A YANG Data Model for Microwave Topology
draft-ye-ccamp-mw-topo-yang-01

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Overview

- The draft defines a YANG data model to describe the topologies of microwave

- Use cases of microwave topology model:
  - UC1-Resource management: the report of microwave link frequency could enable a whole network topology view, and be used as an input for network frequency planning.
  - UC2-Path computation: to understand the current/unserved bandwidth of microwave link is important for path computation, as the microwave radio link could change its bandwidth under the adaptive modulation mode.

- Other questions to be answered by microwave topology model:
  - Q1: Relationship between microwave topology model and microwave interface model, and how to reuse the interface model in the topology model?
  - Q2: How to demonstrate the relationship between ETH topology and microwave topology?
  - Q3: How to represent single microwave link and multiple microwave links in the microwave topology?

Changes in 01 version

Microwave Topology YANG : augments the TE topology model

```
module: ietf-microwave-topology
  augment /nw:networks/nw:network/nw:network-types/tet:te-topology:
    +--rw mw-topology!
  augment /nw:networks/nw:network/nt:link/tet:te/tet:te-link-attributes:
        +--rw mw-link-frequency?              uint32
        +--rw mw-link-channel-separation?     uint32
        +--ro mw-link-nominal-bandwidth? rt-types:bandwidth-ieee-float32
        +--ro mw-link-current-bandwidth? rt-types:bandwidth-ieee-float32
        +--rw mw-unreserved-bandwidth         rt-types:bandwidth-ieee-float32
        +--rw mw-link-availability* [availability]
          +--rw mw-link-availability     rt-types:percentage
          +--ro mw-link-bandwidth        rt-types:bandwidth-ieee-float32
  augment /nw:networks/nw:network/nw:node/nt:termination-point /tet:te:
    +-- mp interface-root
```
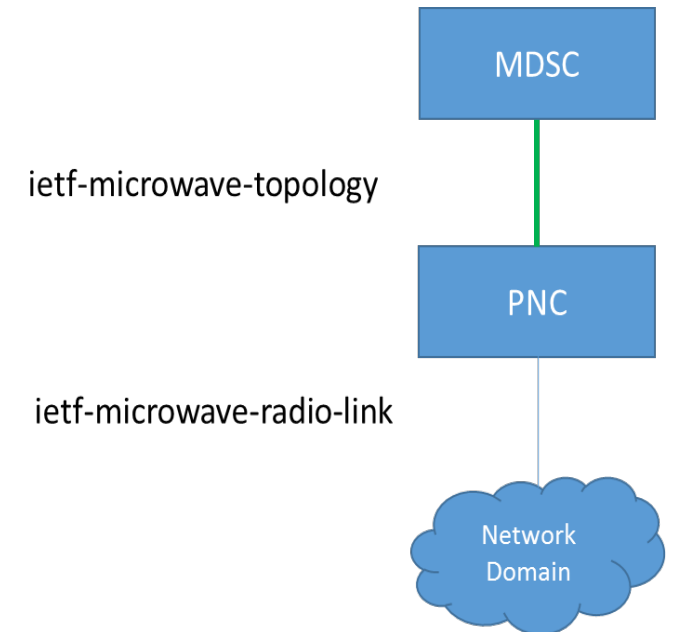
For path computation use case

Mount point for mw interface model

- How is mw-unreserved-bandwidth calculated
  - mw-unreserved-bandwidth = mw-link-nominal-bandwidth – TDM res bw – ETH res bw. Or
  - mw-unreserved-bandwidth = mw-link-current-bandwidth – TDM res bw – ETH res bw

- mw-unreserved-bandwidth may cause ambiguous understanding. Maybe a better way is to define mw-reserved-bandwidth(TDM res bw + ETH res bw)

Q1: Microwave topology model and microwave interface model

- The topology model defines in this draft is a Network Service YANG Module, that is expected to be used between a PNC and a MDSC.

- [I-D.ietf-ccamp-mw-yang] defines an interface YANG model for microwave radio link. It's a Network Element YANG module that is used between the PNC and the physical device for device configuration.

- It's also explained in RFC8199, Layering of modules allows for reusability of existing lower-layer modules by higher-level modules while limiting duplication of features across layers.

