
    +--rw tsg?        identityref
    +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:explicit-route-objects-always
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+--:(otn)
    +--rw otn-tpn?    otn-tpn
    +--rw tsg?        identityref
    +--rw ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment

```

```

    /te:label-restrictions/te:label-restriction:
    +--rw 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:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+--:(otn)
    +--rw (range-type)?

```

```

    +---:(trib-port)
    |   +---rw otn-tpn?   otn-tpn
    +---:(trib-slot)
        +---rw otn-ts?   otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
    +---rw (range-type)?
    +---:(trib-port)
    |   +---rw otn-tpn?   otn-tpn
    +---:(trib-slot)
        +---rw otn-ts?   otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction:
+---rw 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:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+---:(otn)
    +---rw (range-type)?
    +---:(trib-port)
    |   +---rw otn-tpn?   otn-tpn
    +---:(trib-slot)
        +---rw otn-ts?   otn-ts
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-out-segment
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
    +---rw (range-type)?

```

```

+---:(trib-port)
|   +---rw otn-tpn?   otn-tpn
+---:(trib-slot)
    +---rw otn-ts?   otn-ts

```



```

augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
  /te:p2p-secondary-path/te:computed-paths-properties
  /te:computed-path-properties/te:path-properties
  /te:path-route-objects/te:path-computed-route-object
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?   otn-tpn
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
  /te:p2p-secondary-path/te:lsps/te:lsp
  /te:lsp-record-route-information
  /te:lsp-record-route-information/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?   otn-tpn
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
  /te:p2p-secondary-path/te:lsps/te:lsp/te:path-properties
  /te:path-route-objects/te:path-computed-route-object
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro otn-tpn?   otn-tpn
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:lsps-state/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-tpn?   otn-tpn
  +--ro tsg?      identityref
  +--ro ts-list?  string

```

5. OTN Tunnel YANG Code

```

<CODE BEGINS>file "ietf-otn-tunnel@2021-02-10.yang"
module ietf-otn-tunnel {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-otn-tunnel";
  prefix "otn-tunnel";

```

```
import ietf-te-types {
  prefix te-types;
  revision-date "2019-02-06";
  reference "draft-ietf-teas-yang-te-types: A YANG Data Model for
    Common Traffic Engineering Types";
}

import ietf-te {
  prefix "te";
  revision-date "2019-02-15";
  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@ritt.cn>";

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

  The model fully conforms to the Network Management
```

Copyright (c) 2021 IETF Trust and the persons identified as authors of the code. All rights reserved.

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

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

```

revision "2021-04-12" {
  description
    "Initial Revision";
  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 bandwidth of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

```

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

```
/* Augment bandwidth of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

/* Augment bandwidth of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

/* Augment bandwidth of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses l1-types:otn-path-bandwidth;
  }
}

/*
 * Augment TE label.
```

```

*/

/* Augment label hop of route-object-exclude-always of
   named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

```

```

/* Augment label hop of route-object-include-exclude of
   named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-include-exclude/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

```

```

/* Augment label restrictions for the forwarding direction of
   path-in-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-in-segment/"
  + "te:label-restrictions/te:label-restriction" {
  description "OTN label.";
  uses l1-types:otn-label-range-info;
}

```

```

/* Augment label restrictions start for the forwarding direction of
   path-in-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-in-segment/"

```

```

    + "te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

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

```

```

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

/* Augment label restrictions start for the forwarding direction of
   path-out-segment of named-path-constraints */
augment "/te:te/te:globals/te:named-path-constraints/"
    + "te:named-path-constraint/te:path-out-segment/"
    + "te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {

```

```

    uses l1-types:otn-label-start-end;
  }
}

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

/* Augment label hop of route-exclude of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-exclude-objects/"
  + "te:route-object-exclude-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

```

```

/* Augment label hop of route-include of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-include-objects/"
  + "te:route-object-include-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

```

