A YANG Data Model for WDM Tunnels

draft-ietf-ccamp-wdm-tunnel-yang-06

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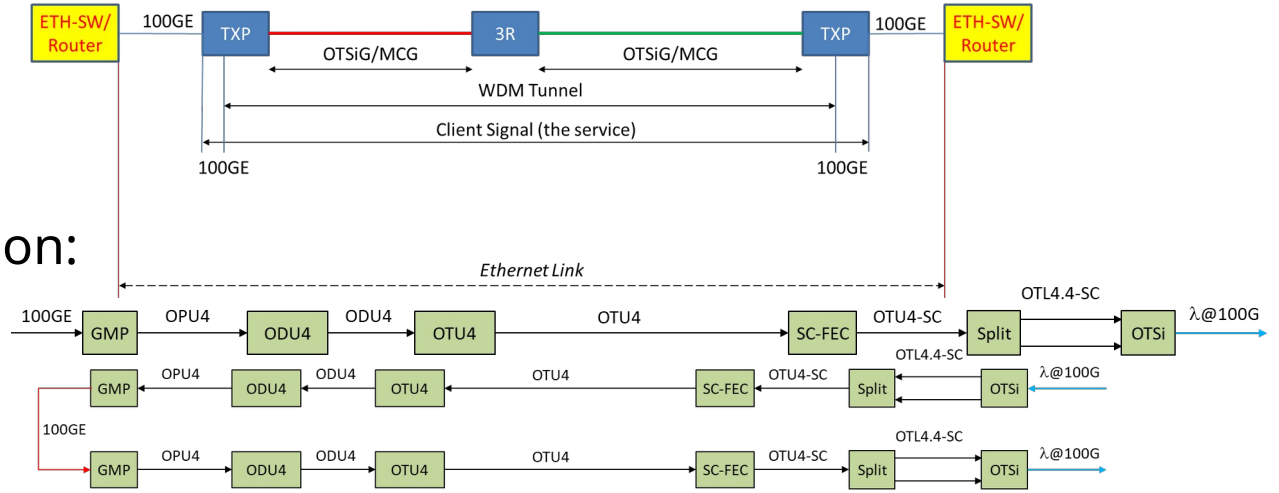
Summary of Updates in -06

- No YANG model and text update

- Ongoing discussion and alignment on 3R regenerator scenarios/gap analysis
  - Review of supported 3R regenerator scenarios
  - Identify key scenarios and gaps in current model to support these scenarios
  - Eliminate edge cases and proprietary cases

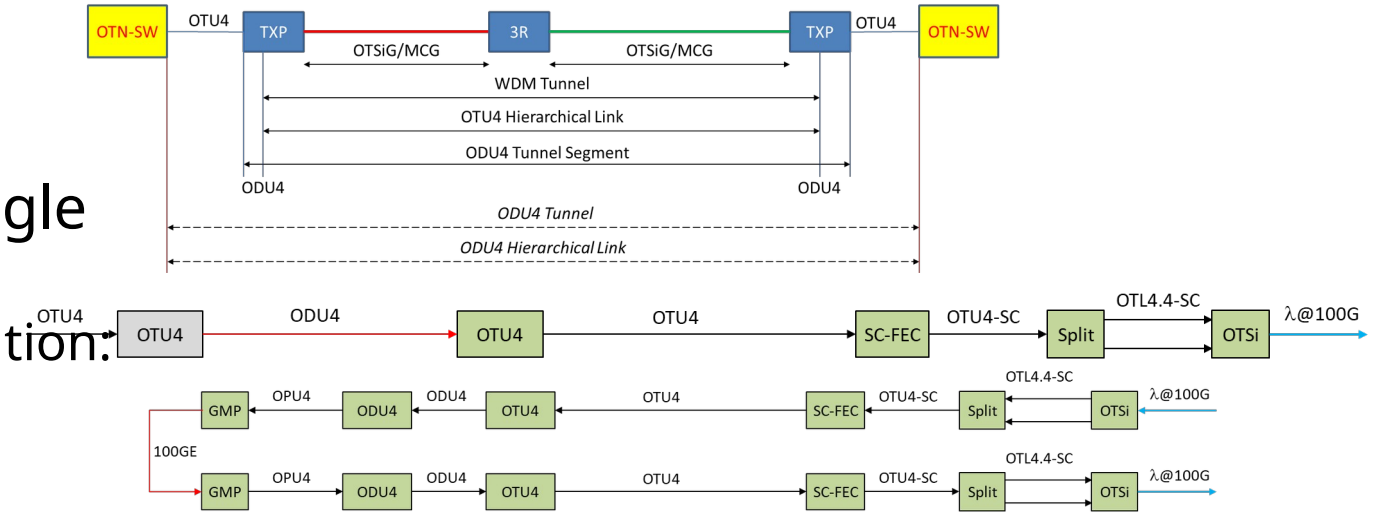
Regenerator Scenarios

- S1: 100GE service over single OTSi
  - Digital terminations at source, destination: {ODU4 (GMP), OTU4}
  - 3R Regenerator layers: 100GE, ODU4



To be discussed

- S2 : ODU4 tunnel segment over single OTSi
  - Digital termination at source, destination: {OTU4}
  - 3R Regenerator layer: ODU4

