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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 [[RFC6020](#)] data model for describing the relationship between a layer 3 network topology [[YANG-L3-TOP0](#)] and a TE topology [[YANG-TE-TOP0](#)].

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



### **[1.1. Terminology](#)**

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#), [[RFC2119](#)].

The following terms are defined in [[RFC6020](#)] and are not redefined here:

- o augment
- o data model
- o data node

## **[2. Modeling Considerations](#)**

### **[2.1. Relationship Between Layer 3 Topology and TE topology](#)**

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

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

### **[2.2. Relationship Modeling](#)**

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

## **[3. Model Structure](#)**

The model tree structure proposed by this document is as shown below:

```
module: ietf-l3-te-topology
```

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

#### 4. Layer 3 TE Topology YANG Module

```
<CODE BEGINS> file "ietf-l3-te-topology@2016-03-17.yang"
module ietf-l3-te-topology {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-l3-te-topology";
  prefix "l3te";

  import ietf-network {
    prefix "nw";
  }
  import ietf-network-topology {
    prefix "nt";
  }
  import ietf-l3-unicast-igp-topology {
    prefix "l3t";
  }
  import ietf-te-topology {
    prefix "tet";
  }
}
```

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

revision "2016-03-17" {
    description "Initial revision";
    reference "TBD";
}

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

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

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

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

```
    uses l3-te-node-attributes;
  }

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

  augment "/nw:networks/nw:network/nt:link/l3t:igp-link-attributes" {
    when "../..../nw:network-types/l3t:l3-unicast-igp-topology/l3-te" {
      description "Augment only for L3 unicast 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. Security Considerations

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

## 6. References

### 6.1. Normative References

- [RFC6020] Bjorklund, M., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", [RFC 6020](#), October 2010.
- [RFC6021] Schoenwaelder, J., "Common YANG Data Types", [RFC 6021](#), October 2010.
- [RFC6241] Enns, R., Bjorklund, M., Schoenwaelder, J., and A. Bierman, "Network Configuration Protocol (NETCONF)", [RFC 6241](#), June 2011.
- [RFC2234] Crocker, D. and Overell, P.(Editors), "Augmented BNF for Syntax Specifications: ABNF", [RFC 2234](#), Internet Mail Consortium and Demon Internet Ltd., November 1997.
- [YANG-L3-TOPO] Clemm, A., et al., "A YANG Data Model for Layer 3 Topologies", [draft-ietf-i2rs-yang-l3-topology](#), (Work in Progress).
- [YANG-TE-TOPO] Liu, X., et al., "YANG Data Model for TE Topologies", [draft-ietf-teas-yang-te-topo](#), Work in Progress).

### 6.2. Informative References

- [RFC6087] Bierman, A., "Guidelines for Authors and Reviewers of YANG Data Model Documents", [RFC 6087](#), January 2011.

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