Transport Network Slice
YANG Data Model

draft-liu-teas-transport-network-slice-yang-00

Xufeng Liu (Volta Networks)
Jeff Tantsura (Apstra Networks)
Igor Bryskin
Luis Miguel Contreras Murillo (Telefonica)
Qin Wu (Huawei)
Existing Network Topology Models

Network Topology Model
RFC8345
ietf-network-topology

- **OTN Topology Model**
  - IETF-CCAMP-OTN-TOPO-YANG

- **L2 Topology Model**
  - IETF-12RS-YANG-L2-NETWORK-TOPOLGY

- **L3 Topology Model**
  - RFC8346

- **TE Topology Model**
  - IETF-TEAS-YANG-TE-TOPO
Augmentation for Network Slice

Network Topology Model
RFC8345
ietf-network-topology

- OTN Topology Model
draft-ietf-ccamp-otn-topo-yang
- L2 Topology Model
draft-ietf-l2rs-yang-l2-network-topology
- L3 Topology Model
RFC8346
- TE Topology Model
draft-ietf-teas-yang-te-topo
- Network Slice Model
Transport Network Slice with TE

- Multiple inheritance:
  - Is both Network Slice topology and TE topology.
  - Uses multiple network types: “network-slice” and “te-topology”.

![Diagram showing the relationship between Network Slice, TE Topology, and Transport Network Slice with TE]
Network Slice with L3 TE and SF Aware

- For L3 packet use cases
  - ietf-te-topology-packet provides extensions for packet network.
  - ietf-l3-unicast-topology provides extensions for L3 network.
  - ietf-te-topology-sf supports network services and functions.
ACTN for Network Slicing

- ACTN topology data models are based on the network topology model defined in RFC8345.
- The augmentations defined in this document are effective augmentations to the ACTN topology data models.
- The augmentations make the ACTN framework [RFC8453] and data models [I-D.ietf-teas-actn-yang] capable of slicing networks with the required network characteristics.
Transport Network Slicing – by Virtualization

