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


Xufeng Liu (Jabil)
Vishnu Pavan Beeram (Juniper Networks)
Igor Bryskin (Huawei Technologies)
Tarek Saad (Cisco)
Himanshu Shah (Ciena)
Oscar Gonzalez De Dios (Telefonica)

Contributors:
Sergio Belotti (Nokia)
Dieter Beller (Nokia)
Carlo Perocchio (Ericsson)
Italo Busi (Huawei Technologies)
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
Multi-layer Topology

- Inter-layer lock IDs “IL-1” and “IL-2” are set on TTP-3
Added name, admin-status, oper-status to LTP and TTP.

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

```plaintext
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
```
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

```
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\} \nsimeq \{1,5,8\}).
Handling of Connectivity-matrix Label

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

```
 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]
            | | | +--rw inclusive-exclusive  enumeration
            | | | +--rw label-start  rt-types:generalized-label
            | | | +--rw label-end?  rt-types:generalized-label
            | | +--rw range-bitmap?  binary
```
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.

```
+-rw te-bandwidth
  +--rw (technology)?
  |  +-rw (psc)
  |     |  +--rw psc?  rt-types:bandwidth-ieee-float32
  |     |  +--rw otn* [rate-type]
  |     |     |  +--rw rate-type  identityref
  |     |     |  +--rw counter?  uint16
  |  +--rw (otn)
  |     |  +--rw otn* [rate-type]
  |     |     |  +--rw rate-type  identityref
  |     |     |  +--rw counter?  uint16
  +--rw (lsc)
  |  +--rw wdm* [spectrum slot]
  |     |  +--rw spectrum  identityref
  |     |  +--rw slot  int16
  |     |  +--rw width?  uint16
  +--rw (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;
    }
  }
}
```

```yaml
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

Xufeng Liu (Jabil)
Vishnu Pavan Beeram (Juniper Networks)
Igor Bryskin (Huawei Technologies)
Tarek Saad (Cisco)
Himanshu Shah (Ciena)
Oscar Gonzalez De Dios (Telefonica)
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

Xufeng Liu (Jabil)
Vishnu Pavan Beeram (Juniper Networks)
Igor Bryskin (Huawei Technologies)
Tarek Saad (Cisco)
Himanshu Shah (Ciena)
Stephane Litkowski (Orange)
SR (Segment Routing) Topology

- Augment layer 3 network topology model

Layer 3 Network Topology
ietf-l3-unicast-topology

Segment Routing Topology
ietf-sr-topology
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.