

A Yang Data Model for Optical Impairment-aware Topology

[draft-ietf-ccamp-optical-impairment-topology-yang-15](#)

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Major Updates Since IETF 118

- Added YANG update and text description for modeling the multi-band (e.g. C+L band) and multi-stage (cascaded) amplifiers
- Completed DGE model with agreement to model the DGE function in different way depending on their HW implementation:
 - as a 2-degrees te-node terminating the OMS MCGs (traditional WSS based DGE)
 - as an amplifier OMS element, not terminating the OMS MCG (Gain Shaping equalization based DGE)
- Introduced “template” at network level to describe both Transceiver and ROADM impairment instances. [#164](#)
- Introduced new type “power-ratio” and “power-ratio-or-null” for delta-power attribute
- Fixing some YANG model details
 - Removed power-param grouping and replaced with two containers with correct relative paths (addressing Tom Petch’s comment)
 - Introduced new type “power-ratio” and “power-ratio-or-null” for delta-power attribute
 - Missing namespace
 - Shorten names of attributes for long lines in the tree

Template for transceiver and ROADM impairment

- In case of large network, when the same values of the explicit parameters are shared among same type of ROADM or transceiver, it could become too verbose reporting ROADM or transceiver capability in case of explicit mode
- We added a template for this set of explicit parameters which can be common to multiple element
- This template need to be referenced by roadm or transceiver instance. (see next slide)

```

+--ro templates
  +--ro roadm-path-impairments
  | +--ro roadm-path-impairment* [roadm-path-
impairments-id]
  |   +--ro roadm-path-impairments-id  string
  |   +--ro (impairment-type)?
  |     +---:(roadm-express-path)
  |       | +--ro roadm-express-path* []
  |-----
  |-----
  |     +---:(roadm-add-path)
  |       | +--ro roadm-add-path* []-
  |-----
  |-----
  |     +---:(roadm-drop-path)
  |       | +--ro roadm-drop-path* []
  |-----
  |-----
+--ro explicit-transceiver-modes
  +--ro explicit-transceiver-mode* [explicit-transceiver-
mode-id]
  +--ro explicit-transceiver-mode-id  string
  +--ro line-coding-bitrate?          identityref
  +--ro bitrate?                      uint16
  +--ro max-diff-group-delay?        decimal-2

```

```

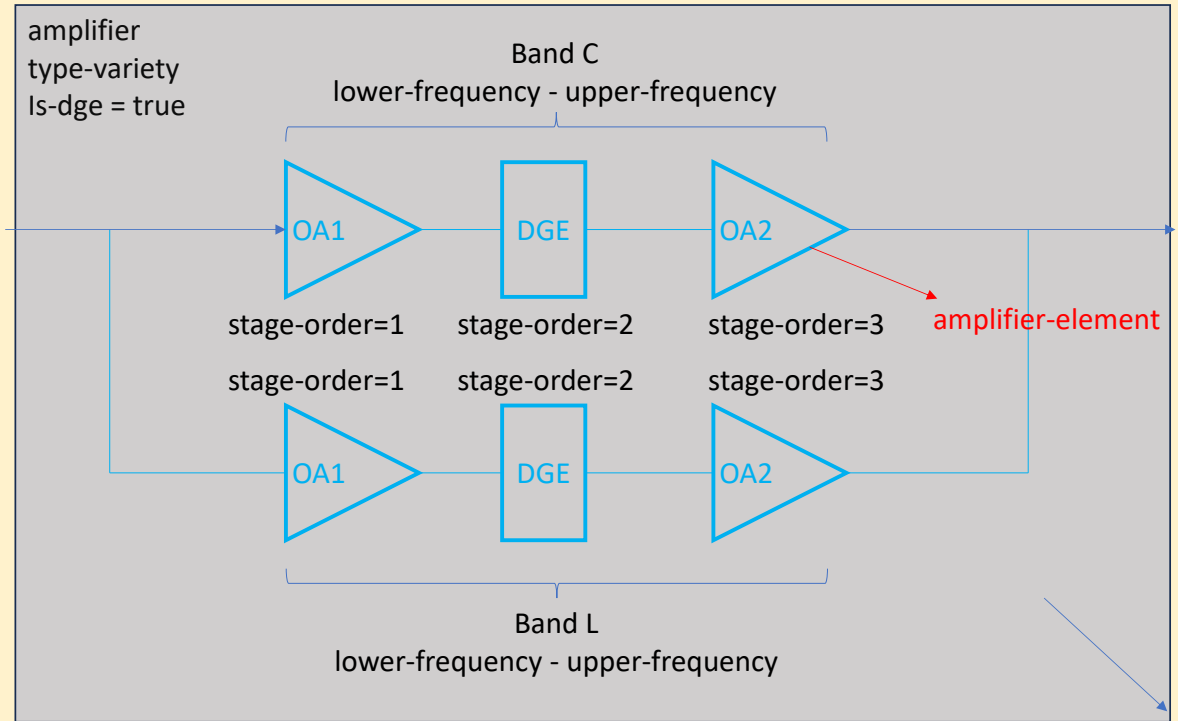
+---:(explicit-mode)
  +--ro explicit-mode
  +--ro min-central-frequency?
  |   frequency-thz
  +--ro max-central-frequency?
  |   frequency-thz
  +--ro transceiver-tunability?
  |   frequency-ghz
  +--ro tx-channel-power-min?
  |   power-dbm
  +--ro tx-channel-power-max?
  |   power-dbm
  +--ro rx-channel-power-min?
  |   power-dbm
  +--ro rx-channel-power-max?
  |   power-dbm
  +--ro rx-total-power-max?
  |   power-dbm
  +--ro compatible-modes
  | +--ro supported-application-codes*
  | |   leafref
  | +--ro supported-organizational-modes*
  | |   leafref
  +--ro explicit-transceiver-mode-ref?
  |   leafref

