

Yang Data Model for TE Topologies

draft-ietf-teas-yang-te-topo-01

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

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Summary Of Changes

▪ [Draft] Changes:

- Reworked “Introduction” and “Modeling Considerations” sections.
- Added “Characterizing TE Topologies” and “Model Applicability” sections.

▪ [Model] Changes:

- Import ietf-te-types.
- Topology Identifiers (te-topology-id, provider-id, client-id).
- Features (configuration-schedule, template, te-topology-hierarchy, te-performance-metric).
- Information Sources (source topology, source routing-instance).

TE Topology – Yang Model

- Yang Data Model for representing, retrieving and manipulating TE Topologies:
 - Technology agnostic building blocks that can be augmented and used by other technology specific TE Topology Models.

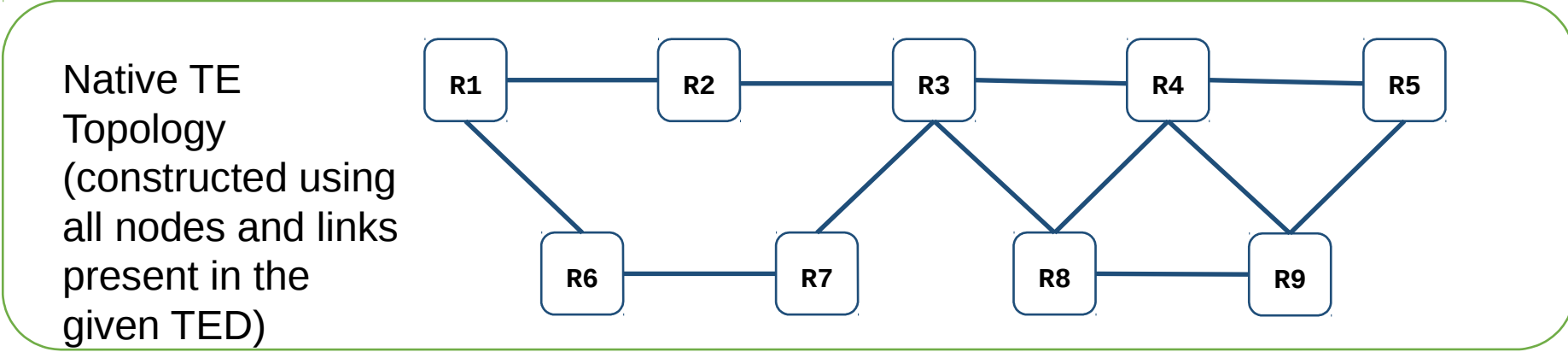
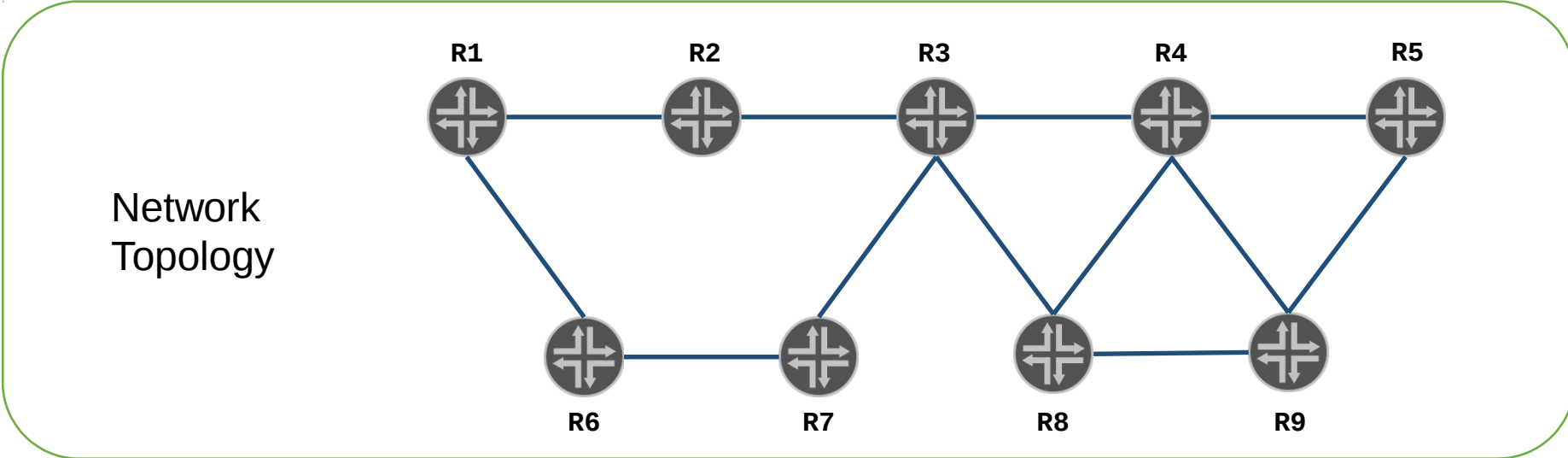
Terminology