```

/* Augment label hop of route-object-exclude-always of
   primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of route-object-include-exclude of
   primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-include-exclude/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label restrictions for the path-in-segment of
   primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:path-in-segment/te:label-restrictions/"
  + "te:label-restriction" {
  description "OTN label.";
  uses l1-types:otn-label-range-info;
}

```

```

/* Augment label restrictions start for the forwarding direction of
   path-in-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:path-in-segment/te:label-restrictions/"

```



```

        + "te:label-restriction/te:label-start/"
        + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

/* Augment label restrictions end for the forwarding direction of
   path-in-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

/* Augment label restrictions for the forwarding direction of
   path-out-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction" {
description "OTN label.";
uses l1-types:otn-label-range-info;
}

/* Augment label restrictions start for the forwarding direction of
   path-out-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

```

```

/* Augment label restrictions end for the forwarding direction of
   path-out-segment of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-start-end;
}
}

/* Augment label hop of path-route of primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:computed-paths-properties/"
  + "te:computed-path-properties/te:path-properties/"
  + "te:path-route-objects/te:path-computed-route-object/"
  + "te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

/* Augment label hop of record-route of primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te: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 "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

/* Augment label hop of path-route of primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:lsp/te:lsp/te:path-properties/"
  + "te:path-route-objects/te:path-computed-route-object/"
  + "te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {

```

```
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of route-exclude of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-exclude-objects/"
  + "te:route-object-exclude-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of route-include of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-include-objects/"
  + "te:route-object-include-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of route-object-exclude-always of
reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/"
  + "te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
```

```
    case otn {
      uses l1-types:otn-label-hop;
    }
  }
}
```

/* Augment label hop of route-object-include-exclude of

```
    reverse primary path */
  augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:p2p-primary-reverse-path/"
    + "te:explicit-route-objects-always/"
    + "te:route-object-include-exclude/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}
```

```
/* Augment label restrictions for the forwarding direction of
   path-in-segment of reverse primary path */
  augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:p2p-primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction" {
  description "OTN label.";
  uses l1-types:otn-label-range-info;
}
```

```
/* Augment label restrictions start for the forwarding direction of
   path-in-segment of reverse primary path */
  augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-primary-paths/te:p2p-primary-path/"
    + "te:p2p-primary-reverse-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
  description "OTN label.";
  case otn {
```

```

    uses l1-types:otn-label-start-end;
  }
}

/* Augment label restrictions end for the forwarding direction of
   path-in-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:path-in-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
description "OTN label.";

```

```

  case otn {
    uses l1-types:otn-label-start-end;
  }
}

/* Augment label restrictions for the forwarding direction of
   path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction" {
description "OTN label.";
uses l1-types:otn-label-range-info;
}

/* Augment label restrictions start for the forwarding direction of
   path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-start/"
  + "te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-start-end;
}
}

```

```

}

/* Augment label restrictions end for the forwarding direction of
   path-out-segment of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-start-end;
}
}

/* Augment label hop of path-route of reverse primary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"

```

```

  + "te:computed-paths-properties/te:computed-path-properties/"
  + "te:path-properties/te:path-route-objects/"
  + "te:path-computed-route-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

/* Augment label hop of record-route of reverse primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te: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 "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

```

```

}

/* Augment label hop of path-route of reverse primary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-primary-paths/te:p2p-primary-path/"
  + "te:p2p-primary-reverse-path/"
  + "te:lsp/te:lsp/te:path-properties/"
  + "te:path-route-objects/te:path-computed-route-object/"
  + "te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}
}

```

```

/* Augment label hop of route-exclude of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-exclude-objects/"
  + "te:route-object-exclude-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

```

```

}

/* Augment label hop of route-include of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:optimizations/te:algorithm/te:metric/"
  + "te:optimization-metric/te:explicit-route-include-objects/"
  + "te:route-object-include-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}
}

```

```

/* Augment label hop of route-object-exclude-always of
secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

```

