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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 can carry various types of client services. In many cases, the client signal is carried over an OTN tunnel across connected domains in a multi-domain network. These OTN services can either be transported or switched in the OTN network. If an OTN tunnel is switched, then additional parameters need to be provided to create a Mux OTN service.

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

[[I-D.ietf-netmod-yang-tree-diagrams](#)]. 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.

[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](#)].

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](#)].

[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

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bandwidth and so on. The OTN label information has been augmenting to label hop of a group of routing objects and also LSPs.

[3.3.](#) OTN Path Compute RPC

Similarly with TE tunnel, a 'compute-only' mode of OTN tunnel model is also supported for stateful path computation. Given the OTN tunnel computed, the client may query and/or subscribe on the tunnel to be notified whenever it changes. In addition, also a stateless Remote Procedural Call (RPC) is specified. On receiving this RPC, the provider is expected to compute the available path subject to the constraints specified in RPC and feedback to the client without any changing of the OTN network or the OTN tunnels.

[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
  augment /te:te/te:tunnels/te:tunnel/te:te-bandwidth/te:technology:
    +--:(otn)
      +--rw odu-type?          identityref
```

```

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
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:p2p-reverse-primary-path
    /te:te-bandwidth/te:technology:
    +---:(otn)
        +---rw odu-type?    identityref
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
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:explicit-route-objects
    /te:route-object-exclude-always/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
    +---:(otn)
        +---rw tpn?        uint16

```

```

    +---rw tsg?            identityref
    +---rw ts-list?       string
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:explicit-route-objects
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
    +---:(otn)
        +---rw tpn?        uint16
        +---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:forward/te:label-restrictions/te:label-restriction:
    +---rw range-type?    identityref
    +---rw tsg?            identityref
    +---rw priority?      uint8
augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:path-in-segment/te:forward
    /te:label-restrictions/te:label-restriction/te:label-start
    /te:te-label/te:technology:
    +---:(otn)
        +---rw (otn-label-type)?

```

```

    +--:(tributary-port)
      | +--rw tpn?  uint16
    +--:(tributary-slot)
      +--rw ts?   uint16
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment/te:forward
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw (otn-label-type)?
  +--:(tributary-port)
    | +--rw tpn?  uint16
  +--:(tributary-slot)
    +--rw ts?   uint16
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment/te:reverse
  /te:label-restrictions/te:label-restriction:
  +--rw range-type?  identityref
  +--rw tsg?         identityref
  +--rw priority?   uint8
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment/te:reverse
  /te:label-restrictions/te:label-restriction/te:label-start
  /te:te-label/te:technology:
+--:(otn)
  +--rw (otn-label-type)?

```

```

    +--:(tributary-port)
      | +--rw tpn?  uint16
    +--:(tributary-slot)
      +--rw ts?   uint16
augment /te:te/te:globals/te:named-path-constraints
  /te:named-path-constraint/te:path-in-segment/te:reverse
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw (otn-label-type)?
  +--:(tributary-port)
    | +--rw tpn?  uint16
  +--:(tributary-slot)
    +--rw ts?   uint16
augment /te:te/te:globals/te:named-path-constraints

```

```

        /te:named-path-constraint/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction:
+---rw range-type?   identityref
+---rw tsg?          identityref
+---rw priority?     uint8
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction/te:label-start
        /te:te-label/te:technology:
+---:(otn)
+---rw (otn-label-type)?
+---:(tributary-port)
| +---rw tpn?   uint16
+---:(tributary-slot)
+---rw ts?     uint16
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+---:(otn)
+---rw (otn-label-type)?
+---:(tributary-port)
| +---rw tpn?   uint16
+---:(tributary-slot)
+---rw ts?     uint16
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-out-segment/te:reverse
        /te:label-restrictions/te:label-restriction:
+---rw range-type?   identityref
+---rw tsg?          identityref
+---rw priority?     uint8
augment /te:te/te:globals/te:named-path-constraints
        /te:named-path-constraint/te:path-out-segment/te:reverse

```

```

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

```

```

augment /te:te/te:globals/te:named-path-constraints
    /te:named-path-constraint/te:path-out-segment/te:reverse
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
  +--:(otn)
    +--rw (otn-label-type)?
      +--:(tributary-port)
        | +--rw tpn?   uint16
      +--:(tributary-slot)
        +--rw ts?     uint16
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 tpn?          uint16
    +--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 tpn?          uint16
    +--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
    /te:route-object-exclude-always/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
  +--:(otn)
    +--rw tpn?          uint16
    +--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
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:

```



```

    +--rw tpn?          uint16
    +--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:forward
    /te:label-restrictions/te:label-restriction:
    +--rw range-type?  identityref
    +--rw tsg?          identityref
    +--rw priority?    uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment/te:forward
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+--:(otn)
    +--rw (otn-label-type)?
        +--:(tributary-port)
            | +--rw tpn?  uint16
        +--:(tributary-slot)
            +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment/te:forward
    /te:label-restrictions/te:label-restriction
    /te:label-end/te:te-label/te:technology:
+--:(otn)
    +--rw (otn-label-type)?
        +--:(tributary-port)
            | +--rw tpn?  uint16
        +--:(tributary-slot)
            +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment/te:reverse
    /te:label-restrictions/te:label-restriction:
    +--rw range-type?  identityref
    +--rw tsg?          identityref
    +--rw priority?    uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment/te:reverse
    /te:label-restrictions/te:label-restriction
    /te:label-start/te:te-label/te:technology:
+--:(otn)
    +--rw (otn-label-type)?
        +--:(tributary-port)
            | +--rw tpn?  uint16
        +--:(tributary-slot)
            +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
    /te:p2p-primary-path/te:path-in-segment/te:reverse

```