- TED
 - Collection of TE information about all TE nodes and TE links in a given network.
- TE-Topology
 - Schematic arrangement of TE nodes and TE links in a given TED.
 - Forms the basis for a graph suitable for TE path computations.
- Native TE-Topology
 - Topology that is learnt by a given TE system via one or more information sources.
 - Topology on which path computational algorithms are run.
- Customized TE-Topology
 - Custom topology that is produced by a provider for a given client.
 - This topology typically augments the Client's Native TE-Topology.
 - Path Computational algorithms are run on the augmented Native TE Topology (not directly on the Customized TE Topology).

Characterizing TE Topologies

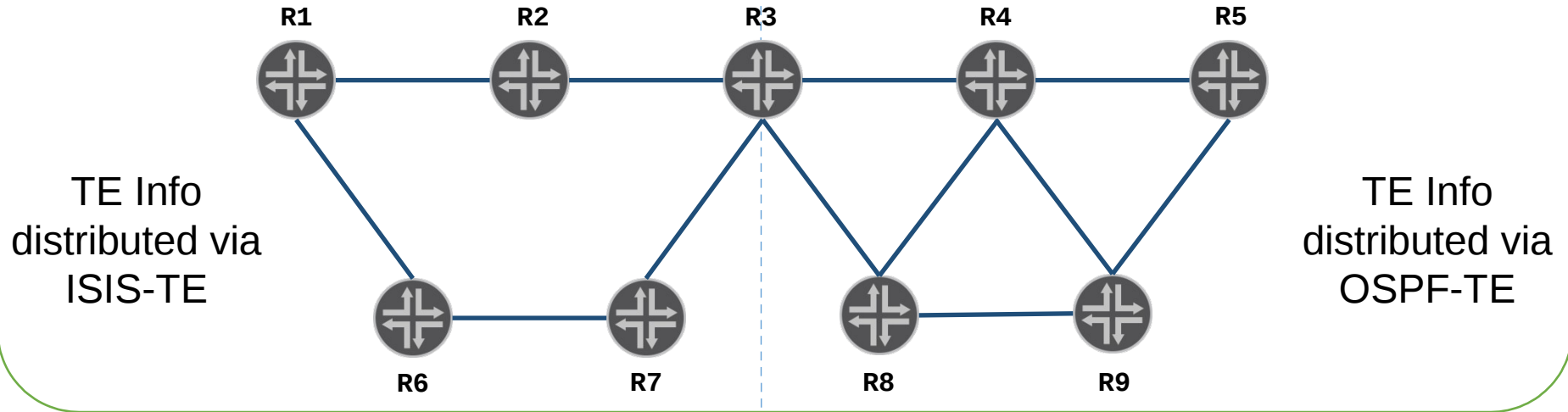
- TE Topology is an abstract control-plane representation of the data-plane topology.
 - Comprises of dynamic auto-discovered data (e.g. unreserved bw) as well as fairly static data (e.g. switching and adaptation capabilities and limitations).
 - Possible for a single TE Topology to encompass TE information at multiple switching layers.
- TE Topologies are protocol independent.
- TE Topology need not be congruent to the routing topology.
 - Presence of a TE link between a pair of nodes doesn't imply the existence of a routing-adjacency between the nodes.
- Each TE Topological element has one or more information source associated with it.
- TE Topologies can be hierarchical.
 - Each node and link of a given TE Topology can be associated with respective underlay topology.
- TE Topologies can be customized.
 - TE topologies of a given network presented by the network provider to its client could be customized on per-client request basis.

