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YANG Data Model for Sync PHY
draft-jiang-ccamp-syncphy-yang-00

Abstract

This document defines a YANG data model for the configuration of physical layer synchronization including SyncE and SyncO. The YANG module in this document conforms to the Network Management Datastore Architecture (NMDA).

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on January 13, 2019.

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1. Introduction

Frequency synchronization based on physical layer clock is generally implemented in network elements and deployed widely in various networks. To achieve frequency synchronization, the physical clock is delivered from a PRTC to an end device across the network over a series of physical links such as PDH, SDH/SONET, OTN or IEEE 802.3.

This document defines a YANG data model for the configuration of frequency synchronization over a single physical link (simplified as Sync PHY) such as Sync Ethernet (SyncE) or Synchronous Optical Transport Network (SyncO). The data model is constructed based on the management attributes as specified in [ITU781] and reference source selection architecture as described in [ITU8264]. The data model is targeted at supporting generic Sync PHY for network elements and industrial internet devices, the details on these physical layer synchronization can refer to those ITU-T recommendations such as [ITU783], [ITU8021], [ITU798] and are out of scope of this document.

The YANG module in this document conforms to the Network Management Datastore Architecture (NMDA) [RFC8342].

1.1. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

1.2. Terminology

Most terminologies used in this document are extracted from ITU recommendations.

OTN Optical Transport Network

SDH Synchronous Digital Hierarchy

SyncE Synchronous Ethernet

SyncO Synchronous Optical Transport Network

2. Sync PHY YANG Model hierarchy

This section describes the hierarchy of the Sync-PHY YANG module.

Query and configuration of Sync-PHY information include:

- sync-node includes all the sync-phy node wide attributes.

- port-list includes all the sync-phy port-specific attributes.

- system-clock includes all the system clock attributes.

- station-clock includes all the station clock attributes.

The readers are assumed to be familiar with the specific ITU-T recommendations. This document only outlines each of them in the YANG module.

A simplified YANG tree diagram [RFC8340] representing the data model is typically used by YANG modules. This document uses the same tree diagram syntax as described in [RFC8340].

```
module: ietf-sync-phy
  +--rw sync-phy
     +--rw sync-node
     |  +--rw sync-network-option sync-network-option-enumeration
     |  +--ro local-quality-level quality-level-enumeration
     |  +--rw quality-level-enabled  boolean
     |  +--rw revertive-enabled  boolean
     |  +--rw wtr-time         uint8
     |  +--rw holdoff-time     uint16
     +--rw port-list
     |  +--rw name   if:interface-ref
     |  +--rw port-type   port-type-enumeration
     |  +--rw sync-enabled  boolean
     |  +--rw ql-overwrite-enabled boolean
     |  +--rw ql-overwrite-val quality-level-enumeration
     |  +--ro ql-in  quality-level-enumeration
     |  +--ro ql-out quality-level-enumeration
     |  +--rw ssm-transmit-enabled  boolean
     +--rw system-clock
     |  +--rw port-list
     |  |  +--rw name  if:interface-ref
     |  |  +--rw priority uint32
     |  +--ro selected-source if:interface-ref
     |  +--rw run-mode  run-mode-enumeration
     +--rw station-clock
       +--rw port-list
        |  +--rw name if:interface-ref
        |  +--rw priority uint32
        +--rw ql-min        uint8
        +--ro selected-source if:interface-ref
        +--ro out-source      if:interface-ref
```

3. Sync PHY YANG Module

This module imports typedef "interface-ref" from [RFC8343]. Most attributes are based on the management information defined in [ITU781], but their names are adapted to the YANG style of naming.

```
<CODE BEGINS> file "ietf-syncphy@2020-07-09.yang"
module ietf-syncphy {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-syncphy";
  prefix "syncphy";

  import ietf-interfaces {
    prefix if;
    reference
      "RFC8343: A YANG Data Model for Interface Management";
  }

  organization "IETF CCAMP Working Group";
  contact
      "WG Web:   http://tools.ietf.org/wg/ccamp/
       WG List:  <mailto:ccamp@ietf.org>
       Author:   Yuanlong Jiang
                 <mailto:jiangyuanlong@huawei.com>
       Author:   Jingfei Lv
                 <mailto:lvjingfei@huawei.com>
       Author:   Liuyan Han
                 <mailto:hanliuyan@chinamobile.com>";
  description
    "This YANG module defines a data model for the configuration
     and management of Sync PHY.";

  revision "2020-07-09" {
    description "Initial version";
    reference "draft-jiang-ccamp-syncphy-yang: YANG Data Model for
               Sync PHY";
  }

  typedef sync-network-option-enumeration {
    type enumeration {
      enum "OptionUnknown" {
        value "1";
      }
      enum "Option1" {
        value "2";
      }
      enum "Option2Gen1" {
```

```
          value "3";
        }
        enum "Option2Gen2" {
          value "4";
        }
        enum "Option3" {
          value "5";
        }
        enum "OptionInvalid" {
          value "6";
        }
      }
      description
        "The Network synchronization networking options.
         Values for this enumeration are specified
         in G.781.";
      reference
        "ITU-T G.781-2017: 5.3.1";
    }

    typedef quality-level-enumeration {
      type enumeration {
        enum "QualityLevelNULL" {
          value "1";
        }
        enum "QualityLevelDNU" {
          value "2";
        }
        enum "QualityLevelDUS" {
          value "3";
        }
        enum "QualityLeveleEEC" {
          value "4";
        }
        enum "QualityLevelePRTC" {
          value "5";
        }
        enum "QualityLevelFAILED" {
          value "6";
        }
        enum "QualityLevelINV0" {
          value "7";
        }
        enum "QualityLevelINV1" {
          value "8";
        }
        enum "QualityLevelINV2" {
```

```
          value "9";
        }
        enum "QualityLevelINV3" {
          value "10";
        }
        enum "QualityLevelINV4" {
          value "11";
        }
        enum "QualityLevelINV5" {
          value "12";
        }
        enum "QualityLevelINV6" {
          value "13";
        }
        enum "QualityLevelINV7" {
          value "14";
        }
        enum "QualityLevelINV8" {
          value "15";
        }
        enum "QualityLevelINV9" {
          value "16";
        }
        enum "QualityLevelINV10" {
          value "17";
        }
        enum "QualityLevelINV11" {
          value "18";
        }
        enum "QualityLevelINV12" {
          value "19";
        }
        enum "QualityLevelINV13" {
          value "20";
        }
        enum "QualityLevelINV14" {
          value "21";
        }
        enum "QualityLevelINV15" {
          value "22";
        }
        enum "QualityLevelNSUPP" {
          value "23";
        }
        enum "QualityLevelPRC" {
          value "24";
        }
```

```
          enum "QualityLevelPROV" {
            value "25";
          }
          enum "QualityLevelPRS" {
            value "26";
          }
          enum "QualityLevelPRTC" {
            value "27";
          }
          enum "QualityLevelSEC" {
            value "28";
          }
          enum "QualityLevelSMC" {
            value "29";
          }
          enum "QualityLevelSSUA" {
            value "30";
          }
          enum "QualityLevelSSUB" {
            value "31";
          }
          enum "QualityLevelST2" {
            value "32";
          }
          enum "QualityLevelST3" {
            value "33";
          }
          enum "QualityLevelST3E" {
            value "34";
          }
          enum "QualityLevelST4" {
            value "35";
          }
          enum "QualityLevelSTU" {
            value "36";
          }
          enum "QualityLevelTNC" {
            value "37";
          }
          enum "QualityLevelUNC" {
            value "38";
          }
          enum "QualityLevelUNK" {
            value "39";
          }
        }
        description
```

```
        "Clock source QL (quality level) as defined in ITU-T G.781.";
      reference
        "ITU-T standard G.781 section 5.4";
    }
    typedef port-type-enumeration {
      type enumeration {
        enum "IfTypeE1" {
          value "1";
        }
        enum "IfTypeT1" {
          value "2";
        }
        enum "IfType2Mhz" {
          value "3";
        }
        enum "IfType2Mbit" {
          value "4";
        }
        enum "IfTypeSDH" {
          value "5";
        }
        enum "IfTypeSONET" {
          value "6";
        }
        enum "IfTypeEthernet" {
          value "7";
        }
        enum "IfTypeOTN" {
          value "8";
        }
      }
      description
        "Sync clock source Interface type.
         Values for this enumeration are specified
         in G.781.";
      reference
        "ITU-T G.781-2017: 5.3.1";
    }
    typedef run-mode-enumeration {
      type enumeration {
        enum "ModeFreeRun" {
          value "1";
        }
        enum "ModeHoldover" {
          value "2";
        }
        enum "ModeLocked" {
```

```
          value "3";
        }
      }
      description
        "The clock operation mode.
         Values for this enumeration are specified in G.781.";
      reference
        "ITU-T G.781-2017: 6.3.1";
    }
    container sync-phy {
      description
        "The sync-phy contains all attributes of Sync-PHY,
         optional attributes can be augmented to this node.";
      container sync-node {
        description
          "The sync-node contains all the node-level Sync-PHY
           management attributes for an equipment.";
        leaf sync-network-option {
          type sync-network-option-enumeration;
          description
            "The Network synchronization networking options.
             Values for this enumeration are specified
             in G.781.";
          reference
            "ITU-T G.781-2017: 5.3.1";
        }
        leaf local-quality-level {
          type quality-level-enumeration;
          config false;
          description
            "The local QL retrieved.";
        }
        leaf quality-level-enabled {
          type boolean;
          description
             "Whether QL is enabled or not.";
        }
        leaf revertive-enabled {
          type boolean;
          description
             "Whether revertive mode is enabled or not.";
        }
        leaf wtr-time {
          type uint8 {
            range "0..12";
        }
          default "5";
```

```
          description
             "The WTR time in the unit of minute for selection
              processes in common.";
        }
        leaf holdoff-time {
          type uint16 {
            range "300..1800";
        }
          description
            "The Holdoff time in the unit of ms for selection
             processes in common.";
        }
      }
      list port-list {
        key "name";
        description
          "List of one or more PHY ports in the device (see G.871).
           Each item of port-list represents port-level management
           information for a physical port.";

        leaf name {
          type if:interface-ref;
          description
             "The interface name of the physical port.";
        }
        leaf port-type {
          type port-type-enumeration;
          description
             "The interface type of the physical port.";
        }
        leaf sync-enabled {
          type boolean;
          description
             "Whether sync mechanism is enabled or not.";
        }
        leaf ql-overwrite-enabled {
          type boolean;
          description
             "Whether QL overwrite is enabled or not, if not enabled,
              it means QL will pass through.";
        }
        leaf ql-overwrite-val {
          type quality-level-enumeration;
          description
             "The quality level used if overwrite mode is enabled.";
        }
        leaf ql-in {
```

```
          type quality-level-enumeration;
          description
             "After overwrite or pass through, the final QL fed into
              the clock.";
        }
        leaf ql-out {
          type quality-level-enumeration;
          description
             "The output QL for the physical port.";
        }
        leaf ssm-transmit-enabled {
          type boolean;
          description
             "Whether SSM transmit is enabled or not.";
        }
      }
      container system-clock {
        description
          "The system-clock contains all attributes on management of
           the system clock in an equipment.";

        list port-list {
          key "name";
          description
               "List of one or more source clock PHY ports for the
                system clock (see G.871).
             Each port-list item represents management information
             on a clock source physical port used in the system
             clock.";
          leaf name {
            type if:interface-ref;
            description
              "The interface name of the clock source physical port.";
          }
          leaf priority {
            type uint32;
            description
              "The source priority of the physical port.";
          }
        }
        leaf selected-source {
          type if:interface-ref;
          description
             "The selected source clock physical port.";
        }
        leaf run-mode {
          type run-mode-enumeration;
```

```
          description
             "The run mode of the system clock.";
        }
      }
      container station-clock {
        description
          "The station-clock contains all attributes on management of
           the station clock in an equipment.";
        list port-list {
          key "name";
          description
               "List of one or more source clock PHY ports for the
                station clock (see G.871).
             Each port-list item represents management information
             on a clock source physical port used in the station
             clock.";
          leaf name {
            type if:interface-ref;
            description
             "The interface name of the clock source physical port.";
          }
          leaf priority {
            type uint32;
            description
              "The source priority of the physical port.";
          }
        }
        leaf ql-min {
          type uint8;
          description
            "The minimum QL of the system clock.";
        }
        leaf selected-source {
          type if:interface-ref;
          description
             "The current selected source of the station clock by
              automatic process.";
        }
        leaf out-source {
          type if:interface-ref;
          description
             "The final output source for the station clock.";
        }
      }
    }
  }
  <CODE ENDS>
```

4. Security Considerations

TBD.