```

    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?   uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:forward
  /te:label-restrictions/te:label-restriction:
+---rw range-type?  identityref
+---rw tsg?         identityref
+---rw priority?   uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:forward
  /te:label-restrictions/te:label-restriction/te:label-start
  /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?   uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:forward
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?   uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:reverse
  /te:label-restrictions/te:label-restriction:
+---rw range-type?  identityref
+---rw tsg?         identityref
+---rw priority?   uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:reverse
  /te:label-restrictions/te:label-restriction/te:label-start
  /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
```

```
+--:(tributary-port)
| +--rw tpn?  uint16
```

```
+--:(tributary-slot)
  +--rw ts?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:path-out-segment/te:reverse
  /te:label-restrictions/te:label-restriction/te:label-end
  /te:te-label/te:technology:
+--:(otn)
  +--rw (otn-label-type)?
    +--:(tributary-port)
      | +--rw tpn?  uint16
    +--:(tributary-slot)
      +--rw ts?  uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:state/te:path-properties
  /te:path-route-objects/te:path-computed-route-object
  /te:state/te:type/te:label/te:label-hop/te:te-label
  /te:technology:
+--:(otn)
  +--ro tpn?      uint16
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:state/te:lsps/te:lsp
  /te:lsp-record-route-subobjects/te:record-route-subobject
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro tpn?      uint16
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:state/te:lsps/te:lsp
  /te:path-properties/te:path-route-objects
  /te:path-computed-route-object/te:state/te:type/te:label
  /te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--ro tpn?      uint16
  +--ro tsg?      identityref
  +--ro ts-list?  string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
```

```

    /te:p2p-primary-path/te:p2p-reverse-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 tpn?          uint16
  +--rw tsg?          identityref
  +--rw ts-list?     string

```

```

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-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 tpn?          uint16
  +--rw tsg?          identityref
  +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:explicit-route-objects/te:route-object-exclude-always
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw tpn?          uint16
  +--rw tsg?          identityref
  +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:explicit-route-objects/te:route-object-include-exclude
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+--:(otn)
  +--rw tpn?          uint16
  +--rw tsg?          identityref
  +--rw ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:path-in-segment/te:forward/te:label-restrictions
  /te:label-restriction:
+--rw range-type?   identityref
+--rw tsg?          identityref

```

```

    +---rw priority?      uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
      /te:p2p-primary-path/te:p2p-reverse-primary-path
      /te:path-in-segment/te:forward/te:label-restrictions
      /te:label-restriction/te:label-start/te:te-label
      /te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?      uint16
    +---:(tributary-slot)
      +---rw ts?        uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
      /te:p2p-primary-path/te:p2p-reverse-primary-path
      /te:path-in-segment/te:forward/te:label-restrictions
      /te:label-restriction/te:label-end/te:te-label

```

```

      /te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?      uint16
    +---:(tributary-slot)
      +---rw ts?        uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
      /te:p2p-primary-path/te:p2p-reverse-primary-path
      /te:path-in-segment/te:reverse/te:label-restrictions
      /te:label-restriction:
  +---rw range-type?    identityref
  +---rw tsg?           identityref
  +---rw priority?      uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
      /te:p2p-primary-path/te:p2p-reverse-primary-path
      /te:path-in-segment/te:reverse/te:label-restrictions
      /te:label-restriction/te:label-start/te:te-label
      /te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?      uint16
    +---:(tributary-slot)
      +---rw ts?        uint16

```

```

augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:path-in-segment/te:reverse/te:label-restrictions
  /te:label-restriction/te:label-end/te:te-label
  /te:technology:
  +--:(otn)
    +--rw (otn-label-type)?
      +--:(tributary-port)
        | +--rw tpn?  uint16
      +--:(tributary-slot)
        +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:path-out-segment/te:forward/te:label-restrictions
  /te:label-restriction:
  +--rw range-type?  identityref
  +--rw tsg?         identityref
  +--rw priority?    uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:path-out-segment/te:forward/te:label-restrictions
  /te:label-restriction/te:label-start/te:te-label
  /te:technology:

```

```

+--:(otn)
  +--rw (otn-label-type)?
    +--:(tributary-port)
      | +--rw tpn?  uint16
    +--:(tributary-slot)
      +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
  /te:p2p-primary-path/te:p2p-reverse-primary-path
  /te:path-out-segment/te:forward/te:label-restrictions
  /te:label-restriction/te:label-end/te:te-label
  /te:technology:
+--:(otn)
  +--rw (otn-label-type)?
    +--:(tributary-port)
      | +--rw tpn?  uint16
    +--:(tributary-slot)
      +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths

```

```

        /te:p2p-primary-path/te:p2p-reverse-primary-path
        /te:path-out-segment/te:reverse/te:label-restrictions
        /te:label-restriction:
+---rw range-type?    identityref
+---rw tsg?           identityref
+---rw priority?     uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
        /te:p2p-primary-path/te:p2p-reverse-primary-path
        /te:path-out-segment/te:reverse/te:label-restrictions
        /te:label-restriction/te:label-start/te:te-label
        /te:technology:
+---:(otn)
+---rw (otn-label-type)?
+---:(tributary-port)
| +---rw tpn?        uint16
+---:(tributary-slot)
+---rw ts?          uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
        /te:p2p-primary-path/te:p2p-reverse-primary-path
        /te:path-out-segment/te:reverse/te:label-restrictions
        /te:label-restriction/te:label-end/te:te-label
        /te:technology:
+---:(otn)
+---rw (otn-label-type)?
+---:(tributary-port)
| +---rw tpn?        uint16
+---:(tributary-slot)
+---rw ts?          uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
        /te:p2p-primary-path/te:p2p-reverse-primary-path

```

```

        /te:state/te:path-properties/te:path-route-objects
        /te:path-computed-route-object/te:state/te:type
        /te:label/te:label-hop/te:te-label/te:technology:
+---:(otn)
+---ro tpn?          uint16
+---ro tsg?          identityref
+---ro ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
        /te:p2p-primary-path/te:p2p-reverse-primary-path
        /te:state/te:lsp/te:lsp-record-route-subobjects
        /te:record-route-subobject/te:type/te:label/te:label-hop

```

