A Yang Data Model for Optical Impairment-aware Topology

draft-ietf-ccamp-optical-impairment-topology-yang-07

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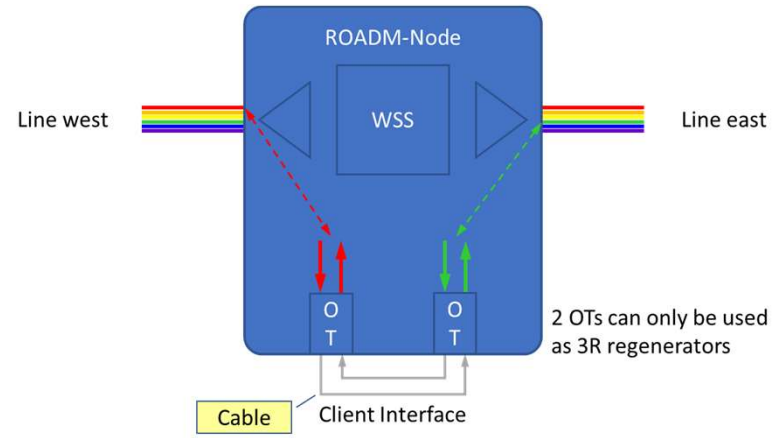
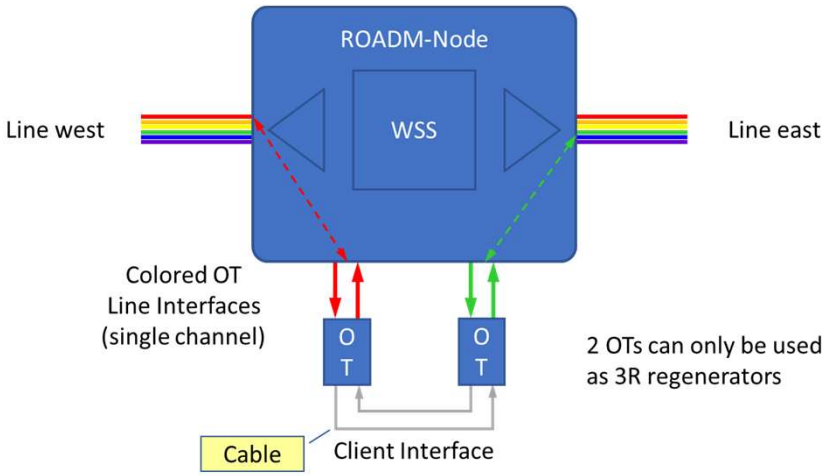
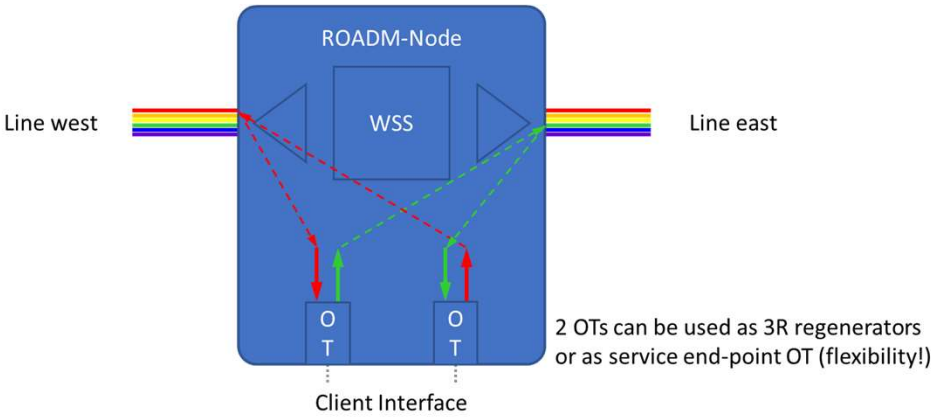
Major Activities since IETF 110 Meeting

