A Yang Data Model for Optical Impairment-aware Topology

draft-ietf-ccamp-optical-impairment-topology-yang-14

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Major Updates Since IETF 117

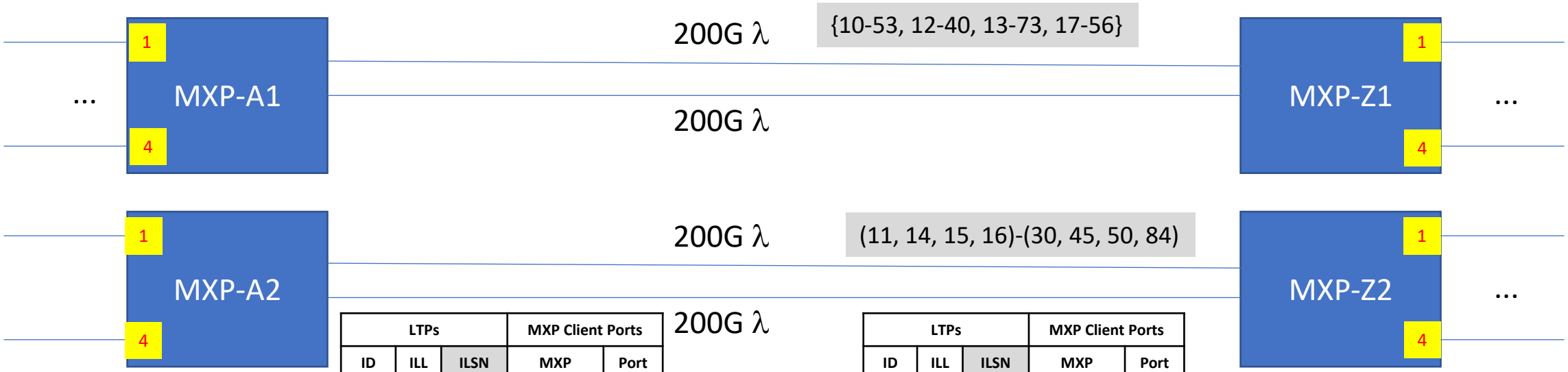
- Examples of how vendors can define their operational modes
  - Added appendix C describing how to use the model to define operational modes
- Modified picture related to Cross-3R Regenerator adding the usual East-West transmission view
- Fixing mistake in the section related to OMS MCG Protection Modeled as Single Protected TE-Link
  - Modified attributes related to protection (protection-type→link-protection-type)
- Muxponders' configuration constraints
- Adding new sub-section 2.5 related to DGE (Dynamic Gain Equalizer)
  - Adding related YANG updates for DGE modeled as amplifier

Muxponder Constraint

- Muxponders
  - Traditional Muxsponders (MXP) such as a 10 x 10GE up to 100G have a fixed mapping between client ports and the trunk (100G) time slots, so port 1 is always connected to TS1, and so on.
  - More recent MXP or if you want crossponders are flexible and the mapping client port <—> time slot may be provisioned
- The muxponder constraints impact which client ports can be connected together between two peer muxponders
- We need to support the constraints disclosure to MDSC for old MXP but also we need to support the possibility to provision the MXP switch matrix
- The inter-layer-sequence-number (ILSN) is used to report additional connectivity constraints between a client layer Link Termination Point (LTP), such as a muxponder port, and the server layer Tunnel Termination Point (TTP).

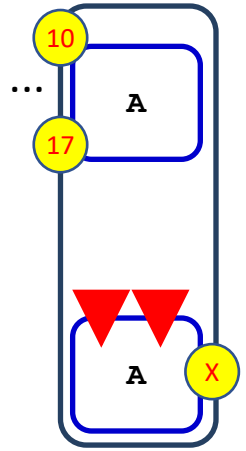
```
augment /nw:networks/nw:network/nw:node/nt:termination-point
              /tet:te:
    +--rw inter-layer-sequence-number?   uint32
```