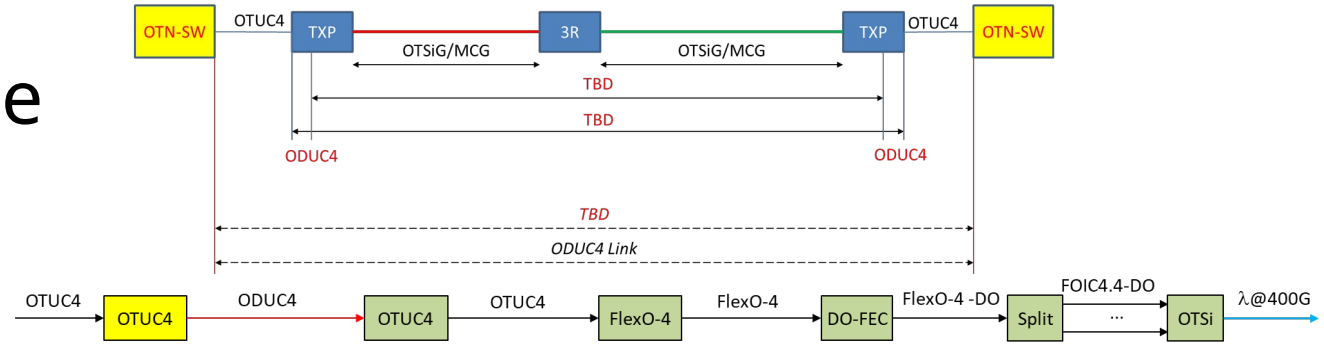


Regenerator Scenarios (Cont.)

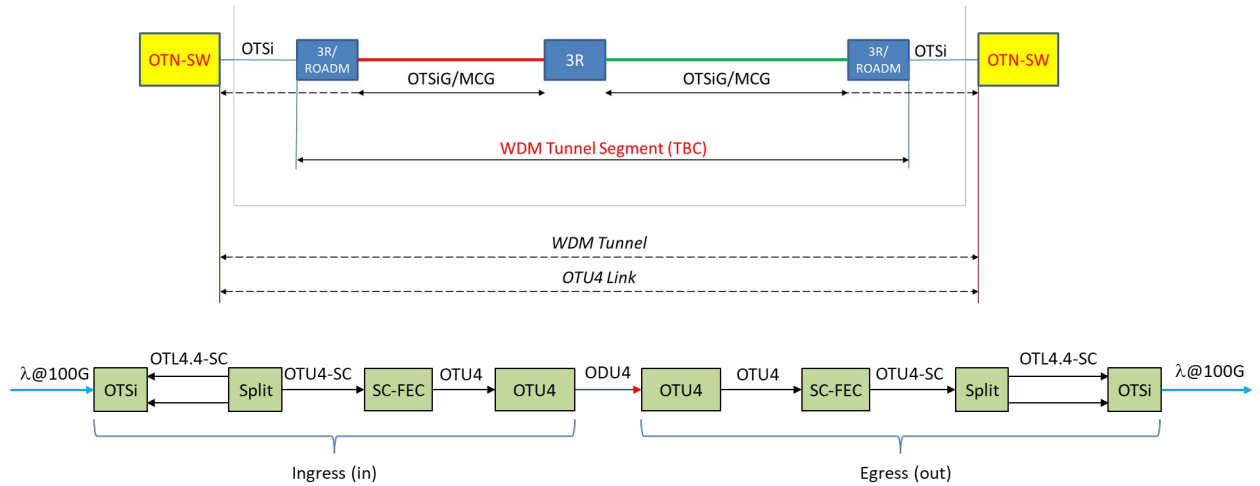
To be discussed

- S3: ODUC4 service over single OTSi
  - Digital termination at source, destination: {OTUC4}
  - 3R Regenerator layer: ODUC4

To be discussed

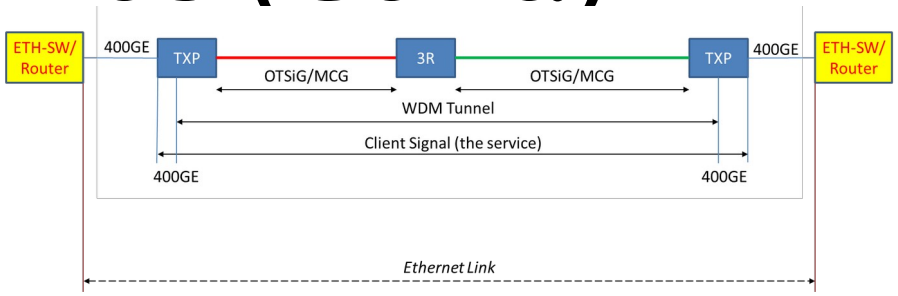


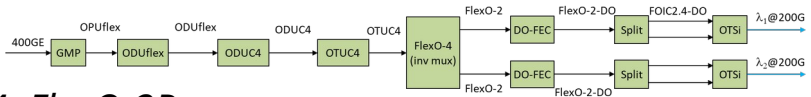
- S4: OTN OTSi service
  - Digital termination at source, destination: N/A
  - 3R Regenerator layer: ODU4

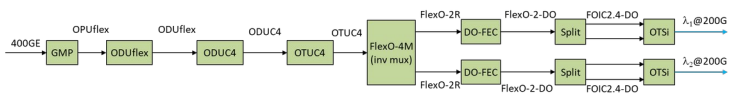


Regenerator Scenarios (Cont.)

