Yang Data Model for TE Topologies
draft-ietf-teas-yang-te-topo-08


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Summary of Changes

- Added modeling of supporting tunnel termination point.
- Added support for specifying default attributes of connectivity matrix and LLCL.
- Added NSRLG (Not Sharing Risk Link Group).
- Allowed configuration of one or more underlay tunnels.
- Provided an option to set underlay tunnel shared or dedicated.
- Improved client layer adaption to support more then two layers in a multi-layer topology.
- Clarified customized and abstract topologies in the draft text.
Supporting Tunnel Termination Point

Abstract TE topology 3

Domain 1 TE topology

Domain 2 TE topology

Supported by

Tunnel Termination Point

C-11

C-12

AN11

C-21

C-22

C-23

S3

S5

S8

S9

S7

S23

S24

S28

S27

S29

S3

S5

S4

S8

S9

S7

S5
Each tunnel termination point may be supported by one or more tunnel termination points in the supporting node or a node in the underlay topology.

```
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 supporting-tunnel-termination-point* [node-ref tunnel-tp-ref]
      +--rw node-ref inet:uri
      +--rw tunnel-tp-ref binary
```
Connectivity Matrix

- Be consistent with other models, and support defaults.

```
augment /nw:networks/nw:network/nw:node:
  +-rw te!
    +-rw config
      |  +-rw te-node-attributes
      |      +-rw connectivity-matrices
      |      |      +-rw number-of-entries?  uint16
      |      |      +-rw is-allowed?        boolean
      |      |      +-rw label-restriction* [inclusive-exclusive label-start]
      |      |      +-rw underlay! {te-topology-hierarchy}?
      |      |      +-rw max-lsp-bandwidth* [priority]
      |      |      +-rw max-link-bandwidth?  te-bandwidth
      |      |      +-rw max-resv-link-bandwidth? te-bandwidth
      |      |      +-rw unreserved-bandwidth* [priority]
      |      |      +-rw te-default-metric?   uint32
      |      |      +-rw te-delay-metric?    uint32
      |      |      +-rw te-srlgs
      |      |      |      +-rw te-nsrlgs {nsrlg}?
      |      |      |      |      +-rw connectivity-matrix* [id]
      |      |      |      |      |      +-rw id                 uint32
      |      |      |      |      |      +-rw from
      |      |      |      |      |      |      +-rw tp-ref? leafref
      |      |      |      |      |      +-rw to
      |      |      |      |      |      |      +-rw tp-ref? leafref
      |      |      |      |      |      +-rw is-allowed? boolean
      |      |      |      |      +-rw label-restriction* [inclusive-exclusive label-start]
      |      |      |      |      +-rw underlay! {te-topology-hierarchy}?
      |      |      |      |      +-rw max-lsp-bandwidth* [priority]
      |      |      |      |      +-rw max-link-bandwidth?  te-bandwidth
      |      |      |      |      +-rw max-resv-link-bandwidth? te-bandwidth
      |      |      |      |      +-rw unreserved-bandwidth* [priority]
      |      |      |      |      +-rw te-default-metric?   uint32
      |      |      |      |      +-rw te-delay-metric?    uint32
      |      |      |      |      +-rw te-srlgs
      |      |      |      |      |      +-rw te-nsrlgs {nsrlg}?
```
LLCL (Local Link Connectivity List)

- Same reasons as Connectivity Matrix.

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 config
    | +--rw local-link-connectivities
    |   +--rw number-of-entries?  uint16
    |   +--rw is-allowed?  boolean
    |   +--rw label-restriction* [inclusive-exclusive label-start]
    |   +--rw underlay! {te-topology-hierarchy}?  
    |   +--rw max-lsp-bandwidth* [priority]
    |   +--rw max-link-bandwidth?  te-bandwidth
    |   +--rw max-resv-link-bandwidth?  te-bandwidth
    |   +--rw unreserved-bandwidth* [priority]
    |   +--rw te-default-metric?  uint32
    |   +--rw te-delay-metric?  uint32
    |   +--rw te-srlgs
    |   +--rw te-nslrags {nsrlg}?  
    |   +--rw local-link-connectivity* [link-tp-ref]
    |     +--rw link-tp-ref  leafref
    |     +--rw is-allowed?  boolean
    |     +--rw label-restriction* [inclusive-exclusive label-start]
    |     +--rw underlay! {te-topology-hierarchy}?  
    |     +--rw max-lsp-bandwidth* [priority]
    |     +--rw max-link-bandwidth?  te-bandwidth
    |     +--rw max-resv-link-bandwidth?  te-bandwidth
    |     +--rw unreserved-bandwidth* [priority]
    |     +--rw te-default-metric?  uint32
    |     +--rw te-delay-metric?  uint32
    |     +--rw te-srlgs
    |     +--rw te-nsrslgs {nsrlg}?
NSRLG (Not Sharing Risk Link Group)

- When an abstract TE link is configured, client can request the TE link to be mutually diverse disjoint with other TE links in the same topology
  - Opposite to SRLG.
  - e.g. TE Links B-C and E-F are diverse at link-disjoint level

