Yang Data Model for TE Topologies
draft-ietf-teas-yang-te-topo-11


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Summary of Changes

- Allowed multiple instances of inter-layer-lock-id on a termination point.
- Added missing TTPs to underlay tunnel.
- Added name, admin-status, oper-status to LTP and TTP.
- Handling of connectivity-matrix labels for regen, splitting and merging.
- Type and grouping sharing with TE tunnel model.
- Improved TE generic bandwidth modeling.
- Addressed YANG doctor’s review comments.
- Updated to NMDA style with “-state” module.
Inter Layer Lock ID

- Allow multiple instances of inter-layer-lock-id on a tunnel termination point or a link termination point.
- Changed from leaf to leaf-list

```
augment /nw:networks/nw:network/nw:node:
  +--rw te-node-id?   te-types:te-node-id  
  +--rw te!
    +--rw tunnel-termination-point* [tunnel-tp-id]
      +--rw tunnel-tp-id    binary
      +--rw admin-status?   te-types:te-admin-status
      +--rw name?           string
      +--rw switching-capability? identityref
      +--rw encoding?       identityref
      +--rw inter-layer-lock-id?      uint32
      +--rw inter-layer-lock-id*       uint32
      +--rw protection-type?          identityref

augment /nw:networks/nw:network/nw:node/nt:termination-point:
  +--rw te-tp-id?   te-types:te-tp-id
  +--rw te!
    +--rw admin-status?   te-types:te-admin-status
    +--rw name?           string
    +--rw inter-layer-lock-id?      uint32
    +--rw inter-layer-lock-id*       uint32
```
Multi-layer Topology

- Inter-layer lock IDs “IL-1” and “IL-2” are set on TTP-3

Tunnel Termination Point (TTP)
- Server Link Termination Point (S-LTP)
- Client Link Termination Point (C-LTP)
Added name, admin-status, oper-status to LTP and TTP.

- Received feedback from implementers, asking a few attributes on LTP and TTP for convenience.

```xml
augment /nw:networks/nw:network/nw:node/nt:termination-point:
  +--rw te-tp-id?  te-types:te-tp-id
  +--rw te!
    +--rw admin-status?  te-types:te-admin-status
    +--rw name?  String
    .......
    +--ro oper-status?  te-types:te-oper-status

augment /nw:networks/nw:network/nw:node:
  +--rw te-node-id?  te-types:te-node-id
  +--rw te!
    +--rw tunnel-termination-point* [tunnel-tp-id]
      +--rw tunnel-tp-id  binary
      +--rw admin-status?  te-types:te-admin-status
      +--rw name?  string
      +--rw switching-capability?  identityref
      .......
      +--ro oper-status?  te-types:te-oper-status
```
Underlay Tunnel TTP

TE-Link B-C in Topology-Blue is catered to by underlay TE-path \{B'-O-M-N-P-C'\} in Topology-Red

TE-Link E-F in Topology-Blue is catered to by underlay TE-path \{E'-Q-O-P-R-F'\} in Topology-Red
Added TTPs to Underlay Tunnel

- Allowed to specify tunnel termination points for under tunnels

```xml
augment /nw:networks/nw:network/nw:node:
    +-rw te-node-id?  te-types:te-node-id
    +-rw te!
        +-rw te-node-attributes
            |  +-rw connectivity-matrices
            |  |  +-rw connectivity-matrix* [id]
            |  |  |  +-rw underlay {te-topology-hierarchy}?
            |  |  |  |  +-rw tunnel-termination-points
            |  |  |  |  |  +-rw source?  binary
            |  |  |  |  |  +-rw destination?  binary
        +-rw tunnel-termination-point* [tunnel-tp-id]
            +-rw local-link-connectivities
                |  +-rw is-allowed?  boolean
                |  +-rw underlay {te-topology-hierarchy}?
                |  |  +-rw protection-type?  identityref
                |  |  +-rw tunnel-termination-points
                |  |  |  +-rw source?  binary
                |  |  |  +-rw destination?  binary

augment /nw:networks/nw:network/nt:link:
    +-rw te!
        +-rw te-link-attributes
            |  +-rw underlay {te-topology-hierarchy}?
            |  |  +-rw protection-type?  identityref
            |  |  +-rw tunnel-termination-points
            |  |  |  +-rw source?  binary
            |  |  |  +-rw destination?  binary
```
Handling of Connectivity-matrix Label

- Label sets on two termination points may be different ($\{1,5,6\} \nleq \{1,5,8\}$).