```

        /te:te-label/te:technology:
+---:(otn)
  +---ro tpn?          uint16
  +---ro tsg?          identityref
  +---ro ts-list?     string
augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths
        /te:p2p-primary-path/te:p2p-reverse-primary-path
        /te:state/te:lsps/te:lsp/te:path-properties
        /te:path-route-objects/te:path-computed-route-object
        /te:state/te:type/te:label/te:label-hop/te:te-label
        /te:technology:
+---:(otn)
  +---ro tpn?          uint16
  +---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 tpn?          uint16
  +---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 tpn?          uint16
  +---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

```

```

        /te:route-object-exclude-always/te:type/te:label
        /te:label-hop/te:te-label/te:technology:
+---:(otn)
  +---rw tpn?          uint16

```



```

    +--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
    /te:route-object-include-exclude/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+---:(otn)
    +--rw tpn?        uint16
    +--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:forward
    /te:label-restrictions/te:label-restriction:
    +--rw range-type? identityref
    +--rw tsg?         identityref
    +--rw priority?   uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment/te:forward
    /te:label-restrictions/te:label-restriction/te:label-start
    /te:te-label/te:technology:
+---:(otn)
    +--rw (otn-label-type)?
        +---:(tributary-port)
            | +--rw tpn?  uint16
        +---:(tributary-slot)
            +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment/te:forward
    /te:label-restrictions/te:label-restriction/te:label-end
    /te:te-label/te:technology:
+---:(otn)
    +--rw (otn-label-type)?
        +---:(tributary-port)
            | +--rw tpn?  uint16
        +---:(tributary-slot)
            +--rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment/te:reverse
    /te:label-restrictions/te:label-restriction:
    +--rw range-type? identityref
    +--rw tsg?         identityref
    +--rw priority?   uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
    /te:p2p-secondary-path/te:path-in-segment/te:reverse

```

```

        /te:label-restrictions/te:label-restriction/te:label-start
        /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
        /te:p2p-secondary-path/te:path-in-segment/te:reverse
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
        /te:p2p-secondary-path/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction:
+---rw range-type?  identityref
+---rw tsg?         identityref
+---rw priority?   uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
        /te:p2p-secondary-path/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction/te:label-start
        /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
        /te:p2p-secondary-path/te:path-out-segment/te:forward
        /te:label-restrictions/te:label-restriction/te:label-end
        /te:te-label/te:technology:
+---:(otn)
  +---rw (otn-label-type)?
    +---:(tributary-port)
      | +---rw tpn?  uint16
    +---:(tributary-slot)
      +---rw ts?    uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
        /te:p2p-secondary-path/te:path-out-segment/te:reverse
        /te:label-restrictions/te:label-restriction:

```

+++rw range-type? identityref

```
+++rw tsg?          identityref
+++rw priority?    uint8
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
      /te:p2p-secondary-path/te:path-out-segment/te:reverse
      /te:label-restrictions/te:label-restriction/te:label-start
      /te:te-label/te:technology:
+++:(otn)
  +++rw (otn-label-type)?
  +++:(tributary-port)
  | +++rw tpn?      uint16
  +++:(tributary-slot)
  +++rw ts?        uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
      /te:p2p-secondary-path/te:path-out-segment/te:reverse
      /te:label-restrictions/te:label-restriction/te:label-end
      /te:te-label/te:technology:
+++:(otn)
  +++rw (otn-label-type)?
  +++:(tributary-port)
  | +++rw tpn?      uint16
  +++:(tributary-slot)
  +++rw ts?        uint16
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
      /te:p2p-secondary-path/te:state/te:path-properties
      /te:path-route-objects/te:path-computed-route-object
      /te:state/te:type/te:label/te:label-hop/te:te-label
      /te:technology:
+++:(otn)
  +++ro tpn?        uint16
  +++ro tsg?        identityref
  +++ro ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
      /te:p2p-secondary-path/te:state/te:lsps/te:lsp
      /te:lsp-record-route-subobjects/te:record-route-subobject
      /te:type/te:label/te:label-hop/te:te-label/te:technology:
+++:(otn)
  +++ro tpn?        uint16
  +++ro tsg?        identityref
  +++ro ts-list?    string
augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths
```

```

    /te:p2p-secondary-path/te:state/te:lsps/te:lsp
    /te:path-properties/te:path-route-objects
    /te:path-computed-route-object/te:state/te:type/te:label
    /te:label-hop/te:te-label/te:technology:
+---:(otn)
+---ro tpn?          uint16
+---ro tsg?          identityref
+---ro ts-list?     string

```

```

augment /te:te/te:lsps-state/te:lsp
  /te:lsp-record-route-subobjects/te:record-route-subobject
  /te:type/te:label/te:label-hop/te:te-label/te:technology:
+---:(otn)
+---ro tpn?          uint16
+---ro tsg?          identityref
+---ro ts-list?     string

```

rpcs:

```

+---x otn-te-tunnel-path-compute
+---w input
|   +---w request* [id]
|   |   +---w id          uint8
|   |   +---w type?       identityref
|   |   +---w source?     inet:ip-address
|   |   +---w destination? inet:ip-address
|   |   +---w src-tp-id?  binary
|   |   +---w dst-tp-id?  binary
|   |   +---w switching-layer? identityref
|   |   +---w encoding?   identityref
|   |   +---w protection-type? identityref
|   |   +---w restoration-type? identityref
|   |   +---w provider-id? te-types:te-global-id
|   |   +---w client-id?  te-types:te-global-id
|   |   +---w te-topology-id? te-types:te-topology-id
|   |   +---w setup-priority? uint8
|   |   +---w hold-priority?  uint8
|   |   +---w te-path-metric-type? identityref
|   |   +---w odu-type?      identityref
|   |   +---w p2p-primary-paths
|   |   |   +---w p2p-primary-path* [name]
|   |   |   |   +---w name          string
|   |   |   |   +---w te-default-metric? uint32

```