5. IANA Considerations

This document proposes the following URI in the "IETF XML registry" [RFC3688]:
URI: urn:ietf:params:xml:ns:yang:ietf-syncphy
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace

This document proposes the following YANG module in the "YANG Module Names" registry [RFC6020]:
Name: ietf-syncphy
Namespace: urn:ietf:params:xml:ns:yang:ietf-syncphy
Prefix: syncphy
Reference: this document

6. References

6.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997

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[RFC6020] Bjorklund, M., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF) ", RFC 6020, October 2010

[RFC6991] Schoenwaelder, J., "Common YANG Data Types", RFC 6991, July 2013

[RFC7950] Bjorklund, M., "The YANG 1.1 Data Modeling Language", RFC 7950, August 2016

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, May 2017

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[RFC8343] Bjorklund, M., "A YANG Data Model for Interface Management", RFC 8343, March 2018

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[ITU8264] ITU-T, "Distribution of timing information through packet networks", ITU-T G.8264 Amendment 1, March 2018

6.2. Informative References

[RFC7384] Mizrahi, T., "Security Requirements of Time Protocols in Packet Switched Networks", RFC 7384, October 2014

[RFC8340] Bjorklund, M., and Berger, L., "YANG Tree Diagrams", RFC 8340, March 2018

[ITU783] ITU-T, "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks", ITU-T G.783, March 2006

[ITU798] ITU-T, "Characteristics of optical transport network hierarchy equipment functional blocks", ITU-T G.798 Amendment 1, August 2018

[ITU8021] ITU-T, "Characteristics of Ethernet transport network equipment functional blocks", ITU-T G.8021, June 2018

7. Acknowledgments

TBD.

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Conveying Transceiver-Related Information within RSVP-TE Signaling
draft-meuric-ccamp-tsvmode-signaling-00

Abstract

The ReSource Reservation Protocol with Traffic Engineering extensions (RSVP-TE) allows to carry optical information so as to set up channels over Wavelength Division Multiplexing (WDM) networks between a pair of transceivers. Nowadays, there are many transceivers that not only support tunable lasers, but also multiple modulation formats. This memo leverages the Generalized Multiprotocol Label Switching protocol extensions to support the signaling of the associated information as a "mode" parameter within a "transceiver type" context.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on September 7, 2020.

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1. Introduction

The ITU-T's recommendation [G.694.1] defines the flexi-grid technology as the latest evolution of the WDM data plane. [RFC7689] defines the extensions to the RSVP-TE signaling ([RFC3473]) to provision lightpaths in WDM networks, from transceiver to transceiver, including transit Reconfigurable Optical Add-Drop Multiplexers (ROADMs). [RFC7792] specifies the encoding of the flex-grid label to be carried within RSVP-TE signaling messages, leveraging the reconfiguration capability of optical switches and the wavelength tunability of the transceivers at both ends of the optical signal.

To address the various requirements of optical networks, some transceivers are supporting multiple modulation formats, baudrates, FECs, etc. This capability enables to select at setup time the right trade-off between bitrate, baudrate, reach, spectral width, etc. This memo defines the required fields to explicitly addresses this case of "elastic" transceivers. Two options are proposed to address this issue. The first extension relies on a two-stage identifier: a Transceiver Type, allowing to summarize the set of capabilities and consistently correlate both ends of a given optical channel, and a Transceiver ModeID, i.e. a hardware-related identifier to be interpreted within the Type context. The second extension replaces the aforementioned ModeID by a set of optical parameters. In the latter, the exact list of fields will follow [I-D.ietf-ccamp-dwdm-if-param-yang]

2. Main Use Cases

In the following section, it is assumed that, to be able to meet optical performance requirements, the Routing and Wavelength Assignment (RWA) tasks are performed before the signaling messages leave the ingress ROADM. This could happen in various ways, provided the network topology is available, including optical parameters (e.g., advertised using [I-D.ietf-ccamp-wson-iv-encode]). This includes ROADM-local computation process, passive PCE responding to the ingress ROADM's request [I-D.ietf-pce-wson-rwa-ext]), as well centralized controllers relying on PCEP to trigger the RSVP-TE signaling in the ingress node ([RFC8281]).

2.1. Single Control Domain

We consider that transceivers are in the same control domain as the optical switches. In many deployments, transceivers are embedded in the edge ROADM shelves, where both the transceiver and the optical switching are configured by the same set of local control processes. In this case, carrying the Mode parameter in RSVP-TE signaling is required to configure the egress side of the signaling session. Even though some receiver implementations may be able to detect the modulation format without configuration, most operational deployments rely on bidirectional signals, thus making the modulation information a mandatory parameter to fully configure the egress transceiver in most cases.

The specification below allows to address this use case.

2.2. Open Line Systems

We now consider that transceivers are installed in shelves independant from the ROADMs. The set of ROADMs is referred to as the "optical line", the shelves carrying the transceivers are named "client devices". This use case is aligned with the problem statement specified in [I-D.ietf-ccamp-dwdm-if-mng-ctrl-fwk] and is consistent with [RFC7698].

The network topology and the associated optical parameters are only advertised among the ROADMs, part of the line system, i.e. the topology information does not leak up to the transceiver shelves (otherwise, that is a specific case of [[CREF1: Section 2.1]]). Therefore, beyond the usual signaling features, the resulting signaling messages serve 3 additional purposes:

- advertise the ingress Transceiver Type to the optical line, in charge of the decision related to the optical path across the network,
- convey the Transceiver Type up to the egress Transceiver, allowing to check correct match between both ends (as in [[CREF2: Section 2.1]]),
- inform transceivers at both ends about the Transceiver Mode allocated by the optical line.

The specification below allows to address this use case.

3. Signaling Messages

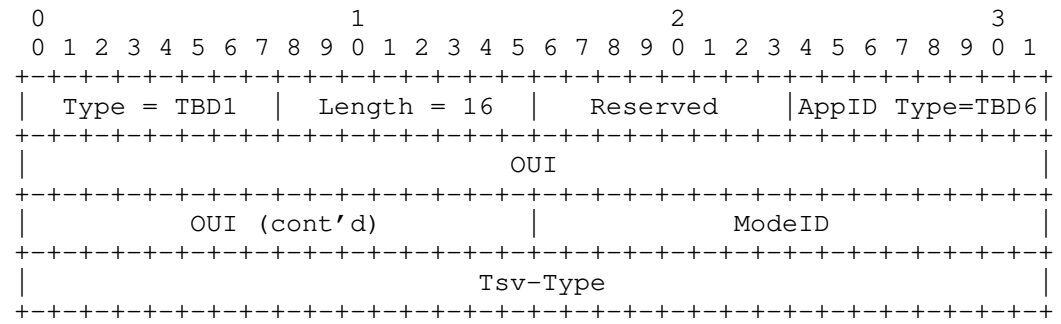
The following sections specify the fields used in the RSVP-TE Path and Resv messages to address the requirements above.

3.1. Encodings

This documents specifies two sub-TLVs. Both serve the same purpose, with a different level of details: the transceiver mode is described either using an identifier or a detailed set of parameters. As a result, an RSVP-TE message SHOULD only carry one of the sub-TLV for a given hop. In case several of the sub-TLVs below are included, the first one takes precedence and the following ones are ignored.

3.1.1. WDM-Transceiver-ModeID Sub-TLV

This document introduces the WDM-Transceiver-ModeID sub-TLV so as to carry the Transceiver Type and ModeID. It has the following format:



Application ID Type (8 bits): As per section 5 of [I-D.ietf-ccamp-dwdm-if-lmp], this field allows to distinguish between the possible encodings of the trailing "Application ID" field. This specification defines a new Application ID Type (value TBD6) that extends the "Proprietary" type and specifies specific fields within the "value" bytes:

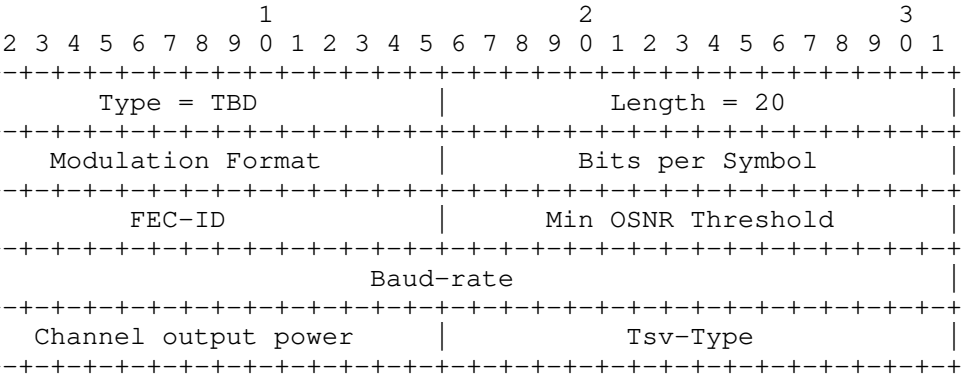
- the first 6 bytes of the Application Identifier must contain the hexadecimal representation of an Organizationally Unique Identifier (OUI);
- the following 2 bytes encode a ModeID;
- the last 4 bytes carry a Tsv-Type.

Tsv-Type (32 bits): A transponder-specific value allowing to identify a compatible Tsv-Type at the remote end, and supporting a set of optical ModeIDs. This value MUST be included by the ingress transceiver, i.e. from the signaling first hop. 0 is a Reserved value that MUST trigger a PathErr message in response, with Error Code 24 (Routing Problem) and Error Sub-code TBD3 ("Unsupported Tsv-Type").