Connectivity matrix entry: LTP-6/labels{1,5,6} $\nleq$ LTP-1/labels{1,5,8}

Regenerator, which changes label on the path
Handling of Connectivity-matrix Label

- Moved label-restriction from the connectivity matrix entry to the termination points.

```yaml
augment /nw:networks/nw:network/nw:node:
  +--rw te-node-id?   te-types:te-node-id
  +--rw te!
    +--rw te-node-template*   leafref {template}?
    +--rw te-node-attributes
      |  +--rw admin-status?   te-types:te-admin-status
      |  +--rw connectivity-matrices
      |     +--rw connectivity-matrix* [id]
      |     |  +--rw id                          uint32
      |     |  +--rw from
      |     |     |  +--rw tp-ref?              leafref
      |     |     |  +--rw label-restriction* [inclusive-exclusive label-start]
      |     |     |     +--rw inclusive-exclusive enumeration
      |     |     |     +--rw label-start             rt-types:generalized-label
      |     |     |     +--rw label-end?             rt-types:generalized-label
      |     |     |     +--rw range-bitmap?          Binary
      |     +--rw to
      |     |  +--rw tp-ref?              leafref
      |     |  +--rw label-restriction* [inclusive-exclusive label-start]
      |     |     +--rw inclusive-exclusive enumeration
      |     |     +--rw label-start             rt-types:generalized-label
      |     |     +--rw label-end?             rt-types:generalized-label
      |     |     +--rw range-bitmap?          Binary
      |  +--rw is-allowed?                 boolean
      |     +--rw label-restriction* [inclusive-exclusive label-start]
```
Type and Grouping Sharing with TE Tunnel Model

- Defined some shared types and groupings in ietf-te-types.yang to share between TE topology model and TE tunnel model.

- The followings groupings have been used in recent topology model for underlay tunnel modeling:
  - path-constraints
  - optimizations
  - computed-path-properties
Improved TE Generic Bandwidth Modeling

- Defined as a grouping with a choice for different technologies to use different cases.
- A few well-known technology cases are defined, while allowing future extensions.

```plaintext
+--rw te-bandwidth
   +--rw (technology)?
   |   +--:(psc)
   |     |   +--rw psc?     rt-types:bandwidth-ieee-float32
   |   +--:(otn)
   |     |   +--rw otn* [rate-type]
   |     |     |   +--rw rate-type    identityref
   |     |     |   +--rw counter?     uint16
   |   +--:(lsc)
   |     |   +--rw wdm* [spectrum slot]
   |     |     |   +--rw spectrum    identityref
   |     |     |   +--rw slot        int16
   |     |     |   +--rw width?      uint16
   +--:(generic)
     +--rw generic?    te-bandwidth
```
Addressed YANG Doctor’s Review Comments

- Removed a few “presence” statements on the “underlay” containers, and used the “enable/disable” leaves instead.
- Fixed several terminology inconsistencies in the draft.
- Removed some unnecessary groupings.
- Changed the model structure to NMDA compatible with a companion “-state” module. (More on the next slide)
NMDA Guidelines

- NMDA guidelines were published at https://tools.ietf.org/html/draft-dsdt-nmda-guidelines-01
  - Models that require immediate "in use" and "system created" information SHOULD be structured for NMDA.
  - A non-NMDA version of these models SHOULD exist, either an existing model or a model created either by hand or with suitable tools that mirror the current modeling strategies.

```yaml
module example-thermostat {
  namespace "tag:ietf:example:thermostat";
  prefix "thermo";
  container thermostat {
    leaf high-temperature {
      description "High temperature threshold";
      type int;
    }
    leaf low-temperature {
      description "Low temperature threshold";
      type int;
    }
    leaf current-temperature {
      description "Current temperature reading";
      type int;
      config false;
    }
  }
}

module example-thermostat-state {
  namespace "tag:ietf:example:thermostat-state";
  prefix "thermo-state";
  container thermostat {
    config false;
    leaf high-temperature {
      description "High temperature threshold";
      type int;
    }
    leaf low-temperature {
      description "Low temperature threshold";
      type int;
    }
    leaf current-temperature {
      description "Current temperature reading";
      type int;
    }
  }
}
```
TE Topology Model Style Considerations

- Maintain sufficient modeling capabilities, including “config” and “state” information.
  - To move to NMDA, the “-state” module is needed.
  - To build the “-state” module, I2RS base topology model needs to be updated first.