```

| | +---w te-delay-metric?          uint32
| | +---w te-hop-metric?           uint32
| | +---w explicit-route-objects
| |   +---w explicit-route-object* [index]
| |     +---w explicit-route-usage? identityref
| |     +---w index                uint32
| |     +---w (type)?
| |       +---:(num-unnum-hop)
| |         | +---w num-unnum-hop
| |           | +---w node-id?      te-types:te-node-id
| |           | +---w link-tp-id?   te-types:te-tp-id
| |           | +---w hop-type?     te-hop-type
| |           | +---w direction?   te-link-direction
| |       +---:(as-number)
| |         | +---w as-number-hop

```

```

| | | +---w as-number?          binary
| | | +---w hop-type?          te-hop-type
| | +---:(label)
| |   +---w label-hop
| |     +---w te-label
| |       +---w (technology)?
| |         | +---:(generic)
| |         | | +---w generic?   rt-types:generalize
| |         | | +---:(otn)
| |         | | +---w tpn?       uint16
| |         | | +---w tsg?       identityref
| |         | | +---w ts-list?   string
| |         +---w direction?    te-label-direction
+---w p2p-secondary-paths
  +---w p2p-secondary-path* [name]
    +---w name                  string
    +---w te-default-metric?    uint32
    +---w te-delay-metric?      uint32
    +---w te-hop-metric?        uint32
    +---w explicit-route-objects
      +---w explicit-route-object* [index]
        +---w explicit-route-usage? identityref
        +---w index              uint32
        +---w (type)?
          +---:(num-unnum-hop)
            | +---w num-unnum-hop

```

```

|         +---w node-id?          te-types:te-node-id
|         +---w link-tp-id?       te-types:te-tp-id
|         +---w hop-type?         te-hop-type
|         +---w direction?        te-link-direction
|         +---:(as-number)
|         |   +---w as-number-hop
|         |   +---w as-number?    binary
|         |   +---w hop-type?     te-hop-type
|         +---:(label)
|         |   +---w label-hop
|         |   |   +---w te-label
|         |   |   |   +---w (technology)?
|         |   |   |   |   +---:(generic)
|         |   |   |   |   |   +---w generic?  rt-types:generalize
|         |   |   |   |   |   +---:(otn)
|         |   |   |   |   |   +---w tpn?      uint16
|         |   |   |   |   |   +---w tsg?      identityref
|         |   |   |   |   |   +---w ts-list?   string
|         |   |   |   |   +---w direction?    te-label-direction
|         +---w src-client-signal?  identityref
|         +---w src-tributary-slots
|         |   +---w values*    uint8

```

```

|         +---w dst-client-signal?  identityref
|         +---w dst-tributary-slots
|         |   +---w values*    uint8
+---ro output
  +---ro return-code?  enumeration
  +---ro result* [id]
    +---ro id          uint8
    +---ro p2p-primary-paths
      |   +---ro p2p-primary-path* [name]
      |   |   +---ro name          string
      |   |   +---ro te-default-metric?  uint32
      |   |   +---ro te-delay-metric?   uint32
      |   |   +---ro te-hop-metric?     uint32
      |   +---ro explicit-route-objects
      |   |   +---ro explicit-route-object* [index]
      |   |   |   +---ro explicit-route-usage?  identityref
      |   |   |   +---ro index          uint32
      |   |   |   +---ro (type)?
      |   |   |   +---:(num-unnum-hop)

```

```

|         | +--ro num-unnum-hop
|         |   +--ro node-id?      te-types:te-node-id
|         |   +--ro link-tp-id?  te-types:te-tp-id
|         |   +--ro hop-type?    te-hop-type
|         |   +--ro direction?   te-link-direction
+--:(as-number)
|   +--ro as-number-hop
|     +--ro as-number?    binary
|     +--ro hop-type?    te-hop-type
+--:(label)
  +--ro label-hop
    +--ro te-label
      +--ro (technology)?
        | +--:(generic)
        | | +--ro generic?  rt-types:generalize
        | | +--:(otn)
        | |   +--ro tpn?    uint16
        | |   +--ro tsg?    identityref
        | |   +--ro ts-list? string
        | +--ro direction? te-label-direction
+--ro p2p-secondary-paths
  +--ro p2p-secondary-path* [name]
    +--ro name                string
    +--ro te-default-metric?  uint32
    +--ro te-delay-metric?    uint32
    +--ro te-hop-metric?      uint32
    +--ro explicit-route-objects
      +--ro explicit-route-object* [index]
        +--ro explicit-route-usage?  identityref

```

```

+--ro index                uint32
+--ro (type)?
  +--:(num-unnum-hop)
    | +--ro num-unnum-hop
    |   +--ro node-id?      te-types:te-node-id
    |   +--ro link-tp-id?  te-types:te-tp-id
    |   +--ro hop-type?    te-hop-type
    |   +--ro direction?   te-link-direction
  +--:(as-number)
    | +--ro as-number-hop
    |   +--ro as-number?    binary
    |   +--ro hop-type?    te-hop-type

```

```

+---:(label)
  +---ro label-hop
    +---ro te-label
      +---ro (technology)?
        | +---:(generic)
        | | +---ro generic?   rt-types:generalize
        | +---:(otn)
        |   +---ro tpn?      uint16
        |   +---ro tsg?      identityref
        |   +---ro ts-list?  string
        +---ro direction?   te-label-direction

```

5. OTN Tunnel YANG Code

```

<CODE BEGINS>file "ietf-otn-tunnel@2018-06-30.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";
  }

  import ietf-otn-types {
    prefix "otn-types";
  }

  import ietf-te-types {
    prefix "te-types";
  }

```

```

import ietf-inet-types {
  prefix "inet";
}

```

organization


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

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

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  Editor: Yunbo Li
          <mailto:liyunbo@chinamobile.com>

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

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

revision "2018-07-02" {
  description
    "Revision 0.6";
  reference
    "draft-ietf-ccamp-otn-tunnel-model-03";
}

/*
```

```

* Groupings
*/

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

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

    leaf dst-client-signal {
        type identityref {
            base otn-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 otn-types:otn-path-bandwidth;
    }
}
}