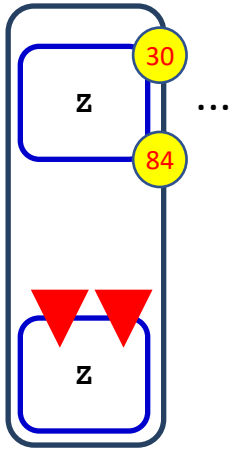
400G Muxponder Example



LTPs			MXP Client Ports	
ID	ILL	ILSN	MXP	Port
10	1	1	MXP-A1	1
11	2	None	MXP-A2	1
12	1	2	MXP-A1	2
13	1	3	MXP-A1	3
14	2	None	MXP-A2	2
15	2	None	MXP-A2	3
16	2	None	MXP-A2	4
17	1	4	MXP-A1	2
TTPs			MXP Line Ports	
ID	ILL		MXP	
110	1		MXP-A1	
210	2		MXP-A2	

LTPs			MXP Client Ports	
ID	ILL	ILSN	MXP	Port
30	4	None	MXP-Z2	1
40	3	2	MXP-Z1	2
45	4	None	MXP-Z2	2
50	4	None	MXP-Z2	3
53	3	1	MXP-Z1	1
56	3	4	MXP-Z1	4
73	3	3	MXP-Z1	3
84	4	None	MXP-Z2	4
TTPs			MXP Line Ports	
ID	ILL		MXP	
120	3		MXP-Z1	
220	4		MXP-Z2	





Guideline for DGE representation (issue #153)

- We 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 a new OMS element, not terminating the OMS MCG (Gain Shaping equalization based DGE)
- added attribute to characterize an amplifier element as "DGE"
- added PDL parameter at amplifier-element level
- added "delta-power" in the amplifier-element to provide pre-emphasis different from the one provided by the ROADM
- There is still debate since there are concerns on the possible limited accuracy in the noise figure of the “equivalent” amplifier i.e. the case of new OMS element as DGE

```
+--ro amplifier-element* []
   +--ro name?
   |       string
   +--ro is-dynamic-gain-equalyzer?
   |       boolean
   +--ro frequency-range
   |  +--ro lower-frequency    frequency-thz
   |  +--ro upper-frequency    frequency-thz
   +--ro actual-gain
   |       l0-types:gain-in-db-or-null
   +--ro tilt-target
   |       l0-types:decimal-2-digits-or-null
   +--ro out-voa
   |       l0-types:loss-in-db-or-null
   +--ro in-voa
   |       l0-types:loss-in-db-or-null
   +--ro total-output-power
   |       l0-types:power-in-dbm-or-null
   +--ro (power-param)?
   |  +--:(channel-power)
   |  |  +--ro nominal-carrier-power?
   |  |           l0-types:power-in-dbm-or-null
   |  +--:(power-spectral-density)
   |     +--ro nominal-power-spectral-density?
   |              l0-types:decimal-16-digits-or-null
   +--ro raman-direction?
   |       enumeration
   +--ro raman-pump* []
   |  +--ro frequency?
   |  |       l0-types:frequency-thz
   |  +--ro power?
   |          l0-types:decimal-2-digits-or-null
   +--ro pdl?
   |       l0-types:loss-in-db-or-null
   +--ro media-channel-groups
      +--ro media-channel-group* []
         +--ro media-channels* []
            +--ro flexi-n?
            |       l0-types:flexi-n
            +--ro flexi-m?
            |       l0-types:flexi-m
            +--ro delta-power?
                    l0-types:power-in-dbm-or-null
```

Status of the draft: Open Issues

- Tracking Open Issues, discussions and resolutions linked to YANG model https://github.com/ietf-ccamp-wg/draft-ietf-ccamp-optical-impairment-topology-yang/issues
- 5 issues closed since IETF-117
  - See the list with details
- 9 open issues :
  - #158: change the type for delta-power attribute as “ratio in dB”
  - #155: The absolute path in the grouping power-param are incorrect since there is no indication of which network instance to check
  - #153: Complete the guideline for DGE solving the remained concerns about accuracy .
  - #145: update Security considerations in the draft as indicated by T- Petch comment
  - #144: complete fixing issue raised by Tom Petch (see issue #155)
  - #134: try to shorten the names of attributes that appears too long, related to https://github.com/ietf-ccamp-wg/ietf-ccamp-layer0-types-ext-RFC9093-bis/issues/69
  - #130: need to document mandatory profile for OI applications
    - Target: indicate the attributes which are optional because not needed for non-OI applications but required to support the OI applications. A JSON example of OI application is ready to be added in an appendix.
  - #124: removed key from media channel list, making the flexi-n attribute optional.
    - Need to check a YANG statement (e.g. unique statement) avoiding to have more elements in the list with the same flexi-n. (we cannot have 2 media-channel with the same flexi-n). Need to make some json examples and make the validation with yanglint and verify if “unique” statement is still valid when flexi-n is not present.
  - #123: “Boundary between Layer 0 and Layer 1” is going on
    - We need to clarify the boundary between what is in (layer 0) and what is out of scope (layer 1). To be also discussed in the context of flexi-grid meeting.
    - E.g. inverse multiplexing and FEC are layer 1 functionality of the transponders which are in the scope of this document

