

Yang Data Model for TE Topologies

draft-ietf-teas-yang-te-topo-11

Github: <https://github.com/ietf-mpls-yang/te/blob/master/ietf-te-topology.yang>

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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

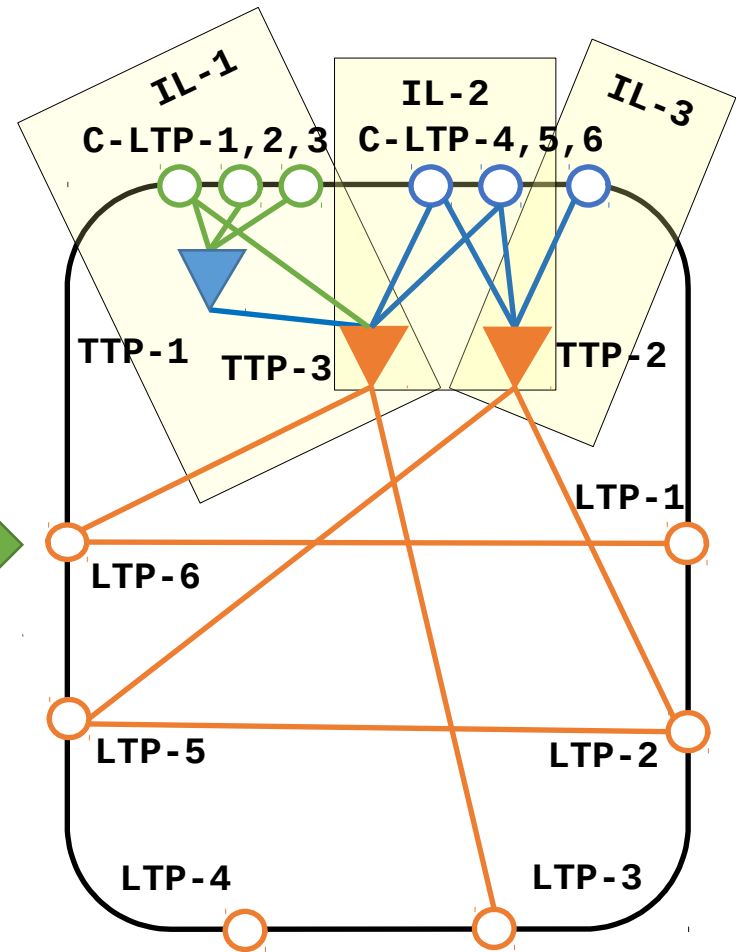
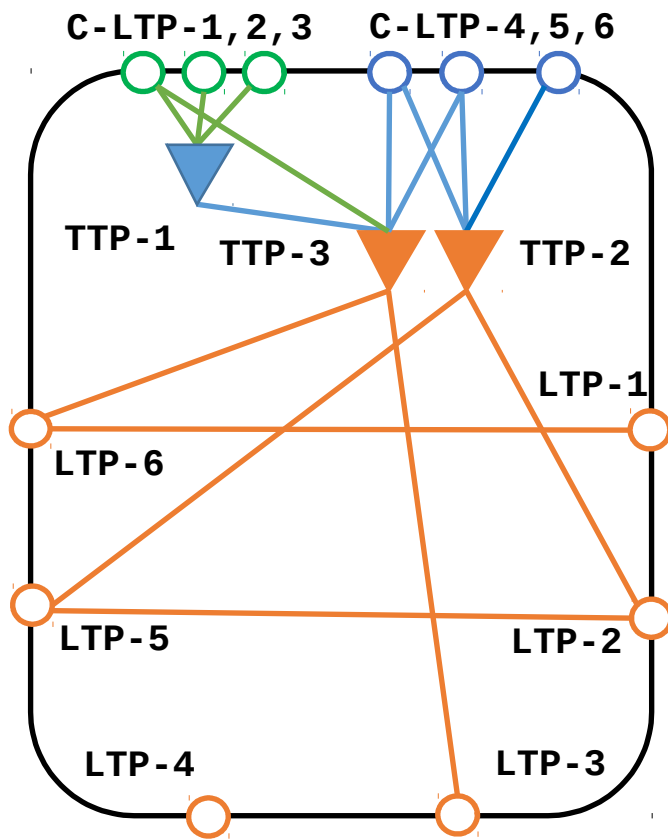
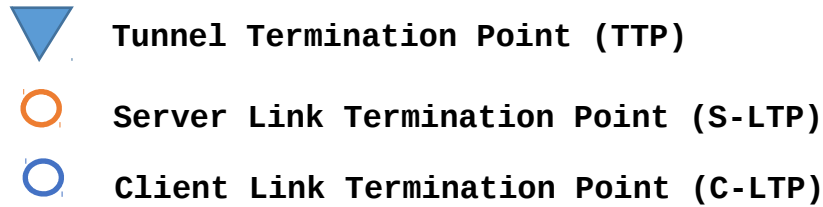
