

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: May 3, 2018

X. Liu
Jabil
I. Bryskin
Huawei Technologies
V. Beeram
Juniper Networks
T. Saad
Cisco Systems Inc
H. Shah
Ciena
O. Gonzalez de Dios
Telefonica
October 30, 2017

YANG Data Model for Layer 3 TE Topologies
draft-liu-teas-yang-l3-te-topo-05

Abstract

This document defines a YANG data model for layer 3 traffic engineering topologies.

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1. Introduction

This document defines a YANG [RFC7950] data model for describing the relationship between a layer 3 network topology [I-D.ietf-i2rs-yang-l3-topology] and a TE topology [I-D.ietf-teas-yang-te-topo].

When traffic engineering is enabled on a layer 3 network topology, there will be a corresponding TE topology. The TE topology may or may not be congruent to the layer 3 network topology. When such a congruent TE topology exists, there will be a one-to-one association between the one modeling element in the layer 3 topology to another element in the TE topology. When such a congruent TE topology does not exist, the association will not be one-to-one. This YANG data model allows both cases.

1.1. Terminology

The keywords "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].

The following terms are defined in [RFC7950] and are not redefined here:

- o augment
- o data model
- o data node

2. Modeling Considerations

2.1. Relationship Between Layer 3 Topology and TE topology

In general, layer 3 network topology model and TE topology model can be used independently. When traffic engineering is enabled on a layer 3 network topology, there will be associations between objects in layer 3 network topologies and objects in TE topologies. The properties of these relations are:

- o The associations are between objects of the same class, i.e. node to node or link to link.
- o The multiplicity of such an association is: 0..1 to 0..1. An object in a layer 3 network may have zero or one associated object in the corresponding TE network.

2.2. Relationship Modeling

YANG data type leafref is used to model the association relationship between a layer 3 network topology and a TE topology. YANG must statements are used to enforce the referenced objects are in the topologies of proper type.

3. Model Structure

3.1. Layer 3 TE Topology Module

The model tree structure of the layer 3 TE topology module is as shown below:

```

module: ietf-l3-te-topology
  augment /nd:networks/nd:network/nd:network-types
  /l3t:l3-unicast-topology:
    +--rw l3-te!
  augment /nd:networks/nd:network/l3t:l3-topology-attributes:
    +--rw l3-te-topology-attributes
      +--rw network-ref? -> /nw:networks/network/network-id
  augment /nd:networks/nd:network/nd:node/l3t:l3-node-attributes:
    +--rw l3-te-node-attributes
      +--rw node-ref? -> /nw:networks
/network[nw:network-id=current()/../network-ref]/node/node-id
    +--rw network-ref? -> /nw:networks/network/network-id
  augment /nd:networks/nd:network/nd:node/lnk:termination-point
  /l3t:l3-termination-point-attributes:
    +--rw l3-te-tp-attributes
      +--rw tp-ref? -> /nw:networks
/network[nw:network-id=current()/../network-ref]
/node[nw:node-id=current()/../node-ref]/nt:termination-point/tp-id
    +--rw node-ref? -> /nw:networks
/network[nw:network-id=current()/../network-ref]/node/node-id
    +--rw network-ref? -> /nw:networks/network/network-id
  augment /nd:networks/nd:network/lnk:link/l3t:l3-link-attributes:
    +--rw l3-te-link-attributes
      +--rw link-ref? -> /nw:networks
/network[nw:network-id=current()/../network-ref]/nt:link/link-id
    +--rw network-ref? -> /nw:networks/network/network-id

```

3.2. Packet Switching TE Topology Module

This is an augmentation to base TE topology model.

```

module: ietf-te-topology-packet
  augment /nd:networks/nd:network/nd:node/tet:te
  /tet:te-node-attributes/tet:connectivity-matrices:
    +--rw performance-metric
      +--rw measurement
        | +--rw unidirectional-delay? uint32
        | +--rw unidirectional-min-delay? uint32
        | +--rw unidirectional-max-delay? uint32
        | +--rw unidirectional-delay-variation? uint32
        | +--rw unidirectional-packet-loss? decimal64
        | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32

```

```

    +--rw normality
      | +--rw unidirectional-delay?
te-types:performance-metric-normality
      | +--rw unidirectional-min-delay?
te-types:performance-metric-normality
      | +--rw unidirectional-max-delay?
te-types:performance-metric-normality
      | +--rw unidirectional-delay-variation?
te-types:performance-metric-normality
      | +--rw unidirectional-packet-loss?
te-types:performance-metric-normality
      | +--rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
      | +--rw unidirectional-available-bandwidth?
te-types:performance-metric-normality
      | +--rw unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
    +--rw throttle
      +--rw unidirectional-delay-offset?          uint32
      +--rw measure-interval?                    uint32
      +--rw advertisement-interval?              uint32
      +--rw suppression-interval?                uint32
      +--rw threshold-out
        +--rw unidirectional-delay?              uint32
        | +--rw unidirectional-min-delay?        uint32
        | +--rw unidirectional-max-delay?        uint32
        | +--rw unidirectional-delay-variation?  uint32
        | +--rw unidirectional-packet-loss?      decimal64
        | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
      +--rw threshold-in
        +--rw unidirectional-delay?              uint32
        | +--rw unidirectional-min-delay?        uint32
        | +--rw unidirectional-max-delay?        uint32
        | +--rw unidirectional-delay-variation?  uint32
        | +--rw unidirectional-packet-loss?      decimal64
        | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
      +--rw threshold-accelerated-advertisement
        +--rw unidirectional-delay?              uint32