Model Applicability – Native TE Topologies

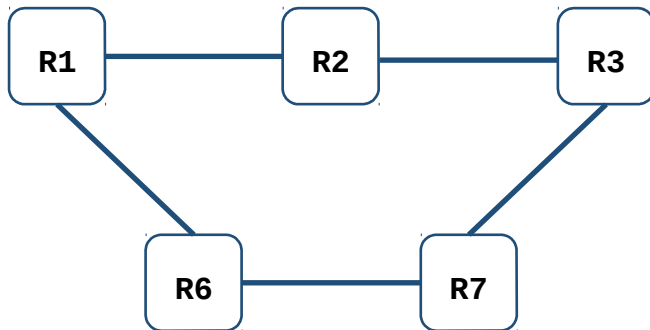


Model Applicability – Native TE Topologies (Cont.)

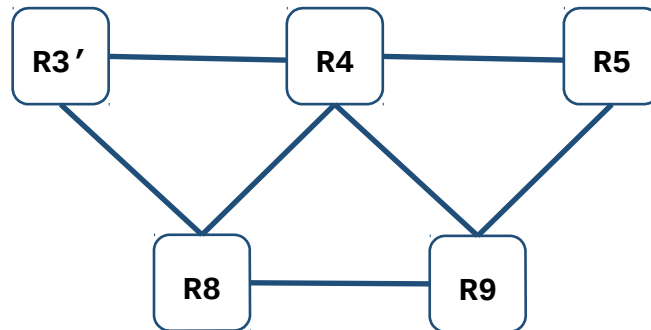
Network Topology



Native TE Topology 1 (as seen on R3) Info-Source: ISIS-TE

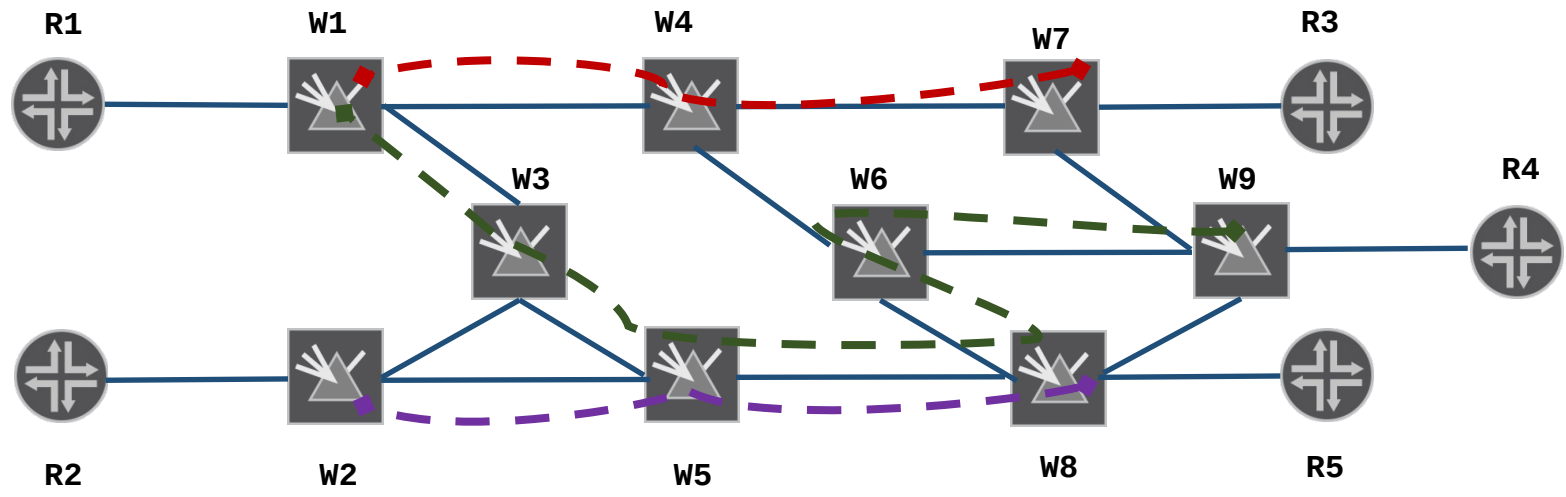