- Allow multiple instances of inter-layer-lock-id on a tunnel termination point or a link termination point.
- Changed from leaf to leaf-list

```
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



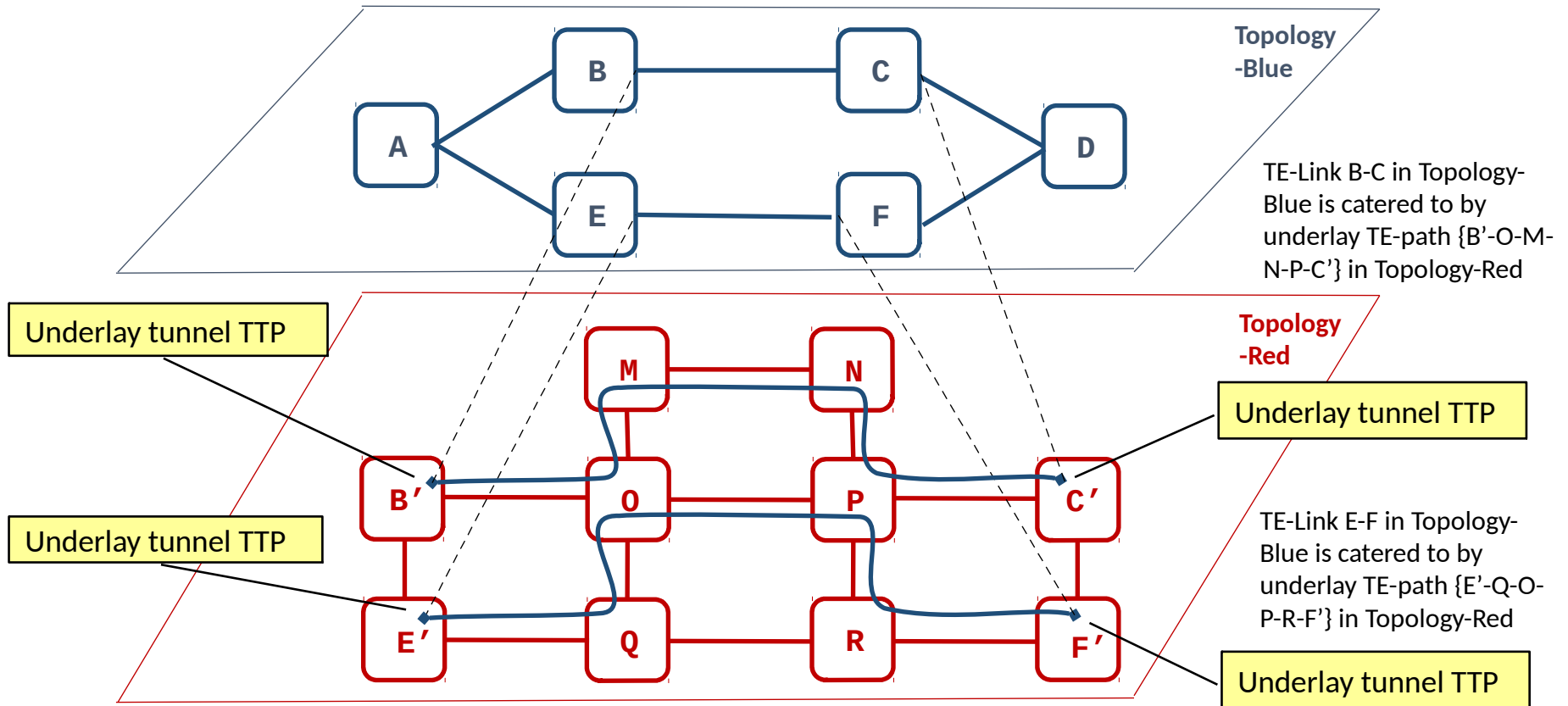
Added name, admin-status, oper-status to LTP and TTP.

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