```

Internet-Draft

OTN Tunnel YANG Model

July 2018

```
/* Augment bandwidth of tunnel */
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses otn-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 otn-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-reverse-primary-path/"
  + "te:te-bandwidth/te:technology" {
  description "OTN bandwidth.";
  case otn {
    uses otn-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 otn-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/"  
  + "te:route-object-exclude-always/te:type/te:label/"
```

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

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

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

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

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

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

```
  }
}
```

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

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

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

```

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

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

```

```

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

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

/* Augment label restrictions for the reverse direction of path-out-segment o

```

```

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-out-segment/"
  + "te:reverse/te:label-restrictions/"
  + "te:label-restriction" {
  description "OTN label.";
  uses otn-types:otn-label-restriction;
}

```

/* Augment label restrictions start for the reverse direction of path-out-segment

```

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-out-segment/"
  + "te:reverse/te:label-restrictions/"
  + "te:label-restriction/te:label-start/"
  + "te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses otn-types:otn-link-label;
  }
}

```

/* Augment label restrictions end for the reverse direction of path-out-segment

```

augment "/te:te/te:globals/te:named-path-constraints/"
  + "te:named-path-constraint/te:path-out-segment/"
  + "te:reverse/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
  description "OTN label.";
}

```

```

  case otn {
    uses otn-types:otn-link-label;
  }
}

```

/* 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 otn-types:otn-path-label;
  }
}

/* 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 otn-types:otn-path-label;
  }
}

/* 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/"
  + "te:route-object-exclude-always/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}

/* 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/"
  + "te:route-object-include-exclude/te:type/te:label/"

```

```

  + "te:label-hop/te:te-label/te:technology" {
  description "OTN label.";
  case otn {
    uses otn-types:otn-path-label;
  }
}

```



```

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

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

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

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

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```
    + "te:path-out-segment/te:forward/te:label-restrictions/"
    + "te:label-restriction/te:label-end/"
    + "te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses otn-types:otn-link-label;
}
}
```

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

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

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

```
/* 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:state/te:path-properties/"
  + "te:path-route-objects/te:path-computed-route-object/"
  + "te:state/te:type/te:label/"
```

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

/* 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:state/te:lsps/te:lsp/te:lsp-record-route-subobjects/"
  + "te:record-route-subobject/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

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

/* 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-reverse-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 otn-types:otn-path-label;
}
}

```

```

/* 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-reverse-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 otn-types:otn-path-label;
}
}

```

```

/* 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-reverse-primary-path/"
    + "te:explicit-route-objects/"
    + "te:route-object-exclude-always/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}

```

```

/* 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-reverse-primary-path/"
    + "te:explicit-route-objects/"
    + "te:route-object-include-exclude/"
    + "te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
    uses otn-types:otn-path-label;
}
}
}

```

```

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

```

```

}

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

}
}

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```



```

    + "te:path-out-segment/te:reverse/te:label-restrictions/"
    + "te:label-restriction" {
description "OTN label.";
uses otn-types:otn-label-restriction;
}

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

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

/* 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-reverse-primary-path/"
    + "te:state/te:path-properties/"
    + "te:path-route-objects/te:path-computed-route-object/"
    + "te:state/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {

```

```

description "OTN label.";

```

```

    case otn {
        uses otn-types:otn-path-label;
    }
}

/* 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-reverse-primary-path/"
    + "te:state/te:lsps/te:lsp/te:lsp-record-route-subobjects/"
    + "te:record-route-subobject/te:type/te:label/"
    + "te:label-hop/te:te-label/te:technology" {
    description "OTN label.";
    case otn {
        uses otn-types:otn-path-label;
    }
}

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

/* 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 otn-types:otn-path-label;
    }
}

/* 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 otn-types:otn-path-label;
}
}
```

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

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

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

```
/* Augment label restrictions start for the forwarding direction of path-in-s
augment "/te:te/te:tunnels/te:tunnel/"
```

```
+ "te:p2p-secondary-paths/te:p2p-secondary-path/"
+ "te:path-in-segment/te:forward/te:label-restrictions/"
```

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

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

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

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

```
}
```

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

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

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

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

```
/* Augment label restrictions end for the forwarding direction of path-out-segment
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:path-out-segment/te:forward/te:label-restrictions/"
  + "te:label-restriction/te:label-end/"
  + "te:te-label/te:technology" {
```

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

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

```
/* Augment label restrictions start for the reverse direction of path-out-seg
```

```
augment "/te:te/te:tunnels/te:tunnel/"
  + "te:p2p-secondary-paths/te:p2p-secondary-path/"
  + "te:path-out-segment/te:reverse/te:label-restrictions/"
  + "te:label-restriction/te:label-start/"
  + "te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses otn-types:otn-link-label;
}
}
```

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

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

```

```

/* 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:state/te:lsps/te:lsp/te:lsp-record-route-subobjects/"
  + "te:record-route-subobject/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
case otn {
  uses otn-types:otn-path-label;
}
}

```

```

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

```

```

/* Augment label hop of record-route of LSP */
augment "/te:te/te:lsps-state/"
  + "te:lsp/te:lsp-record-route-subobjects/"
  + "te:record-route-subobject/te:type/te:label/"
  + "te:label-hop/te:te-label/te:technology" {
description "OTN label.";
}

```

```

    case otn {
      uses otn-types:otn-path-label;
    }
  }

grouping p2p-path-ero {
  description
    "TE tunnel ERO configuration grouping";

  leaf te-default-metric {
    type uint32;
    description
      "Traffic engineering metric.";
  }
  leaf te-delay-metric {
    type uint32;
    description
      "Traffic engineering delay metric.";
  }
  leaf te-hop-metric {
    type uint32;
    description
      "Traffic engineering hop metric.";
  }
  container explicit-route-objects {
    description "Explicit route objects container";
    list explicit-route-object {
      key "index";
      description
        "List of explicit route objects";
    }
  }
}