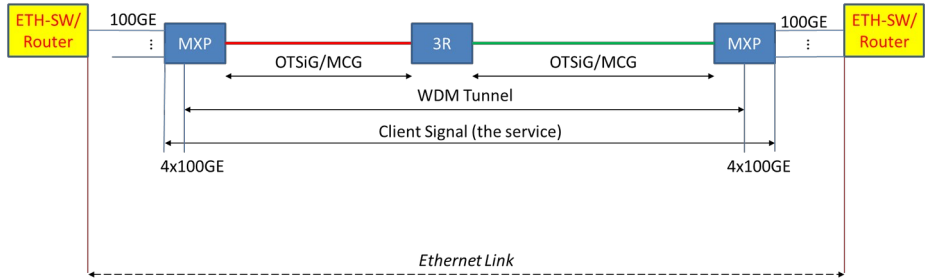
- S6: 400GE service over single or multiple OTSis
  - Digital termination at source, destination: {ODUflex (GMP), ODUC4, OTUC4, FlexO-4(M)}
  - Transceiver:
    - Inverse Multiplexing: FlexO-4
    - Digital termination: FlexO-2(R)
  - 3R Regenerator layer: *400GE, ODUflex, ODUC4, FlexO-2R*
  - Multiple inverse multiplexing variants exist
  - Different numbers of OTSis before/after regeneration

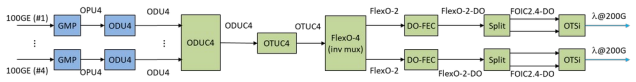


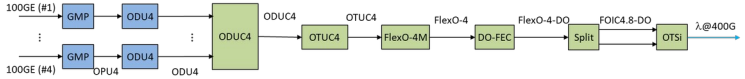




- S7: 4x100GE mux service over single or multiple OTSis
  - Digital termination at source, destination: {ODUC4, OTUC4, FlexO-4(M)}
  - Transceiver:
    - Inverse Multiplexing: FlexO-4
    - Digital termination: FlexO-2(R)
  - 3R Regenerator layer: *ODUC4, FlexO-4R*
  - Need to discuss: whethere there is lifecycle dependency between the client signal and the tunnel model (Issue #83)







YANG entities gaps for supporting regenerator scenarios

- Need to develop the definition and YANG model of
  - Regeneration layer
  - Typedef and sequence of digital termination
  - Inverse multiplexing type

Next Steps

- Complete the review of regenerator scenarios
- Update I-D text:
  - Adding descriptive text about regenerator scenarios
  - Improving the text on the WDM tunnel provisioning
  - Adding a diagram to illustrate the relationship between this model, the optical impairment topology , RFC 9093 bis, optical path computation.(#25)
- YANG model update
  - Develop YANG model definitions for identified gaps (regeneration layer, digital layer mapping/termination (with order) and inverse multiplexing)
- Address Rtgdir and YANG Doctor review comments (#74, #76)
- Consider defining optical layer-specific operations (RPCs), for example automatic power equalization, that are application to a WDM tunnel
- Related work in CCAMP may require additional changes to this draft
  - WDM path computation
  - Ongoing work on pluggable management & control, including the gap analysis and use cases documents, may require additional changes to the model

Thank you!