```
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



Added TTPs to Underlay Tunnel

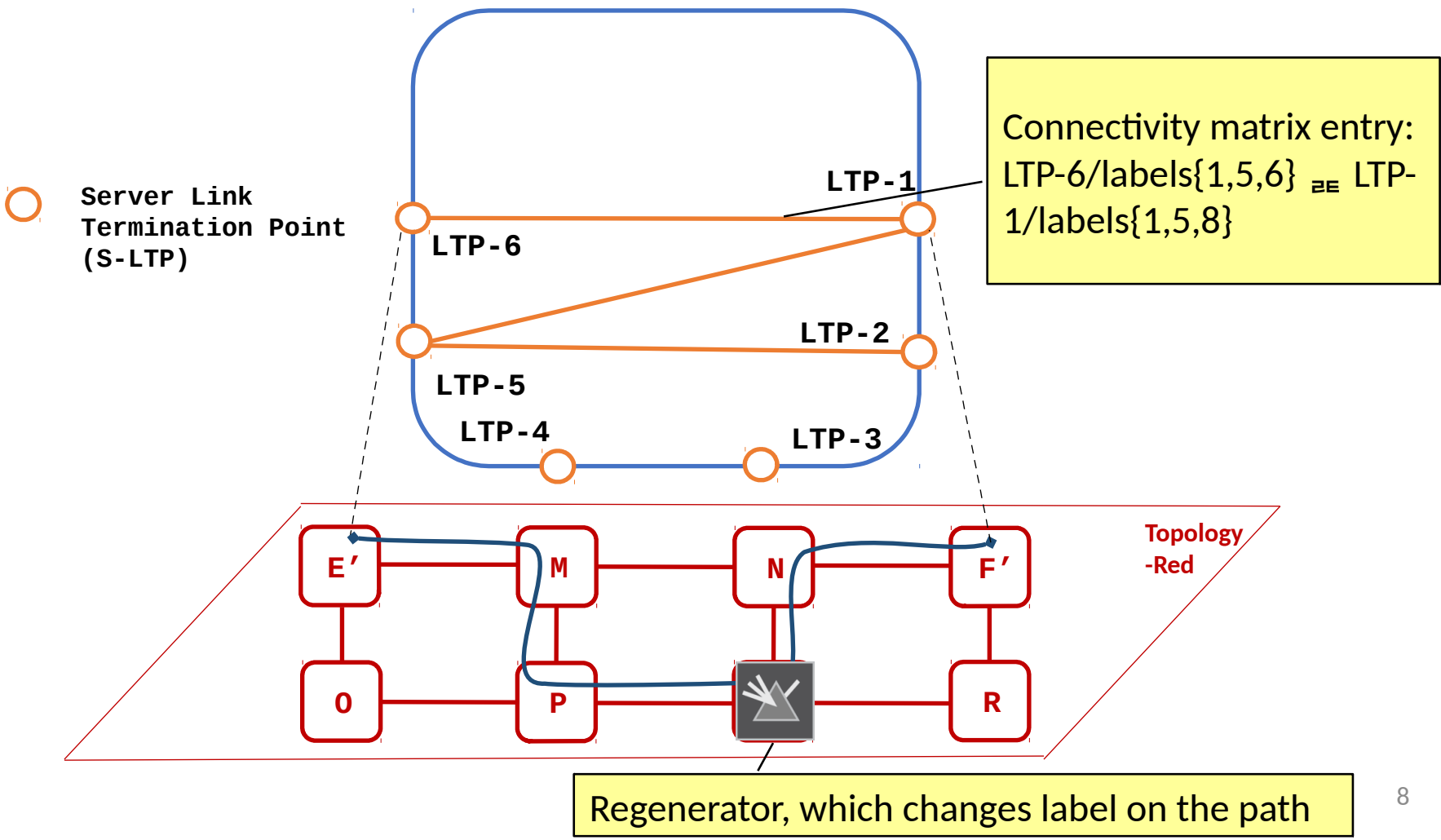
- Allowed to specify tunnel termination points for under tunnels

```
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 ($\{1,5,6\} \neq \{1,5,8\}$).



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)?
    +--:(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.