```

```

  leaf explicit-route-usage {
    type identityref {
      base te-types:route-usage-type;
    }
    description "An explicit-route hop action.";
  }
  uses te-types:explicit-route-hop {
    augment "type/label/label-hop/te-label/technology" {
      description "OTN label.";
      case otn {
        uses otn-types:otn-path-label;
      }
    }
  }
}

```



```

        }
    }
}
}
}

```

```

rpc otn-te-tunnel-path-compute {
  description "OTN TE tunnel path computation";
  input {
    list request {
      key "id";
      description "A list of path computation requests.";

      leaf id {
        type uint8;
        description
          "Request ID.";
      }
      leaf type {
        type identityref {
          base te-types:tunnel-type;
        }
        description "TE tunnel type.";
      }
      leaf source {
        type inet:ip-address;
        description
          "TE tunnel source address.";
      }
      leaf destination {
        type inet:ip-address;
        description
          "TE tunnel destination address";
      }
      leaf src-tp-id {
        type binary;

```

```

    description
      "TE tunnel source termination point identifier.";
  }
  leaf dst-tp-id {

```

```

    type binary;
    description
        "TE tunnel destination termination point identifier.";
}
leaf switching-layer {
    type identityref {
        base te-types:switching-capabilities;
    }
    description
        "Switching layer where the requests are computed.";
}
leaf encoding {
    type identityref {
        base te-types:lsp-encoding-types;
    }
    description "LSP encoding type";
}
leaf protection-type {
    type identityref {
        base te-types:lsp-protection-type;
    }
    description "LSP protection type";
}
leaf restoration-type {
    type identityref {
        base te-types:lsp-restoration-type;
    }
    description "LSP restoration type";
}
leaf provider-id {
    type te-types:te-global-id;
    description
        "An identifier to uniquely identify a provider.";
}
leaf client-id {
    type te-types:te-global-id;
    description
        "An identifier to uniquely identify a client.";
}
leaf te-topology-id {
    type te-types:te-topology-id;
    description
        "It is presumed that a datastore will contain many
        topologies. To distinguish between topologies it is

```

```
        vital to have UNIQUE topology identifiers.";
    }
    leaf setup-priority {
        type uint8 {
            range "0..7";
        }
        description
            "TE LSP setup priority";
    }
    leaf hold-priority {
        type uint8 {
            range "0..7";
        }
        description
            "TE LSP hold priority";
    }
    leaf te-path-metric-type {
        type identityref {
            base te-types:path-metric-type;
        }
        default te-types:path-metric-te;
        description
            "The tunnel path metric type.";
    }
}

leaf odu-type {
    type identityref{
        base otn-types:tributary-protocol-type;
    }
    description "Type of ODU";
}

container p2p-primary-paths {
    description "Set of P2P primary paths container";
    list p2p-primary-path {
        key "name";
        description
            "List of primary paths for this tunnel.";
        leaf name {
            type string;
            description "TE path name";
        }
        uses p2p-path-ero;
    }
}

container p2p-secondary-paths {
    description "Set of P2P secondary paths container";
    list p2p-secondary-path {
```

key "name";

```
        description
          "List of secondary paths for this tunnel.";
        leaf name {
          type string;
          description "TE path name";
        }
        uses p2p-path-ero;
      }
    }
  uses otn-tunnel-attributes;
}
}
output {
  leaf return-code {
    type enumeration {
      enum success {
        description "success";
      }
      enum aborted {
        description "aborted";
      }
      enum destination-not-found {
        description "destination-not-found";
      }
      enum invalid-argument {
        description "invalid-argument";
      }
      enum no-memory {
        description "no-memory";
      }
      enum no-path-found {
        description "no-path-found";
      }
      enum other-error {
        description "other-error";
      }
      enum some-path-not-found {
        description "some-path-not-found";
      }
      enum source-not-found {
```

```

        description "source-not-found";
    }
    enum topology-error {
        description "topology-error";
    }
}
description
    "Return code";

```

```

}
list result {
    key "id";
    description
        "A list of results for all requests.";

    leaf id {
        type uint8;
        description
            "Request ID";
    }
    container p2p-primary-paths {
        description "Set of P2P primary paths container";
        list p2p-primary-path {
            key "name";
            description
                "List of resultant primary paths for this tunnel.";
            leaf name {
                type string;
                description "TE path name";
            }
            uses p2p-path-ero;
        }
    }
}
container p2p-secondary-paths {
    description "Set of P2P secondary paths container";
    list p2p-secondary-path {
        key "name";
        description
            "List of resultant secondary paths for this tunnel.";
        leaf name {
            type string;
            description "TE path name";
        }
    }
}

```

```
    }
    uses p2p-path-ero;
  }
}
}
}
}
```

<CODE ENDS>

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[6.](#) OTN Types YANG Code

<CODE BEGINS> file "ietf-otn-types@2018-06-30.yang"

```
module ietf-otn-types {
  namespace "urn:ietf:params:xml:ns:yang:ietf-otn-types";
  prefix "otn-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: Aihua Guo
```

```
    <mailto:aihuaguo@huawei.com>
```

```
  Editor: Italo Busi
```

```
    <mailto:italo.busi@huawei.com>
```

```
  Editor: Anurag Sharma
```

```
    <mailto:ansha@google.com>
```

Editor: Rajan Rao
<mailto:r rao@infinera.com>

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

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

Editor: Yunbo Li
<mailto:liyunbo@chinamobile.com>

Editor: Yunbin Xu
<mailto:xuyunbin@ritt.cn>;

description
"This module defines OTN types.";

revision "2018-06-30" {
description
"Revision 0.6";