ModeID (16 bits): Within a given Tsv-Type, this ID allows to specify how the transceiver should be configured among the set of options supported by Tsv-Type; e.g. optical modulation format or baudrate. The value 0 means that the sending device has not chosen a particular ModeID and expects this information to be determined by a downstream node (e.g., the edge ROADM of the optical line). If the Tsv-Type resolves into a single ModeID, the ModeID field SHOULD use a non-zero value and MAY be ignored. A transceiver receiving a ModeID with the value 0 MAY select a mode based on local policies combined to other signaling information, e.g. channel spectral width.

3.1.2. WDM-Tranceiver-Param Sub-TLV

This document introduces the WDM-Transceiver-Param sub-TLV so as to carry the Transceiver Type identifier and the "detailed mode" description, which is a subset of the ones specified in [I-D.ietf-ccamp-dwdm-if-param-yang]. It is aligned on figure 3 in [I-D.ggalimbe-ccamp-flexigrid-carrier-label] and has the following format:



Modulation Format: A codepoint identifying the modulation format of the transceiver signal. Knowing this parameter is not mandatory to perform an optical path computation, thus the value 0 is acceptable within a successful signaling session.

Bits per Symbol (16 bits): A nonnegative integer specifying the number of bits encoded per symbol value in case of hybrid modulation format. It is an off-set with values from 0 to 127 to be applied to the specified Modulation Format and indicates the mix between the selected Modulation Format and its upper adjacent (e.g. QPSK + 63 bits per symbol indicates that there is a 50% MIX between QPSK and 8-QAM = 2.5 bits per symbol). If value = 0 the standard Modulation Format is applied.

FEC-ID (16 bits): A codepoint identifying the Forward Error Correction of the transceiver.

Min OSNR Threshold (16 bits): An integer specifying the minimum accepted threshold for the Optical Signal-Noise Ratio in 0.1 nm.

Baud-rate (32 bits): A nonnegative integer specifying the number of symbols per second.

Channel Ouput Power (16 bits): An integer specifying the signal power coming out of the transceiver (in dB or W?).

Tsv-Type (16 bits): A transponder-specific value allowing to identify a compatible Tsv-Type at the remote end. This field MAY be set to 0, which is a reserved value to disable Tsv-Type checking between end transceivers (e.g. because it is useless).

3.2. Processing

3.2.1. Downstream Direction

The parameters to be used by the egress transceivers are carried in Path messages. In RSVP-TE signaling, hop-specific information is encoded within the ERO as hop attributes and WDM parameters are to be carried as sub-TLVs within the Type 4 TLV of the Hop Attribute subobject [RFC7689].

When sending a Path message, if a signaling head end node includes one of the WDM-Transceiver sub-TLVs specified in this document, the entity in charge of the path computation (e.g. the ingress ROADM) MUST include (unless an error is raised), as part of the ERO population step, the same sub-TLV to specify the Hop Attibutes of the tail end transceiver, allowing this information to be propagated along the RSVP-TE Path messages.

A signaling head end node sending a Path message including one of the WDM-Transceiver sub-TLVs specified in the previous section with unallocated values, i.e. Mode-defining fields set to 0 (e.g. "ModeID = 0" in the WDM-Transceiver-ModeID sub-TLV), MUST include an empty RRO to request its population by some downstream nodes [RFC3209]. In case the Mode specification is fully defined before the first signaling hop (e.g. operator-specified), the use of the RRO remains OPTIONAL.

3.2.2. Upstream Direction

When the mode selection happens after the signaling has left the signaling head node, which carries the ingress transceiver, the selected value needs to be sent back to the head node. As specified in [RFC7570], it can be included in the Record Route Object (RRO) within RSVP-TE Resv messages. Starting from the fact that both end transceivers share a common mode to properly set up a channel, this leads to the following processing:

- After a transceiver shelf (signaling tail end or regenerator) has received a Path message:
  - If both an RRO and a WDM-Transceiver sub-TLV (defined above) are included, the node MUST populate, in the responding Resv message, the RRO with its own hop attributes, using the

corresponding sub-TLV. At this stage, the values of the Mode-defining fields MUST be allocated, wherever the selection has happened (e.g., ingress ROADM, local decision).

* If the Mode description is not supported, the node MUST respond using a PathErr with Error Code 24 (Routing Problem) and Error Sub-code TBD4 ("Unsupported Transceiver Mode").

* If the values within the WDM-Transceiver sub-TLV are not allocated and the node is unable to make a local allocation, it MUST respond using a PathErr with Error Code 24 (Routing Problem) and Error Sub-code TBD5 ("Unable to Select Transceiver Mode")

o When a signaling head end node pending a mode information receives a Resv message, it MUST look into the RRO and configure itself consistently with the hop attribute information associated to the remote transceiver. A signaling head node receiving an inconsistent Mode (unupported or not matching the corresponding Path state) MUST respond using a ResvErr with Error Code 24 (Routing Problem) and Error Sub-code TBD4 ("Unsupported Transceiver Mode").

4. IANA Considerations

The IANA is requested to allocate, from the "Sub-TLV Types for WSON Processing Hop Attribute TLV" section within the "RSVP-TE Parameters" registry:

Value	Meaning	Reference
TDB1	WDM-Transceiver-ModeID	[This I-D]
TDB2	WDM-Transceiver-Param	[This I-D]

The IANA is requested to allocate, from the "Error Codes and Globally-Defined Error Value Sub-Codes" section within the "RSVP Parameters" registry:

Error Code	Sub-code	Meaning	Reference
24	TBD3	Unsupported Tsv-Type	[This I-D]
	TBD4	Unsupported Transceiver Mode	[This I-D]
	TBD5	Unable to Select Transceiver Mode	[This I-D]

The IANA is requested to create, within the "GMPLS Signaling Parameters" registry, two new sub-registries named "WDM Modulation Formats" and "WDM FEC Types".

For both of them:

- the value 0 means "Pending selection",
- the range 1-65503 follows the Expert Review policy for registration,
- the range 65504-65535 is for experimental use.

The "WDM Modulation Format" sub-registry is initialized as follows:

Value	Modulation Format
0	Pending selection
1	QPSK
2	8-QAM
3	16-QAM
4	32-QAM
5	64-QAM
6-63999	Unallocated
64000-65535	Vendor-specific use

The "WDM FEC Types" sub-registry is initialized as follows:

Value	FEC Types
0	Pending selection
1	Reed Solomon FEC
2	Staircase FEC
3	O-FEC
4-63999	Unallocated
64000-65535	Vendor-specific use

The IANA is requested to allocate, from the "Application ID Type" section within the "LMP" registry:

Type	Meaning	Reference
TBA	G.698.2	[I-D.ietf-ccamp-dwdm-if-lmp]
TBA	OUI + proprietary value	[I-D.ietf-ccamp-dwdm-if-lmp]
TBD6	OUI + Tsv-Type + ModeID	[This document]

5. Security Considerations

This specification only adds TLVs to RSVP-TE signaling messages. As a result, it relies on security guidelines documented in [RFC5920].

6. Acknowledgements

The authors would like to thank Ramon Casellas for his valuable feedback on the work related to this document.

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A YANG Data Model for Client Signal Performance Monitoring
draft-zheng-ccamp-client-pm-yang-02

Abstract

A transport network is a server-layer network to provide connectivity services to its client. Given the client signal is configured, the followup function for performance monitoring, such as latency and bit error rate, would be needed for network operation.

This document describes the data model to support the performance monitoring functionalities.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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

Table of Contents

1. Introduction

Client-layer network and server-layer network have been respectively modeled to allow the tunnels carrying the client traffic. Server-layers are modeled as tunnels with various switching technologies, such as [I-D.ietf-ccamp-otn-tunnel-model] and [I-D.ietf-ccamp-wson-tunnel-model]. Client-layers are modeled as client signals according to the client-signal identities specified in [I-D.ietf-ccamp-layer1-types]. These client signals can be configured to existing tunnels via the client signal configuration model specified in [I-D.ietf-ccamp-client-signal-yang].

In the network operation, the operator is interested in monitoring for their instantiated client signal over tunnels. The objective for such monitoring is to complete timely adjustment once there is abnormal statistic which may result in failure of the client signal. The parameters specified in the performance monitoring model can be collected for the operation need. The OAM mechanism, can be configured together with the performance monitoring 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 document is defined in [RFC8340]. They are provided below for reference.

- Brackets "[" and "]" enclose list keys.
- Abbreviations before data node names: "rw" means configuration (read-write) and "ro" state data (read-only).
- Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.
- Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- Ellipsis ("...") stands for contents of subtrees that are not shown.

3. Model Relationship

[I-D.ietf-ccamp-client-signal-yang] has specified the two models for the client signal configuration, module ietf-trans-client-service for transparent client service and module ietf-eth-tran-service for Ethernet service. Basically the client signal types in this document is consistent with ietf-eth-tran-types, and focus on different functionality. On the perspective of operator, the modules in [I-D.ietf-ccamp-client-signal-yang] can be used to configure the service given any underlay tunnels, while the operation about monitoring the performance on given service can be achieved by using the model in this document.

Consideration on Key Performance Information (KPI) monitoring for Virtual Network (VN) and tunnels has been specified in [I-D.ietf-teas-actn-pm-telemetry-autonomics]. Usually the monitoring on the tunnels are the VNs should be separately deployed for the network operation, but it is possible to have common parameters that are both needed for the VN/TE and the configured services. Common types are imported in both modules.

VPN-level parameters and their monitoring have been defined in [I-D.www-bess-yang-vpn-service-pm]. This module focus on the performance on the topology at different layer or the overlay topology between VPN sites. On the other hand, this document is focusing on the performance of the service configured between Customer Ends (CE).

4. Consideration on Monitoring Parameters

There can be multiple groups of parameters for monitoring, such as latency, bit error rate (BER). Some of these parameters are layer-dependent, for example, packet loss is only applicable in packet networks are won't be neede for layer 1 OTN and layer 0 WSON.

This document starts with the specification of the latency measurement for both Ethernet service and client signal service. In the future version additional parameters would be added into the data model in the same approach as the latency in the current version. A candidate list of parameters to be monitored include: Latency, Packet Loss, Bit Error Rate (BER), Jitter, Bandwidth, Byte/Packet number and so on.

5. OAM Configuration

The operation, administration and maintenance protocols and data models have been specified in [RFC8531] for the connection-oriented network. The model is referenced in this work to develop an Ethernet-specific OAM models, which is augmenting the service performance monitoring data model.

The definitions of OAM terminologies, such as maintainence Maintenance Domain (MD), Maintenance Association (MA), and Maintenance End Points (MEP), can be found in [RFC8531] as well.