Network Slice Blue

Provider Network
Virtual Devices

Customized topologies

Provider Network
Physical Devices

Native topology

Network Slice Red

Client topology

supporting-node

supporting-link
Transport Network Slicing – by TE Overlay

Network Slice Blue

Network Slice Red

Provider Network with TE isolation

Provider Network with TE tunnels

TE tunnel for Network Slice Blue

TE tunnel for Network Slice Red
module: ietf-network
  +--rw networks
    +--rw network* [network-id]
      +--rw network-id network-id
      +--rw network-types
      +--rw supporting-network* [network-ref]
      | +--rw network-ref -> /networks/network/network-id
    +--rw node* [node-id]
      | +--rw node-id node-id
      | +--rw supporting-node* [network-ref node-ref]
      | | +--rw network-ref -> ../../../supporting-network/network-ref
      | | +--rw node-ref -> /networks/network/node/node-id
    +--rw nt:termination-point* [tp-id]
      | +--rw nt:tp-id tp-id
      | +--rw nt:supporting-termination-point* [network-ref node-ref tp-ref]
      | | +--rw network-ref -> ../../../nw:supporting-node/network-ref
      | | +--rw node-ref -> ../../../nw:supporting-node/node-ref
    +--rw nt:link* [link-id]
      | +--rw nt:link-id link-id
      | +--rw nt:source
      | | +--rw nt:source-node? -> ../../../nw:node/node-id
      | +--rw nt:destination
      | | +--rw nt:dest-node? -> ../../../nw:node/node-id
      | | +--rw nt:dest-tp? -> ../../../nw:node[nw:node-id=current()]/../dest-node]/termination-point/tp-id
    +--rw nt:supporting-link* [network-ref link-ref]
    +--rw nt:network-ref -> ../../../nw:supporting-network/network-ref
    +--rw nt:link-ref -> /nw:networks/network[nw:network-id=current()]/../network-ref]/link/link-id
Transport Network Slice YANG Model Schema

```yang
+--rw networks
   +--rw network* [network-id]
      +--rw network-id            network-id
   +--rw network-types
      | +--rw ns:network-slice!
   +--rw supporting-network* [network-ref]
      | +--rw network-ref    --> /networks/network/network-id
   +--rw node* [node-id]
      | +--rw node-id                 node-id
      | +--rw supporting-node* [network-ref node-ref]
      | +--rw nt:termination-point* [tp-id]
      | | +--rw nt:tp-id                           tp-id
      | | +--rw nt:supporting-termination-point* [network-ref node-ref tp-ref]
      | +--rw ns:network-slice
      |     +--rw ns:isolation-level?   identityref
      |     +--rw ns:compute-node-id?   string
      |     +--rw ns:storage-id?        string
      +--rw nt:link* [link-id]
      | +--rw nt:link-id            link-id
      | +--rw nt:source
      | +--rw nt:destination
      | +--rw nt:supporting-link* [network-ref link-ref]
      +--rw ns:network-slice
      | +--rw ns:delay-tolerance?   boolean
      | +--rw ns:periodicity*       uint64
      | +--rw ns:isolation-level?   identityref
   +--rw ns:network-slice
      +--rw ns:optimization-criterion?   identityref
   +--rw ns:delay-tolerance?          boolean
   +--rw ns:periodicity*              uint64
   +--rw ns:isolation-level?          identityref
```
Data Instance Example – Native Topology

```json
{
    "ietf-network:networks": {
        "network": [
            {
                "network-id": "example-native-topology",
                "network-types": {
                },
                "node": [
                    {
                        "node-id": "R1",
                        "ietf-network-topology:termination-point": [
                            {
                                "tp-id": "1-0-1"
                            }
                        ]
                    }
                ],
                "ietf-network-topology:link": [
                    {
                        "link-id": "R1,1-0-1,,",
                        "source": {
                            "source-node": "R1",
                            "source-tp": "1-0-1"
                        }
                    }
                ]
            }
        ]
    }
}
```
Data Instance Example – Customized Blue

```json
{
    "ietf-network:networks": {
        "network": [
            {
                "network-id": "example-customized-blue-topology",
                "network-types": {
                    "ietf-network-slice:network-slice": {
                        
                    }
                },
                "supporting-network": [  
                    {
                        "network-ref": "example-native-topology"
                    }
                ],
                "node": [
                    {
                        "node-id": "VR1",
                        "supporting-node": [  
                            {
                                "network-ref": "example-native-topology",
                                "node-ref": "R1"
                            }
                        ],
                        "ietf-network-slice:network-slice": {
                            "isolation-level": "ietf-network-slice:physical-memory-isolation"
                        }
                    }
                ],
            }
        ]
    }
}
```

```json
{
    "link-id": ",,VR1,1-0-1",
    "destination": {
        "dest-node": "VR1",
        "dest-tp": "1-0-1"
    },
    "supporting-link": [
        {
            "network-ref": "example-native-topology",
            "link-ref": ",,R1,1-0-1"
        }
    ],
    "ietf-network-slice:network-slice": {
        "optimization-criterion": "ietf-te-types:of-minimize-cost-path",
        "isolation-level": "ietf-network-slice:physical-isolation"
    }
}
```
Data Instance Example – Customized Blue with TE

```json
{
    "ietf-network:networks": {
        "network": [
            {
                "network-id": "example-customized-blue-topology",
                "network-types": {
                    "ietf-te-topology:te-topology": {
                    },
                    "ietf-network-slice:network-slice": {
                    }
                },
                "supporting-network": [
                    {
                        "network-ref": "example-native-topology"
                    }
                ],
                "node": [
                    {
                        "node-id": "R1",
                        "supporting-node": [
                            {
                                "network-ref": "example-native-topology",
                                "node-ref": "R1"
                            }
                        ],
                        "ietf-network-slice:network-slice": {
                            "isolation-level": "ietf-network-slice:virtual-resource-isolation"
                        }
                    }
                ],
            }
        ],
    }
}
```

```json
{
    "link-id": "R1,1-2-1,R2,2-1-1",
    "source": {
        "source-node": "R1",
        "source-tp": "1-2-1"
    },
    "destination": {
        "dest-node": "R2",
        "dest-tp": "2-1-1"
    },
    "ietf-te-topology:te": {
        "te-link-attributes": {
            "underlay": {
                "enabled": true,
                "primary-path": {
                    "network-ref": "example-native-topology",
                    "path-element": {
                        "path-element-id": 10,
                        "numbered-node-hop": {
                            "node-id": "1.0.1.5"
                        }
                    }
                }
            }
        }
    }
}
```
Next Steps

- Align the terminology with the consensus result of the TEAS Network Slicing Design Team and TEAS Working Group.
- Further examine proper attributes to be included in this model.
- Welcome reviews and suggestions.