```
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-tp-id?      te-types:te-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
      |     |     |     |
      |     |     |     |   +--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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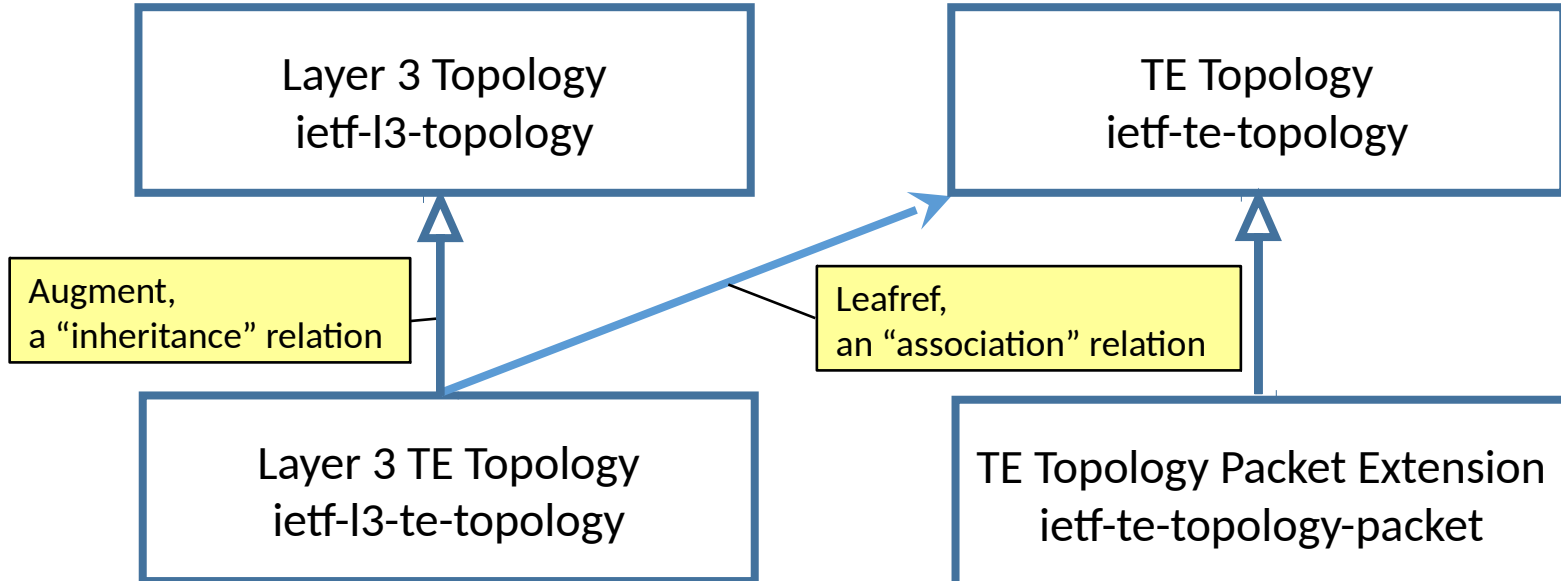
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Augmentation Hierarchy