6. YANG Model for Performance Monitoring

6.1. YANG Tree for Performance Monitoring

```
module: ietf-service-pm
  +--rw performance-monitoring
     +--rw service-pm* [service-name]
        +--rw service-name                union
        +--rw task-pm-enable?             boolean
        +--rw granularity?                identityref
        +--rw performance-data-config* [parameter-name]
        |  +--rw parameter-name    identityref
        |  +--rw measure-method?   identityref
        +--ro service-pm-state
           +--ro oam-state
           |  +--ro cc-state    enumeration
           |  +--ro lm-state?   enumeration
           |  +--ro dm-state?   enumeration
           +--ro performance-data* [parameter-name]
           |  +--ro parameter-name     identityref
           |  +--ro parameter-value* [index]
           |     +--ro index                uint64
           |     +--ro value                performance-parameter-value
           |     +--ro value-unit           string
           |     +--ro value-description?   string
           |     +--ro start-time?          yang:date-and-time
           |     +--ro end-time?            yang:date-and-time
           +--ro monitor-state       identityref
           +--ro error-info
           |  +--ro error-code?      uint32
           |  +--ro error-message?   string
           +--ro alarm
              +--ro status?   identityref
```

6.2. YANG Tree for OAM Configuration

```
module: ietf-eth-service-oam
  augment /svc-pm:performance-monitoring/svc-pm:service-pm:
    +--rw oam-config
       +--rw source
       |  +--rw md-name?         string
       |  +--rw ma-name?         string
       |  +--rw ma-level?        string
       |  +--rw meg-id?          string
       |  +--rw meg-level?       string
       |  +--rw mep-id?          uint8
       |  +--rw remote-mep-id?   uint8
       +--rw destination
       |  +--rw md-name?         string
       |  +--rw ma-name?         string
       |  +--rw ma-level?        string
       |  +--rw meg-id?          string
       |  +--rw meg-level?       string
       |  +--rw mep-id?          uint8
       |  +--rw remote-mep-id?   uint8
       +--rw cc-interval?   identityref
       +--rw lm-interval?   identityref
       +--rw dm-interval?   identityref
```

7. YANG Code for Performance Monitoring

7.1. The Performance Monitoring YANG Code

```
<CODE BEGINS> file "ietf-service-pm@2020-07-13.yang"
module ietf-service-pm {
  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-service-pm";
  prefix "svc-pm";

  import ietf-eth-tran-service {
    prefix "ethtsvc";
  }

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

  import ietf-trans-client-service {
    prefix "clntsvc";
  }
```

```
  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";
  contact
    "
      WG List: <mailto:ccamp@ietf.org>
      ID-draft editor:
        Haomian Zheng (zhenghaomian@huawei.com);
        Italo Busi (italo.busi@huawei.com);
        Yanlei Zheng (zhengyanlei@chinaunicom.cn);
    ";

  description
    "This module defines the performance monitoring for Ethernet
     services. The model fully conforms to the Network Management
     Datastore Architecture (NMDA).

     Copyright (c) 2020 IETF Trust and the persons
     identified as authors of the code.  All rights reserved.
     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject
     to the license terms contained in, the Simplified BSD License
     set forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (https://trustee.ietf.org/license-info).
     This version of this YANG module is part of RFC XXXX; see
     the RFC itself for full legal notices.";

  revision 2020-07-13 {
    description
      "Initial version";
    reference
      "ADD REFERENCE HERE";
  }

  typedef performance-parameter-value {
    type union {
      type uint32;
      type uint64;
      type decimal64 {
        fraction-digits 6;
      }
      type string;
    }
    description
      "A performance parameter value.";
  }

  grouping service-performance-monitor-set{
```

```
      description "the set of parameter name, value and description.";
      leaf parameter-name{
        type identityref {
          base performance-parameter-type;
        }
        description
          "The name of parameters to be monitored.
           For example, latency, Bit Error Rate, Bandwidth and so on.";
      }
      list parameter-value {
        key index;
        description
          "The table of values of the performance and
          their descriptions.";
        leaf index {
          type uint64;
          description
            "Used for list index";
        }
        leaf value {
          type performance-parameter-value;
          mandatory true;
          description
            "The value of the parameter. ";
        }
        leaf value-unit {
          type string;
          mandatory true;
          description
            "The value unit of the parameter.
             For example, second, minute and so on.";
        }
        leaf value-description{
          type string;
          description
            "The description of previous value. ";
        }
        leaf start-time {
          type yang:date-and-time;
          description
            "The time stamp when the parameter is started.";
        }
        leaf end-time {
          type yang:date-and-time;
          description
            "The time stamp when the parameter is ended.";
        }
      }
```

```
    }

    identity performance-parameter-type {
      description
        "Base type of the performance parameter being monitored.";
    }

    identity near-frame-loss {
      base performance-parameter-type;
      description
        "Near frame loss, using one-way eth loss measure,
         the sampling point is the MEP.";
    }

    identity far-frame-loss {
      base performance-parameter-type;
      description
        "Far frame loss, using one-way eth loss measure,
         the sampling point is the MEP.";
    }

    identity one-way-delay {
      base performance-parameter-type;
      description
        "One way delay.";
    }

    identity two-way-delay {
      base performance-parameter-type;
      description
        "Two way delay.";
    }

    identity receive-packets {
      base performance-parameter-type;
      description
        "Total number of received packets.";
    }

    identity transmit-packets {
      base performance-parameter-type;
      description
        "Total number of transmitted packets.";
    }

    identity alarm-status {
      description "indicates whether there is alarm or not";
    }
```

```
identity alarm {
  base alarm-status;
  description "There is one or multiple alarms from the monitor. ";
}

identity no-alarm {
  base alarm-status;
  description "There is no alarms from the monitor. ";
}

identity monitoring-state {
  description
    "The state of performance monitoring. ";
}

identity monitoring {
  base monitoring-state;
  description "The Ethernet client signal is under monitoring. ";
}

identity monitor-finished {
  base monitoring-state;
  description
    "The monitoring of Ethernet client signal is finished. ";
}

identity monitor-failed {
  base monitoring-state;
  description
    "The monitoring of Ethernet client signal is failed. ";
}

identity granularity-type {
  description
    "Monitoring granularity";
}

identity granularity-1min {
  base granularity-type;
  description
    "1 minute";
}

identity granularity-15min {
  base granularity-type;
  description
    "15 minutes";
}
```

```
identity granularity-24h {
  base granularity-type;
  description
    "24 hours";
}

identity measure-method {
  description "Measure method.";
}

identity measure-by-loopback {
  base measure-method;
  description "Loopback measure method.";
}

identity measure-at-ingress {
  base measure-method;
  description "Ingress measure method.";
}

container performance-monitoring {
  description
    "This part is for performance monitoring. ";
  list service-pm {
    key "service-name";
    description
      "The list of service to be monitored.";
    leaf service-name {
      mandatory true;
      type union {
        type leafref {
          path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
             + "/ethtsvc:etht-svc-name";
        }
        type leafref {
          path "/clntsvc:client-svc/clntsvc:client-svc-instances"
             + "/clntsvc:client-svc-name";
        }
      }

      description "The name of service.";
    }

    leaf task-pm-enable {
      type boolean;
      description
        "Indicate whether the performance monitoring
        is enable or not.";
```

```
        }

        leaf granularity {
          type identityref {
            base granularity-type;
          }
          description
            "Monitoring granularity";
        }

        list performance-data-config {
          key parameter-name;
          description
            "Specify the performance parameters to be queried";

          leaf parameter-name {
            type identityref {
              base performance-parameter-type;
            }
            description
              "The name of parameters to be monitored.
               For example, latency, BER, Bandwidth and so on.";
          }
          leaf measure-method {
            type identityref {
              base measure-method;
            }
          }
        }

        container service-pm-state {
          config false;
          description
            "The state of service performance monitoring.";

          container oam-state {
            leaf cc-state {
              mandatory true;
              type enumeration {
                enum up;
                enum down;
              }
            }
            leaf lm-state {
              type enumeration {
                enum up;
                enum down;
              }
```

```
        }
        leaf dm-state {
          type enumeration {
            enum up;
            enum down;
          }
        }
      }

      list performance-data{
        key parameter-name;
        description "The list of performance under monitor.";
        uses service-performance-monitor-set;
      }

      leaf monitor-state {
        mandatory true;
        type identityref {
          base monitoring-state;
        }
        description "The status of performance monitoring. ";
      }

      container error-info {
        description
          "Describe the error message.";
        leaf error-code {
          type uint32;
          description
            "The code of error.";
        }
        leaf error-message {
          type string;
          description
            "The message of error.";
        }
      }

      container alarm {
        description
          "To retrieve the Alarm during performance Monitoring.";
        leaf status {
          type identityref {
            base alarm-status;
          }
          description "The status of the alarm. ";
        }
      }
```

```
        }
      }
    }

  }
```

<CODE ENDS>

7.2. The OAM Configuration YANG Code

```
<CODE BEGINS> file "ietf-eth-service-oam@2020-07-13.yang"
module ietf-eth-service-oam {
  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-eth-service-oam";
  prefix "etht-oam";

  import ietf-eth-tran-service {
    prefix "ethtsvc";
  }

  import ietf-service-pm {
    prefix "svc-pm";
  }

  import ietf-trans-client-service {
    prefix "clntsvc";
  }

  import ietf-network {
    prefix nw;
  }

  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";
  contact
    "
      WG List: <mailto:ccamp@ietf.org>
      ID-draft editor:
        Haomian Zheng (zhenghaomian@huawei.com);
        Italo Busi (italo.busi@huawei.com);
        Yanlei Zheng (zhengyanlei@chinaunicom.cn);
    ";

  description
    "This module defines the performance monitoring for Ethernet
```

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

        Copyright (c) 2020 IETF Trust and the persons
        identified as authors of the code.  All rights reserved.
        Redistribution and use in source and binary forms, with or
        without modification, is permitted pursuant to, and subject
        to the license terms contained in, the Simplified BSD License
        set forth in Section 4.c of the IETF Trust's Legal Provisions
        Relating to IETF Documents
        (https://trustee.ietf.org/license-info).
        This version of this YANG module is part of RFC XXXX; see
        the RFC itself for full legal notices.";

    revision 2020-07-13 {
      description
        "Initial version";
      reference
        "ADD REFERENCE HERE";
    }

    identity interval-type {
      description "Time interval";
    }

    identity interval-3p33ms {
      base interval-type;
      description "3.33 milliseconds";
    }

    identity interval-10ms {
      base interval-type;
      description "10 milliseconds";
    }

    identity interval-100ms {
      base interval-type;
      description "100 milliseconds";
    }

    identity interval-1s {
      base interval-type;
      description "1 second";
    }

    identity interval-10s {
      base interval-type;
      description "10 seconds";
```

```
    }

    identity interval-1m {
      base interval-type;
      description "1 minute";
    }

    identity interval-10m {
      base interval-type;
      description "10 minutes";
    }

    grouping eth-service-oam-config {
        container source {
          uses mep-config;
        }
        container destination {
          uses mep-config;
        }

        uses interval-config;
    }

    grouping interval-config {
      leaf cc-interval {
        description "Continuity check interval";
        type identityref {
          base interval-type;
        }
      }

      leaf lm-interval {
        description "Loss measurement interval";
        type identityref {
          base interval-type;
        }
      }

      leaf dm-interval {
        description "Delay measurement interval";
        type identityref {
          base interval-type;
        }
      }
    }

    grouping mep-config {
      leaf md-name {
```

```
        type string;
        description
          "maintenance domain";
        }
        leaf ma-name {
        type string;
        description
          "An maintenance association(MA) is a part of an MD.
           An MD can be divided into one or more MAs. ";
        }

        leaf ma-level {
          type string;
        }

        leaf meg-id {
          type string;
          description
            "Comply with Y.1731 term, mapping with 802.lag MA name.";
        }
        leaf meg-level {
          type string;
          description "Mapping with 802.lag MA level.";
        }

        leaf mep-id {
          type uint8;
          description "0 if Abnormal";
        }

        leaf remote-mep-id {
          type uint8;
          description "The remote MEP ID must be specified.";
        }
      }


      augment "/svc-pm:performance-monitoring/svc-pm:service-pm" {
        description
          "Augment with additional parameters required for Ethernet OAM";

        container oam-config {
          uses eth-service-oam-config;
        }
      }

      grouping errors {
        leaf error-code {
```

```
        type uint32;
      }

      leaf error-message {
        type string;
      }
    }
<CODE ENDS>
```

8. 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-service-pm
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.
```

```
URI: urn:ietf:params:xml:ns:yang:ietf-eth-service-oam
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-service-pm
namespace:    urn:ietf:params:xml:ns:yang:ietf-service-pm
prefix:       svc-pm
reference:    RFC XXXX (This document)
```

```
name:         ietf-eth-service-oam
namespace:    urn:ietf:params:xml:ns:yang:ietf-eth-service-oam
prefix:       eth-oam
reference:    RFC XXXX (This document)
```

9. Manageability Considerations

TBD.