```

Modeling of multi-band and multi-stage amplifiers

- To support the modeling of multi-band (e.g., C + L band) and multi-stage (cascaded) amplifiers the OMS element that describes an optical amplifier may contain an **unordered list of amplifier-elements**. The position of the element is based on the following attributes:
 - lower-frequency and upper-frequency** describing the frequency band the set of amplifier-elements are operating in.
 - stage-order** describing the sequential order of the cascaded amplifier-elements for the frequency band.

OMS-element



```

+++ro amplifier-element* []
  +--ro name?
  |   string
  +--ro type-variety?
  |   string
  +--ro is-dynamic-gain-equalyzer?
  |   boolean
  +--ro frequency-range
  |   +--ro lower-frequency   frequency-thz
  |   +--ro upper-frequency   frequency-thz
  +--ro stage-order?
  |   uint8
  +--ro power-param
  |   +--ro (power-param)
  |   |   +---: (channel-power)
  |   |   |   +--ro nominal-carrier-power
  |   |   |   |   10-types:power-dbm-or-null
  |   |   |   +---: (power-spectral-density)
  |   |   |   |   +--ro nominal-psd
  |   |   |   |   |   10-types:psd-or-null
  +--ro pdl?
  |   10-types:power-loss-or-null
  +--ro (amplifier-element-type)
  +---: (optical-amplifier)
  |   +--ro optical-amplifier
  |   |   +--ro actual-gain
  |   |   |   10-types:power-gain-or-null
  |   |   +--ro in-voa?
  |   |   |   10-types:power-loss-or-null
  |   |   +--ro out-voa?
  |   |   |   10-types:power-loss-or-null
  |   |   +--ro tilt-target
  |   |   |   10-types:decimal-2-or-null
  |   |   +--ro total-output-power
  |   |   |   10-types:power-dbm-or-null
  |   |   +--ro raman-direction?
  |   |   |   enumeration
  |   |   +--ro raman-pump* []
  |   |   |   +--ro frequency?
  |   |   |   |   10-types:frequency-thz
  |   |   |   +--ro power?
  |   |   |   |   10-types:decimal-2-or-null
  +---: (dynamic-gain-equalyzer)
  +--ro dynamic-gain-equalyzer!
  +--ro media-channel-groups
  +--ro media-channel-group* []
  +--ro media-channels* []
  +--ro flexi-n?
  |   10-types:flexi-n
  +--ro flexi-m?
  |   10-types:flexi-m
  +--ro delta-power?
  |   10-types:power-ratio-or-null

```

Next Steps

- Status of the draft
 - The YANG model is stable
 - There are few sentences to be rephrased to improve clarity
 - The draft will be ready for WG Last Call as soon as the editorial work is finished
- We think that due to the dependency on RFC9093-bis and the good status also of this draft we think it would better to have WG LC together
 - IETF-120 would be a good candidate timeframe

There is an official weekly CCAMP WebEx meetings (Tue, 2-3pm CET) on the subject, everybody is welcome to attend

- <https://mailarchive.ietf.org/arch/browse/ccamp/?q=optical%20impairments%20invitation>

backup

Absolute path in grouping power-param

2 problems:

- the absolute path in the grouping power-param are incorrect since there is no indication of which network instance to check
- the grouping is used in difference places and the relative paths in the 2 cases are different

```
grouping power-param {
  description
    "optical power or PSD after the ROADM or after the out-voa";
  choice power-param {
    description
      "select the mode: channel power or power spectral density";
    case channel-power {
      when "/nw:networks/nw:network/nt:link/tet:te
          /tet:te-link-attributes/OMS-attributes
          /equalization-mode='carrier-power'";
      leaf nominal-carrier-power{
        type 10-types:power-in-dbm-or-null;
        description
          " Reference channel power. Same grouping is used for the
          OMS power after the ROADM (input of the OMS) or after the
          out-voa of each amplifier. ";
      }
    }
    case power-spectral-density{
      when "/nw:networks/nw:network/nt:link/tet:te
          /tet:te-link-attributes/OMS-attributes
          /equalization-mode='power-spectral-density'";
      leaf nominal-power-spectral-density{
        type 10-types:decimal-16-digits-or-null;
        units W/Hz ;
        description
          " Reference power spectral density after
          the ROADM or after the out-voa.
          Typical value : 3.9 E-14, resolution 0.1nW/MHz";
      }
    }
  }
}
```

```
container power-param {
  description
    "Optical channel power or power spectral density (PSD)
    after the ROADM.";
  leaf nominal-carrier-power {
    when "derived-from-or-self(..../equalization-mode, "
        + "'10-types:carrier-power')";
    type 10-types:power-dbm-or-null;
    description
      "Reference channel power.";
  }
  leaf nominal-psd {
    when "derived-from-or-self(..../equalization-mode, "
        + "'10-types:power-spectral-density')";
    type 10-types:psd-or-null;
    description
      " Reference power spectral density (PSD).";
  }
} // container power-param
```

```
container power-param {
  description
    "The optical power after the out-voa of each amplifier
    element.";
  .....
  .....
}
} // container power-param
```