Backup

Defining “Incoming” and “Outgoing” Transponder in Regenerator Scenarios

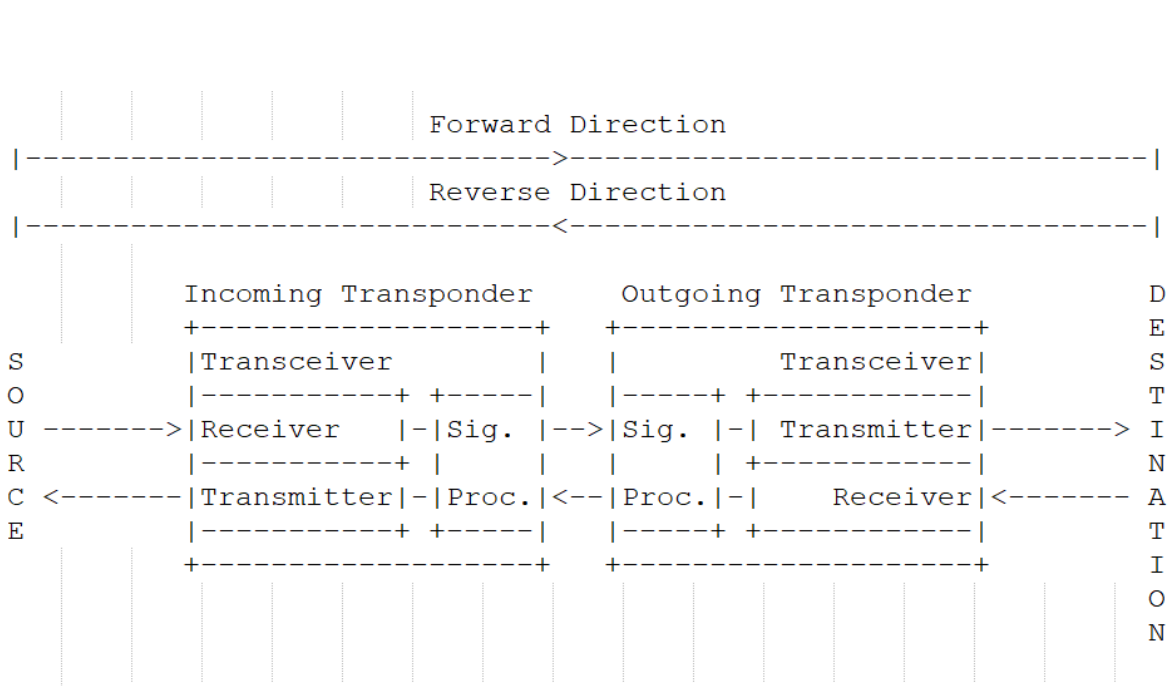


Figure 1: Reference Points in Back-to-back 3R Regeneration

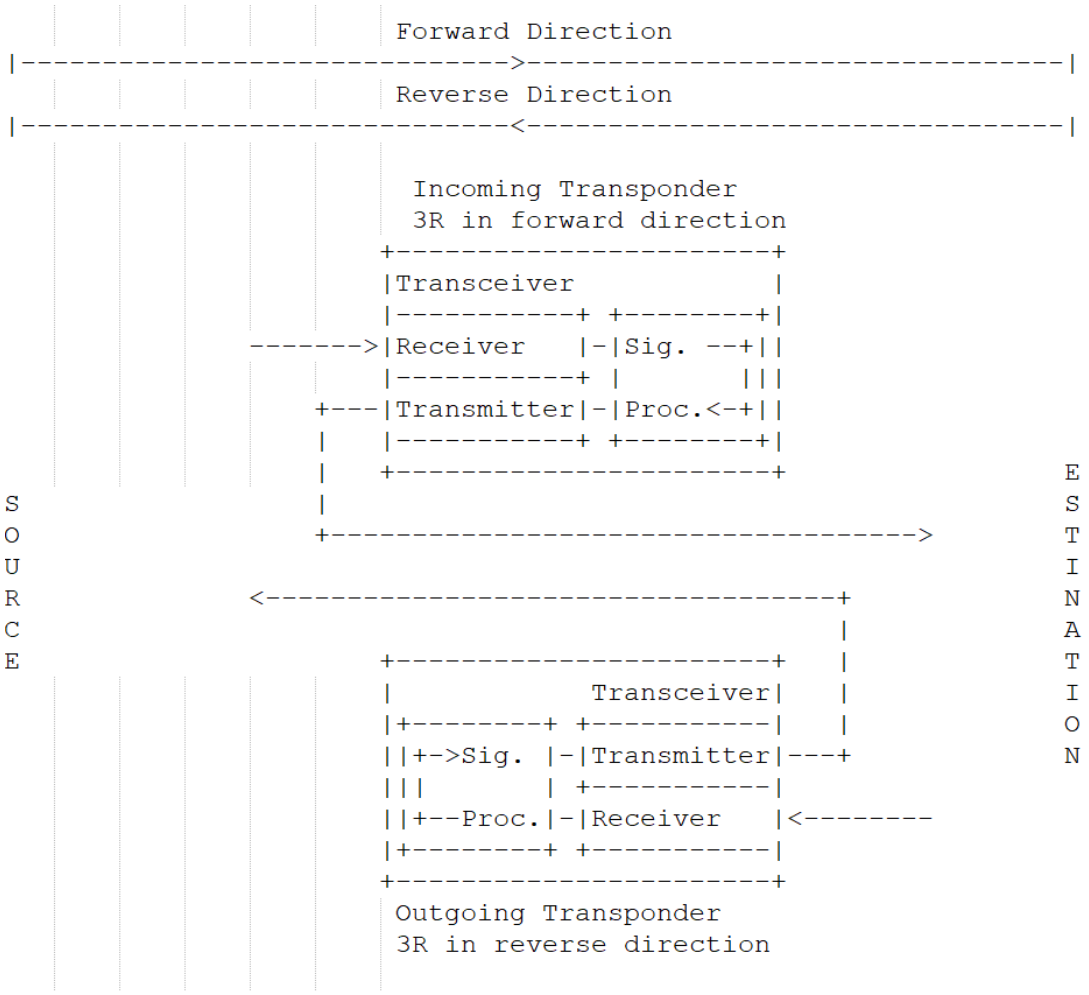


Figure 2: Reference Points in Uni-directional 3R Regeneration

Consistent Transponder Configurations at Source, Destination and Regenerator

```
 +--rw (node-position)?
       +--:(source) or (destination)
       |  +--rw source-transponder (or destination-
transponder)
       |     +--rw transponder-id?         uint32
       |     +--rw digital-terminations
       |     |  +--rw digital-termination* [index]
       |     |     +--rw index               uint8
       |     |     +--rw termination-type?   identityref
       |     |     +--rw mapping-type?       identityref
       |     +--rw transceiver
       |        +--rw transceiver-id?               uint32
       |        +--rw otsi-carrier-id?              uint16
       |        +--rw otsi-carrier-frequency?
       |        |       l0-types:frequency-thz
       |        +--rw tx-channel-power?
       |        |       l0-types:power-dbm
       |        +--rw operational-mode?             string
       |        +--rw line-coding-bitrate?
identityref
       |        +--rw preferred-rx-channel-power?
       |        |       l0-types:power-dbm
       |        +--rw gsnr-extra-margin?           snr
       |        +--rw inverse-multiplexing!
       |           +--rw inverse-mux-type?
identityref
       |           +--rw otsi-lane-termination-type?
identityref
       |           +--rw additional-transceivers
       |              +--rw index?                   uint8
       |              +--rw transceiver-id?          uint32
       |              +--rw otsi-carrier-id?         uint16
       |              +--rw otsi-carrier-frequency?
       |              |       l0-types:frequency-thz
       |              +--rw tx-channel-power?
       |                      l0-types:power-dbm
       |
       +--:(regenerator)
       |  +--rw regenerator
       |     +--rw regen-group-id?         uint32
       |     +--rw regeneration-layer?     identityref
       |     +--rw incoming-transponder
       |     |  +--rw transponder-id?         uint32
       |     |  +--rw digital-terminations
       |     |  |  +--rw digital-termination* [index]
       |     |  |     +--rw index               uint8
       |     |  |     +--rw termination-type?   identityref
       |     |  |     +--rw mapping-type?       identityref
       |     |  +--rw transceiver
       |     |     +--rw transceiver-id?               uint32
       |     |     +--rw otsi-carrier-id?              uint16
       |     |     +--rw otsi-carrier-frequency?
       |     |     |       l0-types:frequency-thz
       |     |     +--rw tx-channel-power?
       |     |     |       l0-types:power-dbm
       |     |     +--rw operational-mode?             string
       |     |     +--rw line-coding-bitrate?          identityref