- But how to reuse the interface model in the topology model?

- RFC8345 "A YANG Data Model for Network Topologies":
  - A node has a list of termination points that are used to terminate links. An example of a termination point might be a physical or logical port or, more generally, an interface.

- YANG Schema Mount(draft-ietf-netmod-schema-mount-10):
  - defines a mechanism to add the schema trees defined by a set of YANG modules onto a mount point defined in the schema tree in some YANG module.
  - This document allows mounting of complete data models only. Other specifications may extend this model by defining additional mechanisms such as mounting sub-hierarchies of a module.

MDSC

ietf-microwave-topology

PNC

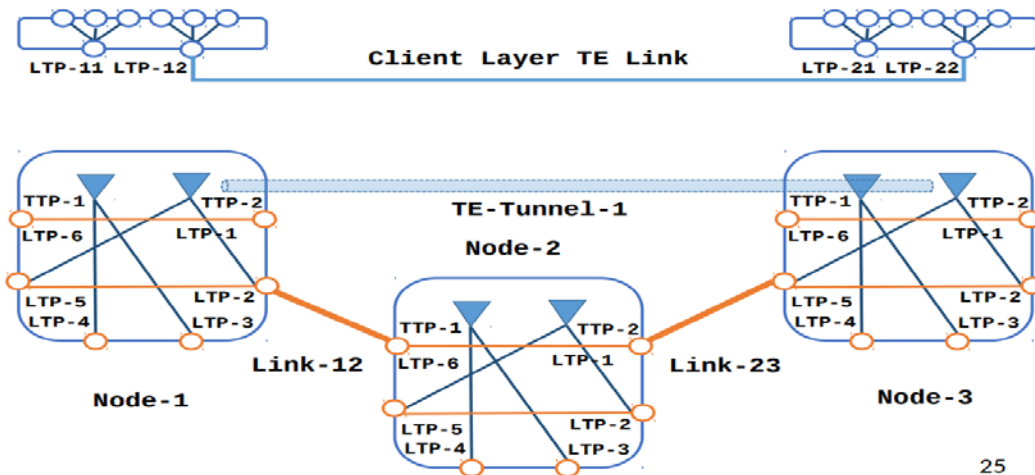ietf-microwave-radio-link

Network Domain

Q1: Microwave Topology YANG– using schema mount

- augment /nw:networks/nw:network/nw:node/nt:termination-point /tet:te:
  +-- mp interface-root

- Option 1:full exposure of the mw interface model:
  1. mount the mw interface model directly (ietf-microwave-radio-link)
- Option 2: abstraction of the mw interface model:
  1. create another model(ietf-microwave-radio-link-deviation):use deviation to delete statements to remove unneeded schema in the mw interface model
  2. Mount the ietf-microwave-radio-link-deviation module

- Mount point to interface model should be optional feature, will be changed in next version.

Q2: ETH topology and microwave topology

- TE topology model allows to separate server and client layer networks into two independent TE topologies, by using overlay/underlay

