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YANG Data Model for Layer 3 TE Topologies
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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 unicast topology [RFC8346] and a Traffic Engineering (TE) topology [I-D.ietf-teas-yang-te-topo].

When traffic engineering is enabled on a layer 3 unicast topology, there will be a corresponding TE topology. The TE topology may or may not be congruent to the layer 3 unicast 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 unicast 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 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.

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

- o augment
- o data model
- o data node

1.2. Tree Diagrams

Tree diagrams used in this document follow the notation defined in [RFC8340].

2. Modeling Considerations for L3 TE Topologies

A layer 3 TE topology is a layer 3 unicast topology with additional TE capabilities enabled. [RFC8346] defines a YANG data model for layer 3 unicast topologies, consisting of two modules: ietf-l3-unicast-topology and ietf-l3-unicast-topology-state. The YANG data model defined in this document augments the YANG data model defined in [RFC8346]. This document specifies two YANG modules ietf-l3-te-topology and ietf-l3-te-topology-state, augmenting ietf-l3-unicast-topology and ietf-l3-unicast-topology-state respectively, to add additional TE capabilities.

```
          +-------------------------+
          |    Network Topology     |
          |  ietf-network-topology | Defined in RFC 8345
          +------------^-----------+
                       |
                       | augments
                       | (A "inheritance" relation)
                       |
        +----------------------------+
        |  Layer 3 Unicast Topology  |
        |  ietf-l3-unicast-topology  | Defined in RFC 8346
        +--------------^-------------+
                       |
                       | augments
                       | (A "inheritance" relation)
                       |
          +------------^-----------+
          |  Layer 3 TE Topology   |
          |  ietf-l3-te-topology   | Defined in this document
          +-------------------------+
```

Figure 1: Model Augmentations

2.1. Relationship Between Layer 3 Unicast Topology and TE topology

In general, the layer 3 unicast topology model specified in [RFC8346] and the TE topology model specified in [I-D.ietf-teas-yang-te-topo] can be used independently. This document provides a method to use both together.

When traffic engineering is enabled on a layer 3 unicast topology, there will be a resulting layer 3 TE topology, which is modeled by the YANG modules defined in this document. A layer 3 TE topology augments a layer 3 unicast topology, so it inherits all the objects and properties of the base layer 3 unicast topology. In addition, in such a layer 3 TE topology, the objects that are inherited from the base layer 3 unicast topology to this layer 3 TE topology may be associated to the objects in one coresponding TE topology. Such associations are supported by the module ietf-l3-te-topology defined in this document.

```
        +----------------------------+  +----------------------+
        |      Layer 3 Topology      |  |     TE Topology      |
        |  ietf-l3-unicast-topology  |  |   ietf-te-topology   |
        +--------------^-------------+  +----------------------+
                       |                  A
                       | augments         |
                       |                 /
                       |                / references by "leafref"
          +------------^-----------+   /  (An "association" relation)
          |  Layer 3 TE Topology   |__/
          |  ietf-l3-te-topology   |
          +------------------------+
```

Figure 2: Model References

The properties of the relations between the objects in a layer 3 TE topology and the objects in the corresponding TE topology 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 TE topology modeled by ietf-l3-te-topology may be associated with zero or one object in the corresponding TE topology.

2.2. Relationship Modeling

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

2.2.1. Topology Referencing

When TE is enabled on a layer 3 unicast topology, if the TE topology is not congruent to the layer 3 unicast topology, the layer 3 TE topology will have a reference to the corresponding TE topology. Such a reference is modeled as follows:

```
augment /nw:networks/nw:network/l3t:l3-topology-attributes:
  +--rw l3-te-topology-attributes
     +--rw network-ref?   -> /nw:networks/network/network-id
```

The above network-ref is a YANG data node of type leafref, used to indicate the network-id of the corresponding TE topology. The leafref relationship is illustrated by the simplified data instances in the following diagram.

```
 +-------------------------------+      +--------------------------+
 |   ietf-l3-te-topology:        |      |  ietf-te-topology:       |
 |+-----------------------------+|      |+------------------------+|
 ||  ietf-l3-unicast-topology:  ||      || ietf-network-topology: ||
 ||+---------------------------+||  +-->||   network-id (key)     ||
 ||| ietf-network-topology:    |||  |   ||   network-types: {     ||
 |||   network-id (key)        |||  |   ||     te-topology        ||
 |||   network-types: {        |||  |   ||   }                    ||
 |||     l3-unicast-topology: {|||  |   ||   <other attributes>   ||
 |||       l3-te               |||  |   |+------------------------+|
 |||     }                     |||  |   |    <TE attributes>       |
 |||   }                       |||  |   +--------------------------+
 |||   <other attributes>      |||  |
 ||+---------------------------+||  |
 ||    <L3 unicast attributes>  ||  |
 |+-----------------------------+|  |
 |     network-ref               |--+
 +-------------------------------+
```

Figure 3: Topology Referencing

network-id defined in in [RFC8345] uniquely identifies a network topology instance of any type. As shown in the above diagram, the value of network-ref in the ietf-l3-te-topology instance matches the value of network-id in the ietf-te-topology instance. To ensure that the topology instance identified by this network-id is of type "te-topology", a "must" statement is defined in module ietf-l3-te-topology. Such "must" statements are also used in all the following leafref nodes in this section.

If the TE topology is congruent to the layer 3 unicast topology, the above reference can still be used to specified TE parameters defined in the TE topology model.

2.2.2. Node Referencing

When TE is enabled on a layer 3 unicast topology, if the TE topology is not congruent to the layer 3 unicast topology, a node in the layer 3 TE topology may have a reference to the corresponding node in the TE Topology. Such a reference is modeled as follows:

```
augment /nw:networks/nw:network/nw:node/l3t:l3-node-attributes:
  +--rw l3-te-node-attributes
     +--rw node-ref?      leafref
     +--rw network-ref?   -> /nw:networks/network/network-id
```

2.2.3. Link Termination Point Referencing

When TE is enabled on a layer 3 unicast topology, if the TE topology is not congruent to the layer 3 unicast topology, a link termination point in the layer 3 TE topology may have a reference to the corresponding link termination point in the TE Topology. Such a reference is modeled as follows:

```
augment /nw:networks/nw:network/nw:node/nt:termination-point
          /l3t:l3-termination-point-attributes:
  +--rw l3-te-tp-attributes
     +--rw tp-ref?        leafref
     +--rw node-ref?      leafref
     +--rw network-ref?   -> /nw:networks/network/network-id
```

2.2.4. Link Referencing

When TE is enabled on a layer 3 unicast topology, if the TE topology is not congruent to the layer 3 unicast topology, a link in the layer 3 topology may have a reference to the corresponding link in the TE Topology. Such a reference is modeled as follows:

```
augment /nw:networks/nw:network/nt:link/l3t:l3-link-attributes:
  +--rw l3-te-link-attributes
     +--rw link-ref?      leafref
     +--rw network-ref?   -> /nw:networks/network/network-id
```

2.3. Topology Type Modeling

A new topology type is defined in this document, to indicate a topology that is a layer 3 TE topology, which both inherits l3 unicast topology properties and is capable of TE.

```
augment /nw:networks/nw:network/nw:network-types
          /l3t:l3-unicast-topology:
  +--rw l3-te!
```

3. Packet Switching Technology Extensions

The technology agnostic TE Topology model is defined in [I-D.ietf-teas-yang-te-topo], which is extended by this document to cover the Packet Switch Capable (PSC) technology [RFC3471] [RFC7074].