```

```

        +--rw unidirectional-min-delay?          uint32
        +--rw unidirectional-max-delay?          uint32
        +--rw unidirectional-delay-variation?    uint32
        +--rw unidirectional-packet-loss?        decimal64
        +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/nd:network/nd:node/tet:te
/tet:te-node-attributes/tet:connectivity-matrices
/tet:connectivity-matrix:
    +--rw performance-metric
        +--rw measurement
            | +--rw unidirectional-delay?          uint32
            | +--rw unidirectional-min-delay?      uint32
            | +--rw unidirectional-max-delay?      uint32
            | +--rw unidirectional-delay-variation? uint32
            | +--rw unidirectional-packet-loss?    decimal64
            | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
            | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
            | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
            +--rw normality
                | +--rw unidirectional-delay?      uint32
te-types:performance-metric-normality
                | +--rw unidirectional-min-delay?  uint32
te-types:performance-metric-normality
                | +--rw unidirectional-max-delay?  uint32
te-types:performance-metric-normality
                | +--rw unidirectional-delay-variation?
te-types:performance-metric-normality
                | +--rw unidirectional-packet-loss?
te-types:performance-metric-normality
                | +--rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
                | +--rw unidirectional-available-bandwidth?
te-types:performance-metric-normality
                | +--rw unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
            +--rw throttle
                +--rw unidirectional-delay-offset? uint32
                +--rw measure-interval?            uint32
                +--rw advertisement-interval?      uint32
                +--rw suppression-interval?        uint32

```

```

        +--rw threshold-out
        |   +--rw unidirectional-delay?                uint32
        |   +--rw unidirectional-min-delay?           uint32
        |   +--rw unidirectional-max-delay?           uint32
        |   +--rw unidirectional-delay-variation?     uint32
        |   +--rw unidirectional-packet-loss?         decimal64
        |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
        +--rw threshold-in
        |   +--rw unidirectional-delay?                uint32
        |   +--rw unidirectional-min-delay?           uint32
        |   +--rw unidirectional-max-delay?           uint32
        |   +--rw unidirectional-delay-variation?     uint32
        |   +--rw unidirectional-packet-loss?         decimal64
        |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
        +--rw threshold-accelerated-advertisement
        |   +--rw unidirectional-delay?                uint32
        |   +--rw unidirectional-min-delay?           uint32
        |   +--rw unidirectional-max-delay?           uint32
        |   +--rw unidirectional-delay-variation?     uint32
        |   +--rw unidirectional-packet-loss?         decimal64
        |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/nd:network/nd:node/tet:te
/tet:information-source-entry/tet:connectivity-matrices:
    +--ro performance-metric
    +--ro measurement
    |   +--ro unidirectional-delay?                uint32
    |   +--ro unidirectional-min-delay?           uint32
    |   +--ro unidirectional-max-delay?           uint32
    |   +--ro unidirectional-delay-variation?     uint32
    |   +--ro unidirectional-packet-loss?         decimal64
    |   +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-available-bandwidth?

```

```

rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--ro normality
    | +--ro unidirectional-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-min-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-max-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-delay-variation?
te-types:performance-metric-normality
  | +--ro unidirectional-packet-loss?
te-types:performance-metric-normality
  | +--ro unidirectional-residual-bandwidth?
te-types:performance-metric-normality
  | +--ro unidirectional-available-bandwidth?
te-types:performance-metric-normality
  | +--ro unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
  +--ro throttle
    +--ro unidirectional-delay-offset?          uint32
    +--ro measure-interval?                    uint32
    +--ro advertisement-interval?              uint32
    +--ro suppression-interval?                uint32
    +--ro threshold-out
      | +--ro unidirectional-delay?            uint32
      | +--ro unidirectional-min-delay?        uint32
      | +--ro unidirectional-max-delay?        uint32
      | +--ro unidirectional-delay-variation?  uint32
      | +--ro unidirectional-packet-loss?      decimal64
      | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--ro threshold-in
    | +--ro unidirectional-delay?            uint32
    | +--ro unidirectional-min-delay?        uint32
    | +--ro unidirectional-max-delay?        uint32
    | +--ro unidirectional-delay-variation?  uint32
    | +--ro unidirectional-packet-loss?      decimal64
    | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-utilized-bandwidth?

```

```

rt-types:bandwidth-ieee-float32
  +--ro threshold-accelerated-advertisement
    +--ro unidirectional-delay?                uint32
    +--ro unidirectional-min-delay?            uint32
    +--ro unidirectional-max-delay?            uint32
    +--ro unidirectional-delay-variation?      uint32
    +--ro unidirectional-packet-loss?          decimal64
    +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  augment /nd:networks/nd:network/nd:node/tet:te
/tet:information-source-entry/tet:connectivity-matrices
/tet:connectivity-matrix:
  +--ro performance-metric
    +--ro measurement
      | +--ro unidirectional-delay?            uint32
      | +--ro unidirectional-min-delay?        uint32
      | +--ro unidirectional-max-delay?        uint32
      | +--ro unidirectional-delay-variation?  uint32
      | +--ro unidirectional-packet-loss?      decimal64
      | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--ro normality
    | +--ro unidirectional-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-min-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-max-delay?
te-types:performance-metric-normality
  | +--ro unidirectional-delay-variation?
te-types:performance-metric-normality
  | +--ro unidirectional-packet-loss?
te-types:performance-metric-normality
  | +--ro unidirectional-residual-bandwidth?
te-types:performance-metric-normality
  | +--ro unidirectional-available-bandwidth?
te-types:performance-metric-normality
  | +--ro unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
  +--ro throttle
    +--ro unidirectional-delay-offset?          uint32