10. Security Considerations

The data following the model defined in this document is exchanged via, for example, the interface between an orchestrator and a transport network controller. The security concerns mentioned in [I-D.ietf-ccamp-client-signal-yang] also applies to this document.

The YANG module defined in this document can be accessed via the RESTCONF protocol defined in [RFC8040], or maybe via the NETCONF protocol [RFC6241].

11. Contributors

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June 3, 2020

A YANG Data Model for Ethernet TE Topology
draft-zheng-ccamp-client-topo-yang-09

Abstract

A transport network is a server-layer network to provide connectivity services to its client. In this draft the topology of Ethernet with TE is described with YANG data model.

Status of This Memo

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Table of Contents

1. Introduction

A transport network is a server-layer network designed to provide connectivity services for a client-layer network to carry the client traffic transparently across the server-layer network resources. The topology model in Traffic-Engineered network has been defined in both generic way and technology-specific way. The generic model, which is the base TE YANG model, can be found at [I-D.ietf-teas-yang-te-topo]. Technology-specific models, such as OTN/WSON topology model, have also been defined in [I-D.ietf-ccamp-otn-topo-yang] and [I-D.ietf-ccamp-wson-yang] respectively. Corresponding topology on client-layer is also required, to have a complete topology view from the perspective of network controllers.

This document defines a data model of all client-layer Topology, using YANG language defined in [RFC7950]. The model is augmenting the generic TE topology model, and can be used by either applications exposing to a network controller or among controllers. Furthermore, it can be used by an application for topology description in client-layer network.

2. Terminology and Notations

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

- Brackets "[" and "]" enclose list keys.
- Abbreviations before data node names: "rw" means configuration (read-write) and "ro" state data (read-only).
- Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.
- Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- Ellipsis ("...") stands for contents of subtrees that are not shown.

3. YANG Model for Topology of Client Layer

3.1. YANG Tree for Ethernet Topology

```
module: ietf-eth-te-topology
  augment /nw:networks/nw:network/nw:network-types
            /tet:te-topology:
    +--rw eth-tran-topology!
  augment /nw:networks/nw:network/nw:node
            /nt:termination-point:
    +--rw ltp-mac-address?
    |       yang:mac-address
    +--rw port-vlan-id?
    |       etht-types:vlanid
    +--rw maximum-frame-size?                        uint16
    +--rw (direction)?
    |  +--:(symmetrical)
    |  |  +--rw ingress-egress-bandwidth-profile
    |  |     +--rw bandwidth-profile-type?
    |  |     |       etht-types:bandwidth-profile-type
    |  |     +--rw CIR?                        uint64
    |  |     +--rw CBS?                        uint64
    |  |     +--rw EIR?                        uint64
    |  |     +--rw EBS?                        uint64
    |  |     +--rw color-aware?                boolean
    |  |     +--rw coupling-flag?              boolean
```

```
|  +--:(asymmetrical)
|     +--rw ingress-bandwidth-profile
|     |  +--rw bandwidth-profile-type?
|     |  |       etht-types:bandwidth-profile-type
|     |  +--rw CIR?                       uint64
|     |  +--rw CBS?                       uint64
|     |  +--rw EIR?                       uint64
|     |  +--rw EBS?                       uint64
|     |  +--rw color-aware?               boolean
|     |  +--rw coupling-flag?             boolean
|     +--rw egress-bandwidth-profile
|        +--rw bandwidth-profile-type?
|        |       etht-types:bandwidth-profile-type
|        +--rw CIR?                       uint64
|        +--rw CBS?                       uint64
|        +--rw EIR?                       uint64
|        +--rw EBS?                       uint64
|        +--rw color-aware?               boolean
|        +--rw coupling-flag?             boolean
+--rw eth-svc!
   +--rw client-facing?               boolean
   +--rw supported-classification
   |  +--rw port-classification?   boolean
   |  +--rw vlan-classification
   |     +--rw vlan-tag-classification?   boolean
   |     +--rw outer-tag
   |     |  +--rw supported-tag-types*
   |     |  |       etht-types:eth-tag-classify
   |     |  +--rw vlan-bundling?         boolean
   |     |  +--rw vlan-range?
   |     |          etht-types:vid-range-type
   |     +--rw second-tag
   |        +--rw second-tag-classification?   boolean
   |        +--rw supported-tag-types*
   |        |       etht-types:eth-tag-classify
   |        +--rw vlan-bundling?               boolean
   |        +--rw vlan-range?
   |                etht-types:vid-range-type
   +--rw supported-vlan-operations
      +--rw asymmetrical-operations?       boolean
      +--rw transparent-vlan-operations?   boolean
      +--rw vlan-pop
      |  +--rw vlan-pop-operations?   boolean
      |  +--rw max-pop-tags?          uint8
      +--rw vlan-push
         +--rw vlan-push-operation?   boolean
         +--rw outer-tag
         |  +--rw supported-tag-types*
```

```
                |  |       etht-types:eth-tag-type
                |  +--rw vlan-range?
                |          etht-types:vid-range-type
                +--rw second-tag
                   +--rw push-second-tag?       boolean
                   +--rw supported-tag-types*
                   |       etht-types:eth-tag-type
                   +--rw vlan-range?
                           etht-types:vid-range-type
     augment /nw:networks/nw:network/nw:node
               /nt:termination-point/tet:te
               /tet:interface-switching-capability
               /tet:max-lsp-bandwidth/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices/tet:path-constraints
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:path-constraints
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices/tet:path-constraints
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--ro eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:path-constraints
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--ro eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:client-layer-adaptation
               /tet:switching-capability/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
```

```
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:path-constraints/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity
               /tet:path-constraints/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes
               /tet:interface-switching-capability
               /tet:max-lsp-bandwidth/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:max-link-bandwidth
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes
               /tet:max-resv-link-bandwidth/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes/tet:unreserved-bandwidth
               /tet:te-bandwidth/tet:technology:
       +--:(eth)
          +--rw eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry
               /tet:interface-switching-capability
               /tet:max-lsp-bandwidth/tet:te-bandwidth
               /tet:technology:
       +--:(eth)
          +--ro eth-bandwidth?   uint64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry
```

```
            /tet:max-link-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--ro eth-bandwidth?   uint64
    augment /nw:networks/nw:network/nt:link/tet:te
            /tet:information-source-entry
            /tet:max-resv-link-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--ro eth-bandwidth?   uint64
    augment /nw:networks/nw:network/nt:link/tet:te
            /tet:information-source-entry
            /tet:unreserved-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--ro eth-bandwidth?   uint64
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:interface-switching-capability
            /tet:max-lsp-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--rw eth-bandwidth?   uint64
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:max-link-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--rw eth-bandwidth?   uint64
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:max-resv-link-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--rw eth-bandwidth?   uint64
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:unreserved-bandwidth/tet:te-bandwidth
            /tet:technology:
      +--:(eth)
         +--rw eth-bandwidth?   uint64
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes
            /tet:connectivity-matrices
            /tet:label-restrictions/tet:label-restriction:
      +--rw tag-type?   etht-types:eth-tag-type
      +--rw priority?   uint8
    augment /nw:networks/nw:network/nw:node/tet:te
```

```
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:label-restrictions/tet:label-restriction
              /tet:label-start/tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:label-restrictions/tet:label-restriction
              /tet:label-end/tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:label-restrictions/tet:label-restriction
              /tet:label-step/tet:technology:
    +--:(eth)
       +--rw eth-step?   uint16
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices/tet:underlay
              /tet:primary-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices/tet:underlay
              /tet:backup-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices/tet:optimizations
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-exclude-objects
              /tet:route-object-exclude-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
```

```
              /tet:te-node-attributes
              /tet:connectivity-matrices/tet:optimizations
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-include-objects
              /tet:route-object-include-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices/tet:path-properties
              /tet:path-route-objects/tet:path-route-object
              /tet:type/tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:from
              /tet:label-restrictions/tet:label-restriction:
      +--rw tag-type?   etht-types:eth-tag-type
      +--rw priority?   uint8
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:from
              /tet:label-restrictions/tet:label-restriction
              /tet:label-start/tet:te-label/tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:from
              /tet:label-restrictions/tet:label-restriction
              /tet:label-end/tet:te-label/tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:te-node-attributes
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:from
              /tet:label-restrictions/tet:label-restriction
              /tet:label-step/tet:technology:
      +--:(eth)
```

```
          +--rw eth-step?   uint16
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction:
       +--rw tag-type?   etht-types:eth-tag-type
       +--rw priority?   uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-start/tet:te-label/tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-end/tet:te-label/tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-step/tet:technology:
       +--:(eth)
          +--rw eth-step?   uint16
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay
               /tet:primary-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay
               /tet:backup-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
```

```
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations
               /tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations
