Further considerations on objectives for PHYs running over point-to-point DWDM systems

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Supporters

- **Steve Trowbridge, Nokia**
- **…….**

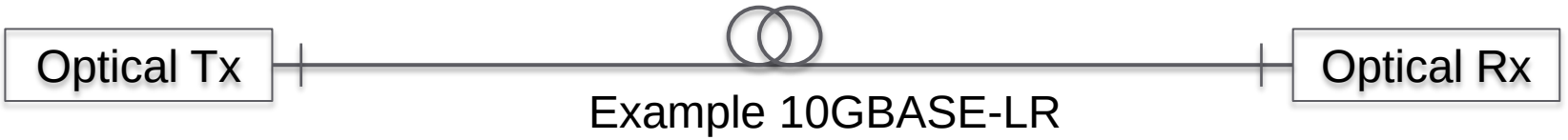
Introduction

- http://www.ieee802.org/3/B10K/public/17_11/stassar_b10k_01a_1117.pdf to the b10k meeting in Orlando, November 2017, provided considerations on objectives proposed in http://www.ieee802.org/3/B10K/public/17_09/villarruel_b10k_01b_0917.pdf to the b10k meeting in Charlotte, September 2017.
- Follow-up presentations were discussed during the b10k ad hoc meeting on 12 December 2017:
  - http://www.ieee802.org/3/B10K/public/adhoc/17_1212/knittle_b10k_01a_171212.pdf
  - http://www.ieee802.org/3/B10K/public/adhoc/17_1212/nicholl_b10k_01_171212.pdf
- In this presentation further considerations are provided.

Link types

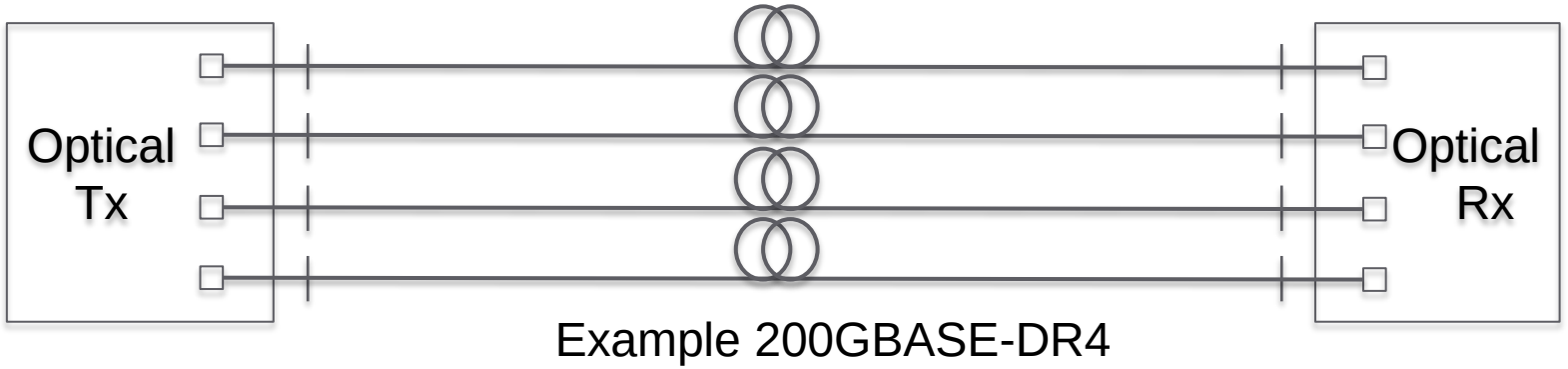
anslow_b10k_01_0118 provides an extended overview of generic link types

Type 1



- **Conventional link**
- **One fiber**
- **One single optical “channel” (or wavelength)**
- **Loss limited**
- **“Traditional” Ethernet cable model, mostly governed by loss.**