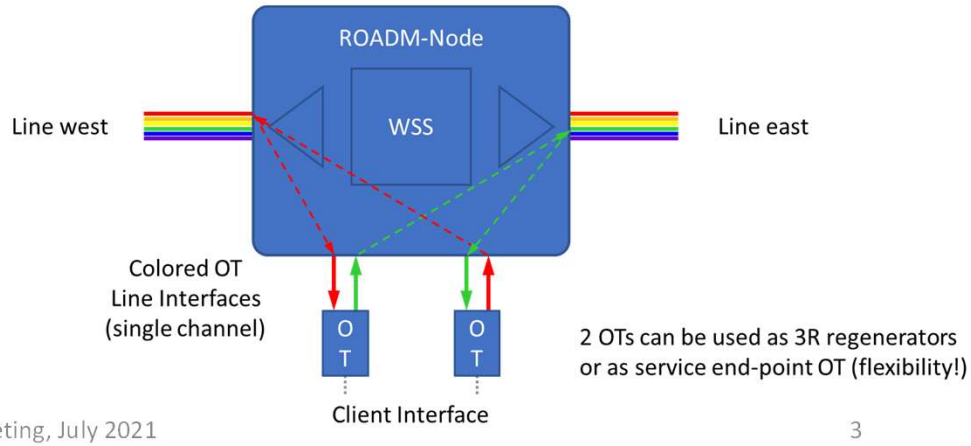
- Continuation of weekly CCAMP WebEx meetings (Tue, 2-3pm CET)
- Added section 2.6 related to the introduction of 3R regenerator in the model
  - General description of 3R functionality
  - Typical realization of 3R functionality (see following slide)
  - 2 options discussed to address 3R function model (see slide 5)
  - Still pending related issue #83
- YANG model update to extend the ROADM model to also support C+L band (addressing issue https://github.com/ietf-ccamp-wg/draft-ietf-ccamp-optical-impairment-topology-yang/issues/51)

Bidir back-to-back and unidir (with internal loop) 3R configuration





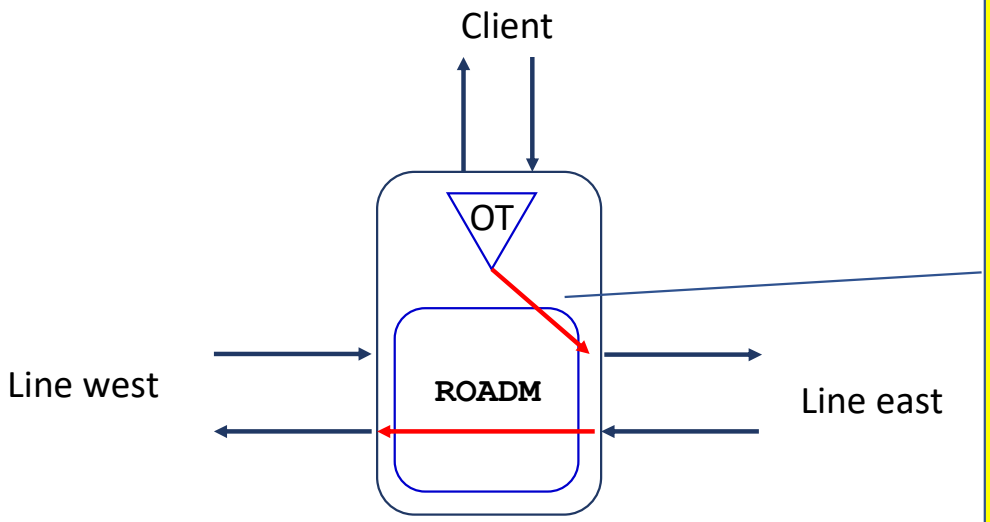




Option 1: present in the updated model

- Starting from the consideration that 3R functionality are composed of an optical transponder pair
  - the capability whether an optical transceiver can be used as a 3R regenerator it is added to the transceiver capabilities.
  - Same physical layer attributes, no additional optical impairment attributes need to be defined, the ROADM model already provides in terms of optical impairment what is needed for 3R regens
  - No needs for new model construct: LLCL can already provides the capability to regenerate when coming from one degree (LTP) and needed TE metric info
- From a functional point of view a regenerator is a kind of lightpath signal termination so having a reference to a regen in a TTP can work.
- Seamless description of 3R functionality with respect transponder model
  - managing 3R with a few augmentations from transponders model will ease implementers task and understanding of the model also from users.
- Not a big deal to change role of one transceiver from regen or back to transceiver
- No additional YANG model dependency
- More natural approach for a bottom-up approach (device)