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reference
"[draft-ietf-ccamp-otn-tunnel-model-03](#)";
}

identity tributary-slot-granularity {
description
"Tributary slot granularity";
reference
"G.709/Y.1331, February 2016: Interfaces for the Optical
Transport Network (OTN)";
}

identity tsg-1.25G {
base tributary-slot-granularity;
description
"1.25G tributary slot granularity";
}

identity tsg-2.5G {

```

    base tributary-slot-granularity;
    description
        "2.5G tributary slot granularity";
}
/*
identity tsg-1.25Gand2.5G {
    base tributary-slot-granularity;
    description
        "Both 1.25G and 2.5G tributary slot granularity";
}
*/
/*
Note: suggest to replace the term 'tributary-protocol-type' with
'odu-type', to avoid misleading.
*/
identity tributary-protocol-type {
    description
        "Base identity for protocol framing used by tributary signals";
}

/*
Note: suggest to remove all the prot-OTUx
*/

identity prot-OTU1 {
    base tributary-protocol-type;
    description
        "OTU1 protocol (2.66G)";
}

```

```

/*
identity prot-OTU1e {
    base tributary-protocol-type;
    description
        "OTU1e type (11.04G)";
}

identity prot-OTU1f {
    base tributary-protocol-type;
    description
        "OTU1f type (11.27G)";
}

```



```

*/
identity prot-OTU2 {
    base tributary-protocol-type;
    description
        "OTU2 type (10.70G)";
}

identity prot-OTU2e {
    base tributary-protocol-type;
    description
        "OTU2e type (11.09G)";
}
/*
identity prot-OTU2f {
    base tributary-protocol-type;
    description
        "OTU2f type (11.31G)";
}
*/
identity prot-OTU3 {
    base tributary-protocol-type;
    description
        "OTU3 type (43.01G)";
}
/*
identity prot-OTU3e1 {
    base tributary-protocol-type;
    description
        "OTU3e1 type (44.57G)";
}

identity prot-OTU3e2 {
    base tributary-protocol-type;
    description
        "OTU3e2 type (44.58G)";
}

```

```

*/
identity prot-OTU4 {
    base tributary-protocol-type;
    description
        "OTU4 type (111.80G)";
}

```

```

}

identity prot-OTUCn {
    base tributary-protocol-type;
    description
        "OTUCn type (beyond 100G)";
}

/*
Note: suggest to rename the term, remove the prefix 'prot-'.
*/

identity prot-ODU0 {
    base tributary-protocol-type;
    description
        "ODU0 protocol (1.24G)";
}

identity prot-ODU1 {
    base tributary-protocol-type;
    description
        "ODU1 protocol (2.49G)";
}
/*
identity prot-ODU1e {
    base tributary-protocol-type;
    description
        "ODU1e protocol (10.35G).";
}

identity prot-ODU1f {
    base tributary-protocol-type;
    description
        "ODU1f protocol (10.56G).";
}
*/
identity prot-ODU2 {
    base tributary-protocol-type;
    description
        "ODU2 protocol (10.03G)";
}

identity prot-ODU2e {

```

```

        base tributary-protocol-type;
        description
            "ODU2e protocol (10.39G)";
    }
/*
    identity prot-ODU2f {
        base tributary-protocol-type;
        description
            "ODU2f protocol (10.60G).";
    }
*/
    identity prot-ODU3 {
        base tributary-protocol-type;
        description
            "ODU3 protocol (40.31G)";
    }
/*
    identity prot-ODU3e1 {
        base tributary-protocol-type;
        description
            "ODU3e1 protocol (41.77G).";
    }

    identity prot-ODU3e2 {
        base tributary-protocol-type;
        description
            "ODU3e2 protocol (41.78G).";
    }
*/
    identity prot-ODU4 {
        base tributary-protocol-type;
        description
            "ODU4 protocol (104.79G)";
    }

    identity prot-ODUFlex-cbr {
        base tributary-protocol-type;
        description
            "ODU Flex CBR protocol for transporting constant bit rate
            signal";
    }

    identity prot-ODUFlex-gfp {
        base tributary-protocol-type;
        description
            "ODU Flex GFP protocol for transporting stream of packets
            using Generic Framing Procedure";
    }

```

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```
identity prot-ODUCn {
  base tributary-protocol-type;
  description
    "ODUCn protocol (beyond 100G)";
}
```

/*

Note: suggest to remove the types with 'prot-xGbE'.

*/

```
identity prot-1GbE {
  base tributary-protocol-type;
  description
    "1G Ethernet protocol";
}
```

```
identity prot-10GbE-LAN {
  base tributary-protocol-type;
  description
    "10G Ethernet LAN protocol";
}
```

```
identity prot-40GbE {
  base tributary-protocol-type;
  description
    "40G Ethernet protocol";
}
```

```
identity prot-100GbE {
  base tributary-protocol-type;
  description
    "100G Ethernet protocol";
}
```

```
identity client-signal {
  description
    "Base identity from which specific client signals for the
    tunnel are derived";
}
```

/*

Note: need to reconsider the prefix 'client-signal'.

Comment 1: need to understand whether for same client-signal, there

should be separate identity for transparent and non-transparent or not?
Comment 2: need to better align the term with other models, like L1CSM.
*/

