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OTN Tunnel YANG Model
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Abstract

This document describes the YANG data model for OTN Tunnels.

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[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 TE Tunnel model.

[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

The OTN tunnel model is using TE tunnel [\[I-D.ietf-teas-yang-te\]](#) as a basic model and augment to the TE tunnel with OTN-specific parameters, including the bandwidth information and label information. 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, such as Tributary Slot (TS), Tributary Port Number (TPN), are specified in the module ietf-layer1-types in [\[I-D.ietf-ccamp-layer1-types\]](#) and used in this document.

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 current model is following the YANG language specification as [\[RFC7950\]](#), and the corresponding protocol is recommended to be Netconf protocol in [\[RFC6241\]](#) or RESTconf protocol in [\[RFC8040\]](#).

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

3.2. OTN-specific Parameters in Tunnel Model

OTN specific parameters have been augmenting to the TE tunnel models. The attributes on both of the source and destination need to be configured when setting up the tunnel. Typical parameters, including client signal, TPN, TSG and corresponding tributary slot information, are required in the OTN tunnel model. These parameters are consistent with the framework in [\[RFC7062\]](#), and the specification in [\[RFC7138\]](#) and [\[RFC7139\]](#).

The OTN bandwidth information has been augmenting to various sections of TE tunnel models, including tunnel bandwidth, primary path bandwidth and so on. The OTN label information has been augmenting to label hop of a group of routing objects and also LSPs.

4. OTN Tunnel YANG Tree

```

module: ietf-otn-tunnel
  augment /te:te/te:tunnels/te:tunnel:
    +--rw src-client-signal?  identityref
    +--rw dst-client-signal?  identityref
  augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:te-bandwidth
    /te:technology:
    +--:(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?                 l1-types:gfp-k
        +--:(flexe-client)
          | +--rw flexe-client
          |   l1-types: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 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?                 l1-types:gfp-k
        +--:(flexe-client)
          | +--rw flexe-client
          |   l1-types: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 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?                          l1-types:gfp-k
    +---:(flexe-client)
      | +--rw flexe-client
      |   l1-types: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 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?                          l1-types:gfp-k
    +---:(flexe-client)
      | +--rw flexe-client
      |   l1-types: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 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?                             l1-types:gfp-k
    +--:(flexe-client)
    |   +--rw flexe-client
    |       l1-types: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?    l1-types: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?    l1-types: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?    l1-types: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?    l1-types:otn-tpn
    +--:(trib-slot)
    |   +--rw otn-ts?     l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?      l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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 (range-type)?
  +--:(trib-port)
  |   +--rw otn-tpn?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?        l1-types: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?    l1-types: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?    l1-types: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?    l1-types: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?    l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?  l1-types:otn-tpn
      +--:(trib-slot)
        +--rw otn-ts?    l1-types: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?    l1-types: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?  l1-types:otn-tpn
            +--:(trib-slot)
              +--rw otn-ts?    l1-types: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?  l1-types:otn-tpn
            +--:(trib-slot)
              +--rw otn-ts?    l1-types: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?  l1-types: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?   l1-types: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?   l1-types: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?   l1-types: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?   l1-types: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?   l1-types: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?    l1-types: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?    l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?    l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  |   +--rw otn-ts?     l1-types: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?    l1-types: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: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?    l1-types: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: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?    l1-types: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?      l1-types: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?      l1-types: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?      l1-types: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?      l1-types: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?      l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  +--rw otn-ts?      l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  +--rw otn-ts?      l1-types: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?      l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  +--rw otn-ts?      l1-types: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?    l1-types:otn-tpn
  +--:(trib-slot)
  +--rw otn-ts?      l1-types: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?   l1-types: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?   l1-types: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?   l1-types: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?   l1-types:otn-tpn
  +--ro tsg?       identityref
  +--ro ts-list?   string

```

5. OTN Tunnel YANG Code

```

<CODE BEGINS>file "ietf-otn-tunnel@2020-03-09.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 {
  prefix "te";
  reference
    "I-D.ietf-teas-yang-te: 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/>
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  Editor: Haomian Zheng
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description
  "This module defines a model for OTN Tunnel Services.
  The model fully conforms to the Network Management
  Datastore Architecture (NMDA).

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  identified as authors of the code. All rights reserved.

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  without modification, is permitted pursuant to, and subject
```


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(<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 "2020-03-09" {
  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
}

/*
 * Groupings
 */

grouping otn-tunnel-attributes {
  description "Parameters for OTN tunnel";

  leaf src-client-signal {
    type identityref {
      base l1-types:client-signal;
    }
    description
      "Client signal at the source endpoint of the tunnel. ";
  }

  leaf dst-client-signal {
    type identityref {
      base l1-types:client-signal;
    }
    description
      "Client signal at the destination endpoint of the tunnel";
  }
}

/*
 * Data nodes
 */

augment "/te:te/te:tunnels/te:tunnel" {
  description
    "Augment with additional parameters required for OTN service";
```



```
    uses otn-tunnel-attributes;
}

/*
 * 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 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" {
  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:lsps/te:lsp/te:lsp-record-route-information/"
    + "te:lsp-record-route-information/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description "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:lsps/te:lsp/te:path-properties/"
    + "te:path-route-objects/te:path-computed-route-object/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description "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:lsps/te:lsp/te:lsp-record-route-information/"
    + "te:lsp-record-route-information/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description "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:lsps/te:lsp/te:path-properties/"
  + "te:path-route-objects/te:path-computed-route-object/"
  + "te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "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:lsps/te:lsp/te:lsp-record-route-information/"
  + "te:lsp-record-route-information/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {

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

```
/* Augment label hop of record-route of LSP */
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" {
  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. These are the subtrees and data nodes and their sensitivity/vulnerability:

```

/te:te/te:tunnels/te:tunnel /te:te/./te:te-bandwidth/te:technology
/te:te/./te:type/te:label/te:label-hop/te:te-label/te:technology
/te:te/./te:label-restrictions/te:label-restriction/te:label-start/
te:te-label/te:technology /te:te/./te:label-restrictions/te:label-
restriction/te:label-end/te:te-label/te:technology
/te:te/./te:label-restrictions/te:label-restriction/ Editors note:
we are using simplified description by folding similar branches to
avoid repetition.

```

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

/te:te/../../te:type/te:label/te:label-hop/te:te-label/te:technology
Editors note: we are using simplified description by folding similar
branches to avoid repetition.

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.

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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-06](#) (work in progress), May 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-10](#) (work in progress), March 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.

[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-11](#) (work in progress), July 2020.

[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>>.

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