       |     |     +--rw preferred-rx-channel-power?
       |     |     |       l0-types:power-dbm
       |     |     +--rw gsnr-extra-margin?           snr
       |     |     +--rw inverse-multiplexing!
       |     |        +--rw inverse-mux-type?
identityref
       |     |        +--rw otsi-lane-termination-type?
identityref
       |     |        +--rw additional-transceivers
       |     |           +--rw index?                   uint8
       |     |           +--rw transceiver-id?          uint32
       |     |           +--rw otsi-carrier-id?         uint16
       |     |           +--rw otsi-carrier-frequency?
       |     |           |       l0-types:frequency-thz
       |     |           +--rw tx-channel-power?
       |     |                   l0-types:power-dbm
       |     +--rw outgoing-transponder
       |           (same structure as incoming-transponder)
       |
       +--:(regenerators)
          +--rw regenerators
             +--rw common-incoming
             |  +--rw operational-mode?             string
             |  +--rw line-coding-bitrate?
identityref
             |  +--rw preferred-rx-channel-power?
             |  |       l0-types:power-dbm
             |  +--rw gsnr-extra-margin?            snr
             +--rw common-outgoing
             |  +--rw operational-mode?             string
             |  +--rw line-coding-bitrate?
identityref
             |  +--rw preferred-rx-channel-power?
             |  |       l0-types:power-dbm
             |  +--rw gsnr-extra-margin?            snr
             +--rw regenerator* [index]
                +--rw index                   uint8
                +--rw regen-group-id?         uint32
                +--rw regeneration-layer?     identityref
                +--rw incoming-transponder
                |  +--rw transponder-id?   uint32
                |  +--rw transceiver
                |     +--rw transceiver-id?           uint32
                |     +--rw otsi-carrier-id?          uint16
                |     +--rw otsi-carrier-frequency?
                |     |       l0-types:frequency-thz
                |     +--rw tx-channel-power?
                |             l0-types:power-dbm
                +--rw outgoing-transponder
                   +--rw transponder-id?   uint32
                   +--rw transceiver
                      +--rw transceiver-id?           uint32
                      +--rw otsi-carrier-id?          uint16
                      +--rw otsi-carrier-frequency?
                      |       l0-types:frequency-thz
                      +--rw tx-channel-power?
                              l0-types:power-dbm
```

Next Steps

- Consolidate the basic reference scenarios out of our complete package
- Address the open issues & WG comments

Weekly team meeting:

Thursday, 14:00 (CET)

CCAMP WebEx Details

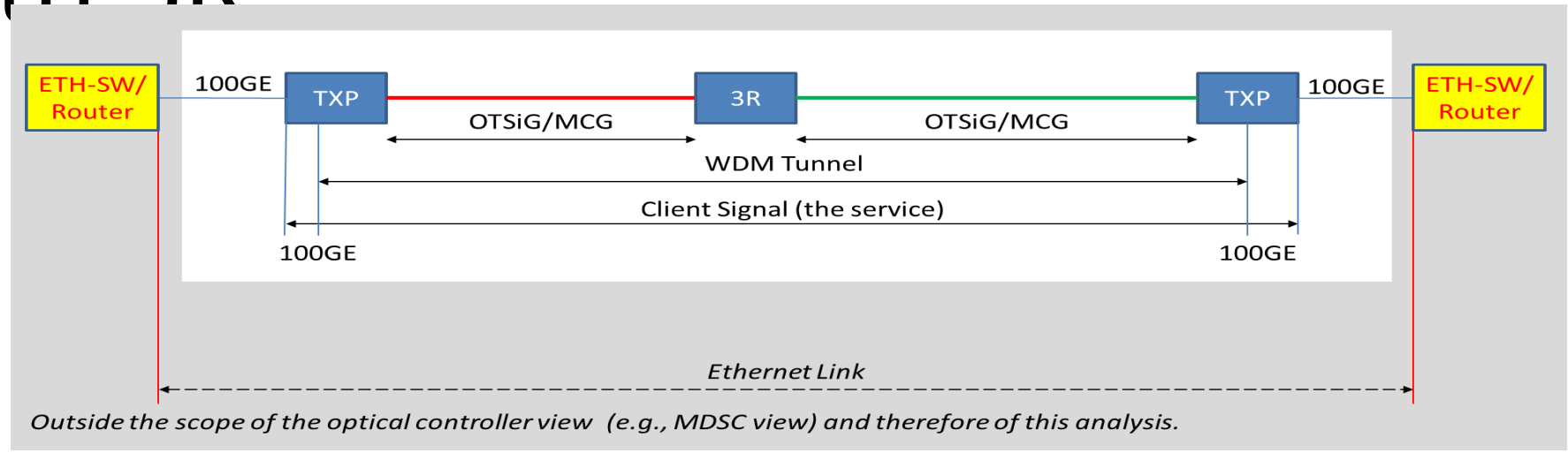
https://ietf.webex.com/ietf/j.php?MTID=ma1ca3bcec716fe1ff93e0a28b3558294