```

```

    +--ro measure-interval?                               uint32
    +--ro advertisement-interval?                         uint32
    +--ro suppression-interval?                          uint32
    +--ro threshold-out
      | +--ro unidirectional-delay?                      uint32
      | +--ro unidirectional-min-delay?                  uint32
      | +--ro unidirectional-max-delay?                  uint32
      | +--ro unidirectional-delay-variation?           uint32
      | +--ro unidirectional-packet-loss?               decimal64
      | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro threshold-in
      | +--ro unidirectional-delay?                      uint32
      | +--ro unidirectional-min-delay?                  uint32
      | +--ro unidirectional-max-delay?                  uint32
      | +--ro unidirectional-delay-variation?           uint32
      | +--ro unidirectional-packet-loss?               decimal64
      | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro threshold-accelerated-advertisement
      | +--ro unidirectional-delay?                      uint32
      | +--ro unidirectional-min-delay?                  uint32
      | +--ro unidirectional-max-delay?                  uint32
      | +--ro unidirectional-delay-variation?           uint32
      | +--ro unidirectional-packet-loss?               decimal64
      | +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
      | +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/nd:network/nd:node/tet:te
/tet:tunnel-termination-point/tet:local-link-connectivities:
  +--rw performance-metric
  +--rw measurement
    | +--rw unidirectional-delay?                      uint32
    | +--rw unidirectional-min-delay?                  uint32
    | +--rw unidirectional-max-delay?                  uint32
    | +--rw unidirectional-delay-variation?           uint32
    | +--rw unidirectional-packet-loss?               decimal64

```

```

    | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw normality
    | +--rw unidirectional-delay?
te-types:performance-metric-normality
    | +--rw unidirectional-min-delay?
te-types:performance-metric-normality
    | +--rw unidirectional-max-delay?
te-types:performance-metric-normality
    | +--rw unidirectional-delay-variation?
te-types:performance-metric-normality
    | +--rw unidirectional-packet-loss?
te-types:performance-metric-normality
    | +--rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
    | +--rw unidirectional-available-bandwidth?
te-types:performance-metric-normality
    | +--rw unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
    +--rw throttle
    +--rw unidirectional-delay-offset?          uint32
    +--rw measure-interval?                    uint32
    +--rw advertisement-interval?             uint32
    +--rw suppression-interval?              uint32
    +--rw threshold-out
    | +--rw unidirectional-delay?              uint32
    | +--rw unidirectional-min-delay?          uint32
    | +--rw unidirectional-max-delay?          uint32
    | +--rw unidirectional-delay-variation?    uint32
    | +--rw unidirectional-packet-loss?        decimal64
    | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw threshold-in
    | +--rw unidirectional-delay?              uint32
    | +--rw unidirectional-min-delay?          uint32
    | +--rw unidirectional-max-delay?          uint32
    | +--rw unidirectional-delay-variation?    uint32
    | +--rw unidirectional-packet-loss?        decimal64
    | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32

```

```

    |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw threshold-accelerated-advertisement
        +--rw unidirectional-delay?                uint32
        +--rw unidirectional-min-delay?            uint32
        +--rw unidirectional-max-delay?            uint32
        +--rw unidirectional-delay-variation?      uint32
        +--rw unidirectional-packet-loss?          decimal64
        +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/nd:network/nd:node/tet:te
/tet:tunnel-termination-point/tet:local-link-connectivities
/tet:local-link-connectivity:
    +--rw performance-metric
        +--rw measurement
            |   +--rw unidirectional-delay?                uint32
            |   +--rw unidirectional-min-delay?            uint32
            |   +--rw unidirectional-max-delay?            uint32
            |   +--rw unidirectional-delay-variation?      uint32
            |   +--rw unidirectional-packet-loss?          decimal64
            |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
            |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
            |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
        +--rw normality
            |   +--rw unidirectional-delay?
te-types:performance-metric-normality
            |   +--rw unidirectional-min-delay?
te-types:performance-metric-normality
            |   +--rw unidirectional-max-delay?
te-types:performance-metric-normality
            |   +--rw unidirectional-delay-variation?
te-types:performance-metric-normality
            |   +--rw unidirectional-packet-loss?
te-types:performance-metric-normality
            |   +--rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
            |   +--rw unidirectional-available-bandwidth?
te-types:performance-metric-normality
            |   +--rw unidirectional-utilized-bandwidth?

```

```

te-types:performance-metric-normality
  +--rw throttle
    +--rw unidirectional-delay-offset?          uint32
    +--rw measure-interval?                    uint32
    +--rw advertisement-interval?              uint32
    +--rw suppression-interval?                uint32
    +--rw threshold-out
      | +--rw unidirectional-delay?            uint32
      | +--rw unidirectional-min-delay?        uint32
      | +--rw unidirectional-max-delay?        uint32
      | +--rw unidirectional-delay-variation?  uint32
      | +--rw unidirectional-packet-loss?      decimal64
      | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw threshold-in
    | +--rw unidirectional-delay?            uint32
    | +--rw unidirectional-min-delay?        uint32
    | +--rw unidirectional-max-delay?        uint32
    | +--rw unidirectional-delay-variation?  uint32
    | +--rw unidirectional-packet-loss?      decimal64
    | +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  | +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw threshold-accelerated-advertisement
    +--rw unidirectional-delay?            uint32
    +--rw unidirectional-min-delay?        uint32
    +--rw unidirectional-max-delay?        uint32
    +--rw unidirectional-delay-variation?  uint32
    +--rw unidirectional-packet-loss?      decimal64
    +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  augment /nd:networks/tet:te/tet:templates/tet:link-template
/tet:te-link-attributes:
  +--rw performance-metric
    +--rw measurement
      | +--rw unidirectional-delay?          uint32
      | +--rw unidirectional-min-delay?      uint32

```

```

    |   +--rw unidirectional-max-delay?           uint32
    |   +--rw unidirectional-delay-variation?    uint32
    |   +--rw unidirectional-packet-loss?        decimal64
    |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw normality
    |   +--rw unidirectional-delay?
te-types:performance-metric-normality
    |   +--rw unidirectional-min-delay?
te-types:performance-metric-normality
    |   +--rw unidirectional-max-delay?
te-types:performance-metric-normality
    |   +--rw unidirectional-delay-variation?
te-types:performance-metric-normality
    |   +--rw unidirectional-packet-loss?
te-types:performance-metric-normality
    |   +--rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
    |   +--rw unidirectional-available-bandwidth?
te-types:performance-metric-normality
    |   +--rw unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
    +--rw throttle
    |   +--rw unidirectional-delay-offset?        uint32
    |   +--rw measure-interval?                  uint32
    |   +--rw advertisement-interval?            uint32
    |   +--rw suppression-interval?              uint32
    |   +--rw threshold-out
    |   |   +--rw unidirectional-delay?           uint32
    |   |   +--rw unidirectional-min-delay?      uint32
    |   |   +--rw unidirectional-max-delay?      uint32
    |   |   +--rw unidirectional-delay-variation? uint32
    |   |   +--rw unidirectional-packet-loss?    decimal64
    |   |   +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--rw threshold-in
    |   +--rw unidirectional-delay?           uint32
    |   +--rw unidirectional-min-delay?      uint32
    |   +--rw unidirectional-max-delay?      uint32
    |   +--rw unidirectional-delay-variation? uint32

