Yang Data Model for TE Topologies

draft-ietf-teas-yang-te-topo-04


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Summary of Changes

- Alignment with new I2RS network topology model (version 2015-12-09).
- Submitted separate draft for schedule.
- Split the packet attributes to an augmentation module.
- In node, added alt-information-sources.
- Support for request containing multiple topologies from client to provider. Added an attribute "preference" in topology.
- Alignment with L3 network topology model.
- Worked with TE Yang model DT to align TE Tunnel modeling.
- Added support for tunnel termination point.
Alignment with New I2RS Network Topology Model

```
module: ietf-network
  +--rw networks
    |   +--rw network* [network-id]
    |       +--rw network-types
    |       +--rw network-id network-id
    |       +--rw supporting-network* [network-ref]
    |           +--rw network-ref leafref
    |       +--rw node* [node-id]
    |           +--rw node-id node-id
    |           +--rw supporting-node* [network-ref node-ref]
    |               +--rw network-ref leafref
    |               +--rw node-ref leafref

augment /nw:networks:
  +--rw te!
  +--rw templates
augment /nw:networks/nw:network:
  +--rw te!
    +--rw provider-id te-global-id
    +--rw client-id te-global-id
    +--rw te-topology-id te-topology-id
    +--rw config
    +--ro state
augment /nw:networks/nw:network/nw:node:
  +--rw te!
    +--rw te-node-id te-node-id
    +--rw config
    +--ro state
augment /nw:networks/nw:network/nt:link:
  +--rw te!
    +--rw config
    +--ro state
```
Submitted Separate Draft for Schedule

- Submitted draft-liu-netmod-yang-schedule-00
  - Has wider applicability.
  - Will present it to Netmod working group.
Split the Packet Attributes to an Augmentation Module

- **Base TE Topology Model Is Technology Agnostic**
  - Packet switching model augments base model.
  - **Packet switching model covers packet switch attributes.**

```
module: ietf-te-topology-psc
Augment /nw:networks/nw:network/nt:link/tet:te/tet:config/tet:te-link-
attributes/tet:interface-switching-capability:
  +--rw packet-switch-capable
    +--rw minimum-lsp-bandwidth?   decimal64
    +--rw interface-mtu?           Uint16
augment /nw:networks/nw:network/nt:link/tet:te/tet:state/tet:te-link-
attributes/tet:interface-switching-capability:
  +--ro packet-switch-capable
    +--ro minimum-lsp-bandwidth?   decimal64
    +--ro interface-mtu?           Uint16
augment /nw:networks/nw:network/nt:link/tet:te/tet:state/tet:alt-information-
sources/tet:interface-switching-capability:
  +--ro packet-switch-capable
    +--ro minimum-lsp-bandwidth?   decimal64
    +--ro interface-mtu?           uint16
augment /tet:te-link-event/tet:te-link-attributes/tet:interface-switching-capability:
  +---- packet-switch-capable
    +---- minimum-lsp-bandwidth?   decimal64
    +---- interface-mtu?           uint16
```
In Node, Added
alt-information-sources

```
augment /nw:networks/nw:network/nw:node:
  +--rw te!
  +--ro state
     |  +--ro information-source?
     |      enumeration
     |  +--ro information-source-state
     |     |  +--ro credibility-preference? uint16
     |     |  +--ro topology
     |     |     |  +--ro provider-id-ref? leafref
     |     |     |  +--ro client-id-ref? leafref
     |     |     |  +--ro te-topology-id-ref? leafref
     |     |  +--ro network-id-ref? leafref
     |     |     |  +--ro routing-instance? string
     |  +--ro alt-information-sources* [information-source]
```
Support for Request Containing Multiple Topologies from Client to Provider

- Added an attribute "preference" in topology.

```
module: ietf-te-topology
augment /nw:networks/nw:network:
  +--rw te!
    +--rw config
      |    +--rw preference?  uint8
```
Alignment with L3 Network Topology Model

- Submitted separate draft
draft-liu-teas-yang-l3-te-topo-00.

```yaml
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
```
Worked with TE Yang Model DT to Align TE Tunnel Modeling

- Both models can be on either device or controller.
- Both models share the same terminologies and types.
- Both models cross reference each other whenever needed.
Support for Tunnel Termination Point

module: ietf-te-topology
augment /nw:networks/nw:network/nw:node:
  +-rw te!
    +-rw te-node-id                       te-node-id
    +-rw tunnel-termination-point* [tunnel-tp-id]
      +-rw tunnel-tp-id       binary
      +-ro state
        +-ro switching-capability? identityref
        +-ro encoding?          identityref
        +-ro termination-capability* [link-tp]
          +-ro link-tp     leafref
Modeling Abstractions
Modeling Abstractions