               /tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:path-properties
               /tet:path-route-objects/tet:path-route-object
               /tet:type/tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction:
       +--ro tag-type?   etht-types:eth-tag-type
       +--ro priority?   uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:label-restrictions/tet:label-restriction
               /tet:label-start/tet:te-label/tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
```

```
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices
          /tet:label-restrictions/tet:label-restriction
          /tet:label-end/tet:te-label/tet:technology:
  +--:(eth)
     +--ro vlanid?   etht-types:vlanid
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices
          /tet:label-restrictions/tet:label-restriction
          /tet:label-step/tet:technology:
  +--:(eth)
     +--ro eth-step?   uint16
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices/tet:underlay
          /tet:primary-path/tet:path-element/tet:type
          /tet:label/tet:label-hop/tet:te-label
          /tet:technology:
  +--:(eth)
     +--ro vlanid?   etht-types:vlanid
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices/tet:underlay
          /tet:backup-path/tet:path-element/tet:type
          /tet:label/tet:label-hop/tet:te-label
          /tet:technology:
  +--:(eth)
     +--ro vlanid?   etht-types:vlanid
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices/tet:optimizations
          /tet:algorithm/tet:metric
          /tet:optimization-metric
          /tet:explicit-route-exclude-objects
          /tet:route-object-exclude-object/tet:type
          /tet:label/tet:label-hop/tet:te-label
          /tet:technology:
  +--:(eth)
     +--ro vlanid?   etht-types:vlanid
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:information-source-entry
          /tet:connectivity-matrices/tet:optimizations
          /tet:algorithm/tet:metric
          /tet:optimization-metric
          /tet:explicit-route-include-objects
          /tet:route-object-include-object/tet:type
```

```
            /tet:label/tet:label-hop/tet:te-label
            /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices/tet:path-properties
            /tet:path-route-objects/tet:path-route-object
            /tet:type/tet:label/tet:label-hop/tet:te-label
            /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices
            /tet:connectivity-matrix/tet:from
            /tet:label-restrictions/tet:label-restriction:
      +--ro tag-type?   etht-types:eth-tag-type
      +--ro priority?   uint8
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices
            /tet:connectivity-matrix/tet:from
            /tet:label-restrictions/tet:label-restriction
            /tet:label-start/tet:te-label/tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices
            /tet:connectivity-matrix/tet:from
            /tet:label-restrictions/tet:label-restriction
            /tet:label-end/tet:te-label/tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices
            /tet:connectivity-matrix/tet:from
            /tet:label-restrictions/tet:label-restriction
            /tet:label-step/tet:technology:
      +--:(eth)
         +--ro eth-step?   uint16
    augment /nw:networks/nw:network/nw:node/tet:te
            /tet:information-source-entry
            /tet:connectivity-matrices
            /tet:connectivity-matrix/tet:to
            /tet:label-restrictions/tet:label-restriction:
```

```
       +--ro tag-type?   etht-types:eth-tag-type
       +--ro priority?   uint8
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-start/tet:te-label/tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-end/tet:te-label/tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:to
               /tet:label-restrictions/tet:label-restriction
               /tet:label-step/tet:technology:
       +--:(eth)
          +--ro eth-step?   uint16
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay
               /tet:primary-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:underlay
               /tet:backup-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--ro vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry
               /tet:connectivity-matrices
               /tet:connectivity-matrix/tet:optimizations
```

```
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-exclude-objects
              /tet:route-object-exclude-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:information-source-entry
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:optimizations
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-include-objects
              /tet:route-object-include-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:information-source-entry
              /tet:connectivity-matrices
              /tet:connectivity-matrix/tet:path-properties
              /tet:path-route-objects/tet:path-route-object
              /tet:type/tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:label-restrictions/tet:label-restriction:
      +--rw tag-type?   etht-types:eth-tag-type
      +--rw priority?   uint8
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:label-restrictions/tet:label-restriction
              /tet:label-start/tet:te-label/tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:label-restrictions/tet:label-restriction
              /tet:label-end/tet:te-label/tet:technology:
      +--:(eth)
```

```
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:label-restrictions/tet:label-restriction
               /tet:label-step/tet:technology:
       +--:(eth)
          +--rw eth-step?   uint16
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:underlay
               /tet:primary-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:underlay
               /tet:backup-path/tet:path-element/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:optimizations
               /tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-exclude-objects
               /tet:route-object-exclude-object/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities/tet:optimizations
               /tet:algorithm/tet:metric
               /tet:optimization-metric
               /tet:explicit-route-include-objects
               /tet:route-object-include-object/tet:type
               /tet:label/tet:label-hop/tet:te-label
               /tet:technology:
       +--:(eth)
          +--rw vlanid?   etht-types:vlanid
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
```

```
              /tet:local-link-connectivities
              /tet:path-properties/tet:path-route-objects
              /tet:path-route-object/tet:type/tet:label
              /tet:label-hop/tet:te-label/tet:technology:
    +--:(eth)
       +--ro vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity
              /tet:label-restrictions/tet:label-restriction:
    +--rw tag-type?   etht-types:eth-tag-type
    +--rw priority?   uint8
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity
              /tet:label-restrictions/tet:label-restriction
              /tet:label-start/tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity
              /tet:label-restrictions/tet:label-restriction
              /tet:label-end/tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity
              /tet:label-restrictions/tet:label-restriction
              /tet:label-step/tet:technology:
    +--:(eth)
       +--rw eth-step?   uint16
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity/tet:underlay
              /tet:primary-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
```

```
              /tet:local-link-connectivities
              /tet:local-link-connectivity/tet:underlay
              /tet:backup-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity/tet:optimizations
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-exclude-objects
              /tet:route-object-exclude-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity/tet:optimizations
              /tet:algorithm/tet:metric
              /tet:optimization-metric
              /tet:explicit-route-include-objects
              /tet:route-object-include-object/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nw:node/tet:te
              /tet:tunnel-termination-point
              /tet:local-link-connectivities
              /tet:local-link-connectivity/tet:path-properties
              /tet:path-route-objects/tet:path-route-object
              /tet:type/tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--ro vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nt:link/tet:te
              /tet:te-link-attributes/tet:underlay
              /tet:primary-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/nw:network/nt:link/tet:te
```

```
              /tet:te-link-attributes/tet:underlay
              /tet:backup-path/tet:path-element/tet:type
              /tet:label/tet:label-hop/tet:te-label
              /tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:te-link-attributes/tet:label-restrictions
              /tet:label-restriction:
    +--rw tag-type?   etht-types:eth-tag-type
    +--rw priority?   uint8
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:te-link-attributes/tet:label-restrictions
              /tet:label-restriction/tet:label-start
              /tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:te-link-attributes/tet:label-restrictions
              /tet:label-restriction/tet:label-end
              /tet:te-label/tet:technology:
    +--:(eth)
       +--rw vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:te-link-attributes/tet:label-restrictions
              /tet:label-restriction/tet:label-step
              /tet:technology:
    +--:(eth)
       +--rw eth-step?   uint16
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:information-source-entry
              /tet:label-restrictions/tet:label-restriction:
    +--ro tag-type?   etht-types:eth-tag-type
    +--ro priority?   uint8
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:information-source-entry
              /tet:label-restrictions/tet:label-restriction
              /tet:label-start/tet:te-label/tet:technology:
    +--:(eth)
       +--ro vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:information-source-entry
              /tet:label-restrictions/tet:label-restriction
              /tet:label-end/tet:te-label/tet:technology:
    +--:(eth)
       +--ro vlanid?   etht-types:vlanid
  augment /nw:networks/nw:network/nt:link/tet:te
              /tet:information-source-entry
```

```
            /tet:label-restrictions/tet:label-restriction
            /tet:label-step/tet:technology:
      +--:(eth)
         +--ro eth-step?   uint16
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:underlay/tet:primary-path/tet:path-element
            /tet:type/tet:label/tet:label-hop/tet:te-label
            /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:underlay/tet:backup-path/tet:path-element
            /tet:type/tet:label/tet:label-hop/tet:te-label
            /tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:label-restrictions/tet:label-restriction:
      +--rw tag-type?   etht-types:eth-tag-type
      +--rw priority?   uint8
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:label-restrictions/tet:label-restriction
            /tet:label-start/tet:te-label/tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:label-restrictions/tet:label-restriction
            /tet:label-end/tet:te-label/tet:technology:
      +--:(eth)
         +--rw vlanid?   etht-types:vlanid
    augment /nw:networks/tet:te/tet:templates
            /tet:link-template/tet:te-link-attributes
            /tet:label-restrictions/tet:label-restriction
            /tet:label-step/tet:technology:
      +--:(eth)
         +--rw eth-step?   uint16
```