Next Steps

- Address the issues still on the list
  - The YANG model is pretty stable
  - The remaining issues does not mandate big discussion, the solution has been already identified and we need to make homework to update the draft
- Be ready for WG Last Call asap (possibly IETF 119).

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

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Client service between MXP-A2 and MXP-Z2

- Example: client service betwen LTP A-11 (LTP 11 on node A) and LTP Z-84 (LTP 84 on node Z)
  1. Check ILL information
     - The only possibility to setup this client service is through a TE tunnel between TTP A-210 (TTP 210 on node A) and TTP Z-220 (TTP 220 on node Z)
  2. Check server-layer switching capabilities of the two TTPs
     - If the two TTPs (i.e., A-210 and Z-220) do not have any common server-layer switching capability, no TE tunnel can be setup between the two TTPs and therefore the client service cannot be setup
     - If there is at least one server-layer switching capability in common (e.g., WDM or both WDM and OTN), a TE tunnel with any of the common switching capabilities can be setup between the two TTPs
  3. Check client-layer switching capabilities of the two TTPs
     - If the two TTPs (i.e., A-210 and Z-220) do not have any common client-layer switching capability, no client service can be multiplexed over any TE tunnel setup between the two TTPs
     - If there is at least one client-layer switching capability in common, then client services can be multiplexed over a TE tunnel setup between the two TTPs
  4. Check ILSN (inter-layer sequence number)
     - Since there is no ILSN reported for LTP A-11 nor for LTP Z-84, the client service can be setup

A YANG Data Model for Layer 0 Types

draft-ietf-ccamp-rfc9093-bis-07

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Major Updates Since IETF 117 (1)

- Convert definition based on dbm-t using power-in-dbm issue #77
- Delete the FEC definitions without reference (reed-solomon, hamming-code, and golay FEC types) #76
- YANG module updates to fix YD last call comments #68
- Description of the operational-mode has been aligned with what described in Optical Impairment #8
- Change definition and related description for flexible-grid channel-spacing #56
  - "deprecate" the flexi-ch-spc-type, with "deprecated" status statement
  - substituted that attribute with "*flexi-ncf-granularity-type*" with a new description. e.g. "Flexi-grid nominal central frequency granularity type“
  - to add new identity "flexi-ncfg-6p25ghz"

Major Updates Since IETF 117 (2)

- Normative reference to Informational RFCs (RFC 6163 and RFC 7698) have been substituted with normative references to Standard-Track RFC 6205 or RFC 7699 or RFC 7689 issue #64
- Updated flexi-grid-label-hop grouping to use a unique way to describe a single-channel label to avoid interoperability issues in case for single channel you would use the "super" option in the branch.“ #33
- Updated YANG model and text in the I-D to introduce the new groupings combining the definition that was defined separately in wson and flexi-grid , to support optical network scenarios that contain both fixed- and flexi-grid links. The new grouping are:
  - wdm-label-start-end, wdm-label-hop, wdm-label-range-info, wdm-label-step

```
grouping flexi-grid-label-hop {
        description
          "Generic label-hop information for flexi-grid";
        choice single-or-super-channel {
          description
            "single or super channel";
          case single {
            uses flexi-grid-frequency-slot;
          }
          case super {
            status deprecated;
            list subcarrier-flexi-n {
              key "flexi-n";
              uses flexi-grid-frequency-slot;
              description
                "List of subcarrier channels for flexi-grid super
                 channel.";
            }
          }
          case multi {
            container frequency-slots {
              description
                "The top level container for the list of frequency
                slots used for flexi-grid super channel.";
              list frequency-slot {
                key "flexi-n";
                min-elements 2;
                uses flexi-grid-frequency-slot;
                description
                  "List of frequency slots used for flexi-grid super
                  channel.";
```