3.1. Technology Specific Link Attributes

The technology agnostic TE Topology model is augmented with packet switching specific link attributes:

```
augment /nw: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 /nw:networks/nw:network/nt: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 /nw:networks/nw:network/nt: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
```

3.2. Performance Metric

[RFC7471], [RFC8570] and [RFC7823] specify TE performance metric parameters and their usage. The packet switching augmentations specified in this document support such a capability, which can be conditional enabled by a YANG feature "te-performance-metric".

```
augment /nw:networks/nw:network/nw:node/tet:te
          /tet:te-node-attributes/tet:connectivity-matrices:
  +--rw performance-metric
     +--rw measurement
     |     ......
     +--rw normality
     |     ......
     +--rw throttle
           ......
```

Such an augmentation has been applied to:

- o Connectivity matrices container
- o Connectivity matrix entry
- o Local link connectivities container
- o Local link connectivity entry
- o TE link attributes container in a TE link template

- o TE link attributes container in a TE link

- o Information source entry in a TE link

4. Complete Model Tree Structure

4.1. 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 /nw:networks/nw:network/nw:network-types
            /l3t:l3-unicast-topology:
    +--rw l3-te!
  augment /nw:networks/nw:network/l3t:l3-topology-attributes:
    +--rw l3-te-topology-attributes
       +--rw network-ref?   -> /nw:networks/network/network-id
  augment /nw:networks/nw:network/nw:node/l3t:l3-node-attributes:
    +--rw l3-te-node-attributes
       +--rw node-ref?      leafref
       +--rw network-ref?   -> /nw:networks/network/network-id
  augment /nw:networks/nw:network/nw:node/nt:termination-point
            /l3t:l3-termination-point-attributes:
    +--rw l3-te-tp-attributes
       +--rw tp-ref?        leafref
       +--rw node-ref?      leafref
       +--rw network-ref?   -> /nw:networks/network/network-id
  augment /nw:networks/nw:network/nt:link/l3t:l3-link-attributes:
    +--rw l3-te-link-attributes
       +--rw link-ref?      leafref
       +--rw network-ref?   -> /nw:networks/network/network-id
```

4.2. Packet Switching TE Topology Module

This is an augmentation to base TE topology model.

```
module: ietf-te-topology-packet
  augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
    +--rw packet!
  augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes/tet:connectivity-matrices:
```

```
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                    decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--ro performance-metrics-two-way {te-performance-metric}?
       |  +--ro two-way-delay?                      uint32
       |  +--ro two-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-min-delay?                  uint32
       |  +--ro two-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-max-delay?                  uint32
       |  +--ro two-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-delay-variation?            uint32
       |  +--ro two-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-packet-loss?                decimal64
       |  +--ro two-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--rw throttle {te-performance-metric}?
          +--rw one-way-delay-offset?                 uint32
          +--rw measure-interval?                     uint32
          +--rw advertisement-interval?               uint32
```

```
          +--rw suppression-interval?                  uint32
          +--rw threshold-out
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-in
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-accelerated-advertisement
             +--rw one-way-delay?                 uint32
             +--rw one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                 uint32
             +--rw one-way-min-delay?             uint32
             +--rw one-way-max-delay?             uint32
             +--rw one-way-delay-variation?       uint32
             +--rw one-way-packet-loss?           decimal64
```

```
             +--rw two-way-min-delay?             uint32
             +--rw two-way-max-delay?             uint32
             +--rw two-way-delay-variation?       uint32
             +--rw two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:te-node-attributes/tet:connectivity-matrices
               /tet:connectivity-matrix:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                    decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--ro performance-metrics-two-way {te-performance-metric}?
       |  +--ro two-way-delay?                      uint32
       |  +--ro two-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-min-delay?                  uint32
       |  +--ro two-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-max-delay?                  uint32
       |  +--ro two-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-delay-variation?            uint32
       |  +--ro two-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
```

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

```
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                uint32
             +--rw one-way-min-delay?            uint32
             +--rw one-way-max-delay?            uint32
             +--rw one-way-delay-variation?      uint32
             +--rw one-way-packet-loss?          decimal64
             +--rw two-way-min-delay?            uint32
             +--rw two-way-max-delay?            uint32
             +--rw two-way-delay-variation?      uint32
             +--rw two-way-packet-loss?          decimal64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                    decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--ro performance-metrics-two-way {te-performance-metric}?
       |  +--ro two-way-delay?                      uint32
       |  +--ro two-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-min-delay?                  uint32
       |  +--ro two-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
```

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

```
          +--ro threshold-accelerated-advertisement
             +--ro one-way-delay?                 uint32
             +--ro one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro two-way-delay?                 uint32
             +--ro one-way-min-delay?             uint32
             +--ro one-way-max-delay?             uint32
             +--ro one-way-delay-variation?       uint32
             +--ro one-way-packet-loss?           decimal64
             +--ro two-way-min-delay?             uint32
             +--ro two-way-max-delay?             uint32
             +--ro two-way-delay-variation?       uint32
             +--ro two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:information-source-entry/tet:connectivity-matrices
               /tet:connectivity-matrix:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                    decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
```

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

```
          |  +--ro one-way-max-delay?             uint32
          |  +--ro one-way-delay-variation?       uint32
          |  +--ro one-way-packet-loss?           decimal64
          |  +--ro two-way-min-delay?             uint32
          |  +--ro two-way-max-delay?             uint32
          |  +--ro two-way-delay-variation?       uint32
          |  +--ro two-way-packet-loss?           decimal64
          +--ro threshold-accelerated-advertisement
             +--ro one-way-delay?                 uint32
             +--ro one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro two-way-delay?                 uint32
             +--ro one-way-min-delay?             uint32
             +--ro one-way-max-delay?             uint32
             +--ro one-way-delay-variation?       uint32
             +--ro one-way-packet-loss?           decimal64
             +--ro two-way-min-delay?             uint32
             +--ro two-way-max-delay?             uint32
             +--ro two-way-delay-variation?       uint32
             +--ro two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
```