4. YANG Code for Topology Client Layer

4.1. The ETH Topology YANG Code

```
<CODE BEGINS> file "ietf-eth-te-topology@2019-11-18.yang"
module ietf-eth-te-topology {

  namespace "urn:ietf:params:xml:ns:yang:ietf-eth-te-topology";

  prefix "ethtetopo";

  import ietf-network {
    prefix "nw";
  }

  import ietf-network-topology {
    prefix "nt";
  }

  import ietf-te-topology {
    prefix "tet";
  }

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

  import ietf-eth-tran-types {
    prefix "etht-types";
  }

  organization
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  contact
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    ";

  description
```

```
     "This module defines a YANG data model for describing
      layer-2 Ethernet transport topologies. The model fully
      conforms to the Network Management Datastore
      Architecture (NMDA).

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

   revision 2019-11-18 {
     description
       "Initial Revision";
     reference
       "RFC XXXX: A YANG Data Model for Client-layer Topology";
     // RFC Ed.: replace XXXX with actual RFC number, update date
     // information and remove this note
   }

   /*
    * Groupings
    */

   grouping eth-tran-topology-type {
     description
       "Identifies the Ethernet Transport topology type";

     container eth-tran-topology {
       presence "indicates a topology type of
                 Ethernet Transport Network.";
       description "Eth transport topology type";
     }
   }

   grouping ltp-bandwidth-profiles {
     description
       "A grouping which represents the bandwidth profile(s)
       for the ETH LTP.";

     choice direction {
       description
```

```
        "Whether the bandwidth profiles are symmetrical or
         asymmetrical";
      case symmetrical {
        description
          "The same bandwidth profile is used to describe the ingress
           and the egress bandwidth profile.";

        container ingress-egress-bandwidth-profile {
          description
            "The bandwith profile used in the ingress and egress
             direction.";
          uses etht-types:etht-bandwidth-profiles;
        }
      }
      case asymmetrical {
        description
          "Different ingress and egress bandwidth profiles
           can be specified.";
        container ingress-bandwidth-profile {
          description
            "The bandwidth profile used in the ingress direction.";
          uses etht-types:etht-bandwidth-profiles;
        }
        container egress-bandwidth-profile {
          description
            "The bandwidth profile used in the egress direction.";
          uses etht-types:etht-bandwidth-profiles;
        }
      }
    }
  }

  grouping eth-ltp-attributes {
    description
      "Ethernet transport link termination point attributes";

    /*
     * Open Issue: should we remove this attribute
     * (duplicates with I2RS L2 attributes)?
     */
    leaf ltp-mac-address {
      type yang:mac-address;
      description "the MAC address of the LTP.";
    }
    /*
     * Open Issue: should we remove this attribute
     * (duplicates with I2RS L2 attributes)?
     */
```

```
    leaf port-vlan-id {
      type etht-types:vlanid;
      description "the port VLAN ID of the LTP.";
    }
    /*
     * Open Issue: should we remove this attribute
     * (duplicates with I2RS L2 attributes)?
     */
    leaf maximum-frame-size {
      type uint16 {
        range "64 .. 65535";
      }
      description
        "Maximum frame size";
    }
      uses ltp-bandwidth-profiles;
  }

  grouping svc-vlan-classification {
    description
      "Grouping defining the capabilities for VLAN classification.";

    leaf-list supported-tag-types {
      type etht-types:eth-tag-classify;
      description
        "List of VLAN tag types that can be used for the VLAN
         classification. In case VLAN classification is not
         supported, the list is empty.";
    }
    leaf vlan-bundling {
      type boolean;
      description
        "In case VLAN classification is supported, indicates whether
        VLAN bundling classification is also supported.";
    }
    leaf vlan-range {
      type etht-types:vid-range-type;
      description
        "In case VLAN classification is supported, indicates the
        of available VLAN ID values.";
    }
  }

  grouping svc-vlan-push {
    description
      "Grouping defining the capabilities for VLAN push or swap
       operations.";
```

```
    leaf-list supported-tag-types {
      type etht-types:eth-tag-type;
      description
        "List of VLAN tag types that can be used to push or swap a
         VLAN tag. In case VLAN push/swap is not supported, the list
         is empty.";
    }
    leaf vlan-range {
      type etht-types:vid-range-type;
      description
        "In case VLAN push/swap operation is supported, the range
        of available VLAN ID values.";
    }
  }

  grouping eth-ltp-svc-attributes {
    description
      "Ethernet link termination point (LTP) service attributes.";

    container supported-classification {
      description
        "Service classification capability supported by the ETH LTP.";

      leaf port-classification {
        type boolean;
        description
          "Indicates that the ETH LTP support port-based service
          classification.";
      }
      container vlan-classification {
        description
          "Service classification capabilities based on the VLAN
           tag(s) supported by the ETH LTP.";

        leaf vlan-tag-classification {
          type boolean;
          description
            "Indicates that the ETH LTP supports VLAN service
            classification.";
        }
        container outer-tag {
          description
            "Service classification capabilities based on the outer
             VLAN tag, supported by the ETH LTP.";
          uses svc-vlan-classification;
        }
        container second-tag {
          description
```

```
            "Service classification capabilities based on the second
             VLAN tag, supported by the ETH LTP.";
        /*
         * Open issue: indicates that second-tag-classification
         * can be True only if outer-tag-classification is also True.
        */
          leaf second-tag-classification {
            type boolean;
            description
              "Indicates that the ETH LTP support  VLAN service
               classification based on the second VLAN tag.";
          }
          uses svc-vlan-classification;
        }
      }
    }

    container supported-vlan-operations {
      description
        "Reports the VLAN operations supported by the ETH LTP.";

      leaf asymmetrical-operations {
        type boolean;
        description
          "Indicates whether the ETH LTP supports also asymmetrical
           VLAN operations.It is assumed that symmetrical VLAN
           operations are alwyas supported.";
      }
      leaf transparent-vlan-operations {
        type boolean;
        description
          "Indicates that the ETH LTP supports transparent
          operations.";
      }
      container vlan-pop {
        description
          "Indicates VLAN pop or swap operations capabilities.";

        leaf vlan-pop-operations {
          type boolean;
          description
            "Indicates that the ETH LTP supports VLAN pop or
             swap operations.";
        }
        leaf max-pop-tags {
          type uint8 {
            range "1..2";
          }
```

```
          description
            "Indicates the maximum number of tags that can be
             popped/swapped.";
        }
      }
      container vlan-push {
        description
          "Indicates VLAN push or swap operations capabilities.";

        leaf vlan-push-operation {
          type boolean;
          description
            "Indicates that the ETH LTP supports VLAN push or
             swap operations.";
        }
        container outer-tag {
          description
            "Indicates the supported VLAN operation capabilities
             on the outer VLAN tag.";
          uses svc-vlan-push;
        }
        container second-tag {
          description
            "Indicates the supported VLAN operation capabilities
             on the second VLAN tag.";
          leaf push-second-tag {
            type boolean;
            description
              "Indicates that the ETH LTP supports VLAN push or swap
               operations for the second VLAN tag.";
          }
          uses svc-vlan-push;
        }
      }
    }
  }

  /*
   * Data nodes
   */

  augment "/nw:networks/nw:network/nw:network-types/tet:te-topology" {
    description
      "Augment network types to include ETH transport newtork";

    uses eth-tran-topology-type;
  }
```

```
  augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
    when "../../nw:network-types/tet:te-topology/"
      + "ethtetopo:eth-tran-topology" {
      description
        "Augment only for ETH transport network";
    }
    description
      "Augment ETH LTP attributes";

    uses eth-ltp-attributes;

    container eth-svc {
      presence "client-facing LTP.";
      description
        "ETH LTP Service attributes.";

      leaf client-facing {
        type boolean;
        default "false";
        description
          "Indicates whether this LTP is a client-facing LTP.";
      }
      uses eth-ltp-svc-attributes;
    }
  }

  /*
   * Augment TE bandwidth
   */

  /* Augment maximum LSP bandwidth of link terminationpoint (LTP) */
  augment "/nw:networks/nw:network/nw:node/nt:termination-point/"
        + "tet:te/"
        + "tet:interface-switching-capability/tet:max-lsp-bandwidth/"
        + "tet:te-bandwidth/tet:technology" {
    when "../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
    }
  }
  /* Augment bandwidth path constraints of connectivity-matrices */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
```

```
      when "../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE bandwidth";
      }
      description "Ethernet bandwidth.";
      case eth {
        uses etht-types:eth-bandwidth;
      }
    }

    /* Augment bandwidth path constraints of connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE bandwidth";
      }
      description "Ethernet bandwidth.";
      case eth {
        uses etht-types:eth-bandwidth;
      }
    }

    /* Augment bandwidth path constraints of connectivity-matrices
     * information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE bandwidth";
      }
      description "Ethernet bandwidth.";
      case eth {
        uses etht-types:eth-bandwidth;
      }
    }

    /* Augment bandwidth path constraints of connectivity-matrix
     * information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:path-constraints/tet:te-bandwidth/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
```

```
      description "Ethernet TE bandwidth";
    }
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
    }
  }

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

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

  /* Augment bandwidth path constraints of local-link-connectivity */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/tet:path-constraints/"
        + "tet:te-bandwidth/tet:technology" {
    when "../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
```

```
      description "Ethernet bandwidth.";
      case eth {
        uses etht-types:eth-bandwidth;
      }
    }

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

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

    /* Augment maximum reservable bandwidth of TE link */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:max-resv-link-bandwidth/"
          + "tet:te-bandwidth/tet:technology" {
      when "../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE bandwidth";
      }
      description "Ethernet bandwidth.";
      case eth {
        uses etht-types:eth-bandwidth;
```

```
    }
  }

  /* Augment unreserved bandwidth of TE Link */
  augment "/nw:networks/nw:network/nt:link/tet:te/"
        + "tet:te-link-attributes/"
        + "tet:unreserved-bandwidth/"
        + "tet:te-bandwidth/tet:technology" {
    when "../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
    }
  }
  /* Augment maximum LSP bandwidth of TE link information-source */
  augment "/nw:networks/nw:network/nt:link/tet:te/"
        + "tet:information-source-entry/"
        + "tet:interface-switching-capability/"
        + "tet:max-lsp-bandwidth/"
        + "tet:te-bandwidth/tet:technology" {
    when "../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
    }
  }

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

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

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

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

```
  /* Augment maximum bandwidth of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:max-link-bandwidth/"
        + "tet:te-bandwidth/tet:technology" {
/*
    when "../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
*/
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
    }
  }

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

  /* Augment unreserved bandwidth of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:unreserved-bandwidth/"
        + "tet:te-bandwidth/tet:technology" {
/*
    when "../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE bandwidth";
    }
*/
    description "Ethernet bandwidth.";
    case eth {
      uses etht-types:eth-bandwidth;
```

```
    }
  }

  /*
   * Augment TE label.
   */

  /* Augment label restrictions of connectivity-matrices */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:label-restrictions/tet:label-restriction" {
    when "../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label restriction.";
    uses etht-types:eth-label-restriction;
  }

  /* Augment label restrictions start of connectivity-matrices */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-start/tet:te-label/tet:technology" {
    when "../../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions end of connectivity-matrices */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:label-restrictions/tet:label-restriction/tet:label-end/"
        + "tet:te-label/tet:technology" {
    when "../../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }
```

```
   /* Augment label restrictions step of connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-step/tet:technology" {
     when "../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label-step;
     }
   }

   /* Augment label hop of underlay primary path of
    * connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:underlay/tet:primary-path/tet:path-element/"
         + "tet:type/tet:label/tet:label-hop/"
         + "tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }
   /* Augment label hop of underlay backup path of
    * connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:underlay/tet:backup-path/tet:path-element/"
         + "tet:type/tet:label/tet:label-hop/"
         + "tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
```

```
   }

   /* Augment label hop of route-exclude of connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-exclude-objects/"
         + "tet:route-object-exclude-object/"
         + "tet:type/tet:label/tet:label-hop/"
         + "tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of route-include of connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-include-objects/"
         + "tet:route-object-include-object/"
         + "tet:type/tet:label/tet:label-hop/"
         + "tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of path-route of connectivity-matrices */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:te-node-attributes/tet:connectivity-matrices/"
         + "tet:path-properties/tet:path-route-objects/"
         + "tet:path-route-object/tet:type/tet:label/tet:label-hop/"
         + "tet:te-label/tet:technology"{
```

```
      when "../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment ingress label restrictions of connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      uses etht-types:eth-label-restriction;
    }

    /* Augment ingress label restrictions start of
     * connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment ingress label restrictions end of connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/tet:label-end/"
          + "tet:te-label/tet:technology" {
```

```
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment ingress label restrictions step of connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:from/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label-step;
      }
    }

    /* Augment egress label restrictions of connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:to/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      uses etht-types:eth-label-restriction;
    }

    /* Augment egress label restrictions start of
     * connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/tet:to/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
```

```
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment egress label restrictions end of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/tet:to/"
        + "tet:label-restrictions/tet:label-restriction/tet:label-end/"
        + "tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment egress label restrictions step of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/tet:to/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

 /* Augment label hop of underlay primary path of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
```

```
        + "tet:connectivity-matrix/"
        + "tet:underlay/tet:primary-path/tet:path-element/"
        + "tet:type/tet:label/tet:label-hop/"
        + "tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

 /* Augment label hop of underlay backup path of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:underlay/tet:backup-path/tet:path-element/"
        + "tet:type/tet:label/tet:label-hop/"
        + "tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of route-exclude of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/tet:optimizations/"
        + "tet:algorithm/tet:metric/tet:optimization-metric/"
        + "tet:explicit-route-exclude-objects/"
        + "tet:route-object-exclude-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
```

```
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of route-include of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/tet:optimizations/"
        + "tet:algorithm/tet:metric/tet:optimization-metric/"
        + "tet:explicit-route-include-objects/"
        + "tet:route-object-include-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of path-route of connectivity-matrix */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:te-node-attributes/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:path-properties/tet:path-route-objects/"
        + "tet:path-route-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions of connectivity-matrices
   * information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/"
        + "tet:connectivity-matrices/tet:label-restrictions/"
        + "tet:label-restriction" {
    when "../../../../../../nw:network-types/tet:te-topology/"
```

```
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     uses etht-types:eth-label-restriction;
   }