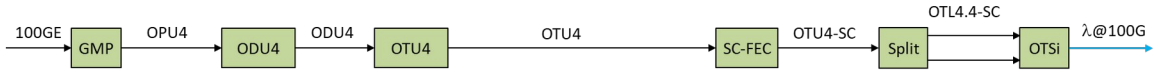
Join by meeting number

Meeting number (access code): 2422 698 1495

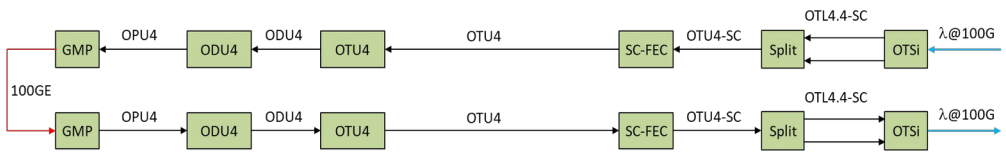
Meeting password: 6UbM2tEJJd6

Reference Scenario (1) - 100GE Service with 3R

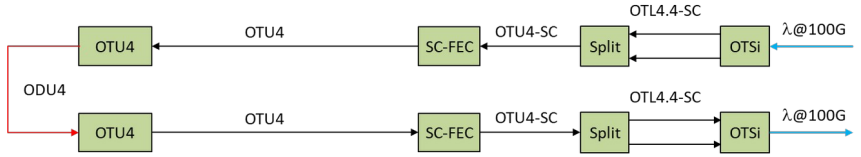




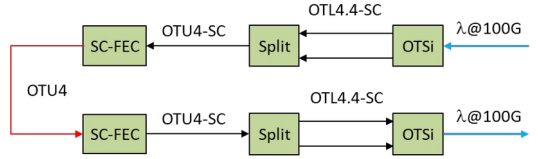
Source Transponder
Destination Transponder (in reverse signal direction)