```
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                 uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                     decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--ro performance-metrics-two-way {te-performance-metric}?
       |  +--ro two-way-delay?                       uint32
       |  +--ro two-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-min-delay?                   uint32
       |  +--ro two-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-max-delay?                   uint32
       |  +--ro two-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-delay-variation?             uint32
       |  +--ro two-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-packet-loss?                 decimal64
       |  +--ro two-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--rw throttle {te-performance-metric}?
          +--rw one-way-delay-offset?                  uint32
          +--rw measure-interval?                      uint32
          +--rw advertisement-interval?                uint32
          +--rw suppression-interval?                  uint32
          +--rw threshold-out
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-in
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
```

```
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-accelerated-advertisement
             +--rw one-way-delay?                 uint32
             +--rw one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                 uint32
             +--rw one-way-min-delay?             uint32
             +--rw one-way-max-delay?             uint32
             +--rw one-way-delay-variation?       uint32
             +--rw one-way-packet-loss?           decimal64
             +--rw two-way-min-delay?             uint32
             +--rw two-way-max-delay?             uint32
             +--rw two-way-delay-variation?       uint32
             +--rw two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nw:node/tet:te
               /tet:tunnel-termination-point
               /tet:local-link-connectivities
               /tet:local-link-connectivity:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
```

```
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-utilized-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-min-delay?                      uint32
        |  +--ro one-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-max-delay?                      uint32
        |  +--ro one-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-delay-variation?                uint32
        |  +--ro one-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-packet-loss?                    decimal64
        |  +--ro one-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--ro performance-metrics-two-way {te-performance-metric}?
        |  +--ro two-way-delay?                      uint32
        |  +--ro two-way-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-min-delay?                  uint32
        |  +--ro two-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-max-delay?                  uint32
        |  +--ro two-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-delay-variation?            uint32
        |  +--ro two-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-packet-loss?                decimal64
        |  +--ro two-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--rw throttle {te-performance-metric}?
           +--rw one-way-delay-offset?                  uint32
           +--rw measure-interval?                      uint32
           +--rw advertisement-interval?                uint32
           +--rw suppression-interval?                  uint32
           +--rw threshold-out
           |  +--rw one-way-delay?                uint32
           |  +--rw one-way-residual-bandwidth?
           |  |       rt-types:bandwidth-ieee-float32
           |  +--rw one-way-available-bandwidth?
           |  |       rt-types:bandwidth-ieee-float32
           |  +--rw one-way-utilized-bandwidth?
           |  |       rt-types:bandwidth-ieee-float32
           |  +--rw two-way-delay?                uint32
           |  +--rw one-way-min-delay?            uint32
           |  +--rw one-way-max-delay?            uint32
           |  +--rw one-way-delay-variation?      uint32
```

```
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-in
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-accelerated-advertisement
             +--rw one-way-delay?                 uint32
             +--rw one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                 uint32
             +--rw one-way-min-delay?             uint32
             +--rw one-way-max-delay?             uint32
             +--rw one-way-delay-variation?       uint32
             +--rw one-way-packet-loss?           decimal64
             +--rw two-way-min-delay?             uint32
             +--rw two-way-max-delay?             uint32
             +--rw two-way-delay-variation?       uint32
             +--rw two-way-packet-loss?           decimal64
     augment /nw:networks/tet:te/tet:templates/tet:link-template
               /tet:te-link-attributes:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
```

```
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-available-bandwidth?
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-available-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-utilized-bandwidth?
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-utilized-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-min-delay?                      uint32
        |  +--ro one-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-max-delay?                      uint32
        |  +--ro one-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-delay-variation?                uint32
        |  +--ro one-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-packet-loss?                    decimal64
        |  +--ro one-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--ro performance-metrics-two-way {te-performance-metric}?
        |  +--ro two-way-delay?                      uint32
        |  +--ro two-way-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-min-delay?                  uint32
        |  +--ro two-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-max-delay?                  uint32
        |  +--ro two-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-delay-variation?            uint32
        |  +--ro two-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-packet-loss?                decimal64
        |  +--ro two-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--rw throttle {te-performance-metric}?
           +--rw one-way-delay-offset?                  uint32
           +--rw measure-interval?                      uint32
           +--rw advertisement-interval?                uint32
           +--rw suppression-interval?                  uint32
           +--rw threshold-out
           |  +--rw one-way-delay?                uint32
           |  +--rw one-way-residual-bandwidth?
           |  |       rt-types:bandwidth-ieee-float32
           |  +--rw one-way-available-bandwidth?
           |  |       rt-types:bandwidth-ieee-float32
```

```
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-in
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-accelerated-advertisement
             +--rw one-way-delay?                 uint32
             +--rw one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                 uint32
             +--rw one-way-min-delay?             uint32
             +--rw one-way-max-delay?             uint32
             +--rw one-way-delay-variation?       uint32
             +--rw one-way-packet-loss?           decimal64
             +--rw two-way-min-delay?             uint32
             +--rw two-way-max-delay?             uint32
             +--rw two-way-delay-variation?       uint32
             +--rw two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:te-link-attributes:
       +--ro performance-metrics-one-way {te-performance-metric}?
```

```
        |  +--ro one-way-delay?                          uint32
        |  +--ro one-way-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-residual-bandwidth?
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-residual-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-available-bandwidth?
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-available-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-utilized-bandwidth?
        |  |       rt-types:bandwidth-ieee-float32
        |  +--ro one-way-utilized-bandwidth-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-min-delay?                      uint32
        |  +--ro one-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-max-delay?                      uint32
        |  +--ro one-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-delay-variation?                uint32
        |  +--ro one-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro one-way-packet-loss?                    decimal64
        |  +--ro one-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--ro performance-metrics-two-way {te-performance-metric}?
        |  +--ro two-way-delay?                      uint32
        |  +--ro two-way-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-min-delay?                  uint32
        |  +--ro two-way-min-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-max-delay?                  uint32
        |  +--ro two-way-max-delay-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-delay-variation?            uint32
        |  +--ro two-way-delay-variation-normality?
        |  |       te-types:performance-metrics-normality
        |  +--ro two-way-packet-loss?                decimal64
        |  +--ro two-way-packet-loss-normality?
        |          te-types:performance-metrics-normality
        +--rw throttle {te-performance-metric}?
           +--rw one-way-delay-offset?                 uint32
           +--rw measure-interval?                     uint32
           +--rw advertisement-interval?               uint32
           +--rw suppression-interval?                 uint32
```

```
          +--rw threshold-out
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-in
          |  +--rw one-way-delay?                 uint32
          |  +--rw one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--rw two-way-delay?                 uint32
          |  +--rw one-way-min-delay?             uint32
          |  +--rw one-way-max-delay?             uint32
          |  +--rw one-way-delay-variation?       uint32
          |  +--rw one-way-packet-loss?           decimal64
          |  +--rw two-way-min-delay?             uint32
          |  +--rw two-way-max-delay?             uint32
          |  +--rw two-way-delay-variation?       uint32
          |  +--rw two-way-packet-loss?           decimal64
          +--rw threshold-accelerated-advertisement
             +--rw one-way-delay?                 uint32
             +--rw one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--rw two-way-delay?                 uint32
             +--rw one-way-min-delay?             uint32
             +--rw one-way-max-delay?             uint32
             +--rw one-way-delay-variation?       uint32
             +--rw one-way-packet-loss?           decimal64
             +--rw two-way-min-delay?             uint32
```