A YANG Data Model for Layer 0 Types

draft-ietf-ccamp-rfc9093-bis-09

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Updates Since IETF 118 (1)

- Moved authors to contributors list: fix Authors on the front page [#90](#)
 - Following recommendation from RFC [7322](#), the front page authors should be limited to 5.
- Resolved yanglint warnings: fix Check yanglint compilation errors [#91](#)
- Agreed to define identities only for the standard OTU types defined in G.709 [#21](#)
 - Since [ITU-T_G.Sup43] does not guarantee interoperability in the data plane, the type of OTUk defined in {{ITU-T_G.Sup43}} can be defined in vendor-specific YANG modules using the otu-type identity, defined in this document, as the base.
- Fixed bug in the XPath of leafref augmented to the “compatible-modes” container (when transceiver-mode grouping is used in transceiver-capabilities grouping) [#95](#)
- Made line-coding-bitrate configurable (config true) in the common-configured-param grouping [#85](#)
 - Depending on the application the attribute can or cannot be configured (e.g. in OI the scope is just to report how the transceiver is configured and not to configure that). This is not the same e.g. in wdm-tunnel , and the attributes defined as config true in the LO types shall be instanced as RW since they are intended to be used by the controller to configure the transceiver on the device.
- Updated data types for max-diff-group-delay, min-Q-factor, available-baud-rate attributes leaf [#94](#)
 - ro max-diff-group-delay? decimal-2 (decimal-2 is defined as decimal64 with 2 fraction-digits)
 - min-Q-factor? decimal-2
 - ro available-baud-rate? decimal64

Updates Since IETF 118 (2)

- Added new identities for wavelength assignment [#92](#)
- Split the grouping common-transceiver-configured-param between the config true and config false leaves [#86](#)
- Add frequency and power range attributes also in Standard mode. [#10](#)
 - ITU-T Q6 experts confirmed that transceiver need just to support a range (or as extreme case just one frequency) comprised in the entire range specified in G.698.2.
- Change name for gsnr-margin → gsnr-extra-margin [#87](#)
 - It is an “additional” margin added to OSNR-min
- Added new section for L0 label definition [#5](#)
- Shortened types and attribute names [#69](#)

```
identity lower-first-wavelength-assignment {  
  base wavelength-assignment;  
  description  
    "Allocate wavelengths in ascending order, beginning from the  
    lowest frequency and progressing toward the highest frequency  
    within the permissible frequency range."  
}
```

```
identity upper-first-wavelength-assignment {  
  base wavelength-assignment;  
  description  
    "Allocate wavelengths in decending order, beginning from the  
    highest frequency and progressing toward the lowest frequency  
    within the permissible frequency range."  
}
```

```
grouping common-transceiver-configured-param:
```

```
+-- line-coding-bitrate? identityref  
+-- tx-channel-power? power-dbm-or-null
```

```
grouping common-transceiver-readonly-param:
```

```
+--ro rx-channel-power? power-dbm-or-null  
+--ro rx-total-power? power-dbm-or-null
```

```
grouping transceiver-mode:
```

```
+-- (mode)
```

```
+--:(G.698.2)  
| +--ro standard-mode? standard-mode  
| +--ro line-coding-bitrate* identityref  
| +--ro standard-mode? standard-mode  
| +--ro line-coding-bitrate* identityref  
| +-- min-central-frequency? frequency-thz  
| +-- max-central-frequency? frequency-thz  
| +-- transceiver-tunability? frequency-ghz  
| +--ro tx-channel-power-min? power-dbm  
| +--ro tx-channel-power-max? power-dbm  
| +--ro rx-channel-power-min? power-dbm  
| +--ro rx-channel-power-max? power-dbm  
| +--ro rx-total-power-max? power-dbm
```

Next Steps

- Closed almost all the technical open issues from IETF 118
- Only one technical open issue left [#81](#)
- Some editorial work is needed to complete the text of the draft

Target:

- Get ready for WG LC, by IETF 120

Administrative:

- We have weekly call associated with Optical Impairments aware Topology model on **Tuesday 2pm CET**
- <https://mailarchive.ietf.org/arch/browse/ccamp/?q=optical%20impairments%20invitation>