Impairments attributes on LLCL




```
+--rw tunnel-termination-point* [tunnel-tp-id]
        +--rw tunnel-tp-id                      binary
        ...........
        +--rw local-link-connectivities
        |  +--rw number-of-entries?       uint16
        |  ...........
        |  +--rw is-allowed?              boolean
        |  ...........
        |  +--ro path-properties
        |  |  ...........
/* ADD (Start) */
        |  +--ro add-path-impairments     leafref
        |  +--ro drop-path-impairments    leafref
/* ADD (End) */
        |  +--rw local-link-connectivity* [link-tp-ref]
        |     +--rw link-tp-ref
        |     |      -> ../../../../../nt:termination-point/tp-id
        |     ...........
        |     +--rw is-allowed?           boolean
        |     ...........
        |     +--ro path-properties
        |     |  ...........
/* ADD (Start) */
        |     +--ro add-path-impairments    leafref
        |     +--ro drop-path-impairments   leafref
/* ADD (End) */
```

TTP local link connectivity would provide the impairments of the ROADM add/drop paths towards the 3R.

3R YANG update

```
module: ietf-optical-impairment-topology

  augment /nw:networks/nw:network/nw:network-types/tet:te-
topology:
    +--rw optical-impairment-topology!
  augment /nw:networks/nw:network/nw:node:
    +--ro transponder* [transponder-id]
       +--ro transponder-id    uint32
       +--ro transceiver* [transceiver-id]
          +--ro transceiver-id                      uint32
          +--ro termination-type-capabilities?      enumeration
          +--ro supported-3r-mode?                  enumeration
          +--ro configured-termination-type?        enumeration
          +--ro supported-modes
             +--ro supported-mode* [mode-id]
                +--ro mode-id                        string
                +--ro (mode)
                   +--:(G.698.2)
```

```
augment /nw:networks/nw:network/nw:node/tet:te
            /tet:tunnel-termination-point:
    +--ro otsi-group* [otsi-group-id]
    |  +--ro otsi-group-id    int16
    |  +--ro otsi* [otsi-carrier-id]
    |     +--ro otsi-carrier-id            int16
    |     +--ro transponder-ref?
    |     |       -> ../../../../../transponder/transponder-
id
    |     +--ro transceiver-ref?           leafref
    |     +--ro configured-mode?           leafref
    |     +--ro otsi-carrier-frequency?    frequency-thz
    |     +--ro tx-channel-power?          dbm-t
    |     +--ro rx-channel-power?          dbm-t
    |     +--ro rx-total-power?            dbm-t
    +--ro transceiver* []
       +--ro transponder-ref?
       |       -> ../../../../transponder/transponder-id
       +--ro tranceiver-ref?    leafref
```

Option 2: discussed during our weekly call

- Use the service function topology model, introducing a new topology entity, “service-function 3R”
- From path computation application TTP is a path computation input →no subject to path selection and constraints, while 3R is the output of path computation → subject to selection, optimization and constraints (e.g. incl/excl some 3R elements) ,requires advertised info that TTP does not need necessarily
  - From path computation application behavior no changes regarding TTP management with this option
  - In the actual option L0 path computation should manage the TTPs differently depending on whether they support only L0 tunnel termination or 3R functionality
- More natural for a top-down approach (abstraction)
- 3R function as SF is client friendly
  - topological unique identification
  - indication of whether a particular instance of the 3R function is feasible, taken by another service or available (and at what priority level)
  - TE metric for selecting instance of 3R function
- SF is inherently modeling layer violations (3R realization is outside of L0)
  - Protection against potential layer violation concerns

ROADM model support for C+L band

- Following the optical amplifier model extensions to support C+L band amplifiers, model extensions have been added for ROADM
- Link-id and amp-uid can identify uniquely amplifiers solving issue to have more amp on one band (ILA or booster/preamp)
- The model can support already more than 2 bands for possible future extensions
- The mapping between abstract view in our model of ROADM and the possibility to have multiple intput/output ports of the pre-ampl and booster, should not be exposed at NBI interface and the mapping should be inside domain controller, based on device model.