Native TE Topology 2 (as seen on R3) Info-Source: OSPF-TE

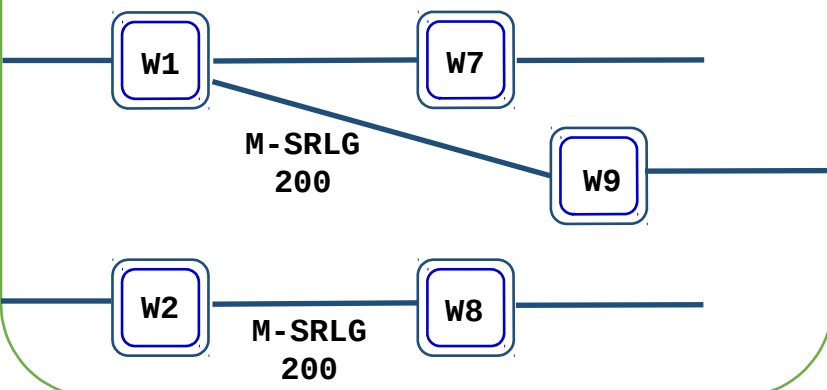


Model Applicability - Customized TE Topologies

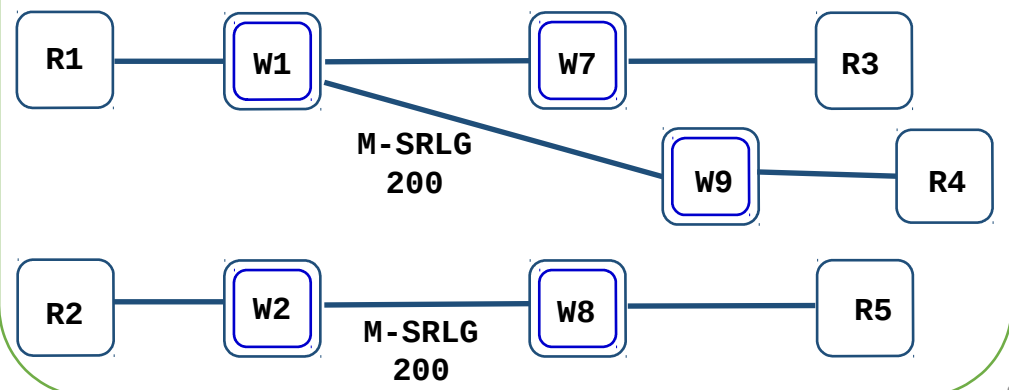
Network Topology



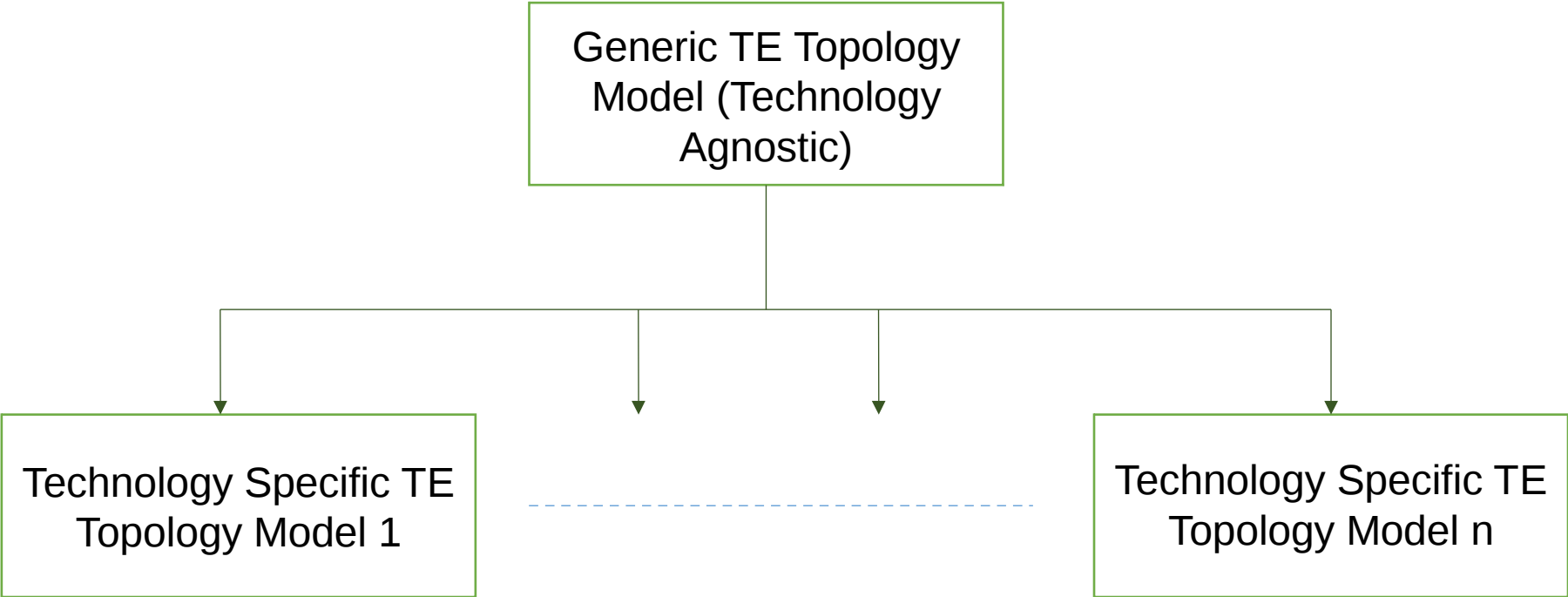
Customized TE Topology provided to the Client