```
             +--rw two-way-max-delay?             uint32
             +--rw two-way-delay-variation?       uint32
             +--rw two-way-packet-loss?           decimal64
     augment /nw:networks/nw:network/nt:link/tet:te
               /tet:information-source-entry:
       +--ro performance-metrics-one-way {te-performance-metric}?
       |  +--ro one-way-delay?                          uint32
       |  +--ro one-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-residual-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-residual-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-available-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-available-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-utilized-bandwidth?
       |  |       rt-types:bandwidth-ieee-float32
       |  +--ro one-way-utilized-bandwidth-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-min-delay?                      uint32
       |  +--ro one-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-max-delay?                      uint32
       |  +--ro one-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-delay-variation?                uint32
       |  +--ro one-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro one-way-packet-loss?                    decimal64
       |  +--ro one-way-packet-loss-normality?
       |          te-types:performance-metrics-normality
       +--ro performance-metrics-two-way {te-performance-metric}?
       |  +--ro two-way-delay?                      uint32
       |  +--ro two-way-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-min-delay?                  uint32
       |  +--ro two-way-min-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-max-delay?                  uint32
       |  +--ro two-way-max-delay-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-delay-variation?            uint32
       |  +--ro two-way-delay-variation-normality?
       |  |       te-types:performance-metrics-normality
       |  +--ro two-way-packet-loss?                decimal64
       |  +--ro two-way-packet-loss-normality?
```

```
       |          te-types:performance-metrics-normality
       +--ro throttle {te-performance-metric}?
          +--ro one-way-delay-offset?                  uint32
          +--ro measure-interval?                      uint32
          +--ro advertisement-interval?                uint32
          +--ro suppression-interval?                  uint32
          +--ro threshold-out
          |  +--ro one-way-delay?                 uint32
          |  +--ro one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro two-way-delay?                 uint32
          |  +--ro one-way-min-delay?             uint32
          |  +--ro one-way-max-delay?             uint32
          |  +--ro one-way-delay-variation?       uint32
          |  +--ro one-way-packet-loss?           decimal64
          |  +--ro two-way-min-delay?             uint32
          |  +--ro two-way-max-delay?             uint32
          |  +--ro two-way-delay-variation?       uint32
          |  +--ro two-way-packet-loss?           decimal64
          +--ro threshold-in
          |  +--ro one-way-delay?                 uint32
          |  +--ro one-way-residual-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro one-way-available-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro one-way-utilized-bandwidth?
          |  |       rt-types:bandwidth-ieee-float32
          |  +--ro two-way-delay?                 uint32
          |  +--ro one-way-min-delay?             uint32
          |  +--ro one-way-max-delay?             uint32
          |  +--ro one-way-delay-variation?       uint32
          |  +--ro one-way-packet-loss?           decimal64
          |  +--ro two-way-min-delay?             uint32
          |  +--ro two-way-max-delay?             uint32
          |  +--ro two-way-delay-variation?       uint32
          |  +--ro two-way-packet-loss?           decimal64
          +--ro threshold-accelerated-advertisement
             +--ro one-way-delay?                 uint32
             +--ro one-way-residual-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-available-bandwidth?
             |       rt-types:bandwidth-ieee-float32
             +--ro one-way-utilized-bandwidth?
             |       rt-types:bandwidth-ieee-float32
```

```
            +--ro two-way-delay?                uint32
            +--ro one-way-min-delay?            uint32
            +--ro one-way-max-delay?            uint32
            +--ro one-way-delay-variation?      uint32
            +--ro one-way-packet-loss?          decimal64
            +--ro two-way-min-delay?            uint32
            +--ro two-way-max-delay?            uint32
            +--ro two-way-delay-variation?      uint32
            +--ro two-way-packet-loss?          decimal64
    augment /nw: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 /nw:networks/nw:network/nt: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 /nw:networks/nw:network/nt: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
```

5. YANG Modules

5.1. Layer 3 TE Topology Module

This module references [RFC8345], [RFC8346], and [I-D.ietf-teas-yang-te-topo].

```
<CODE BEGINS> file "ietf-l3-te-topology@2020-05-03.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 "nw";
    reference "RFC 8345: A YANG Data Model for Network Topologies";
  }
```

```
     import ietf-network-topology {
       prefix "nt";
       reference "RFC 8345: A YANG Data Model for Network Topologies";
     }
     import ietf-l3-unicast-topology {
       prefix "l3t";
       reference "RFC 8346: A YANG Data Model for Layer 3 Topologies";
     }
     import ietf-te-topology {
       prefix "tet";
       reference
         "I-D.ietf-teas-yang-te-topo: YANG Data Model for Traffic
          Engineering (TE) Topologies";
     }

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

     contact
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        WG List:  <mailto:teas@ietf.org>

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                  <mailto:oscar.gonzalezdedios@telefonica.com>";

     description
       "YANG data model for representing and manipulating Layer 3 TE
        Topologies.

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        authors of the code.  All rights reserved.
```

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

     revision 2020-05-03 {

       description
         "Initial revision";
       reference "RFC XXXX: YANG Data Model for Layer 3 TE Topologies";
     }

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

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

     augment "/nw:networks/nw:network/nw:node/l3t:l3-node-attributes" {
       when "../../nw:network-types/l3t:l3-unicast-topology/"
         + "l3tet:l3-te" {
         description
```

```
            "Augment only for L3 TE topology";
        }
        description
          "Augment node configuration";
        uses l3-te-node-attributes;
      }

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

      augment "/nw:networks/nw:network/nt:link/l3t:l3-link-attributes" {
        when "../../nw:network-types/l3t:l3-unicast-topology/"
          + "l3tet: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 "/nw:networks/nw:network"
            + "[nw:network-id = current()/network-ref]/nw: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 nw: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 "/nw:networks/nw:network"
           + "[nw:network-id = current()/network-ref]/nw: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 nw: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 "/nw:networks/nw:network"
           + "[nw:network-id = current()/network-ref]/nw: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 nt: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 "/nw:networks/nw:network"
           + "[nw:network-id = current()/network-ref]/nw: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 nt:link-ref;
      }
    } // l3-te-link-attributes
  }
  <CODE ENDS>
```