```

```

        |   +-rw unidirectional-packet-loss?           decimal64
        |   +-rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +-rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +-rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
        +-rw threshold-accelerated-advertisement
        +-rw unidirectional-delay?                   uint32
        +-rw unidirectional-min-delay?               uint32
        +-rw unidirectional-max-delay?               uint32
        +-rw unidirectional-delay-variation?         uint32
        +-rw unidirectional-packet-loss?             decimal64
        +-rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        +-rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        +-rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/nd:network/lnk:link/tet:te
/tet:te-link-attributes:
    +-rw performance-metric
        +-rw measurement
            +-rw unidirectional-delay?                 uint32
            +-rw unidirectional-min-delay?             uint32
            +-rw unidirectional-max-delay?             uint32
            +-rw unidirectional-delay-variation?       uint32
            +-rw unidirectional-packet-loss?           decimal64
            +-rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +-rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
        |   +-rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +-rw normality
        |   +-rw unidirectional-delay?
te-types:performance-metric-normality
        |   +-rw unidirectional-min-delay?
te-types:performance-metric-normality
        |   +-rw unidirectional-max-delay?
te-types:performance-metric-normality
        |   +-rw unidirectional-delay-variation?
te-types:performance-metric-normality
        |   +-rw unidirectional-packet-loss?
te-types:performance-metric-normality
        |   +-rw unidirectional-residual-bandwidth?
te-types:performance-metric-normality
        |   +-rw unidirectional-available-bandwidth?

```

```

te-types:performance-metric-normality
  |  +--rw unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
  +--rw throttle
    +--rw unidirectional-delay-offset?          uint32
    +--rw measure-interval?                    uint32
    +--rw advertisement-interval?              uint32
    +--rw suppression-interval?                uint32
    +--rw threshold-out
      |  +--rw unidirectional-delay?            uint32
      |  +--rw unidirectional-min-delay?       uint32
      |  +--rw unidirectional-max-delay?       uint32
      |  +--rw unidirectional-delay-variation? uint32
      |  +--rw unidirectional-packet-loss?     decimal64
      |  +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  |  +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  |  +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw threshold-in
    |  +--rw unidirectional-delay?            uint32
    |  +--rw unidirectional-min-delay?       uint32
    |  +--rw unidirectional-max-delay?       uint32
    |  +--rw unidirectional-delay-variation? uint32
    |  +--rw unidirectional-packet-loss?     decimal64
    |  +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  |  +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  |  +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw threshold-accelerated-advertisement
    +--rw unidirectional-delay?            uint32
    +--rw unidirectional-min-delay?       uint32
    +--rw unidirectional-max-delay?       uint32
    +--rw unidirectional-delay-variation? uint32
    +--rw unidirectional-packet-loss?     decimal64
    +--rw unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
  +--rw unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
  augment /nd:networks/nd:network/lnk:link/tet:te
/tet:information-source-entry:
  +--ro performance-metric
  +--ro measurement

```

```

    |   +--ro unidirectional-delay?           uint32
    |   +--ro unidirectional-min-delay?      uint32
    |   +--ro unidirectional-max-delay?      uint32
    |   +--ro unidirectional-delay-variation? uint32
    |   +--ro unidirectional-packet-loss?    decimal64
    |   +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro normality
    |   +--ro unidirectional-delay?
te-types:performance-metric-normality
    |   +--ro unidirectional-min-delay?
te-types:performance-metric-normality
    |   +--ro unidirectional-max-delay?
te-types:performance-metric-normality
    |   +--ro unidirectional-delay-variation?
te-types:performance-metric-normality
    |   +--ro unidirectional-packet-loss?
te-types:performance-metric-normality
    |   +--ro unidirectional-residual-bandwidth?
te-types:performance-metric-normality
    |   +--ro unidirectional-available-bandwidth?
te-types:performance-metric-normality
    |   +--ro unidirectional-utilized-bandwidth?
te-types:performance-metric-normality
    +--ro throttle
    |   +--ro unidirectional-delay-offset?    uint32
    |   +--ro measure-interval?              uint32
    |   +--ro advertisement-interval?        uint32
    |   +--ro suppression-interval?          uint32
    |   +--ro threshold-out
    |   |   +--ro unidirectional-delay?      uint32
    |   |   +--ro unidirectional-min-delay?  uint32
    |   |   +--ro unidirectional-max-delay?  uint32
    |   |   +--ro unidirectional-delay-variation?
    |   |   |   +--ro unidirectional-packet-loss?    decimal64
    |   |   |   +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro threshold-in
    |   +--ro unidirectional-delay?          uint32
    |   +--ro unidirectional-min-delay?      uint32