Regen layer:
100GE

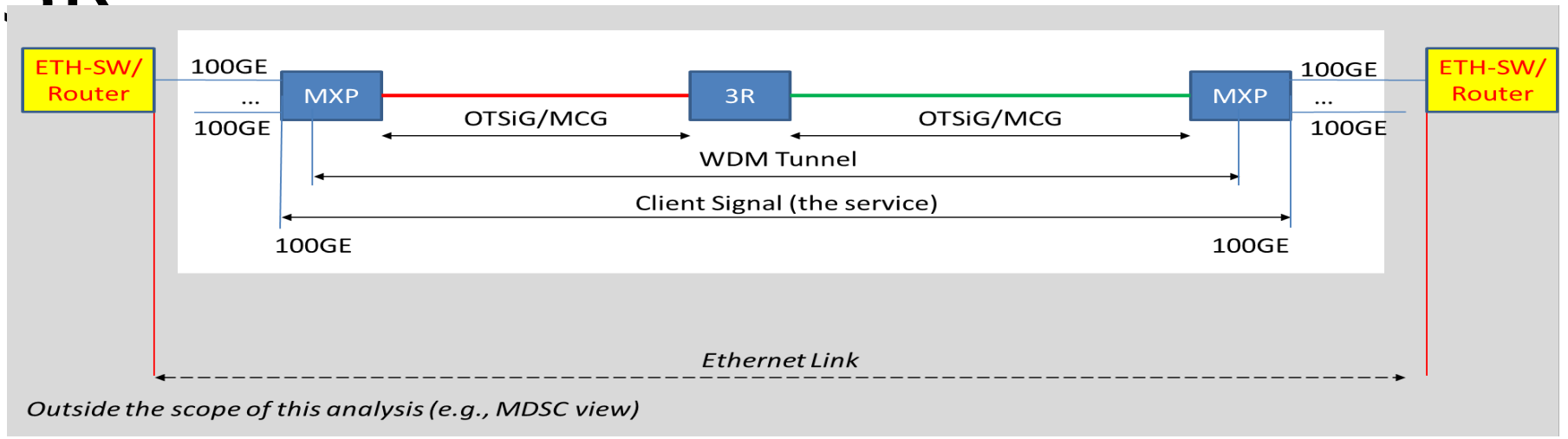


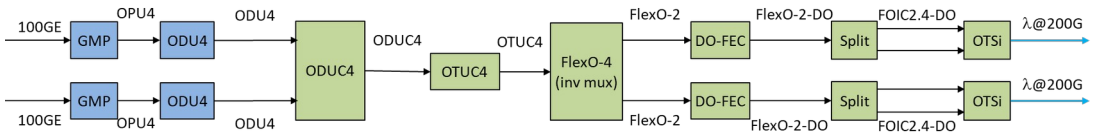
Regen layer:
ODU4



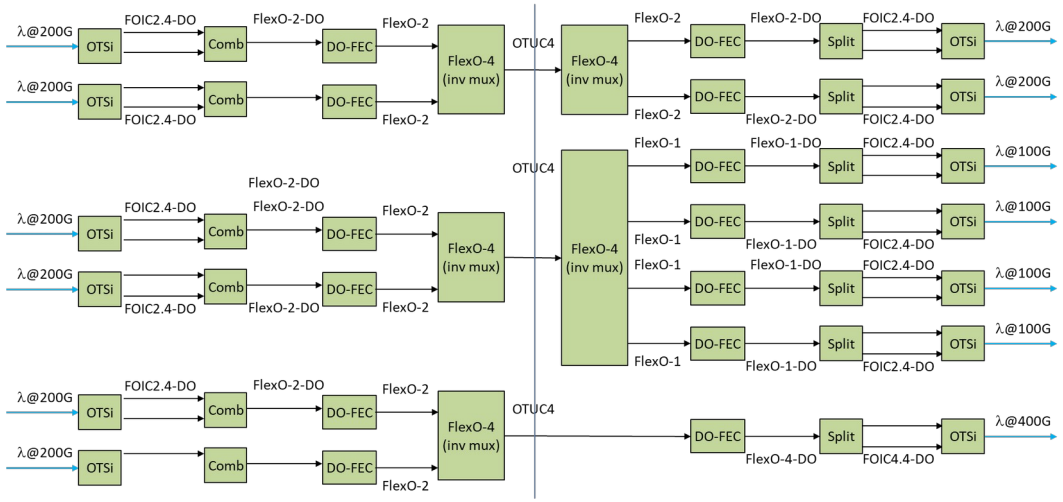
Regen layer:
OTU4

Reference Scenario (2) – 4 x 100GE Service with 3R





Source Muxponder
Destination Muxponder (in reverse signal direction, can have different digital mapping than the source muxponder)



Regen layer:
OTUC4

Regen layer:
FlexOnM/FlexO xR

YANG modules impacts (1)

To align and merge with previous

draft-ietf-ccamp-client-signal-yang (client information)	draft-ietf-ccamp-wdm-tunnel-yang (configuration)	Optical Impai (capabilities)
Client Payload	Multiplexing schema type (e.g. LO-ODU,VLAN etc.))	Inverse Multiplexing types
Digital Mapping (inferred ?) GMP, GFP-F	Digital-termination-type (ordered list)	3R regeneration layer supported
Multiplexing label value(s) (e.g. tsg/tpn in case of OTN))	3R regeneration layer (list in the tunnel, single value for an hop in the ERO) (1)	List of multiplexing schema types supported
LEGENDA	Inverse Multiplexing types (single value)	Digital-termination-types supported

Client Signal YANG

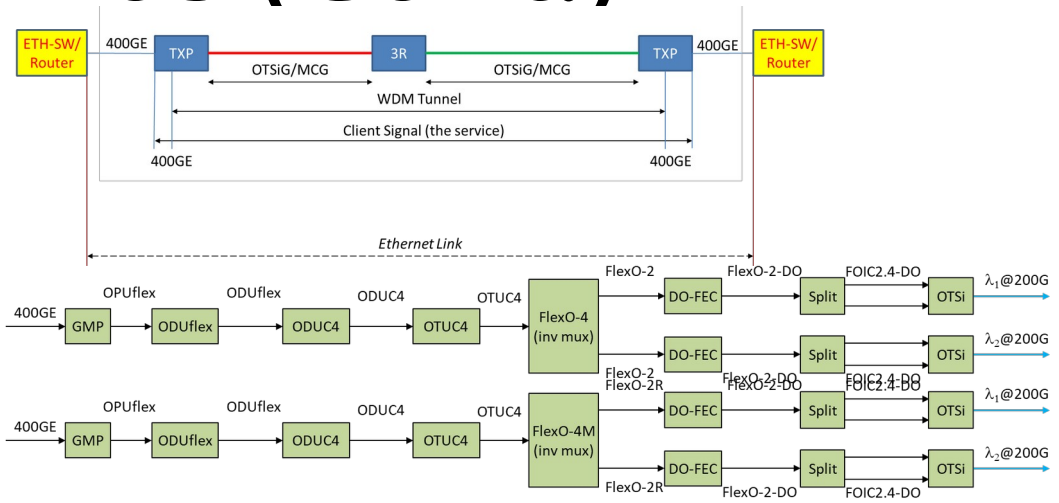
WDM Tunnel YANG model + OI topology

- Multiplexing schema type: identifies the type of multiplexing technology used (e.g ODUj,K)
- Digital Mapping: identifies the mapping technology used to map the client ETH signal (e.g. OTN, VLAN) (GMP, GFP-F)
- Client Payload: identifies the client signal that will be carried by WDM tunnel (e.g. 100GE, 400GE, etc.)
- Multiplexing label value(s): identifies which multiplexing slot(s) are used by the client (if OTN tributary slot/tributary port numb
- Digital termination type: identifies the type of the multiplexing container (e.g. ODUC4)