- Be feature-rich, clear, efficient, and user-friendly.

- Progress this document without delay.

- Minimal impacts to implementations.

- Implementable now, before NMDA protocol updates.

- Have a migration path to move to NMDA structure.
Updated to NMDA with a “-state” Module

- I2RS topology model has agreed to update to NMDA with a “-state” module.
- TE topology model has been updated to NMDA with a “-state” module.
  - Tried to share groupings between the NMDA module and the “-state” module.
  - Any YANG statement with name space prefix, e.g. XPath, cannot be shared.
  - YANG grouping does not allow parameters, so that many groupings cannot be shared between the two modules, without re-structuring.
- After the restructuring, the sizes of YANG modules are:
  - Before NMDA: ~1950 lines
  - NMDA: ~1940 lines
  - “-state” module: ~300 lines
Updated to NMDA with a “-state” Module

module: ietf-network
  +--rw networks
    +--rw network* [network-id]
      +--rw tet:provider-id?       te-types:te-global-id
      +--rw tet:client-id?         te-types:te-global-id
      +--rw tet:te-topology-id?    te-types:te-topology-id
      +--rw tet:te!
        +--rw tet:preference?      uint8
    | +--rw node* [node-id]
    | | +--rw node-id               node-id
    | | +--rw tet:te-node-id?       te-types:te-node-id
    | | +--rw tet:te!
    |    | +--rw tet:config
    |    | | +--rw tet:te-node-attributes
    |    | | +--ro tet:state
    |    | | +--ro tet:te-node-attributes
    |    | +--rw tet:te-node-attributes
    | | +--rw lnk:termination-point* [tp-id]
    | | | +--rw lnk:tp-id               tp-id
    | | | +--rw tet:te!
    | | | | +--rw tet:config
    | | | | | +--rw tet:admin-status?    te-types:te-admin-status
    | | | | | +--ro tet:state
    | | | | | +--ro tet:admin-status?    te-types:te-admin-status
    | | | | +--rw tet:admin-status?     te-types:te-admin-status
    | | +--rw lnk:link* [link-id]
    | | | +--rw lnk:source
    | | | +--rw lnk:destination
    | | | +--rw tet:te!
    | | | +--rw tet:te!
    | | | | +--rw tet:config
    | | | | | +--rw tet:te-link-attributes
    | | | | | +--ro tet:state
    | | | | | +--ro tet:te-link-attributes
    | | | | +--rw tet:te-link-attributes

Next Steps

- Ready for WG last call
Yang Data Model for Layer 3 TE Topologies

draft-liu-teas-yang-l3-te-topo-04

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Augmentation Hierarchy

- L3 TE Topology augments L3 Topology and references TE Topology.
- Packet extension module augments ietf-te-topology.
Model Reorganizations

- Modules ietf-te-topology-packet and ietf-l3-te-topology have been updated to NMDA with a “-state” module.
- Grouping sharing does not cause problems, because these two modules do not use XPath statements in groupings.
- The size comparison of ietf-te-topology-packet:
  - Before NMDA: 285 lines
  - NMDA: 244 lines
  - “-state” module: 207 lines
- The size comparison of ietf-l3-te-topology:
  - Before NMDA: 144 lines
  - NMDA: 144 lines
  - “-state” module: 74 lines
Next Steps

- Request further review.
- Ask for WG adoption.
Yang Data Model for SR and SR TE Topologies

draft-liu-teas-yang-sr-te-topo-03

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SR (Segment Routing) Topology

- Augment layer 3 network topology model
SR (Segment Routing) TE Topology

- Multiple inheritance:
  - Is both SR topology and layer 3 TE topology model.
  - Uses multiple network types: “l3-te” and “sr”.

Diagram:
- SR Topology
  - ietf-sr-topology
- Layer 3 TE Topology
  - ietf-l3-te-topology
- SR TE Topology
Model Reorganizations

- Module ietf-sr-topology has been updated to NMDA with a “-state” module.
- Grouping sharing does not cause problems, because this module does not use Xpath statements in groupings.
- The size comparison of ietf-sr-topology:
  - Before NMDA: 231 lines
  - NMDA: 211 lines
  - “-state” module: 94 lines
Next Steps

- Request further review.
- Ask for WG adoption.