```

```

    |   +--ro unidirectional-max-delay?           uint32
    |   +--ro unidirectional-delay-variation?    uint32
    |   +--ro unidirectional-packet-loss?        decimal64
    |   +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    |   +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro threshold-accelerated-advertisement
    +--ro unidirectional-delay?                   uint32
    +--ro unidirectional-min-delay?               uint32
    +--ro unidirectional-max-delay?               uint32
    +--ro unidirectional-delay-variation?         uint32
    +--ro unidirectional-packet-loss?             decimal64
    +--ro unidirectional-residual-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro unidirectional-available-bandwidth?
rt-types:bandwidth-ieee-float32
    +--ro unidirectional-utilized-bandwidth?
rt-types:bandwidth-ieee-float32
    augment /nd:networks/tet:te/tet:templates/tet:link-template
/tet:te-link-attributes/tet:interface-switching-capability:
    +--rw packet-switch-capable
    +--rw minimum-lsp-bandwidth?   rt-types:bandwidth-ieee-float32
    +--rw interface-mtu?           uint16
    augment /nd:networks/nd:network/lnk:link/tet:te
/tet:te-link-attributes/tet:interface-switching-capability:
    +--rw packet-switch-capable
    +--rw minimum-lsp-bandwidth?   rt-types:bandwidth-ieee-float32
    +--rw interface-mtu?           uint16
    augment /nd:networks/nd:network/lnk:link/tet:te
/tet:information-source-entry/tet:interface-switching-capability:
    +--ro packet-switch-capable
    +--ro minimum-lsp-bandwidth?   rt-types:bandwidth-ieee-float32
    +--ro interface-mtu?           uint16

```

4. YANG Modules

4.1. Layer 3 TE Topology Module

```

<CODE BEGINS> file "ietf-l3-te-topology@2017-07-03.yang"
module ietf-l3-te-topology {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-l3-te-topology";
  prefix "l3tet";

```

```
import ietf-network {
  prefix "nd";
}
import ietf-network-topology {
  prefix "lnk";
}
import ietf-l3-unicast-topology {
  prefix "l3t";
}
import ietf-te-topology {
  prefix "tet";
}

organization "TBD";
contact "TBD";
description "L3 TE Topology model";

revision 2017-07-03 {

  description "Initial revision";
  reference "TBD";
}

grouping l3-te-topology-type {
  description
    "Identifies the L3 TE topology type.";
  container l3-te {
    presence "indicates L3 TE Topology";
    description
      "Its presence identifies the L3 TE topology type.";
  }
}

augment "/nd:networks/nd:network/nd:network-types/"
+ "l3t:l3-unicast-topology" {
  description
    "Defines the L3 TE topology type.";
  uses l3-te-topology-type;
}

augment "/nd:networks/nd:network/l3t:l3-topology-attributes" {
  when "../nd:network-types/l3t:l3-unicast-topology/l3-te" {
    description "Augment only for L3 TE topology";
  }
  description "Augment topology configuration";
  uses l3-te-topology-attributes;
}
```

```
augment "/nd:networks/nd:network/nd:node/l3t:l3-node-attributes" {
  when "../..//nd:network-types/l3t:l3-unicast-topology/l3-te" {
    description "Augment only for L3 TE topology";
  }
  description "Augment node configuration";
  uses l3-te-node-attributes;
}

augment "/nd:networks/nd:network/nd:node/lnk:termination-point/"
+ "l3t:l3-termination-point-attributes" {
  when "../..//nd:network-types/l3t:l3-unicast-topology/"
+ "l3-te" {
    description "Augment only for L3 TE topology";
  }
  description "Augment termination point configuration";
  uses l3-te-tp-attributes;
}

augment "/nd:networks/nd:network/lnk:link/l3t:l3-link-attributes" {
  when "../..//nd:network-types/l3t:l3-unicast-topology/l3-te" {
    description "Augment only for L3 TE topology";
  }
  description "Augment link configuration";
  uses l3-te-link-attributes;
}

grouping l3-te-topology-attributes {
  description "L3 TE topology scope attributes";
  container l3-te-topology-attributes {
    must "/nd:networks/nd:network"
+ "[nd:network-id = current()/network-ref]/nd:network-types/"
+ "tet:te-topology" {
      error-message
        "The referenced network must be a TE topology.";
      description
        "The referenced network must be a TE topology.";
    }
    description "Containing TE topology references";
    uses nd:network-ref;
  } // l3-te-topology-attributes
} // l3-te-topology-attributes

grouping l3-te-node-attributes {
  description "L3 TE node scope attributes";
  container l3-te-node-attributes {
    must "/nd:networks/nd:network"
+ "[nd:network-id = current()/network-ref]/nd:network-types/"
+ "tet:te-topology" {
  }
```

```
        error-message
            "The referenced network must be a TE topology.";
        description
            "The referenced network must be a TE topology.";
    }
    description "Containing TE node references";
    uses nd:node-ref;
} // l3-te
} // l3-te-node-attributes

grouping l3-te-tp-attributes {
    description "L3 TE termination point scope attributes";
    container l3-te-tp-attributes {
        must "/nd:networks/nd:network"
            + "[nd:network-id = current()/network-ref]/nd:network-types/"
            + "tet:te-topology" {
            error-message
                "The referenced network must be a TE topology.";
            description
                "The referenced network must be a TE topology.";
        }
        description "Containing TE termination point references";
        uses lnk:tp-ref;
    } // l3-te
} // l3-te-tp-attributes

grouping l3-te-link-attributes {
    description "L3 TE link scope attributes";
    container l3-te-link-attributes {
        must "/nd:networks/nd:network"
            + "[nd:network-id = current()/network-ref]/nd:network-types/"
            + "tet:te-topology" {
            error-message
                "The referenced network must be a TE topology.";
            description
                "The referenced network must be a TE topology.";
        }
        description "Containing TE link references";
        uses lnk:link-ref;
    }
} // l3-te-link-attributes
}
<CODE ENDS>
```

4.2. Packet Switching TE Topology Module

```
<CODE BEGINS> file "ietf-te-topology-packet@2017-10-29.yang"
module iETF-te-topology-packet {
  yang-version 1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-te-topology-packet";

  prefix "tet-pkt";

  import iETF-network {
    prefix "nd";
  }

  import iETF-network-topology {
    prefix "lnk";
  }

  import iETF-routing-types {
    prefix "rt-types";
  }

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

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

  organization
    "Traffic Engineering Architecture and Signaling (TEAS)
     Working Group";

  contact
    "WG Web: <http://tools.ietf.org/wg/teas/>
     WG List: <mailto:teas@ietf.org>

     WG Chair: Lou Berger
               <mailto:lberger@labn.net>

     WG Chair: Vishnu Pavan Beeram
               <mailto:vbeeram@juniper.net>

     Editors: Xufeng Liu
              <mailto:Xufeng_Liu@jabil.com>

             Igor Bryskin
```