Two independent TE topologies

From: slides-95-teas-4

5.8. Overlay/Underlay Relationship

The model captures overlay and underlay relationship for TE nodes/links. For example - in networks where multiple TE Topologies are built hierarchically, this model allows the user to start from a specific topological element in the top most topology and traverse all the way down to the supporting topological elements in the bottom most topology.
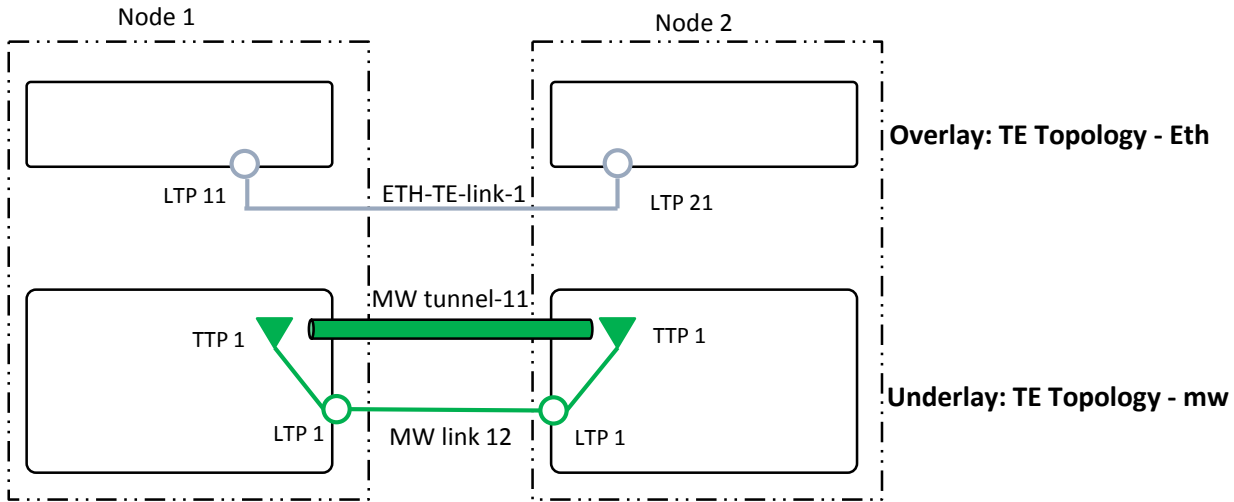
This relationship is captured via the "underlay-topology" field for the node and via the "underlay" field for the link. The use of these fields is optional and this functionality is tagged as a "feature" ("te-topology-hierarchy").

From: draft-ietf-teas-yang-te-topo-18

Q3: Single microwave link

Node 1   Node 2

LTP 11   ETH-TE-link-1   LTP 21

Overlay: TE Topology - Eth

MW tunnel-11

TTP 1   TTP 1

Underlay: TE Topology - mw
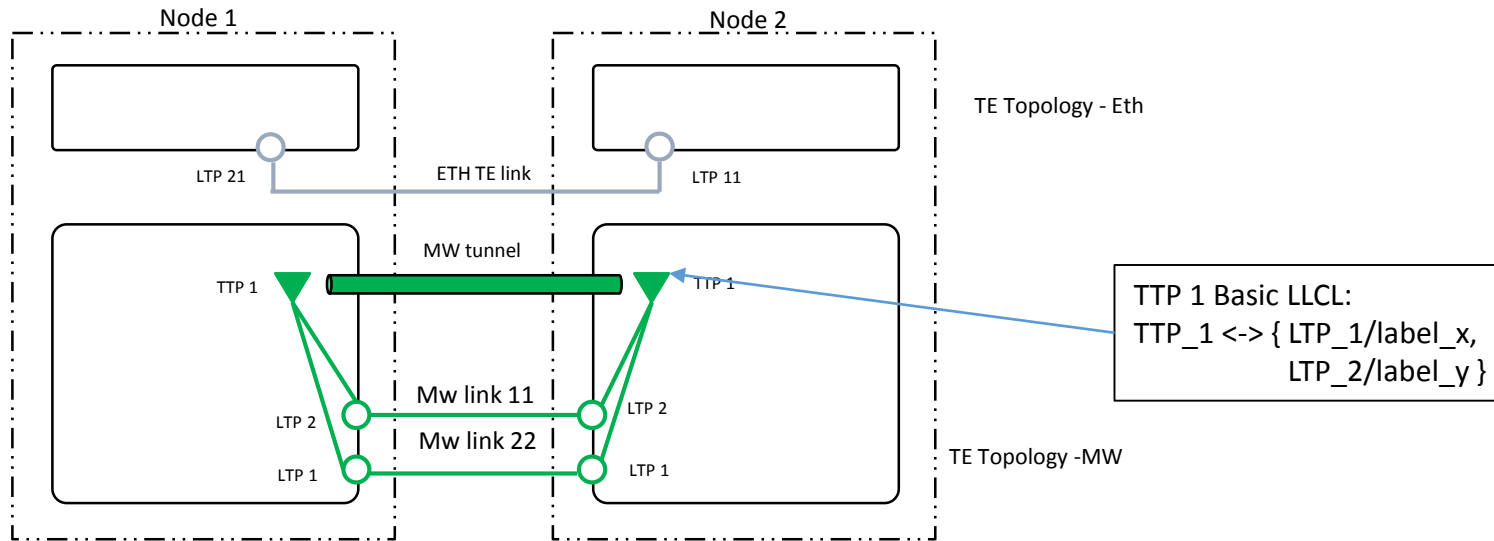
LTP 1   MW link 12   LTP 1