Customized TE Topology merged with the Client's Native TE Topology



Modeling Considerations: Generic Extensible Model



Modeling Considerations: High-Level Structure

```

+--rw te-topologies
  |   +--rw topology* [provider-id client-id te-topology-id]
  |   |   .....
  |   |   +--rw node* [te-node-id]
  |   |   |   .....
  |   |   |   +--rw te-link* [te-link-id]
  |   |   |   |   .....
  |   |   |   |   +--rw link* [source-te-node-id source-te-link-id dest-te-node-id dest-te-
link-id]
  |   |   |   |   |   .....
  |   |   |   |   |   +--rw node-template* [name] {template}?
  |   |   |   |   |   |   .....
  |   |   |   |   |   |   +--rw link-template* [name] {template}?
  |   |   |   |   |   |   |   .....
+--ro te-topologies-state
  +--ro topology* [provider-id client-id te-topology-id]
    |   .....
    +--ro node* [te-node-id]
      |   |   .....
      |   |   +--ro te-node-state
      |   |   |   .....
    +--ro link* [source-te-node-id source-te-link-id dest-te-node-id dest-te-
link-id]
      |   |   .....
      |   |   +--ro te-link-state
      |   |   |   .....

notifications:
  +---n te-node-event

```

Modeling Considerations: Topology Identifiers

- TE-Topology is uniquely identified by a key that has 3 constituents.
 - te-topology-id
 - provider-id
 - client-id
- Combination of provider-id and te-topology-id uniquely identifies the native TE topology on a given provider.
- Client-ID is used only when Customized TE Topologies come into play.

```
+--rw topology* [provider-id client-id te-topology-id]
  | +--rw provider-id          te-global-id
  | +--rw client-id           te-global-id
  | +--rw te-topology-id      te-topology-id
```

Modeling Considerations: Generic TE-Link Attributes

- Model covers definitions for generic TE Link attributes
 - Bandwidth, Admin-Groups, SRLGs, Switching Capabilities, TE metric extensions

```

+--rw te-link-attributes
| .....
| +--rw performance-metric-throttle {te-performance-metric}?
| | .....
| +--rw administrative-group?          te-types:admin-groups
| +--rw max-link-bandwidth?           decimal64
| +--rw max-resv-link-bandwidth?      decimal64
| +--rw unreserved-bandwidth* [priority]
| | .....
| +--rw te-default-metric?            uint32
| +--rw performance-metric {te-performance-metric}?
| | .....
| +--rw link-protection-type?         enumeration
| +--rw interface-switching-capabilities* [switching-capability]
| | .....
| +--rw te-srlgs
| | .....

```

Modeling Considerations: Generic TE-Node Attributes

- Model covers definitions for generic TE Node attributes
 - Generic Connectivity Matrix

```

+--rw te-node-attributes
  | .....
  | +--rw connectivity-matrix* [id]
  |   +--rw id                uint32
  |   +--rw from-link
  |     +--rw provider-id-ref? leafref
  |     +--rw client-id-ref?  leafref
  |     +--rw topology-id-ref? leafref
  |     +--rw node-ref?       leafref
  |     +--rw link-end-ref?   leafref
  |   +--rw to-link
  |     +--rw provider-id-ref? leafref
  |     +--rw client-id-ref?  leafref
  |     +--rw topology-id-ref? leafref
  |     +--rw node-ref?       leafref
  |     +--rw link-end-ref?   leafref
  |   +--rw is-allowed?      boolean