<mailto:Igor.Bryskin@huawei.com>

Vishnu Pavan Beeram
<mailto:vbeeram@juniper.net>

Tarek Saad
<mailto:tsaad@cisco.com>

Himanshu Shah
<mailto:hshah@ciena.com>

Oscar Gonzalez De Dios
<mailto:oscar.gonzalezdedios@telefonica.com>;

```
description "TE topology model";

revision 2017-10-29 {
  description "Initial revision";
  reference "TBD";
}

/*
 * Features
 */

feature te-performance-metric {
  description
    "This feature indicates that the system supports
    TE performance metric.";
  reference
    "RFC7471: OSPF Traffic Engineering (TE) Metric Extensions.
    RFC7810: IS-IS Traffic Engineering (TE) Metric Extensions.
    RFC7823: Performance-Based Path Selection for Explicitly
    Routed Label Switched Paths (LSPs) Using TE Metric
    Extensions";
}

/*
 * Groupings
 */

grouping packet-switch-capable-container {
  description
    "The container of packet switch capable attributes.";
  container packet-switch-capable {
    description
      "Interface has packet-switching capabilities.";
    leaf minimum-lsp-bandwidth {
      type rt-types:bandwidth-ieee-float32;
    }
  }
}
```

```
        description
            "Minimum LSP Bandwidth. Units in bytes per second";
    }
    leaf interface-mtu {
        type uint16;
        description
            "Interface MTU.";
    }
}

/*
 * Augmentations
 */
/* Augmentations to connectivity-matrix */
augment "/nd:networks/nd:network/nd:node/tet:te/"
    + "tet:te-node-attributes/tet:connectivity-matrices" {
    description
        "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
        if-feature te-performance-metric;
    }
}

augment "/nd:networks/nd:network/nd:node/tet:te/"
    + "tet:te-node-attributes/tet:connectivity-matrices/"
    + "tet:connectivity-matrix" {
    description
        "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
        if-feature te-performance-metric;
    }
}

augment "/nd:networks/nd:network/nd:node/tet:te/"
    + "tet:information-source-entry/tet:connectivity-matrices" {
    description
        "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
        if-feature te-performance-metric;
    }
}

augment "/nd:networks/nd:network/nd:node/tet:te/"
    + "tet:information-source-entry/tet:connectivity-matrices/"
    + "tet:connectivity-matrix" {
```

```
description
  "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature te-performance-metric;
  }
}

/* Augmentations to tunnel-termination-point */
augment "/nd:networks/nd:network/nd:node/tet:te/"
  + "tet:tunnel-termination-point/"
  + "tet:local-link-connectivities" {
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature te-performance-metric;
  }
}

augment "/nd:networks/nd:network/nd:node/tet:te/"
  + "tet:tunnel-termination-point/"
  + "tet:local-link-connectivities/"
  + "tet:local-link-connectivity" {
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature te-performance-metric;
  }
}

/* Augmentations to te-link-attributes */
augment "/nd:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes" {
  when "tet:interface-switching-capability "
    + "[tet:switching-capability = 'te-types:switching-psc1']" {
    description "Valid only for PSC";
  }
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature te-performance-metric;
  }
}

augment "/nd:networks/nd:network/lnk:link/tet:te/"
  + "tet:te-link-attributes" {
  when "tet:interface-switching-capability "
    + "[tet:switching-capability = 'te-types:switching-psc1']" {
    description "Valid only for PSC";
  }
}
```

```

    }
    description
      "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
      if-feature te-performance-metric;
    }
  }
}

augment "/nd:networks/nd:network/lnk:link/tet:te/"
  + "tet:information-source-entry" {
  when "tet:interface-switching-capability "
    + "[tet:switching-capability = 'te-types:switching-psc1']" {
    description "Valid only for PSC";
  }
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature te-performance-metric;
  }
}

/* Augmentations to interface-switching-capability */
augment "/nd:networks/tet:te/tet:templates/"
  + "tet:link-template/tet:te-link-attributes/"
  + "tet:interface-switching-capability" {
  when "tet:switching-capability = 'te-types:switching-psc1' " {
    description "Valid only for PSC";
  }
  description
    "Parameters for PSC TE topology.";
  uses packet-switch-capable-container;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/"
  + "tet:te-link-attributes/"
  + "tet:interface-switching-capability" {
  when "tet:switching-capability = 'te-types:switching-psc1' " {
    description "Valid only for PSC";
  }
  description
    "Parameters for PSC TE topology.";
  uses packet-switch-capable-container;
}

augment "/nd:networks/nd:network/lnk:link/tet:te/"
  + "tet:information-source-entry/"
  + "tet:interface-switching-capability" {
  when "tet:switching-capability = 'te-types:switching-psc1' " {

```

```

        description "Valid only for PSC";
    }
    description
        "Parameters for PSC TE topology.";
    uses packet-switch-capable-container;
    }
}
<CODE ENDS>

```

5. IANA Considerations

RFC Ed.: In this section, replace all occurrences of 'XXXX' with the actual RFC number (and remove this note).