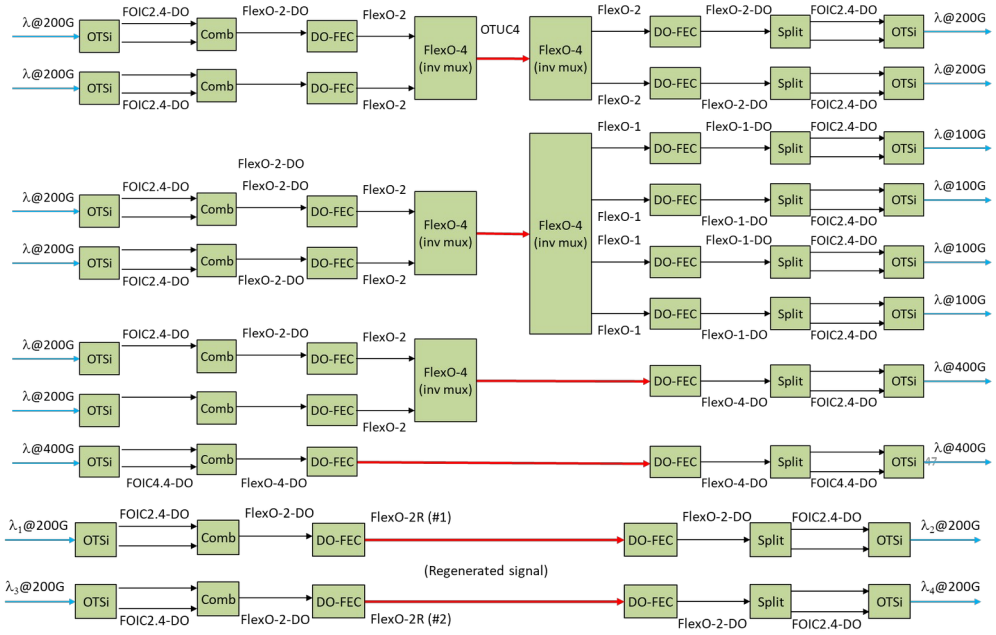
(1) 3R reg list as constraints for tunnel, single value for transceiver configuration in the ERO

Regenerator Scenarios (Cont.)

- S6: 400GE service over single or multiple OTSis
  - Digital termination at source, destination: {GMP, ODUflex, ODUC4, OTUC4}
  - Transceiver:
    - Inverse Multiplexing: FlexO-4
    - Digital termination: FlexO-2
  - 3R Regenerator layer: *400GE, ODUflex, ODUC4*
  - Multiple inverse multiplexing variants exist
  - Different numbers of OTSis before/after regeneration
  - Single or multiple regenerators



Digital termination @source/destination

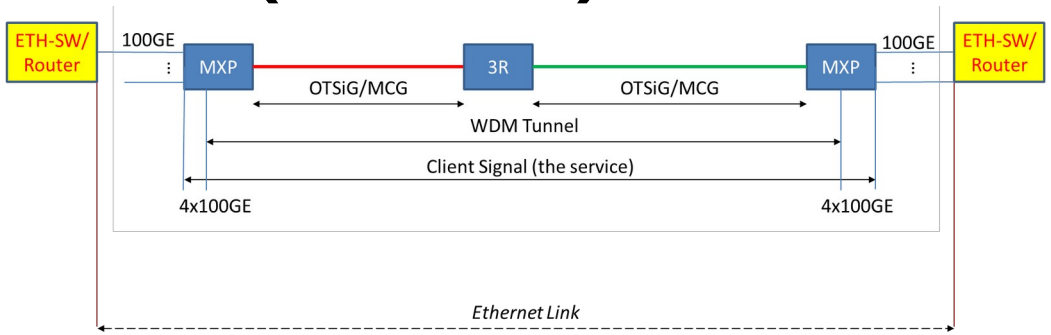


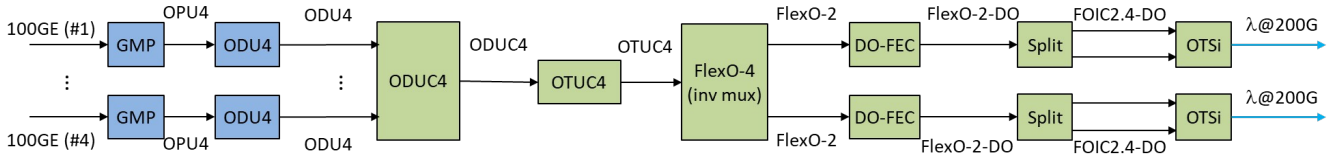
Single regen

Multiple regens

Regenerator Scenarios (Cont.)

- S7: 4x100GE mux service over single or multiple OTSis
  - Digital termination at source, destination: {ODUC4, OTUC4, FlexO-4M}
  - Transceiver:
    - Inverse Multiplexing: FlexO-4
    - Digital termination: FlexO-2
  - 3R Regenerator layer: *ODUC4, FlexO-4R*
  - Need to discuss: whethere there is lifecycle dependency between the client signal and the tunnel model (Issue #83)





Digital termination @source/destination