TE Topology - Eth

"ietf-network-topology:node/te/te-node-attributes/underlay-topology": [
{
    "network-ref": "mw-topo-1"
}
]
"ietf-te-topology:link/te/te-link-attributes/underlay": [
    {
      "enabled": ture,
        "primary-path":{
         "path-element": {
          "path-element-id": "MW-11"
            //no backup-path
            //no protection-type
         }
        }
      "tunnel-termination-points": {
       "source": "N1/TTP-1",
        "destination": "N2/TTP-1"
      }
      "tunnels" : {
       "sharing": "false",
       "tunnel":{
        "tunnel-name": "MW-11",
         "sharing": "false"
       }
      }
    }
  ]

TE Topology - MW

"ietf-network-topology:link": [
    {
     "link-id": "N1,LTP1,N2,LTP1",
     "source": {
      "source-node": "N1",
      "source-tp": "LTP1"
     }
     "destination": {
      "dest-node": "N2",
      "dest-tp": "LTP1"
     }
    }
   ]

"ietf-te-topology:link/te/te-link-attributes": [
    {
      "mw-link-frequency": 10728000,
      "mw-link-channel-separation": "28000",
      "mw-link-nominal-bandwidth": "1000",
      "mw-link-current-bandwidth": "1000",
      "mw-unreserved-bandwidth": "400",
      "mw-link-availability":{
       "mw-link-availability":"0.9999",
       "mw-link-bandwidth": "1000"
      }
    }
  ]

Q3: Multiple microwave links

Node 1

Node 2

TE Topology - Eth

LTP 21

ETH TE link

LTP 11

MW tunnel

TTP 1

TTP 1

TTP 1 Basic LLCL:
TTP_1 <-> { LTP_1/label_x,
LTP_2/label_y }

Mw link 11

LTP 2

LTP 2

Mw link 22

TE Topology -MW

LTP 1

LTP 1

- The ETH topology is the same, it should not see the difference in the underlay topology.
- In microwave topology model, the microwave tunnel is supported by two microwave links
- TTP Local Link Connectivity List (LLCL) is a List of TE links terminated by the TTP hosting TE node (i.e. list of the TE link LTPs)

TE Topology - MW

MW link 11

"ietf-te-topology:link/te/te-link-attributes": [
    {
        "mw-link-frequency": 10618000,
        "mw-link-channel-separation": "28000",
        "mw-link-actual-tx-cm":"qam-512",
        "mw-link-nominal-bandwidth": "1000",
        "mw-link-current-bandwidth": "1000",
        "mw-unreserved-bandwidth": "400",
        "mw-link-availability":{
         "mw-link-availability":"0.9999",
         "mw-link-bandwidth": "1000"
        }
    }
]

MW link 22

"ietf-te-topology:link/te/te-link-attributes": [
    {
        "mw-link-frequency": 10728000,
        "mw-link-channel-separation": "28000",
        "mw-link-actual-tx-cm":"qam-512",
        "mw-link-nominal-bandwidth": "1000",
        "mw-link-current-bandwidth": "1000",
        "mw-unreserved-bandwidth": "400",
        "mw-link-availability":{
         "mw-link-availability":"0.9999",
         "mw-link-bandwidth": "1000"
        }
    }
]

Next steps

- Open issues:
  - mw-unreserved-bandwidth or mw-reserved-bandwidth?
  - Change mount point to interface model to an optional feature
  - Editorial improvement:
    - explain more about the topology & interface model, e.g., link in the topology model is the link between the carrier-terminations in the interface model
    - Update the appendix example
- Review and comments are welcome!
- A microwave SDN plugtest will be hosted by ETSI ISG mWT in Jan. 2019. The microwave topology model will be verified in the plugtest.
- It's proposed to use the draft as a starting point to define the microwave topology YANG model, would like to ask for WG adoption