This document registers the following namespace URIs in the IETF XML registry [RFC3688]:

```

-----
URI: urn:ietf:params:xml:ns:yang:ietf-l3-te-topology
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
-----

```

```

-----
URI: urn:ietf:params:xml:ns:yang:ietf-l3-te-topology-state
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
-----

```

```

-----
URI: urn:ietf:params:xml:ns:yang:ietf-te-topology-packet
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
-----

```

```

-----
URI: urn:ietf:params:xml:ns:yang:ietf-te-topology-packet-state
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
-----

```

This document registers the following YANG modules in the YANG Module Names registry [RFC6020]:

```
-----  
name:          ietf-l3-te-topology  
namespace:     urn:ietf:params:xml:ns:yang:ietf-l3-te-topology  
prefix:        l3te  
reference:     RFC XXXX  
-----
```

```
-----  
name:          ietf-l3-te-topology-state  
namespace:     urn:ietf:params:xml:ns:yang:ietf-l3-te-topology-state  
prefix:        l3te-s  
reference:     RFC XXXX  
-----
```

```
-----  
name:          ietf-te-topology-packet  
namespace:     urn:ietf:params:xml:ns:yang:ietf-te-topology-packet  
prefix:        tet-pkt  
reference:     RFC XXXX  
-----
```

```
-----  
name:          ietf-te-topology-packet-state  
namespace:     urn:ietf:params:xml:ns:yang:ietf-te-topology-packet-state  
prefix:        tet-pkt-s  
reference:     RFC XXXX  
-----
```

6. Security Considerations

The configuration, state, action and notification data defined in this document are designed to be accessed via the NETCONF protocol [RFC6241]. The data-model by itself does not create any security implications. The security considerations for the NETCONF protocol are applicable. The NETCONF protocol used for sending the data supports authentication and encryption.

7. References

7.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.

[RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <<https://www.rfc-editor.org/info/rfc7950>>.

[I-D.ietf-netmod-revised-datastores]
Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture", draft-ietf-netmod-revised-datastores-05 (work in progress), October 2017.

7.2. Informative References

[I-D.ietf-i2rs-yang-l3-topology]
Clemm, A., Medved, J., Varga, R., Liu, X., Ananthakrishnan, H., and N. Bahadur, "A YANG Data Model for Layer 3 Topologies", draft-ietf-i2rs-yang-l3-topology-12 (work in progress), October 2017.

[I-D.ietf-teas-yang-te-topo]
Liu, X., Bryskin, I., Beeram, V., Saad, T., Shah, H., and O. Dios, "YANG Data Model for TE Topologies", draft-ietf-teas-yang-te-topo-12 (work in progress), July 2017.

Appendix A. Companion YANG Model for Non-NMDA Compliant Implementations

The YANG modules `ietf-l3-te-topology` and `ietf-te-topology-packet` defined in this document are designed to be used in conjunction with implementations that support the Network Management Datastore Architecture (NMDA) defined in [I-D.ietf-netmod-revised-datastores]. In order to allow implementations to use the model even in cases when NMDA is not supported, the following companion modules, `ietf-l3-te-topology-state` and `ietf-te-topology-packet-state`, are defined as state models, which mirror the modules `ietf-l3-te-topology` and `ietf-te-topology-packet` defined earlier in this document. However, all data nodes in the companion module are non-configurable, to represent the applied configuration or the derived operational states.

The companion modules, `ietf-l3-te-topology-state` and `ietf-te-topology-packet-state`, are redundant and SHOULD NOT be supported by implementations that support NMDA.

As the structure of the companion modules mirrors that of the cooresponding NMDA models, the YANG trees of the companion modules are not depicted separately.

A.1. Layer 3 TE Topology State Module

```
<CODE BEGINS> file "ietf-l3-te-topology-state@2017-07-03.yang"
module ietf-l3-te-topology-state {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-l3-te-topology-state";
  prefix "l3tet-s";

  import ietf-l3-te-topology {
    prefix "l3tet";
  }
  import ietf-network-state {
    prefix "nd-s";
  }
  import ietf-network-topology-state {
    prefix "lnk-s";
  }
  import ietf-l3-unicast-topology-state {
    prefix "l3t-s";
  }

  organization "TBD";
  contact "TBD";
  description "L3 TE Topology model";
}
```

```
revision 2017-07-03 {
    description "Initial revision";
    reference "TBD";
}

augment "/nd-s:networks/nd-s:network/nd-s:network-types/"
+ "l3t-s:l3-unicast-topology" {
    description
        "Defines the L3 TE topology type.";
    uses l3tet:l3-te-topology-type;
}

augment "/nd-s:networks/nd-s:network/"
+ "l3t-s:l3-topology-attributes" {
    when "../nd-s:network-types/l3t-s:l3-unicast-topology/l3-te" {
        description "Augment only for L3 TE topology";
    }
    description "Augment topology configuration";
    uses l3tet:l3-te-topology-attributes;
}

augment "/nd-s:networks/nd-s:network/nd-s:node/"
+ "l3t-s:l3-node-attributes" {
    when "../..../nd-s:network-types/l3t-s:l3-unicast-topology/l3-te" {
        description "Augment only for L3 TE topology";
    }
    description "Augment node configuration";
    uses l3tet:l3-te-node-attributes;
}

augment "/nd-s:networks/nd-s:network/nd-s:node/"
+ "lnk-s:termination-point/"
+ "l3t-s:l3-termination-point-attributes" {
    when "../..../nd-s:network-types/l3t-s:l3-unicast-topology/"
+ "l3-te" {
        description "Augment only for L3 TE topology";
    }
    description "Augment termination point configuration";
    uses l3tet:l3-te-tp-attributes;
}

augment "/nd-s:networks/nd-s:network/lnk-s:link/"
+ "l3t-s:l3-link-attributes" {
    when "../..../nd-s:network-types/l3t-s:l3-unicast-topology/l3-te" {
        description "Augment only for L3 TE topology";
    }
    description "Augment link configuration";
}
```

```
    uses l3tet:l3-te-link-attributes;
  }
}
<CODE ENDS>
```

A.2. Packet Switching TE Topology State Module

```
<CODE BEGINS> file "ietf-te-topology-packet-state@2017-10-29.yang"
module ietf-te-topology-packet-state {
  yang-version 1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-te-topology-packet-state";

  prefix "tet-pkt-s";

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

  import ietf-network-state {
    prefix "nd-s";
  }

  import ietf-network-topology-state {
    prefix "lnk-s";
  }

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

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

  organization
    "Traffic Engineering Architecture and Signaling (TEAS)
    Working Group";

  contact
    "WG Web: <http://tools.ietf.org/wg/teas/>
    WG List: <mailto:teas@ietf.org>

    WG Chair: Lou Berger
    <mailto:lberger@labn.net>
```