   /* Augment label restrictions start of connectivity-matrices
    * information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/"
         + "tet:connectivity-matrices/tet:label-restrictions/"
         + "tet:label-restriction/"
         + "tet:label-start/tet:te-label/tet:technology" {
     when "../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label restrictions end of connectivity-matrices
    * information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/"
         + "tet:connectivity-matrices/tet:label-restrictions/"
         + "tet:label-restriction/"
         + "tet:label-end/tet:te-label/tet:technology" {
     when "../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label restrictions step of connectivity-matrices
    * information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/"
         + "tet:connectivity-matrices/tet:label-restrictions/"
```

```
        + "tet:label-restriction/"
        + "tet:label-step/tet:technology" {
    when "../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

  /* Augment label hop of underlay primary path of
   * connectivity-matrices information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of underlay backup path of
   * connectivity-matrices information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of route-exclude of
```

```
    * connectivity-matrices information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-exclude-objects/"
         + "tet:route-object-exclude-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of route-include of
    * connectivity-matrices information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-include-objects/"
         + "tet:route-object-include-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of path-route of
    * connectivity-matrices information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:path-properties/tet:path-route-objects/"
         + "tet:path-route-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
```

```
        + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment ingress label restrictions of
     * connectivity-matrix information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:from/tet:label-restrictions/tet:label-restriction" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      uses etht-types:eth-label-restriction;
    }

    /* Augment ingress label restrictions start of
     * connectivity-matrix information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:from/tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment ingress label restrictions end of
     * connectivity-matrix information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:from/tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
```

```
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment ingress label restrictions step of
   * connectivity-matrix information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:from/tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

  /* Augment egress label restrictions of
   * connectivity-matrix information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:to/tet:label-restrictions/tet:label-restriction" {
    when "../../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    uses etht-types:eth-label-restriction;
  }

  /* Augment egress label restrictions start of
   * connectivity-matrix information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
```

```
        + "tet:to/tet:label-restrictions/tet:label-restriction/"
        + "tet:label-start/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment egress label restrictions end of
   * connectivity-matrix information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:to/tet:label-restrictions/tet:label-restriction/"
        + "tet:label-end/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment egress label restrictions step of
   * connectivity-matrix information-source */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:information-source-entry/tet:connectivity-matrices/"
        + "tet:connectivity-matrix/"
        + "tet:to/tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }
```

```
   /* Augment label hop of underlay primary path of
    * connectivity-matrix information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:connectivity-matrix/"
         + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of underlay backup path of
    * connectivity-matrix information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:connectivity-matrix/"
         + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of route-exclude of
    * connectivity-matrix information-source */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:information-source-entry/tet:connectivity-matrices/"
         + "tet:connectivity-matrix/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-exclude-objects/"
         + "tet:route-object-exclude-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
```

```
        + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment label hop of route-include of
     * connectivity-matrix information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:optimizations/tet:algorithm/tet:metric/"
          + "tet:optimization-metric/"
          + "tet:explicit-route-include-objects/"
          + "tet:route-object-include-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment label hop of path-route of
     * connectivity-matrix information-source */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix/"
          + "tet:path-properties/tet:path-route-objects/"
          + "tet:path-route-object/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }
```

```
   /* Augment label restrictions of local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:label-restrictions/tet:label-restriction" {
     when "../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     uses etht-types:eth-label-restriction;
   }

   /* Augment label restrictions start of local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-start/tet:te-label/tet:technology" {
     when "../../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label restrictions end of local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-end/tet:te-label/tet:technology"{
     when "../../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label restrictions step of local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
```

```
        + "tet:local-link-connectivities/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology"{
    when "../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

  /* Augment label hop of underlay primary path of
   * local-link-connectivities */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of underlay backup path of
   * local-link-connectivities */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }
```

```
   /* Augment label hop of route-exclude of
    * local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-exclude-objects/"
         + "tet:route-object-exclude-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of route-include of
    * local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:optimizations/tet:algorithm/tet:metric/"
         + "tet:optimization-metric/"
         + "tet:explicit-route-include-objects/"
         + "tet:route-object-include-object/tet:type/"
         + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
     when "../../../../../../../../../../"
        + "nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label hop of path-route of local-link-connectivities */
   augment "/nw:networks/nw:network/nw:node/tet:te/"
         + "tet:tunnel-termination-point/"
         + "tet:local-link-connectivities/"
         + "tet:path-properties/tet:path-route-objects/"
         + "tet:path-route-object/tet:type/"
```

```
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions of local-link-connectivity  */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:label-restrictions/tet:label-restriction" {
    when "../../../../../../../nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    uses etht-types:eth-label-restriction;
  }

  /* Augment label restrictions start of local-link-connectivity */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-start/tet:te-label/tet:technology" {
    when "../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions end of local-link-connectivity */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
```

```
        + "tet:local-link-connectivity/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-end/tet:te-label/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions step of local-link-connectivity  */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology" {
    when "../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

  /* Augment label hop of underlay primary path of
   * local-link-connectivity */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
```

```
    }
  }

  /* Augment label hop of underlay backup path of
   * local-link-connectivity (LLC) */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of route-exclude of
   * local-link-connectivity (LLC) */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:optimizations/tet:algorithm/tet:metric/"
        + "tet:optimization-metric/"
        + "tet:explicit-route-exclude-objects/"
        + "tet:route-object-exclude-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of route-include of
   * local-link-connectivity (LLC) */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
```

```
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:optimizations/tet:algorithm/tet:metric/"
        + "tet:optimization-metric/"
        + "tet:explicit-route-include-objects/"
        + "tet:route-object-include-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of path-route of
   * local-link-connectivity (LLC) */
  augment "/nw:networks/nw:network/nw:node/tet:te/"
        + "tet:tunnel-termination-point/"
        + "tet:local-link-connectivities/"
        + "tet:local-link-connectivity/"
        + "tet:path-properties/tet:path-route-objects/"
        + "tet:path-route-object/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of underlay primary path of TE link */
  augment "/nw:networks/nw:network/nt:link/tet:te/"
        + "tet:te-link-attributes/"
        + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
    when "../../../../../../../../../../../../"
       + "nw:network-types/tet:te-topology/"
       + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
```

```
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment label hop of underlay backup path of TE link */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
      when "../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment label restrictions of TE link */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction" {
      when "../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      uses etht-types:eth-label-restriction;
    }

    /* Augment label restrictions start of TE link */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-start/tet:te-label/tet:technology" {
      when "../../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }
```

```
   /* Augment label restrictions end of TE link */
   augment "/nw:networks/nw:network/nt:link/tet:te/"
         + "tet:te-link-attributes/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-end/tet:te-label/tet:technology" {
     when "../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label;
     }
   }

   /* Augment label restrictions step of TE link */
   augment "/nw:networks/nw:network/nt:link/tet:te/"
         + "tet:te-link-attributes/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-step/tet:technology" {
     when "../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     case eth {
       uses etht-types:eth-label-step;
     }
   }

   /* Augment label restrictions of TE link information-source */
   augment "/nw:networks/nw:network/nt:link/tet:te/"
         + "tet:information-source-entry/"
         + "tet:label-restrictions/tet:label-restriction" {
     when "../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
       description "Ethernet TE label";
     }
     description "Ethernet label.";
     uses etht-types:eth-label-restriction;
   }

   /* Augment label restrictions start of TE link information-source */
   augment "/nw:networks/nw:network/nt:link/tet:te/"
         + "tet:information-source-entry/"
         + "tet:label-restrictions/tet:label-restriction/"
         + "tet:label-start/tet:te-label/tet:technology" {
     when "../../../../../../../nw:network-types/tet:te-topology/"
```

```
        + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }
    /* Augment label restrictions end of TE link information-source */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-end/tet:te-label/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label;
      }
    }

    /* Augment label restrictions step of TE link information-source */
    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:label-restrictions/tet:label-restriction/"
          + "tet:label-step/tet:technology" {
      when "../../../../../../../nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
      }
      description "Ethernet label.";
      case eth {
        uses etht-types:eth-label-step;
      }
    }

    /* Augment label hop of underlay primary path of TE link template */
    augment "/nw:networks/tet:te/tet:templates/"
          + "tet:link-template/tet:te-link-attributes/"
          + "tet:underlay/tet:primary-path/tet:path-element/tet:type/"
          + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
 /*
      when "../../../../../../../../../../../"
         + "nw:network-types/tet:te-topology/"
         + "ethtetopo:eth-tran-topology" {
        description "Ethernet TE label";
```

```
    }
 */
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label hop of underlay backup path of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:underlay/tet:backup-path/tet:path-element/tet:type/"
        + "tet:label/tet:label-hop/tet:te-label/tet:technology" {
 /*
    when "../../../../../../../../../../nw:network-types/"
        + "tet:te-topology/ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
 */
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:label-restrictions/tet:label-restriction" {
 /*
    when "../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
 */
    description "Ethernet label.";
    uses etht-types:eth-label-restriction;
  }

  /* Augment label restrictions start of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-start/tet:te-label/tet:technology" {
 /*
    when "../../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
```

```
    }
 */
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions end of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-end/tet:te-label/tet:technology" {
 /*
    when "../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
 */
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label;
    }
  }

  /* Augment label restrictions step of TE link template */
  augment "/nw:networks/tet:te/tet:templates/"
        + "tet:link-template/tet:te-link-attributes/"
        + "tet:label-restrictions/tet:label-restriction/"
        + "tet:label-step/tet:technology" {
 /*
    when "../../../../../../../nw:network-types/tet:te-topology/"
        + "ethtetopo:eth-tran-topology" {
      description "Ethernet TE label";
    }
 */
    description "Ethernet label.";
    case eth {
      uses etht-types:eth-label-step;
    }
  }

 }

 <CODE ENDS>
```

5. Considerations and Open Issue

Editor Notes: This section is used to note temporary discussion/ conclusion that to be fixed in the future version, and will be removed before publication. 201902: we have noticed that Ethernet is the only client signal (on the perspective of OTN) which need a topology. So it is possible that the title of this document will be changed to "A YANG Data Model for Ethernet Topology". The proposal of this work is that the document will follow up the progress of draft-zheng-ccamp-client-signal-yang, with draft-zheng-ccamp-client-tunnel-yang together. (solved in -06) 201902: will have to align with TE topology model, currently is a totally different format with necessary parameters, a big change is expected. (solved in -06.)

6. IANA Considerations

It is proposed that IANA should assign new URIs from the "IETF XML Registry" [RFC3688] as follows:

```
URI: urn:ietf:params:xml:ns:yang:ietf-eth-te-topology
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-eth-te-topology
namespace:    urn:ietf:params:xml:ns:yang:ietf-eth-te-topology
prefix:       ethtetopo
reference:    RFC XXXX (This document)
```

7. Manageability Considerations

TBD.

8. Security Considerations

The data following the model defined in this document is exchanged via, for example, the interface between an orchestrator and a transport network controller. The security concerns mentioned in [I-D.ietf-teas-yang-te-topo] for using ietf-te-topology.yang model also applies to this document.

The YANG module defined in this document can be accessed via the RESTCONF protocol defined in [RFC8040], or maybe via the NETCONF protocol [RFC6241].

There are a number of data nodes defined in the YANG module which 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., POST) to these data nodes without proper protection can have a negative effect on network operations.

Editors note: to list specific subtrees and data nodes and their sensitivity/vulnerability.

9. Acknowledgements

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10. Contributors

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