5.2. Packet Switching TE Topology Module

This module references [RFC7471], [RFC7823], [RFC8294], [RFC8345], [RFC8346]. [RFC8570], [I-D.ietf-teas-yang-te-types], and [I-D.ietf-teas-yang-te-topo].

```
<CODE BEGINS> file "ietf-te-topology-packet@2020-07-03.yang"
module ietf-te-topology-packet {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-te-topology-packet";

  prefix "tet-pkt";

  import ietf-network {
    prefix "nw";
    reference
      "RFC 8345: A YANG Data Model for Network Topologies";
  }

  import ietf-network-topology {
    prefix "nt";
    reference
      "RFC 8345: A YANG Data Model for Network Topologies";
  }

  import ietf-routing-types {
    prefix "rt-types";
    reference
      "RFC 8294: Common YANG Data Types for the Routing Area";
  }

  import ietf-te-topology {
    prefix "tet";
    reference
      "I-D.ietf-teas-yang-te-topo: YANG Data Model for Traffic
       Engineering (TE) Topologies";
  }
```

```
     import ietf-te-types {
       prefix "te-types";
       reference
         "I-D.ietf-teas-yang-te-types: Traffic Engineering Common YANG
          Types";
     }

     import ietf-te-packet-types {
       prefix "te-packet-types";
       reference
         "I-D.ietf-teas-yang-te-types: Traffic Engineering Common YANG
          Types";
     }

     organization
       "Traffic Engineering Architecture and Signaling (TEAS)
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        Editor:   Oscar Gonzalez De Dios
                  <mailto:oscar.gonzalezdedios@telefonica.com>";

     description
       "YANG data model for representing and manipulating PSC (Packet
        Switching) TE Topologies.

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```

```
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        Relating to IETF Documents
        (http://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 2020-07-03 {
       description
         "Initial revision";
       reference
         "RFC XXXX: YANG Data Model for Layer 3 TE Topologies";
     }

     /*
      * Features
      */

     feature te-performance-metric {
       description
         "This feature indicates that the system supports
          TE performance metric.";
       reference
         "RFC7471: OSPF Traffic Engineering (TE) Metric Extensions.
          RFC8570: 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 network-types */
    augment "/nw:networks/nw:network/nw:network-types/"
      + "tet:te-topology" {
      description
        "Defines the packet TE topology type.";
      container packet {
        presence "Indicates packet TE topology.";
        description
          "Its presence identifies the packet TE topology type.";
      }
    }

    /* Augmentations to connectivity-matrix */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
      + "tet:te-node-attributes/tet:connectivity-matrices" {
      when "../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:te-node-attributes/tet:connectivity-matrices/"
```

```
          + "tet:connectivity-matrix" {
      when "../../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices" {
      when "../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:information-source-entry/tet:connectivity-matrices/"
          + "tet:connectivity-matrix" {
      when "../../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
```

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

    /* Augmentations to tunnel-termination-point */
    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities" {
      when "../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nw:node/tet:te/"
          + "tet:tunnel-termination-point/"
          + "tet:local-link-connectivities/"
          + "tet:local-link-connectivity" {
      when "../../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
```

```
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    /* Augmentations to te-link-attributes */
    augment "/nw: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-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes" {
      when "(../../../nw:network-types/tet:te-topology/tet-pkt:packet)"
        + " and (tet:interface-switching-capability "
        + "[tet:switching-capability = 'te-types:switching-psc1'])" {
        description
          "Valid only for PSC";
```

```
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
        refine performance-metrics-one-way {
          config false;
        }
        refine performance-metrics-two-way {
          config false;
        }
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry" {
      when "(../../../nw:network-types/tet:te-topology/tet-pkt:packet)"
        + " and (tet:interface-switching-capability "
        + "[tet:switching-capability = 'te-types:switching-psc1'])" {
        description
          "Valid only for PSC";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature te-performance-metric;
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature te-performance-metric;
      }
    }

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

    augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:information-source-entry/"
          + "tet:interface-switching-capability" {
      when "(../../../../nw:network-types/tet:te-topology/"
        + "tet-pkt:packet) and "
        + "(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>
```

6. 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:       l3tet
reference:    RFC XXXX
--------------------------------------------------------------------

--------------------------------------------------------------------
name:         ietf-l3-te-topology-state
namespace:    urn:ietf:params:xml:ns:yang:ietf-l3-te-topology-state
prefix:       l3tet-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
--------------------------------------------------------------------
```

7. Security Considerations

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

The Network Configuration Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:

/nw:networks/nw:network/nw:network-types/l3t:l3-unicast-topology/l3-te
This subtree specifies the layer 3 TE topology type. Modifying the configurations can make layer 3 TE topology type invalid and cause interruption to all layer 3 TE networks.

/nw:networks/nw:network/l3t:l3-topology-attributes/l3-te-topology-attributes
This subtree specifies the topology-wide configurations, including the reference to a TE topology from a layer 3 TE topology. Modifying the configurations here can cause traffic disabled or rerouted in this topology and the connected topologies.

/nw:networks/nw:network/nw:node/l3t:l3-node-attributes/l3-te-node-attributes
This subtree specifies the configurations of layer 3 TE nodes. Modifying the configurations in this subtree can change the relationship between a TE node and a node in a layer 3 TE topology, causing traffic disabled or rerouted in the specified nodes and the related layer 3 topologies.

/nw:networks/nw:network/nw:node/nt:termination-point//l3t:l3-termination-point-attributes/l3-te-tp-attributes
This subtree specifies the configurations of layer 3 TE link termination points. Modifying the configurations in this subtree

can change the relationship between a TE link termination point and a link termination point in a layer 3 TE topology, causing traffic disabled or rerouted on the related layer 3 links and the related layer 3 topologies.

/nw:networks/nw:network/nt:link/l3t:l3-link-attributes/l3-te-link-attributes
This subtree specifies the configurations of layer 3 TE links. Modifying the configurations in this subtree can change the relationship between a TE link and a link in a layer 3 TE topology, causing traffic disabled or rerouted on the specified layer 3 link and the related layer 3 topologies.

performance-metric containers
The container "performance-metric" is augmented to multiple locations of the base TE topology model, as specified in Section 3.2. Modifying the configuration in such a container can change the behaviors of performance metric monitoring, causing traffic disabled or rerouted on the related layer 3 links, nodes, or topologies.

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

/nw:networks/nw:network/nw:network-types/l3t:l3-unicast-topology/l3-te
Unauthorized access to this subtree can disclose the layer 3 TE topology type.

/nw:networks/nw:network/l3t:l3-topology-attributes/l3-te-topology-attributes
Unauthorized access to this subtree can disclose the topology-wide configurations, including the reference to a TE topology from a layer 3 topology.

/nw:networks/nw:network/nw:node/l3t:l3-node-attributes/l3-te-node-attributes
Unauthorized access to this subtree can disclose the operational state information of layer 3 TE nodes.

/nw:networks/nw:network/nw:node/nt:termination-point//l3t:l3-termination-point-attributes/l3-te-tp-attributes
Unauthorized access to this subtree can disclose the operational state information of layer 3 TE link termination points.

/nw:networks/nw:network/nt:link/l3t:l3-link-attributes/l3-te-link-attributes
Unauthorized access to this subtree can disclose the operational state information of layer 3 TE links.

performance-metric containers
The container "performance-metric" is augmented to multiple locations of the base TE topology model, as specified in Section 3.2. Unauthorized access to this subtree can disclose the operational state information of performance metric monitoring.

8. References

8.1. Normative References

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8.2. Informative References

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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 [RFC8342]. 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 coorespinding NMDA models, the YANG trees of the companion modules are not depicted separately.

A.1. Layer 3 TE Topology State Module

This module references [RFC8345], and [RFC8346].