Link type 2



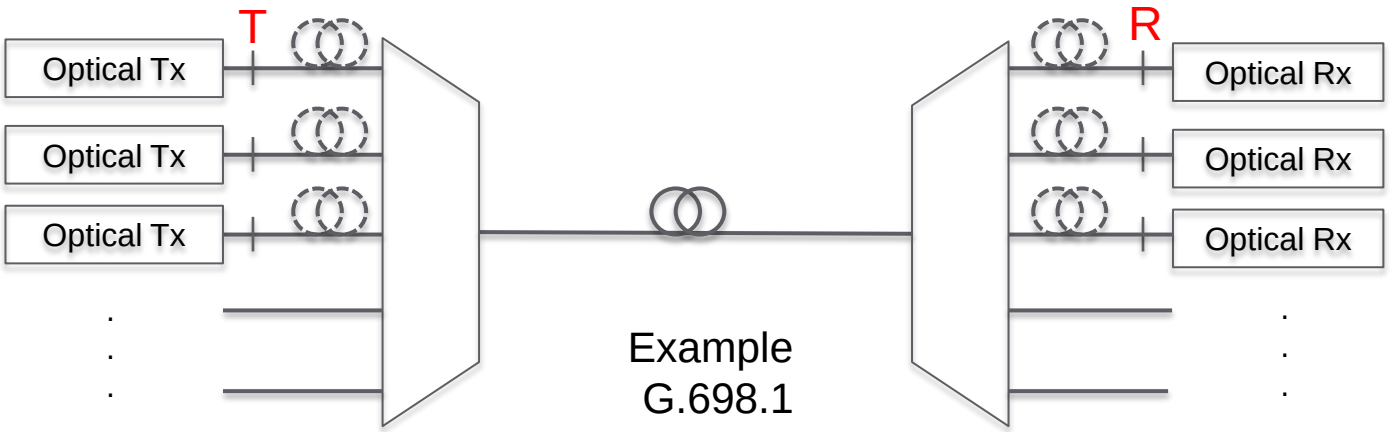
Example 200GBASE-DR4

- **Optically the same as Link type 1, except BER performance is specified over aggregate rate.**
  - **Conventional link**
  - **One single optical “channel” (or wavelength) per fiber**
  - **Loss limited**
  - **“Traditional” Ethernet cable model, mostly governed by loss.**

Link type 3

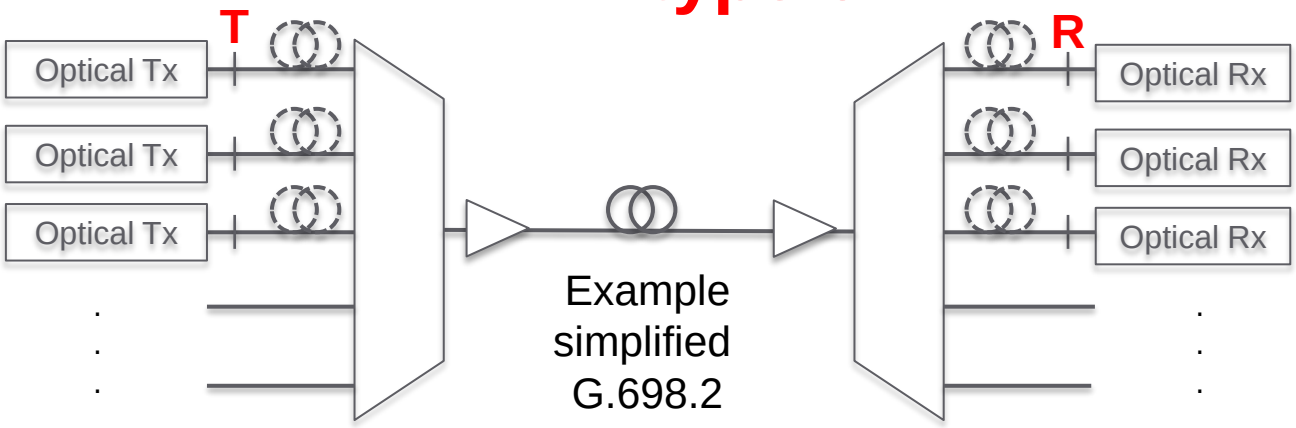
- **Difference with Link types 1 & 2:**
  - **Multiple optical “channels” (or wavelengths) over one fiber, wavelength multiplexed via a mux inside the Optical Tx and demultiplexed via a demux inside the Optical Rx**
  - **Mux & demux performance responsibility of respectively Tx and Rx supplier**
- **Identical to Link types 1 & 2:**
  - **Conventional link with one fiber.**
  - **“Traditional” Ethernet cable model, mostly governed by loss.**