```
identity client-signal-1GbE {  
    base client-signal;
```

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```
    description  
        "Client signal type of 1GbE";  
}
```

```
identity client-signal-10GbE-LAN {  
    base client-signal;  
    description  
        "Client signal type of 10GbE LAN";  
}
```

```
identity client-signal-10GbE-WAN {  
    base client-signal;  
    description  
        "Client signal type of 10GbE WAN";  
}
```

```
identity client-signal-40GbE {  
    base client-signal;  
    description  
        "Client signal type of 40GbE";  
}
```

```
identity client-signal-100GbE {  
    base client-signal;  
    description  
        "Client signal type of 100GbE";  
}
```

```
identity client-signal-OC3_STM1 {  
    base client-signal;  
    description  
        "Client signal type of OC3 & STM1";  
}
```

```
identity client-signal-OC12_STM4 {
```

```
    base client-signal;
    description
        "Client signal type of OC12 & STM4";
}
```

```
identity client-signal-OC48_STM16 {
    base client-signal;
    description
        "Client signal type of OC48 & STM16";
}
```

```
identity client-signal-OC192_STM64 {
    base client-signal;
```

```
    description
        "Client signal type of OC192 & STM64";
}
```

```
identity client-signal-OC768_STM256 {
    base client-signal;
    description
        "Client signal type of OC768 & STM256";
}
```

```
identity client-signal-ODU0 {
    base client-signal;
    description
        "Client signal type of ODU0 (1.24G)";
}
```

```
identity client-signal-ODU1 {
    base client-signal;
    description
        "ODU1 protocol (2.49G)";
}
```

```
identity client-signal-ODU2 {
    base client-signal;
    description
        "Client signal type of ODU2 (10.03G)";
}
```

```

identity client-signal-ODU2e {
    base client-signal;
    description
        "Client signal type of ODU2e (10.39G)";
}

identity client-signal-ODU3 {
    base client-signal;
    description
        "Client signal type of ODU3 (40.31G)";
}
/*
identity client-signal-ODU3e2 {
    base client-signal;
    description
        "Client signal type of ODU3e2 (41.78G)";
}
*/
identity client-signal-ODU4 {
    base client-signal;

```

```

    description
        "Client signal type of ODU4 (104.79G)";
}

identity client-signal-ODUflex-cbr {
    base client-signal;
    description
        "Client signal type of ODU Flex CBR";
}

identity client-signal-ODUflex-gfp {
    base client-signal;
    description
        "Client signal type of ODU Flex GFP";
}

identity client-signal-ODUCn {
    base client-signal;
    description
        "Client signal type of ODUCn (beyond 100G)";
}

```

```
identity client-signal-FC400 {
  base client-signal;
  description
    "Client signal type of Fibre Channel FC400";
}
```

```
identity client-signal-FC800 {
  base client-signal;
  description
    "Client signal type of Fibre Channel FC800";
}
```

```
identity client-signal-FICON-4G {
  base client-signal;
  description
    "Client signal type of Fibre Connection 4G";
}
```

```
identity client-signal-FICON-8G {
  base client-signal;
  description
    "Client signal type of Fibre Connection 8G";
}
```

```
identity client-signal-OTU1 {
  base client-signal;
```

```
  description
    "Client signal type of OTU1";
}
```

```
identity client-signal-OTU2 {
  base client-signal;
  description
    "Client signal type of OTU2";
}
```

```
identity client-signal-OTU2e {
  base client-signal;
  description
    "Client signal type of OTU2e";
```



```

}

identity client-signal-OTU3 {
  base client-signal;
  description
    "Client signal type of OTU3";
}

identity client-signal-OTU4 {
  base client-signal;
  description
    "Client signal type of OTU4";
}

identity otn-label-range-type {
  description
    "Base identity from which specific OTN label
      range types derived";
}

identity label-range-trib-slot {
  base otn-label-range-type;
  description
    "Defines a range of OTN tributary slots";
}

identity label-range-trib-port {
  base otn-label-range-type;
  description
    "Defines a range of OTN tributary ports";
}

grouping otn-link-bandwidth {
  list odulist {

```

```

  key "odu-type";
  description
    "OTN bandwidth definition";
  leaf odu-type {
    type identityref {
      base otn-types:tributary-protocol-type;
    }

```

```

        description "ODU type";
    }
    leaf number {
        type uint16;
        description "Number of ODUs";
    }
}

grouping otn-path-bandwidth {
    leaf odu-type {
        type identityref {
            base otn-types:tributary-protocol-type;
        }
        description "ODU type";
    }
}

grouping otn-label-restriction {
    leaf range-type {
        type identityref {
            base otn-types:otn-label-range-type;
        }
    }
    leaf tsg {
        type identityref {
            base otn-types:tributary-slot-granularity;
        }
        description "Tributary slot granularity.";
        reference
            "G.709/Y.1331, February 2016: Interfaces for the
            Optical Transport Network (OTN)";
    }
    leaf priority {
        type uint8;
        description "priority.";
    }
}

grouping otn-link-label {

```

```

choice otn-label-type {
  description
    "OTN label type";
  case tributary-port {
    leaf tpn {
      type uint16 {
        range "1..4095";
      }
      description
        "Tributary Port Number. Applicable in case of mux services.";
      reference
        "RFC7139: GMPLS Signaling Extensions for Control of Evolving
        G.709 Optical Transport Networks.";
    }
  }
  case tributary-slot {
    leaf ts {
      type uint16 {
        range "1..4095";
      }
      description
        "Tributary Slot Number. Applicable in case of mux services.";
      reference
        "RFC7139: GMPLS Signaling Extensions for Control of Evolving
        G.709 Optical Transport Networks.";
    }
  }
}

```

```

grouping otn-path-label {
  leaf tpn {
    type uint16 {
      range "1..4095";
    }
    description
      "Tributary Port Number. Applicable in case of mux services.";
    reference
      "RFC7139: GMPLS Signaling Extensions for Control of Evolving
      G.709 Optical Transport Networks.";
  }
  leaf tsg {
    type identityref {
      base otn-types:tributary-slot-granularity;
    }
    description "Tributary slot granularity.";
    reference
      "G.709/Y.1331, February 2016: Interfaces for the

```

```
        Optical Transport Network (OTN)";
    }
    leaf ts-list {
        type string {
            pattern "([1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?"
                + "(,[1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?)*)";
        }
        description
            "A list of available tributary slots ranging
            between 1 and 9999.
            For example 1-20,25,50-1000";
        reference "RFC 7139: GMPLS Signaling Extensions for Control
            of Evolving G.709 Optical Transport Networks";
    }
}
}
```

<CODE ENDS>

[7.](#) Security Considerations

TBD.

[8.](#) IANA Considerations

TBD.

[9.](#) Acknowledgements

TBD.

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