```
<CODE BEGINS> file "ietf-l3-te-topology-state@2020-05-03.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 "nw-s";
    reference "RFC 8345: A YANG Data Model for Network Topologies";
  }
  import ietf-network-topology-state {
    prefix "nt-s";
    reference "RFC 8345: A YANG Data Model for Network Topologies";
  }
  import ietf-l3-unicast-topology-state {
    prefix "l3t-s";
    reference "RFC 8346: A YANG Data Model for Layer 3 Topologies";
  }
```

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

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

        Editor:   Xufeng Liu
                  <mailto:xufeng.liu.ietf@gmail.com>

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

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

        Editor:   Tarek Saad
                  <mailto:tsaad@cisco.com>

        Editor:   Himanshu Shah
                  <mailto:hshah@ciena.com>

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

     description
       "YANG data model for representing operational state information
        of Layer 3 TE Topologies, when NMDA is not supported.

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        authors of the code.  All rights reserved.

        Redistribution and use in source and binary forms, with or
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        Relating to IETF Documents
        (http://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 2020-05-03 {
       description
         "Initial revision";
       reference "RFC XXXX: YANG Data Model for Layer 3 TE Topologies";
     }
```

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

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

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

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

     augment "/nw-s:networks/nw-s:network/nt-s:link/"
       + "l3t-s:l3-link-attributes" {
       when "../../nw-s:network-types/l3t-s:l3-unicast-topology/"
         + "l3tet-s: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@2020-07-03.yang"
  module ietf-te-topology-packet-state {
    yang-version 1.1;
    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 "nw-s";
      reference
        "RFC 8345: A YANG Data Model for Network Topologies";
    }

    import ietf-network-topology-state {
      prefix "nt-s";
      reference
        "RFC 8345: A YANG Data Model for Network Topologies";
    }

    import ietf-te-topology-state {
      prefix "tet-s";
      reference
        "I-D.ietf-teas-yang-te-topo: YANG Data Model for Traffic
         Engineering (TE) Topologies";
    }

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

```
       reference
         "I-D.ietf-teas-yang-te-types: Traffic Engineering Common YANG
          Types";
     }

     import ietf-te-packet-types {
       prefix "te-packet-types";
       reference
         "I-D.ietf-teas-yang-te-types: Traffic Engineering Common YANG
          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>

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        Editor:   Himanshu Shah
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     description
       "YANG data model for representing operational state information
        of PSC (Packet Switching) TE Topologies, when NMDA is not
         supported.

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        authors of the code.  All rights reserved.

        Redistribution and use in source and binary forms, with or
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```

```
        the license terms contained in, the Simplified BSD License set
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        Relating to IETF Documents
        (http://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 2020-07-03 {
       description
         "Initial revision";
       reference
         "RFC XXXX: YANG Data Model for Layer 3 TE Topologies";
     }

     /*
      * Augmentations
      */
     /* Augmentations to network-types */
     augment "/nw-s:networks/nw-s:network/nw-s:network-types/"
       + "tet-s:te-topology" {
       description
         "Defines the packet TE topology type.";
       container packet {
         presence "Indicates packet TE topology.";
         description
           "Its presence identifies the packet TE topology type.";
       }
     }

     /* Augmentations to connectivity-matrix */
     augment "/nw-s:networks/nw-s:network/nw-s:node/tet-s:te/"
       + "tet-s:te-node-attributes/tet-s:connectivity-matrices" {
       when "../../../../nw-s:network-types/tet-s:te-topology/"
         + "tet-pkt-s:packet" {
         description
           "Augment only for packet TE topology";
       }
       description
         "Parameters for PSC (Packet Switching) TE topology.";
       uses te-packet-types:performance-metrics-attributes-packet {
         if-feature tet-pkt:te-performance-metric;
       }
       uses
         te-packet-types:performance-metrics-throttle-container-packet {
         if-feature tet-pkt:te-performance-metric;
       }
     }
```

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

     augment "/nw-s:networks/nw-s:network/nw-s:node/tet-s:te/"
           + "tet-s:information-source-entry/"
           + "tet-s:connectivity-matrices" {
       when "../../../../nw-s:network-types/tet-s:te-topology/"
         + "tet-pkt-s:packet" {
         description
           "Augment only for packet TE topology";
       }
       description
         "Parameters for PSC TE topology.";
       uses te-packet-types:performance-metrics-attributes-packet {
         if-feature tet-pkt:te-performance-metric;
       }
       uses
         te-packet-types:performance-metrics-throttle-container-packet {
         if-feature tet-pkt:te-performance-metric;
       }
     }

     augment "/nw-s:networks/nw-s:network/nw-s:node/tet-s:te/"
           + "tet-s:information-source-entry/"
           + "tet-s:connectivity-matrices/"
           + "tet-s:connectivity-matrix" {
       when "../../../../../nw-s:network-types/tet-s:te-topology/"
         + "tet-pkt-s:packet" {
         description
           "Augment only for packet TE topology";
       }
       description
```

```
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature tet-pkt:te-performance-metric;
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature tet-pkt:te-performance-metric;
      }
    }

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

    augment "/nw-s:networks/nw-s:network/nw-s:node/tet-s:te/"
          + "tet-s:tunnel-termination-point/"
          + "tet-s:local-link-connectivities/"
          + "tet-s:local-link-connectivity" {
      when "../../../../../nw-s:network-types/tet-s:te-topology/"
        + "tet-pkt-s:packet" {
        description
          "Augment only for packet TE topology";
      }
      description
        "Parameters for PSC TE topology.";
      uses te-packet-types:performance-metrics-attributes-packet {
        if-feature tet-pkt:te-performance-metric;
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature tet-pkt:te-performance-metric;
      }
```

```
     }

     /* Augmentations to te-link-attributes */
     augment "/nw-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-packet-types:performance-metrics-attributes-packet {
         if-feature tet-pkt:te-performance-metric;
       }
       uses
         te-packet-types:performance-metrics-throttle-container-packet {
         if-feature tet-pkt:te-performance-metric;
       }
     }

     augment "/nw-s:networks/nw-s:network/nt-s:link/tet-s:te/"
           + "tet-s:te-link-attributes" {
       when "(../../../nw-s:network-types/tet-s:te-topology/"
         + "tet-pkt-s:packet) and "
         + "(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-packet-types:performance-metrics-attributes-packet {
         if-feature tet-pkt:te-performance-metric;
       }
       uses
         te-packet-types:performance-metrics-throttle-container-packet {
         if-feature tet-pkt:te-performance-metric;
       }
     }

     augment "/nw-s:networks/nw-s:network/nt-s:link/tet-s:te/"
           + "tet-s:information-source-entry" {
       when "(../../../nw-s:network-types/tet-s:te-topology/"
         + "tet-pkt-s:packet) and "
         + "(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-packet-types:performance-metrics-attributes-packet {
        if-feature tet-pkt:te-performance-metric;
      }
      uses
        te-packet-types:performance-metrics-throttle-container-packet {
        if-feature tet-pkt:te-performance-metric;
      }
    }

    /* Augmentations to interface-switching-capability */
    augment "/nw-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 "/nw-s:networks/nw-s:network/nt-s:link/tet-s:te/"
          + "tet-s:te-link-attributes/"
          + "tet-s:interface-switching-capability" {
      when "(../../../../nw-s:network-types/tet-s:te-topology/"
        + "tet-pkt-s:packet) and "
        + "(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 "/nw-s:networks/nw-s:network/nt-s:link/tet-s:te/"
          + "tet-s:information-source-entry/"
          + "tet-s:interface-switching-capability" {
      when "(../../../../nw-s:network-types/tet-s:te-topology/"
        + "tet-pkt-s:packet) and "
        + "(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>
```