YANG update for both fixed- and flexi-grid links

```
grouping wdm-label-start-end:
    +-- (grid-type)?
       +--:(fixed-dwdm)
       |  +-- dwdm-n?    l0-types:dwdm-n
       +--:(cwdm)
       |  +-- cwdm-n?    l0-types:cwdm-n
       +--:(flexi-grid)
          +-- flexi-n?   l0-types:flexi-n
grouping wdm-label-step:
  +-- (l0-grid-type)?
       +--:(fixed-dwdm)
       |  +-- wson-dwdm-channel-spacing?    identityref
       +--:(cwdm)
       |  +-- wson-cwdm-channel-spacing?    identityref
       +--:(flexi-grid)
          x-- flexi-grid-channel-spacing?   identityref
          +-- flexi-ncfg?                   identityref
          +-- flexi-n-step?                 uint8
```

```
grouping transmitter-tuning-range:
    +-- min-central-frequency?    frequency-thz
    +-- max-central-frequency?    frequency-thz
    +-- transceiver-tunability?   frequency-ghz
```

```
grouping wdm-label-hop:
  +-- (grid-type)?
       +--:(fixed-dwdm)
       |  +-- (fixed-single-or-super-channel)?
       |     +--:(single)
       |     |  +-- dwdm-n?                 l0-types:dwdm-n
       |     +--:(multi)
       |        +-- subcarrier-dwdm-n*     l0-types:dwdm-n
       +--:(cwdm)
       |  +-- cwdm-n?                      l0-types:cwdm-n
       +--:(flexi-grid)
          +-- (single-or-super-channel)?
             +--:(single)
             |  +-- flexi-n?                l0-types:flexi-n
             |  +-- flexi-m?                l0-types:flexi-m
             x--:(super)
             |  +-- subcarrier-flexi-n* [flexi-n]
             |     +-- flexi-n?   l0-types:flexi-n
             |     +-- flexi-m?   l0-types:flexi-m
             +--:(multi)
                +-- frequency-slots
                   +-- frequency-slot* [flexi-n]
                      +-- flexi-n?   l0-types:flexi-n
                      +-- flexi-m?   l0-types:flexi-m
grouping wdm-label-range-info:
  +-- grid-type?    identityref
  +-- priority?     uint8
  +-- flexi-grid
     +-- slot-width-granularity?   identityref
     +-- min-slot-width-factor?    uint16
     +-- max-slot-width-factor?    uint16
```

Open issues

- Tracking Open Issues, discussions and resolutions linked to YANG model https://github.com/ietf-ccamp-wg/ietf-ccamp-layer0-types-ext-RFC9093-bis/issues
- 7 issues closed since IETF-117 (see the list)
  - Priority given to issues creating dependency for stable draft almost ready for LC (e.g. optical impairments)
- Still 10 open issues: most of them already discussed
  - Pyang tree length issue #65 : too long lines in the tree, even if character limit is set to 69 (in pyang) => It seems a general problem not strictly related to this draft
  - Try to shorten the names of attributes #69, this is related to the issue #65
  - Add changes from RFC 9093 issue #40: no discussion needed , just homework
  - Issue #10: it seems useful to add also to the standard mode the attributes used to report the frequency and power ranges supported by a given transceiver for a given application code. Check with Q6 experts is needed.
  - Issue #21 : OTU-types identities not used by any other model and defined without standard reference
  - Issue #6 :Add needed standard reference: More references are needed to where attributes and identities are defined
  - Issue #5 Clarification of layer0 label definitions : As for ODU case, we need for WSON and Flexgrid a description of what is the information needed to characterize the label in the two cases .
  - Issue #2 Transponder typedefs and groupings: old issue to be addressed again in the next calls.
  - Issue #47 Hybrid Modulation format: not clear if this enhancement is really needed. To discuss again in the calls.