WG Chair: Vishnu Pavan Beeram
<mailto:vbeeram@juniper.net>

Editors: Xufeng Liu
<mailto:Xufeng_Liu@jabil.com>

Igor Bryskin
<mailto:Igor.Bryskin@huawei.com>

Vishnu Pavan Beeram
<mailto:vbeeram@juniper.net>

Tarek Saad
<mailto:tsaad@cisco.com>

Himanshu Shah
<mailto:hshah@ciena.com>

Oscar Gonzalez De Dios
<mailto:oscar.gonzalezdedios@telefonica.com>;

```
description "TE topology model";

revision 2017-10-29 {
  description "Initial revision";
  reference "TBD";
}

/*
 * Augmentations
 */
/* Augmentations to connectivity-matrix */
augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
+ "tet-s:te-node-attributes/tet-s:connectivity-matrices" {
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature tet-pkt:te-performance-metric;
  }
}

augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
+ "tet-s:te-node-attributes/tet-s:connectivity-matrices/"
+ "tet-s:connectivity-matrix" {
  description
    "Parameters for PSC TE topology.";
  uses te-types:performance-metric-container {
    if-feature tet-pkt:te-performance-metric;
  }
}
```

```

    }
  }

  augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
    + "tet-s:information-source-entry/"
    + "tet-s:connectivity-matrices" {
    description
      "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
      if-feature tet-pkt:te-performance-metric;
    }
  }

  augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
    + "tet-s:information-source-entry/"
    + "tet-s:connectivity-matrices/"
    + "tet-s:connectivity-matrix" {
    description
      "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
      if-feature tet-pkt:te-performance-metric;
    }
  }

  /* Augmentations to tunnel-termination-point */
  augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
    + "tet-s:tunnel-termination-point/"
    + "tet-s:local-link-connectivities" {
    description
      "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
      if-feature tet-pkt:te-performance-metric;
    }
  }

  augment "/nd-s:networks/nd-s:network/nd-s:node/tet-s:te/"
    + "tet-s:tunnel-termination-point/"
    + "tet-s:local-link-connectivities/"
    + "tet-s:local-link-connectivity" {
    description
      "Parameters for PSC TE topology.";
    uses te-types:performance-metric-container {
      if-feature tet-pkt:te-performance-metric;
    }
  }

  /* Augmentations to te-link-attributes */
  augment "/nd-s:networks/tet-s:te/tet-s:templates/"

```

```

    + "tet-s:link-template/tet-s:te-link-attributes" {
when "tet-s:interface-switching-capability "
  + "[tet-s:switching-capability = 'te-types:switching-psc1']" {
  description "Valid only for PSC";
}
description
  "Parameters for PSC TE topology.";
uses te-types:performance-metric-container {
  if-feature tet-pkt:te-performance-metric;
}
}

augment "/nd-s:networks/nd-s:network/lnk-s:link/tet-s:te/"
  + "tet-s:te-link-attributes" {
when "tet-s:interface-switching-capability "
  + "[tet-s:switching-capability = 'te-types:switching-psc1']" {
  description "Valid only for PSC";
}
description
  "Parameters for PSC TE topology.";
uses te-types:performance-metric-container {
  if-feature tet-pkt:te-performance-metric;
}
}

augment "/nd-s:networks/nd-s:network/lnk-s:link/tet-s:te/"
  + "tet-s:information-source-entry" {
when "tet-s:interface-switching-capability "
  + "[tet-s:switching-capability = 'te-types:switching-psc1']" {
  description "Valid only for PSC";
}
description
  "Parameters for PSC TE topology.";
uses te-types:performance-metric-container {
  if-feature tet-pkt:te-performance-metric;
}
}

/* Augmentations to interface-switching-capability */
augment "/nd-s:networks/tet-s:te/tet-s:templates/"
  + "tet-s:link-template/tet-s:te-link-attributes/"
  + "tet-s:interface-switching-capability" {
when "tet-s:switching-capability = 'te-types:switching-psc1' " {
  description "Valid only for PSC";
}
description
  "Parameters for PSC TE topology.";
uses tet-pkt:packet-switch-capable-container;
}

```

```
    }  
  
    augment "/nd-s:networks/nd-s:network/lnk-s:link/tet-s:te/"  
      + "tet-s:te-link-attributes/"  
      + "tet-s:interface-switching-capability" {  
        when "tet-s:switching-capability = 'te-types:switching-psc1' " {  
          description "Valid only for PSC";  
        }  
        description  
          "Parameters for PSC TE topology.";  
        uses tet-pkt:packet-switch-capable-container;  
      }  
  
    augment "/nd-s:networks/nd-s:network/lnk-s:link/tet-s:te/"  
      + "tet-s:information-source-entry/"  
      + "tet-s:interface-switching-capability" {  
        when "tet-s:switching-capability = 'te-types:switching-psc1' " {  
          description "Valid only for PSC";  
        }  
        description  
          "Parameters for PSC TE topology.";  
        uses tet-pkt:packet-switch-capable-container;  
      }  
  }  
}<CODE ENDS>
```

Authors' Addresses

Xufeng Liu
Jabil
8281 Greensboro Drive, Suite 200
McLean VA 22102
USA

EMail: Xufeng_Liu@jabil.com

Igor Bryskin
Huawei Technologies

EMail: Igor.Bryskin@huawei.com

Vishnu Pavan Beeram
Juniper Networks

EMail: vbeeram@juniper.net

Tarek Saad
Cisco Systems Inc

EMail: tsaad@cisco.com

Himanshu Shah
Ciena

EMail: hshah@ciena.com

Oscar Gonzalez de Dios
Telefonica

EMail: oscar.gonzalezdedios@telefonica.com