- 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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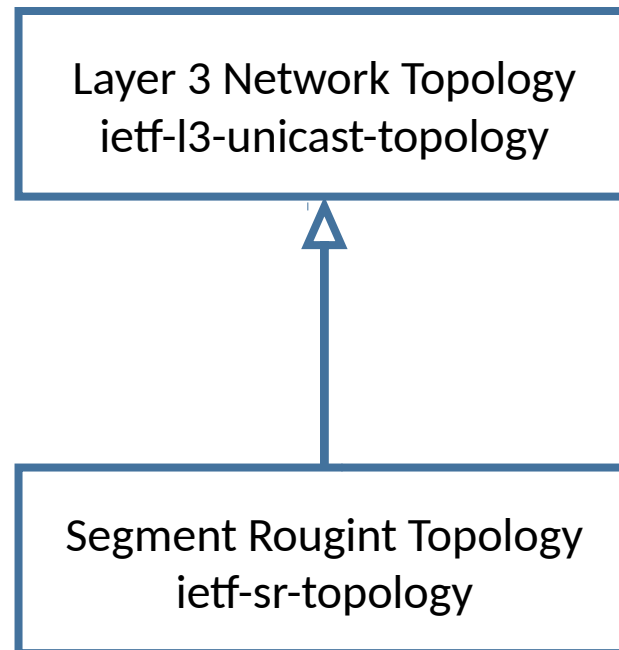
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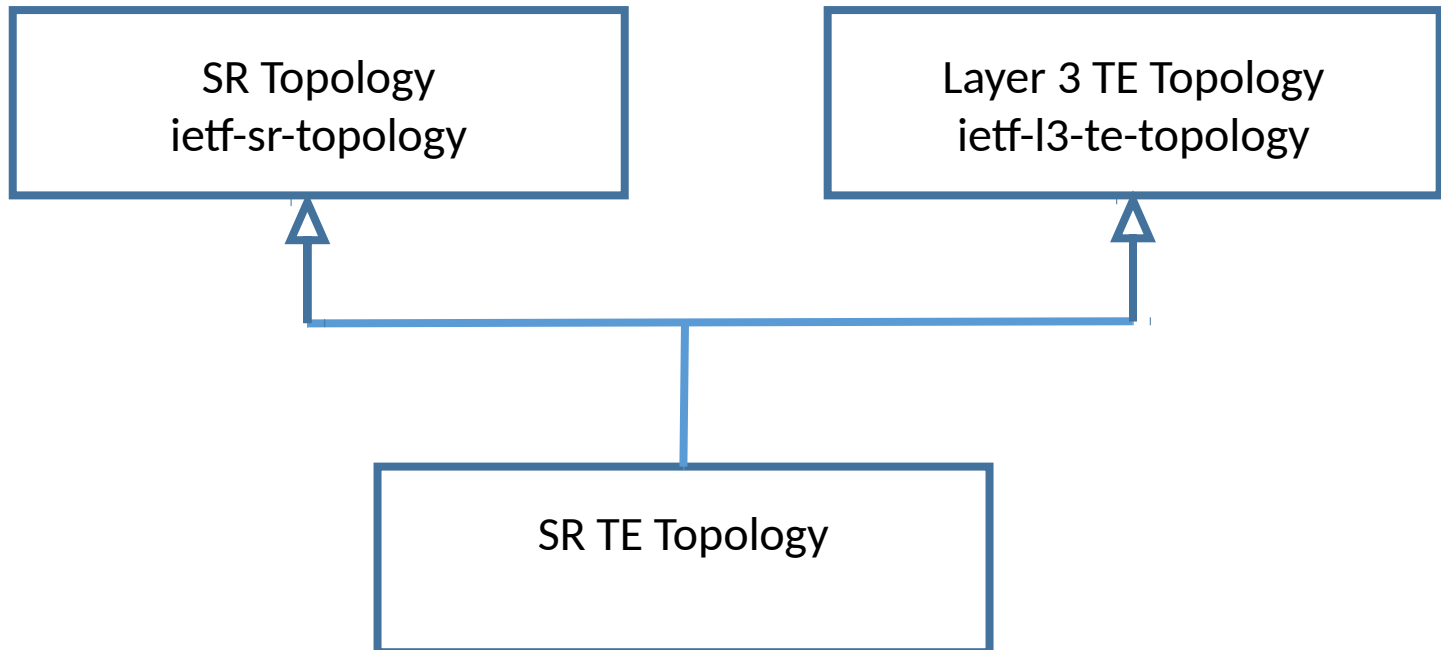
SR (Segment Routing) Topology

- 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”.



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.