Appendix B. Data Tree Example

This section contains an example of an instance data tree in the JSON encoding [RFC7951]. The example instantiates "ietf-l3-te-topology" for the topology that is depicted in the following diagram.

```
                +------------+                  +------------+
                |     D1     |                  |     D2     |
               /-\          /-\     (TE)       /-\          /-\
               | | 1-0-1    | |---------------->| | 2-1-1    | |
               | |    1-2-1 | |<----------------| |    2-0-1 | |
               \-/  1-3-1   \-/     (TE)       \-/  2-3-1   \-/
                |   /----\   |                  |   /----\   |
                +---|    |---+                  +---|    |---+
                    \----/                          \----/
                     A  |                            A  |
                  (TE)|  |(TE)                (Non-TE)|  |(Non-TE)
                      |  |                            |  |
                      |  |       +------------+       |  |
                      |  |       |     D3     |       |  |
                      |  |      /-\          /-\      |  |
                      |  +----->| | 3-1-1    | |------+  |
                      +---------| |    3-2-1 | |<---------+
                                \-/          \-/
                                 |            |
                                 +------------+
```

The corresponding instance data tree is depicted below. Note that some lines have been wrapped to adhere to the 72-character line limitation of RFCs.

```
{
  "ietf-network:networks": {
    "network": [
      {
        "network-id":"example-topo-te",
        "network-types": {
          "ietf-te-topology:te-topology": {
          }
        },
```

```
            "ietf-te-topology:te-topology-identifier": {
              "provider-id":200,
              "client-id":300,
              "topology-id":"example-topo-te"
            },
            "ietf-te-topology:te": {
            },
            "node": [
              {
                "node-id":"D1",
                "ietf-te-topology:te-node-id":"2.0.1.1",
                "ietf-te-topology:te": {
                  "te-node-attributes": {
                  }
                },
                "ietf-network-topology:termination-point": [
                  {
                    "tp-id":"1-2-1",
                    "ietf-te-topology:te-tp-id":10201,
                    "ietf-te-topology:te": {
                      "interface-switching-capability": [
                        {
                          "switching-capability":
                            "ietf-te-types:switching-psc1",
                          "encoding":
                            "ietf-te-types:lsp-encoding-ethernet"
                        }
                      ]
                    }
                  },
                  {
                    "tp-id": "1-3-1",
                    "ietf-te-topology:te-tp-id":10301,
                    "ietf-te-topology:te": {
                      "interface-switching-capability": [
                        {
                          "switching-capability":
                            "ietf-te-types:switching-psc1",
                          "encoding":
                            "ietf-te-types:lsp-encoding-ethernet"
                        }
                      ]
                    }
                  }
                ]
              },
              {
                "node-id":"D2",
```

```
                "ietf-te-topology:te-node-id":"2.0.2.1",
                "ietf-te-topology:te": {
                  "te-node-attributes": {
                  }
                },
                "ietf-network-topology:termination-point": [
                  {
                    "tp-id":"2-1-1",
                    "ietf-te-topology:te-tp-id":20101,
                    "ietf-te-topology:te": {
                      "interface-switching-capability": [
                        {
                          "switching-capability":
                            "ietf-te-types:switching-psc1",
                          "encoding":
                            "ietf-te-types:lsp-encoding-ethernet"
                        }
                      ]
                    }
                  }
                ]
              },
              {
                "node-id":"D3",
                "ietf-te-topology:te-node-id":"2.0.3.1",
                "ietf-te-topology:te": {
                  "te-node-attributes": {
                  }
                },
                "ietf-network-topology:termination-point": [
                  {
                    "tp-id":"3-1-1",
                    "ietf-te-topology:te-tp-id":30101,
                    "ietf-te-topology:te": {
                      "interface-switching-capability": [
                        {
                          "switching-capability":
                            "ietf-te-types:switching-psc1",
                          "encoding":
                            "ietf-te-types:lsp-encoding-ethernet"
                        }
                      ]
                    }
                  }
                ]
              }
            ],
            "ietf-network-topology:link": [
```

```
              {
                "link-id":"D1,1-2-1,D2,2-1-1",
                "source": {
                  "source-node":"D1",
                  "source-tp":"1-2-1"
                },
                "destination": {
                  "dest-node":"D2",
                  "dest-tp":"2-1-1"
                },
                "ietf-te-topology:te": {
                  "te-link-attributes": {
                    "interface-switching-capability": [
                      {
                        "switching-capability":
                          "ietf-te-types:switching-psc1",
                        "encoding":"ietf-te-types:lsp-encoding-ethernet"
                      }
                    ],
                    "max-link-bandwidth": {
                      "te-bandwidth": {
                        "generic":"0x1p+18"
                      }
                    },
                    "te-default-metric":100
                  }
                }
              },
              {
                "link-id":"D2,2-1-1,D1,1-2-1",
                "source": {
                  "source-node":"D2",
                  "source-tp":"2-1-1"
                },
                "destination": {
                  "dest-node":"D1",
                  "dest-tp":"1-2-1"
                },
                "ietf-te-topology:te": {
                  "te-link-attributes": {
                    "interface-switching-capability": [
                      {
                        "switching-capability":
                          "ietf-te-types:switching-psc1",
                        "encoding":"ietf-te-types:lsp-encoding-ethernet"
                      }
                    ],
                    "max-link-bandwidth": {
```

```
                "te-bandwidth": {
                  "generic":"0x1p+18"
                }
              },
              "te-default-metric":100
            }
          }
        },
        {
          "link-id":"D1,1-3-1,D3,3-1-1",
          "source": {
            "source-node":"D1",
            "source-tp":"1-3-1"
          },
          "destination": {
            "dest-node":"D3",
            "dest-tp":"3-1-1"
          },
          "ietf-te-topology:te": {
            "te-link-attributes": {
              "interface-switching-capability": [
                {
                  "switching-capability":
                    "ietf-te-types:switching-psc1",
                  "encoding":"ietf-te-types:lsp-encoding-ethernet"
                }
              ],
              "max-link-bandwidth": {
                "te-bandwidth": {
                  "generic":"0x1p+18"
                }
              },
              "te-default-metric":100
            }
          }
        },
        {
          "link-id":"D3,3-1-1,D1,1-3-1",
          "source": {
            "source-node":"D3",
            "source-tp":"3-1-1"
          },
          "destination": {