```

Modeling Considerations: Information Sources

- Model allows each TE topological element to have multiple TE information sources (OSPF-TE, ISIS-TE, BGP-LS, User-Configured, System-Processed, Other)

```

+--ro te-topologies-state
+--ro topology* [provider-id client-id te-topology-
id]
| .....
+--ro node* [te-node-id]
| .....
+--ro te-node-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 topology-id-ref?     leafref
|   +--ro routing-instance?      string

```

```

+--ro te-topologies-state
+--ro topology* [provider-id client-id te-topology-
id]
| .....
+--ro link* [source-te-node-id source-te-link-id
dest-te-node-id dest-te-link-id]
| .....
+--ro te-link-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 topology-id-ref?     leafref
|   | +--ro routing-instance?      string
|   +--ro alt-information-sources* [information-
source]
|   | +--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 topology-id-ref?     leafref
|   | | +--ro routing-instance?      string
|   | .....

```

Modeling Considerations: Overlay/Underlay Relationship

- Model captures overlay and underlay relationship for TE nodes/links.
- This relationship is captured via the “underlay-topology” field for the node and via the “underlay” field for the link.
- This functionality is tagged as a “feature” – {te-topology-hierarchy}.

```

+--rw node* [te-node-id]
  | .....
  | +--rw te-node-attributes
  | | .....
  | | +--rw underlay-topology {te-
  | | topology-hierarchy}?
  | | | +--rw provider-id-ref?
  | | | leafref
  | | | +--rw client-id-ref?
  | | | leafref
  | | | +--rw topology-id-ref?
  | | | leafref

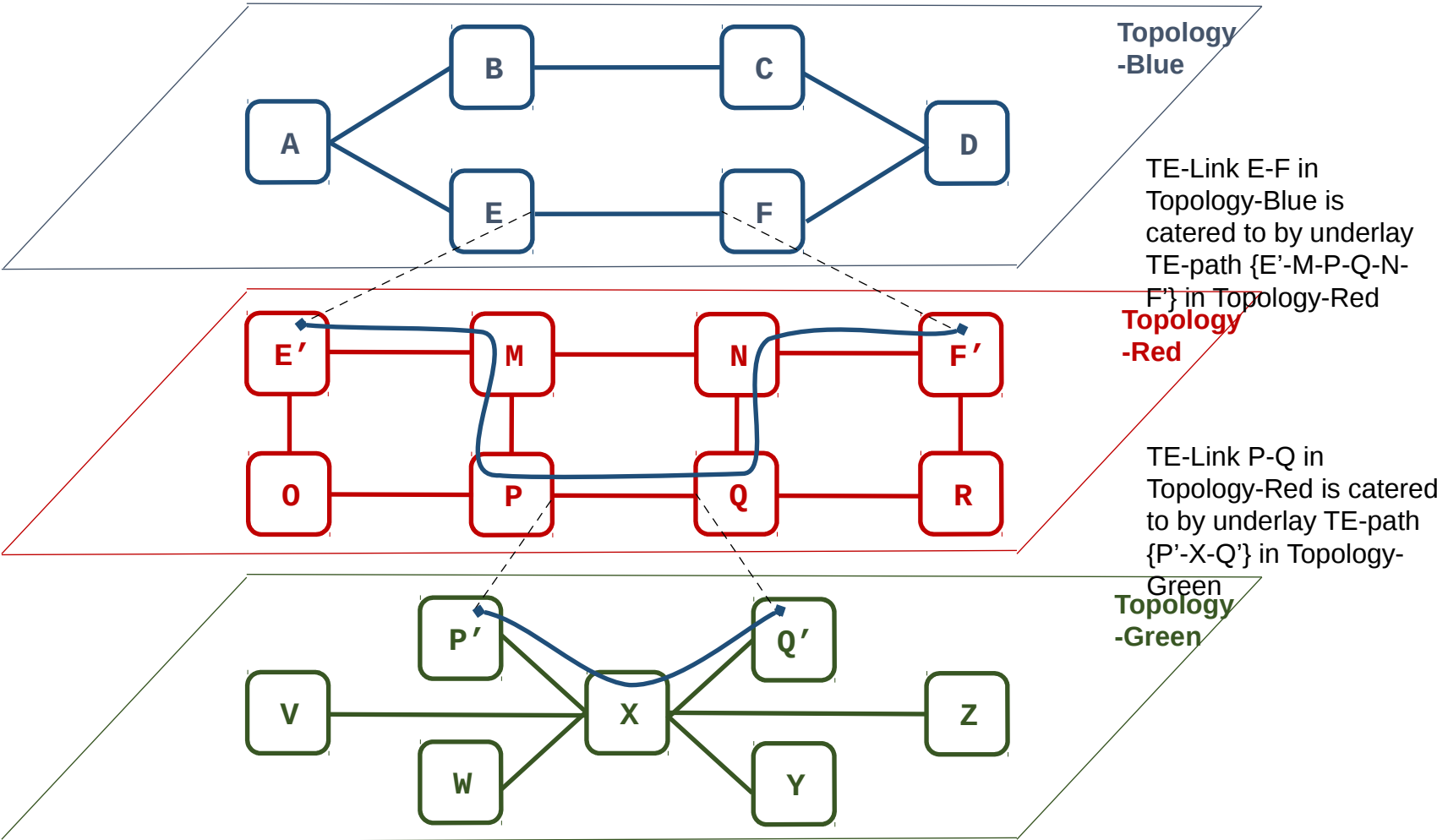
```

```

+--rw link* [source-te-node-id source-te-link-id
  dest-te-node-id
  dest-te-link-id]
  | .....
  | +--rw te-link-attributes
  | | .....
  | | +--rw underlay! {te-topology-
  | | hierarchy}?
  | | | +--rw underlay-primary-path
  | | | | +--rw provider-id-ref? leafref
  | | | | +--rw client-id-ref? leafref
  | | | | +--rw topology-id-ref? leafref
  | | | | +--rw path-element* [path-
  | | | | element-id]
  | | | | | .....
  | | | | | +--rw underlay-backup-path* [index]
  | | | | | +--rw index uint32
  | | | | | +--rw provider-id-ref? leafref
  | | | | | +--rw client-id-ref? leafref
  | | | | | +--rw topology-id-ref? leafref
  | | | | | +--rw path-element* [path-
  | | | | | element-id]
  | | | | | | .....
  | | | | | +--rw underlay-protection-type?
  | | | | | uint16
  | | | | | +--rw underlay-trail-src
  | | | | | .....
  | | | | | +--rw underlay-trail-des
  | | | | | .....