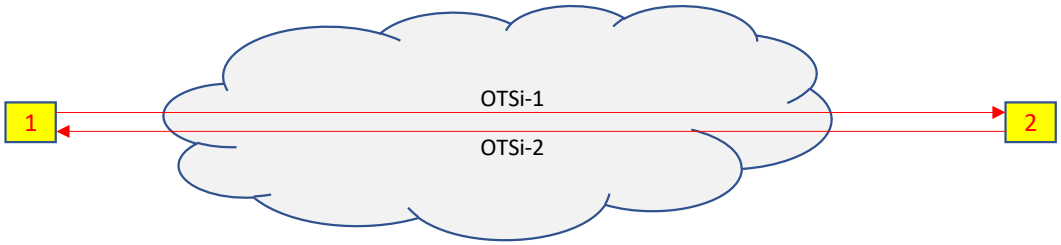
```
augment /nw:networks/nw:network/nw:node/tet:te
            /tet:te-node-attributes:
    +--ro roadm-path-impairments* [roadm-path-impairments-
id]
       +--ro roadm-path-impairments-id    uint32
       +--ro (impairment-type)?
          +--:(roadm-express-path)
          |  +--ro roadm-express-path* []
          |     +--ro frequency-range
          |     |  +--ro lower-frequency    frequency-thz
          |     |  +--ro upper-frequency    frequency-thz
          |     +--ro roadm-pmd?                decimal64
          |     +--ro roadm-cd?                 decimal64
          |……..

          +--:(roadm-add-path)
          |  +--ro roadm-add-path* []
          |     +--ro frequency-range
          |     |  +--ro lower-frequency    frequency-thz
          |     |  +--ro upper-frequency    frequency-thz
          |……..
          +--:(roadm-drop-path)
             +--ro roadm-drop-path* []
                +--ro frequency-range
                |  +--ro lower-frequency    frequency-thz
                |  +--ro upper-frequency    frequency-thz
                +--ro roadm-pmd?                decimal64
                +--ro roadm-cd?                 decimal64
                +--ro roadm-pdl?                decimal64
                +--ro roadm-inband-crosstalk?   decimal6
```

Open issues

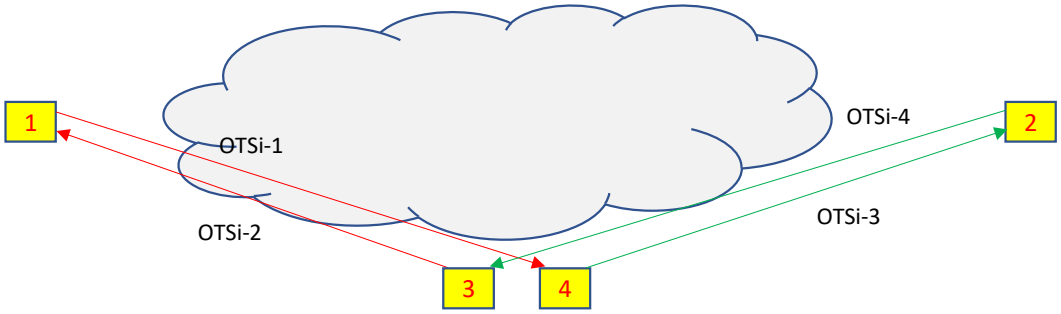
- Tracking Open Issues, discussions and resolutions linked to YANG model https://github.com/ietf-ccamp-wg/draft-ietf-ccamp-optical-impairment-topology-yang/issues:
- 6 issues closed from the last IETF meeting
- Still 21 open issues
  - 2 out of them are real YANG general issues that specifically for this draft and should require NETMOD specific clarifications (issues #79, #84)
  - 5 have an identified resolution and will be addressed with the next YANG model commit (issues #26, #69, #72, #76,#75)
  - 2 editorial for review terminology (#24,#25)
  - 3 are request to remove “unused” groupings to be investigated against real needs (#55, #56, #57)
  - Pending enhancement of the model (#8, #70,)
  - 1 pending issue related to 3R (#83, #23)
  - Clarifications are required (#77,#74, #42, #38)
  - Admin integration (#71)
  - https://github.com/ietf-ccamp-wg

Issue #83: How to connect transceivers in 3R

how the transceivers used in a 3R configuration can be associated, especially in case of multi-carrier (OTSiG with >1 OTSi) cases.