```

/* Augment label hop of route-object-include-exclude of
secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:explicit-route-objects-always/"
  + "te:route-object-include-exclude/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses l1-types:otn-label-hop;
}
}

```

```

/* Augment label restrictions for the forwarding direction of
path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:path-in-segment/te:label-restrictions/"
  + "te:label-restriction" {
description "OTN label.";
}

```

```

  uses l1-types:otn-label-range-info;
}

```

```

/* Augment label restrictions start for the forwarding direction of
path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"

```



```

    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

/* Augment label restrictions end for the forwarding direction of
   path-in-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-in-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-start-end;
}
}

/* Augment label restrictions for the forwarding direction of
   path-out-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction" {
description "OTN label.";
uses l1-types:otn-label-range-info;
}

/* Augment label restrictions start for the forwarding direction of
   path-out-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
    + "te:p2p-secondary-paths/te:p2p-secondary-path/"
    + "te:path-out-segment/te:label-restrictions/"
    + "te:label-restriction/te:label-start/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {

```

```

    uses l1-types:otn-label-start-end;
  }
}

/* Augment label restrictions end for the forwarding direction of
   path-out-segment of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:path-out-segment/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-start-end;
  }
}

/* Augment label hop of path-route of secondary path */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:computed-paths-properties/"
  + "te:computed-path-properties/"
  + "te:path-properties/te:path-route-objects/"
  + "te:path-computed-route-object/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of record-route of secondary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:lsp/te:lsp/te:lsp-record-route-information/"
  + "te:lsp-record-route-information/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses l1-types:otn-label-hop;
  }
}

/* Augment label hop of path-route of secondary LSP */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:lsp/te:lsp/te:path-properties/"
  + "te:path-route-objects/"

```

```
        + "te:path-computed-route-object/te:type/te:label/"
        + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses l1-types:otn-label-hop;
}
}

/* Augment label hop of record-route of LSP */
augment "/te:te/te:lsp-state/"
    + "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 "OTN label.";
case otn {
    uses l1-types:otn-label-hop;
}
}
}
}
<CODE ENDS>
```

6. Security Considerations

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

The NETCONF access control model [RFC8341] provides the means to restrict access for particular NETCONF 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.

[7.](#) 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-tunnel
reference:     RFC XXXX
```

[8.](#) Acknowledgements

TBD.

[9.](#) Contributors

Aihua Guo
Futurewei

Email: aihuaguo.ietf@gmail.com

Anurag Sharma
Google
Email: ansha@google.com

Rajan Rao
Infinera
Email: rrao@infinera.com

Yunbo Li
China Mobile

Zheng, et al.

Expires October 14, 2021

[Page 32]

Internet-Draft

OTN Tunnel YANG Model

April 2021

Email: liyunbo@chinamobile.com

Dieter Beller
Nokia
Email: dieter.beller@nokia.com

Yanlei Zheng
China Unicom
Email: zhengyanlei@chinaunicom.cn

Xian Zhang
Huawei Technologies
Email: zhang.xian@huawei.com

Lei Wang
China Mobile
Email: wangleiyj@chinamobile.com

Oscar Gonzalez de Dios
Telefonica
Email: oscar.gonzalezdedios@telefonica.com

10. References

10.1. Normative References

[I-D.ietf-ccamp-layer1-types]

Zheng, H. and I. Busi, "A YANG Data Model for Layer 1 Types", [draft-ietf-ccamp-layer1-types-08](#) (work in

progress), November 2020.

[I-D.ietf-ccamp-otn-topo-yang]

Zheng, H., Busi, I., Liu, X., Belotti, S., and O. Dios, "A YANG Data Model for Optical Transport Network Topology", [draft-ietf-ccamp-otn-topo-yang-11](#) (work in progress), September 2020.

[I-D.ietf-teas-yang-te]

Saad, T., Gandhi, R., Liu, X., Beeram, V., and I. Bryskin, "A YANG Data Model for Traffic Engineering Tunnels, Label Switched Paths and Interfaces", [draft-ietf-teas-yang-te-25](#) (work in progress), July 2020.