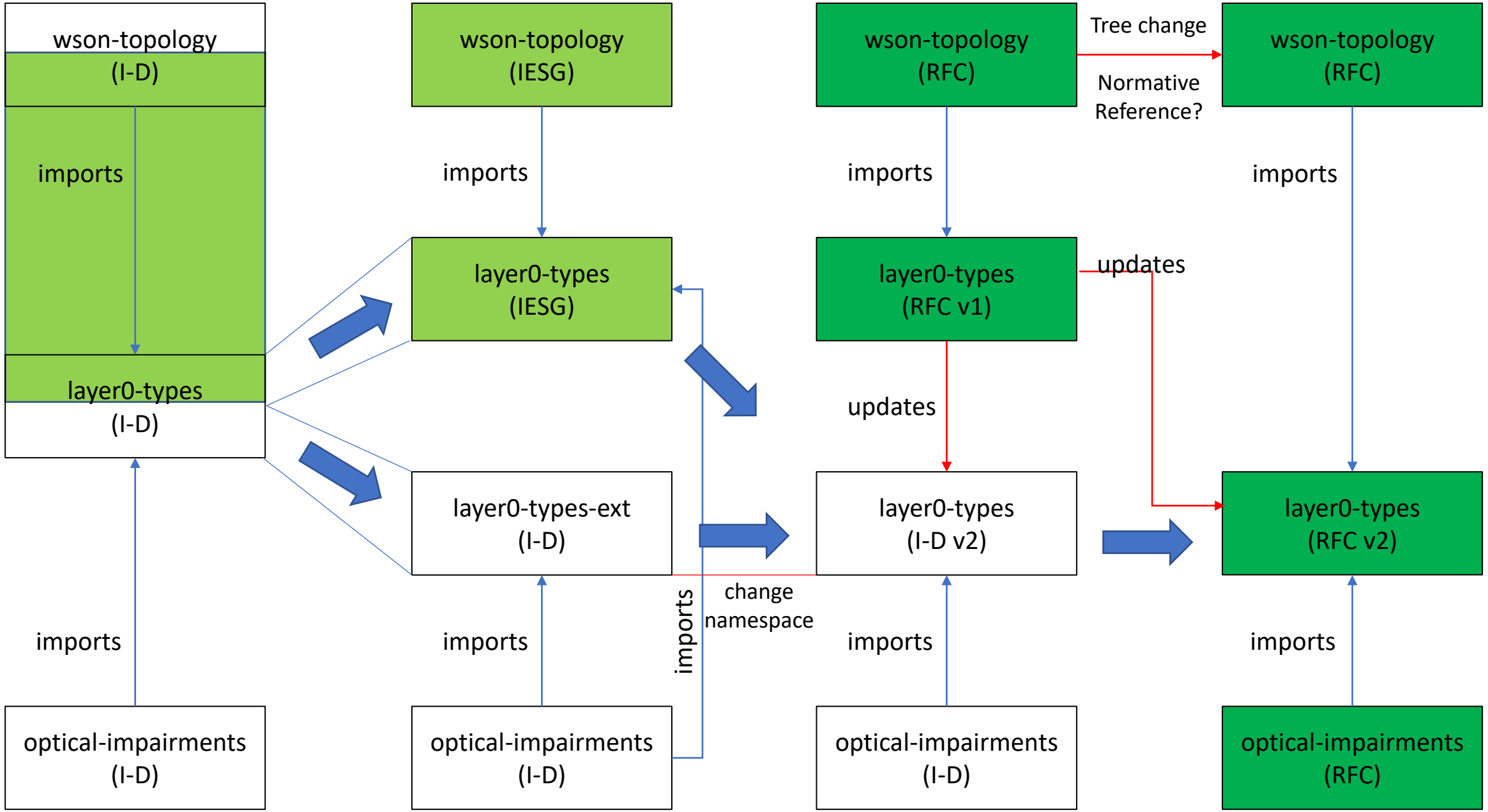
Administrative:

- 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

Next Steps

- Address the issues still on the list
- Review terminology
- Get ready for WG LC, asap with possible target on IETF 119

backup


wson-topology
(I-D)
imports
layer0-types
(I-D)
wson-topology
(IESG)
imports
layer0-types
(IESG)
layer0-types-ext
(I-D)
wson-topology
(RFC)
imports
layer0-types
(RFC v1)
updates
layer0-types
(I-D v2)
Tree change
Normative
Reference?
wson-topology
(RFC)
imports
updates
layer0-types
(RFC v2)
imports
optical-impairments
(I-D)
imports
optical-impairments
(I-D)
imports
change
namespace
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optical-impairments
(I-D)
imports
optical-impairments
(RFC)