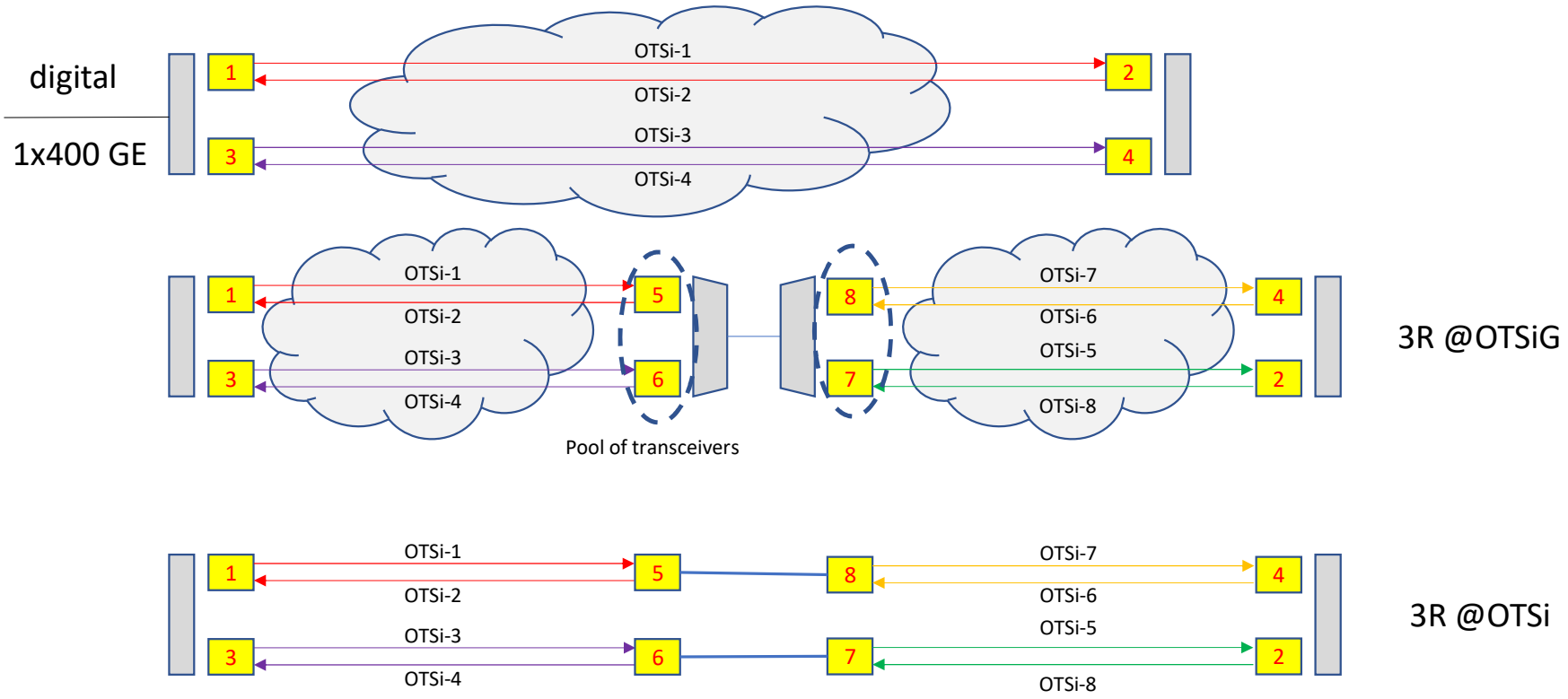


Single OTSi – E2E

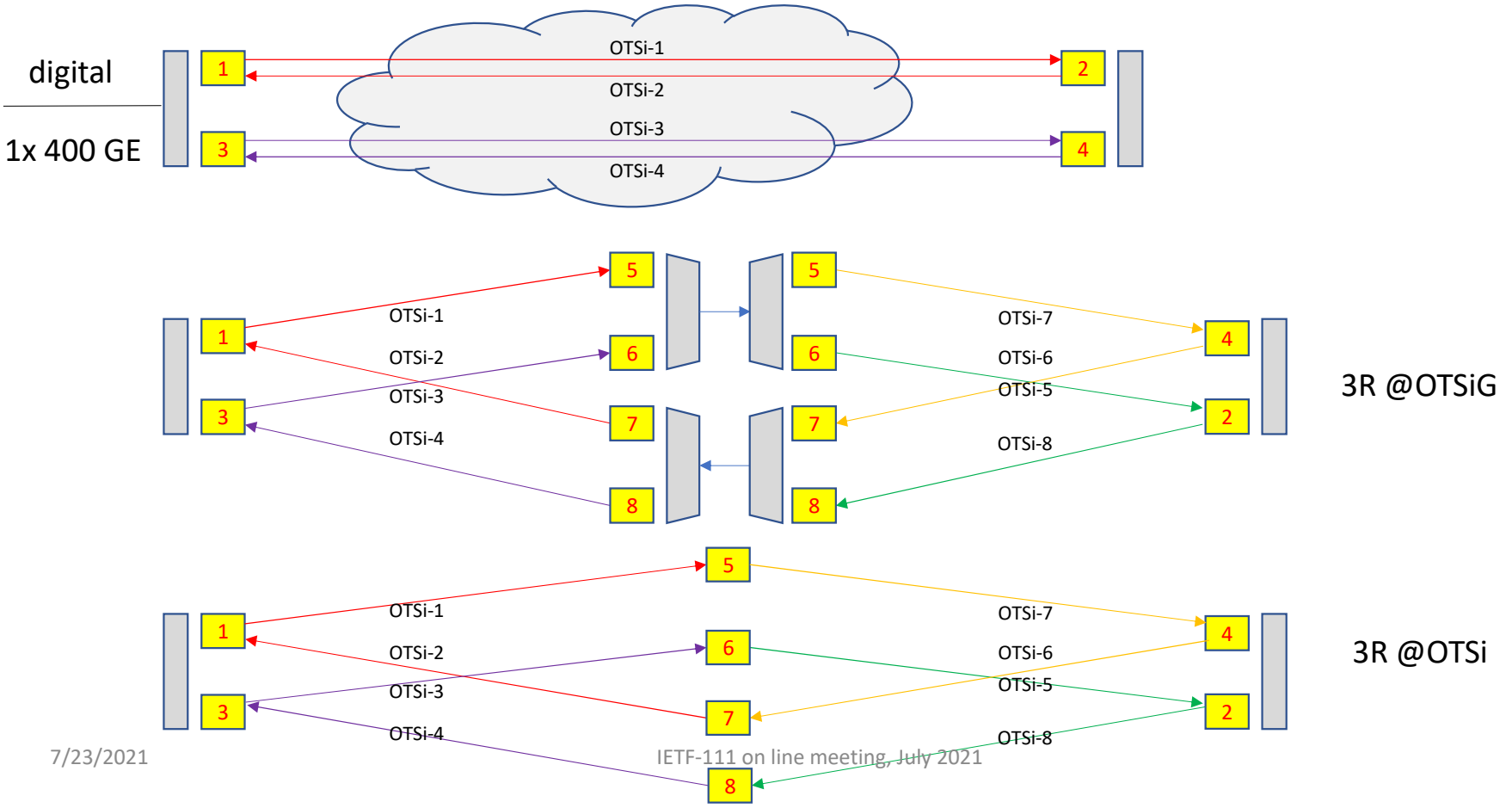


Single OTSi – 3R unidir

Issue #83: How to connect transceivers in 3R- back-to-back configuration



3R unidir configuration



Next Steps

- Finalizing 3R , with solving issue #83
- Addressing the issues with already a discussed solution (both model enhancement and editorial)
- Be ready for YANG doctor review for November meeting
- Stable version by end of the year