```

Modeling Considerations: Overlay/Underlay Relationship (Cont.)



Modeling Considerations: Scheduling Parameters

- Model allows time scheduling parameters to be specified for each topological element or for the topology as a whole.
- This functionality is tagged as a “feature” – {configuration-schedule}

```
+--rw schedules* [schedule-id] {configuration-schedule}?  
  | +--rw schedule-id          uint32  
  | +--rw start?               yang:date-and-time  
  | +--rw schedule-duration?  string  
  | +--rw repeat-interval?    string
```

Modeling Considerations - Templates

- Model provides the users with the ability to define templates and apply them to link and node configurations.
- This functionality is tagged as a “feature” - {template}.

```

+--rw topology* [provider-id client-id te-topology-id]
|   .....
|   +--rw node* [te-node-id]
|   |   +--rw te-node-template?    leafref {template}?
|   |   .....
|   +--rw link* [source-te-node-id source-te-link-id dest-te-node-
id dest-te-link-id]
|       +--rw te-link-template?    leafref {template}?
|       .....
+--rw node-template* [name] {template}?
|   +--rw name                      te-template-name
|   +--rw priority?                 uint16
|   +--rw reference-change-policy?  enumeration
|   +--rw te-node-template*         leafref
|   +--rw te-node-attributes
|   .....
+--rw link-template* [name] {template}?
|   +--rw name                      te-template-name
|   +--rw priority?                 uint16
|   +--rw reference-change-policy?  enumeration
|   +--rw te-link-template*         leafref
|   +--rw te-link-attributes
|   .....

```

Modeling Considerations - Notifications

- Document recommends the use of the subscription and push mechanism for YANG datastores discussed in <draft-clemm-netconf-yang-push-01>.
- Desired extensions to <draft-clemm-netconf-yang-push-01>:
 - Specify specific entities that will trigger the push notifications (can be specified by xpath).
 - Specify or limit the triggering event type.
 - Option to request either “incremental” or “full” notifications for an entity.

Next Steps

- Co-ordinate with teams working on I2RS topology models.
- Co-ordinate with authors of <draft-clemm-netconf-yang-push-01>.
- Address review comments.
 - To Do List:
 - <https://github.com/ietf-mpls-yang/te/blob/master/ietf-te-topology-todo-list.txt>
- Request further review.