Link type 4



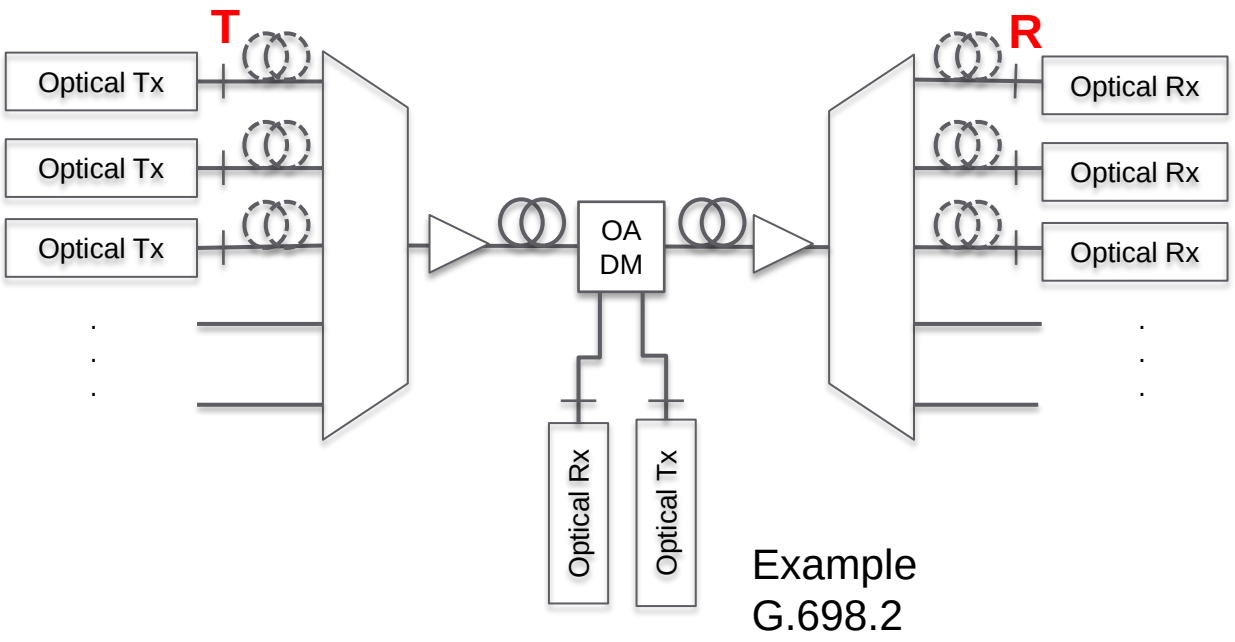
- **Significant differences with link types 1 - 3.**
  - **Introduction of “black link” between T and R.**
  - **Need for defining “tunnel” transfer characteristics between T and R, via “width”, “height”, cross-talk effects.**
  - **Need to extend “Traditional” Ethernet cable model, mostly governed by loss and filter function.**
- **Same with link types 1 – 3: Loss limited system for individual Tx to Rx.**

Link type 5



- **Significant differences with link type 4.**
  - **Introduction of optical amplifiers inside “black link” between T and R.**
  - **No longer loss limited system. OSNR at Rx input (R).**
  - **Introduction of non-linear impairments inside “black link”.**
  - **Individual channels “interfere” inside “black link” between T and R.**
  - **Need for extended “tunnel” transfer characteristics between T and R, to take account of non-linear & cross-talk effects.**
  - **Need completely different cable model, no longer governed by loss.**
- **Similar with link type 4: “Tunnel” width and height.**