- Network Facing Line Card
- Termination Device with Client Ports
- Blocking Switching component

Abstraction

Tunnel Termination Point (TTP)
- Server Link Termination Point (S-LTP)
- Client Link Termination Point (C-LTP)
Modeling Abstractions

Triangle: Tunnel Termination Point (TTP)
Circle: Server Link Termination Point (S-LTP)
Circle: Client Link Termination Point (C-LTP)
Multi-layer Transformations

N1 -> N2 -> N3 -> N4 -> N5 -> N6

client layer link

EP<sub>11</sub> - N2 - EP<sub>61</sub>

client layer

server layer

TTP

N1

N2

N3

N4

N5

N6
Multi-layer Transformations

Tunnel Termination Point (TTP)
Server Link Termination Point (LTP)
Client Link Termination Point (LTP)
Option 1: Transitional Link
Multi-layer node decomposition
Example: L1+L0 OTN switch

Dual-layer node N2 is decomposed into 2 logical sub-nodes: N2_L1 and N2_L0
Transitional link between N2_L1 and N2_L0 with following TPs on the link ends:
N2_L1 side: set of ODUk TPs, N2_L0 side: single OCh TP
Example: 100G OCh TP → ODUk TPs {80 x ODU0, 40 x ODU1, 10 x ODU2, 2 x ODU3, 1 x ODU4}
Option 1: Transitional Link

- Tunnel Termination Point (TTP)
- Server Link Termination Point (S-LTP)
- Client Link Termination Point (C-LTP)

![Diagram of network topology with nodes labeled as TTP-1, TTP-2, LTP-1, LTP-6, etc., and arrows indicating logical TP and Transformation]
Option 1: Transitional Link

- Decompose one node into two logical nodes.
- Treat Tunnel TP the same as Link TP.
- Modeling changes:
  - On Link TP: need to have an attribute for switch-layer.
  - On Link: have a flag to indicate the link is transitional.
Option 1: Transitional Link

- Transition links are going across layers, asking path computations on both layer to be aware.
- Causing a more complex topology, because the additional nodes and links, in mixed layers.
- Need a mechanism to decompose nodes, generate links and assign attributes.
- Existing TE link attributes are not applicable to transition links.
Option 2: Inter-layer Locks

- Tunnel Termination Point (TTP)
- Server Link Termination Point (S-LTP)
- Client Link Termination Point (C-LTP)

- Describe client-server layer adaptation relationship.
- It is an association of M client layer LTPs and N server layer TTPs.
- Each association is uniquely identified by an inter-layer lock ID.

<table>
<thead>
<tr>
<th>TTP</th>
<th>IL</th>
<th>C-LTP</th>
<th>IL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTP1</td>
<td>IL-1</td>
<td>C-LTP-1</td>
<td>IL-1</td>
</tr>
<tr>
<td>TTP2</td>
<td>IL-2, IL-3</td>
<td>C-LTP-2</td>
<td>IL-1</td>
</tr>
<tr>
<td>TTP3</td>
<td>IL-2</td>
<td>C-LTP-3</td>
<td>IL-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C-LTP-4</td>
<td>IL-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C-LTP-5</td>
<td>IL-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C-LTP-6</td>
<td>IL-3</td>
</tr>
</tbody>
</table>
Option 2: Inter-layer Locks

- Do not decompose nodes.

- Modeling changes:
  - On Link TP and TTP: add an attribute for inter-layer-lock-id.

- Inter-layer properties are separate and independent from TE links, having different attributes from TE link attributes.

- Inter-layer properties are used only for multi-layer, not for single layer cases.
Modeling Considerations

- The inter-layer lock approach and transition-link approach can both be supported at the same time.
- The two approaches can co-exist, with some parts of the system modeled by one approach and other parts modeled by another approach.
Topography Layer Separation

- Besides putting multiple layers into one topology, TE topology model allows to separate server and client layer networks into two independent TE topologies.
Topology Layer Separation

Node-1

Link-12

Node-2

TE-Tunnel-1

Node-3

Link-23

Client Layer TE Link
Topology Layer Separation

- In such a case, a transitional link cannot be used between LTP-11 and TTP-1.
Next Steps

- Address review comments.
  - To Do List:
- Request further review.