            "dest-node":"D1",
            "dest-tp":"1-3-1"
          },
          "ietf-te-topology:te": {
            "te-link-attributes": {
```

```
                "interface-switching-capability": [
                  {
                    "switching-capability":
                      "ietf-te-types:switching-psc1",
                    "encoding":"ietf-te-types:lsp-encoding-ethernet"
                  }
                ],
                "max-link-bandwidth": {
                  "te-bandwidth": {
                    "generic":"0x1p+18"
                  }
                },
                "te-default-metric":100
              }
            }
          }
        ]
      },
      {
        "network-id":"example-topo-l3-te",
        "network-types": {
          "ietf-l3-unicast-topology:l3-unicast-topology": {
            "ietf-l3-te-topology:l3-te": {
            }
          }
        },
        "ietf-l3-unicast-topology:l3-topology-attributes": {
          "ietf-l3-te-topology:l3-te-topology-attributes": {
            "network-ref":"example-topo-te"
          }
        },
        "node": [
          {
            "node-id":"D1",
            "ietf-l3-unicast-topology:l3-node-attributes": {
              "router-id": [
                "203.0.113.1"
              ],
              "prefix": [
                {
                  "prefix":"203.0.113.1/32"
                }
              ],
              "ietf-l3-te-topology:l3-te-node-attributes": {
                "node-ref":"D1",
                "network-ref":"example-topo-te"
              }
            },
```

```
               "ietf-network-topology:termination-point": [
                 {
                   "tp-id":"1-0-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":101
                   }
                 },
                 {
                   "tp-id":"1-2-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":121,
                     "ietf-l3-te-topology:l3-te-tp-attributes": {
                       "network-ref":"example-topo-te",
                       "tp-ref":"1-2-1"
                     }
                   }
                 },
                 {
                   "tp-id":"1-3-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":131,
                     "ietf-l3-te-topology:l3-te-tp-attributes": {
                       "network-ref":"example-topo-te",
                       "tp-ref":"1-3-1"
                     }
                   }
                 }
               ]
             },
             {
               "node-id":"D2",
               "ietf-l3-unicast-topology:l3-node-attributes": {
                 "router-id": [
                   "203.0.113.2"
                 ],
                 "prefix": [
                   {
                     "prefix":"203.0.113.2/32"
                   }
                 ],
                 "ietf-l3-te-topology:l3-te-node-attributes": {
                   "node-ref":"D2",
                   "network-ref":"example-topo-te"
                 }
               },
               "ietf-network-topology:termination-point": [
                 {
                   "tp-id":"2-0-1",
```

```
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":201
                   }
                 },
                 {
                   "tp-id":"2-1-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":211,
                     "ietf-l3-te-topology:l3-te-tp-attributes": {
                       "tp-ref":"2-1-1",
                       "network-ref":"example-topo-te"
                     }
                   }
                 },
                 {
                   "tp-id":"2-3-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":231
                   }
                 }
               ]
             },
             {
               "node-id":"D3",
               "ietf-l3-unicast-topology:l3-node-attributes": {
                 "router-id": [
                   "203.0.113.3"
                 ],
                 "prefix": [
                   {
                     "prefix":"203.0.113.3/32"
                   }
                 ],
                 "ietf-l3-te-topology:l3-te-node-attributes": {
                   "node-ref":"D3",
                   "network-ref":"example-topo-te"
                 }
               },
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   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                     "unnumbered-id":301
                   }
                 },
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   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
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                      "tp-ref":"3-1-1",
                      "network-ref":"example-topo-te"
                    }
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                },
                {
                  "tp-id":"3-2-1",
   "ietf-l3-unicast-topology:l3-termination-point-attributes": {
                    "unnumbered-id":321
                  }
                }
              ]
            }
          ],
          "ietf-network-topology:link": [
            {
              "link-id":"D1,1-2-1,D2,2-1-1",
              "source": {
                "source-node":"D1",
                "source-tp":"1-2-1"
              },
              "destination": {
                "dest-node":"D2",
                "dest-tp":"2-1-1"
              },
              "ietf-l3-unicast-topology:l3-link-attributes": {
                "metric1":"100",
                "ietf-l3-te-topology:l3-te-link-attributes": {
                  "link-ref":"D1,1-2-1,D2,2-1-1",
                  "network-ref":"example-topo-te"
                }
              }
            },
            {
              "link-id":"D2,2-1-1,D1,1-2-1",
              "source": {
                "source-node":"D2",
                "source-tp":"2-1-1"
              },
              "destination": {
                "dest-node":"D1",
                "dest-tp":"1-2-1"
              },
              "ietf-l3-unicast-topology:l3-link-attributes": {
                "metric1":"100",
                "ietf-l3-te-topology:l3-te-link-attributes": {
```

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                "link-ref":"D2,2-1-1,D1,1-2-1",
                "network-ref":"example-topo-te"
              }
            }
          },
          {
            "link-id":"D1,1-3-1,D3,3-1-1",
            "source": {
              "source-node":"D1",
              "source-tp":"1-3-1"
            },
            "destination": {
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              "dest-tp":"3-1-1"
            },
            "ietf-l3-unicast-topology:l3-link-attributes": {
              "metric1":"100",
              "ietf-l3-te-topology:l3-te-link-attributes": {
                "link-ref":"D1,1-3-1,D3,3-1-1",
                "network-ref":"example-topo-te"
              }
            }
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          {
            "link-id":"D3,3-1-1,D1,1-3-1",
            "source": {
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              "source-tp":"3-1-1"
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              }
            }
          },
          {
            "link-id":"D2,2-3-1,D3,3-2-1",
            "source": {
              "source-node":"D2",
              "source-tp":"2-3-1"
            },
            "destination": {
```

```
                "dest-node":"D3",
                "dest-tp":"3-2-1"
              },
              "ietf-l3-unicast-topology:l3-link-attributes": {
                "metric1":"100"
              }
            },
            {
              "link-id":"D3,3-2-1,D2,2-3-1",
              "source": {
                "source-node":"D3",
                "source-tp":"3-2-1"
              },
              "destination": {
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                "dest-tp":"2-3-1"
              },
              "ietf-l3-unicast-topology:l3-link-attributes": {
                "metric1":"100"
              }
            }
          ]
        }
      ]
    }
  }
```


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