[ITU-Tg709]

International Telecommunication Union, "Interfaces for the optical transport network", ITU-T G.709, March 2020.

Zheng, et al.

Expires October 14, 2021

[Page 33]

Internet-Draft

OTN Tunnel YANG Model

April 2021

- [RFC3688] Mealling, M., "The IETF XML Registry", [BCP 81](#), [RFC 3688](#), DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.
- [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", [RFC 6241](#), DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.
- [RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", [RFC 6242](#), DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.
- [RFC7139] Zhang, F., Ed., Zhang, G., Belotti, S., Ceccarelli, D., and K. Pithewan, "GMPLS Signaling Extensions for Control of Evolving G.709 Optical Transport Networks", [RFC 7139](#), DOI 10.17487/RFC7139, March 2014, <<https://www.rfc-editor.org/info/rfc7139>>.
- [RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", [RFC 7950](#), DOI 10.17487/RFC7950, August 2016, <<https://www.rfc-editor.org/info/rfc7950>>.

- [RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF Protocol", [RFC 8040](#), DOI 10.17487/RFC8040, January 2017, <<https://www.rfc-editor.org/info/rfc8040>>.
- [RFC8341] Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, [RFC 8341](#), DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.
- [RFC8342] Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture (NMDA)", [RFC 8342](#), DOI 10.17487/RFC8342, March 2018, <<https://www.rfc-editor.org/info/rfc8342>>.
- [RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", [RFC 8446](#), DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

10.2. Informative References

- [I-D.ietf-ccamp-transport-nbi-app-statement]
 Busi, I., King, D., Zheng, H., and Y. Xu, "Transport Northbound Interface Applicability Statement", [draft-ietf-ccamp-transport-nbi-app-statement-12](#) (work in progress), January 2021.

Zheng, et al.

Expires October 14, 2021

[Page 34]

Internet-Draft

OTN Tunnel YANG Model

April 2021

- [I-D.ietf-teas-actn-yang]
 Lee, Y., Zheng, H., Ceccarelli, D., Yoon, B., Dios, O., Shin, J., and S. Belotti, "Applicability of YANG models for Abstraction and Control of Traffic Engineered Networks", [draft-ietf-teas-actn-yang-06](#) (work in progress), August 2020.
- [RFC7062] Zhang, F., Ed., Li, D., Li, H., Belotti, S., and D. Ceccarelli, "Framework for GMPLS and PCE Control of G.709 Optical Transport Networks", [RFC 7062](#), DOI 10.17487/RFC7062, November 2013, <<https://www.rfc-editor.org/info/rfc7062>>.
- [RFC7138] Ceccarelli, D., Ed., Zhang, F., Belotti, S., Rao, R., and J. Drake, "Traffic Engineering Extensions to OSPF for

GMPLS Control of Evolving G.709 Optical Transport Networks", [RFC 7138](#), DOI 10.17487/RFC7138, March 2014, <<https://www.rfc-editor.org/info/rfc7138>>.

[RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", [BCP 215](#), [RFC 8340](#), DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.

Authors' Addresses

Haomian Zheng
Huawei Technologies
H1, Huawei Xiliu Beipo Village, Songshan Lake
Dongguan, Guangdong 523808
China

Email: zhenghaomian@huawei.com

Italo Busi
Huawei Technologies
HUAWEI TECHNOLOGIES ITALIA Srl Centro Direzionale Milano 2
Milan, Milan 20090
Italy

Email: Italo.Busi@huawei.com

Sergio Belotti
Nokia

Email: sergio.belotti@nokia.com

Zheng, et al.

Expires October 14, 2021

[Page 35]

Internet-Draft

OTN Tunnel YANG Model

April 2021

Victor Lopez
Telefonica

Email: victor.lopezalvarez@telefonica.com

Yunbin Xu
CAICT

Email: xuyunbin@caict.ac.cn