- 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
**NSRLG Modeling**

### On TE Link

```
augment /nw:networks/nw:network/nt:link:
  +++rw te!
    +++rw config
      |  +++rw te-link-attributes
      |    |  +++rw is-abstract? empty
      |    |  +++rw underlay! {te-topology-hierarchy}?
      |    |    ......
      |    |  +++rw te-srlgs
      |    |    +++rw value* te-types:srlg
      |    |    +++rw te-srlgs {nsrlg}?
      |    |    |    +++rw id* leafref
    ++ro state
      |  +++ro te-link-attributes
      |    |  +++ro te-srlgs {nsrlg}?
      |    |    +++ro id* leafref
```

### NSRLG Definition

```
augment /nw:networks/nw:network:
  +++rw provider-id? te-types:te-global-id
  +++rw client-id?  te-types:te-global-id
  +++rw te-topology-id? te-types:te-topology-id
  +++rw te!
    +++rw config
      |  +++rw preference? uint8
      |  +++rw optimization-criterion? identityref
      |  +++rw nsrlg* [id] {nsrlg}?
      |    |    +++rw id uint32
      |    |    +++rw disjointness? bits {node, link, srlg}
```
A TE link can be requested to utilize one or more existing underlay TE tunnels.

- The underlay TE tunnels can be looked up by tunnel names in the TE tunnel model.
- The tunnel names of the underlay TE tunnels are specified in this model.

```
augment /nw:networks/nw:network/nt:link:
   +--rw te!
       +--rw config
           |   +--rw te-link-attributes
           |       +--rw underlay! {te-topology-hierarchy}?
           |           |   +--rw primary-path
           |           |   +--rw backup-path* [index]
           |           |   +--rw protection-type? uint16
           |           |   +--rw tunnels
           |           |       +--rw tunnel* [tunnel-name]
           |           |           +--rw tunnel-name string
```
Underlay Tunnel Sharing

- An underlay TE tunnels may or may not be shared by multiple TE links.
- The operator can request an underlay TE tunnels to shared or dedicated.

```xml
augment /nw:networks/nw:network/nt:link:
  +--rw te!
    +--rw config
      |   +--rw te-link-attributes
      |     +--rw underlay! {te-topology-hierarchy}?
      |     |   +--rw primary-path
      |     |     +--rw backup-path* [index]
      |     |     +--rw protection-type? uint16
      |     +--rw tunnels
      |     |   +--rw sharing? boolean
      |     |     +--rw tunnel* [tunnel-name]
      |     |     |   +--rw tunnel-name string
      |     |     |   +--rw sharing? boolean
```
Multi-layer Topology

- Transitional link approach

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

- Inter-layer lock approach

- Tunnel Termination Point (TTP)
- Server Link Termination Point (S-LTP)
- Client Link Termination Point (C-LTP)
Multi-layer Topology Modeling

- Added client layer adaptation information to tunnel termination point.
Customized and Abstract Topologies

- **Abstract TE topology**
  - contains abstract topological elements (nodes, links, tunnel termination points).

- **Customized TE topology**
  - was modified by the provider to honor a particular client’s requirements or preferences.

- A customized TE topology is not necessarily an abstract TE topology; a customized TE topology may not be abstract.

- The client ID field indicates which client the TE topology is customized for.

- A client may receive a TE topology
  - with any client ID field

- A client can customize a TE topology
  - with matching the ID, or
  - client ID == 0.
Next Steps

- Align to potential change in draft-ietf-i2rs-yang-network-topo
  - Use revised datastores.
  - No impact to TE topology model.

```
module: ietf-network
  +--rw networks
    +--rw network* [network-id]
      +--rw network-types
        +--rw network-id network-id
        +--ro server-provided? Boolean
    +--rw supporting-network* [network-ref]
      |  +--rw network-ref -> /networks/network/network-id
    +--rw node* [node-id]
      |  +--rw node-id node-id
      |  +--rw lnk:termination-point* [tp-id]
      |     +--rw lnk:tp-id tp-id
    +--rw lnk:link* [link-id]
      +--rw lnk:source
        |  +--rw lnk:source-node? leafref
        |  +--rw lnk:source-tp? leafref
      +--rw lnk:destination
        |  +--rw lnk:dest-node? leafref
        |  +--rw lnk:dest-tp? leafref
```
Next Steps

- Request further review
- WG last call
Yang Data Model for Layer 3 TE Topologies

draft-liu-teas-yang-l3-te-topo-03

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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

- Moved the performance metric related groupings to generic TE types module.
- Imported ietf-routing-types module to use common types.
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-02

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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
Collaboration with SR Yang Model

- Worked with authors of draft-ietf-spring-sr-yang
  - Updated to synch up with latest ietf-segment-routing-routing-common.yang
- Added support for SRLB

```yang
augment /nw:networks/nw:network/nw:node/l3t:l3-node-attributes:
  +--rw sr
    +--rw config
      |   +--rw srgb* [lower-bound upper-bound]
      |     |   +--rw lower-bound   uint32
      |     |   +--rw upper-bound   uint32
      |   +--rw srlb* [lower-bound upper-bound]
      |     |   +--rw lower-bound   uint32
      |     |   +--rw upper-bound   uint32
    +--rw node-capabilities
      |   +--rw transport-planes* [transport-plane]
      |     |   +--rw transport-plane   identityref
      |   +--rw readable-label-stack-depth?   uint8
```
Next Steps

- Request further review.
- Ask for WG adoption.