Link type 6

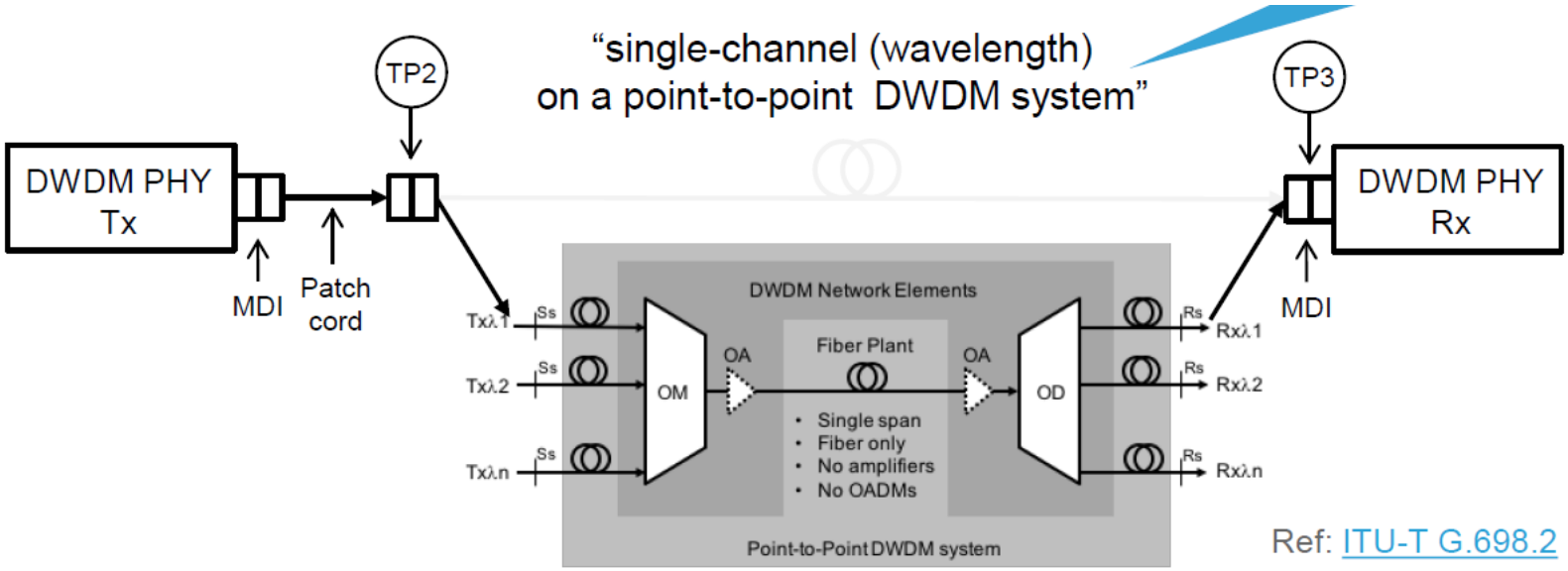


- **Incremental differences with link type 5.**
  - **Narrowing of “tunnel” due to presence of more filtering elements (OADMs)**
  - **Tighter OSNR requirements on Rx, because of higher number OAs .**
- **Similar with link type 5: Non-linear black link specification methodology**

Proposals in nicholl_b10k_01_171212

In nicholl_b10k_01_171212 it is clarified that Option 2 described in stassar_b10k_01a_1117 is being aimed for.

- **Option 2: A PHY that has detailed characteristics enabling direct operation of transceivers onto single-channel (wavelength) ports of a DWDM link (optical mux, optical amplifier, fiber, optical demux).**



Proposal for option 2 in nicholl_b10k_01_171212

- **The proposal in nicholl_b10k_01_171212 to target Option 2 described in stassar_b10k_01a_1117 is equivalent to adopt on objective for a PMD covering link type 5 in anslow_b10k_01_0118**
- **Statements in nicholl_b10k_01_171212:**
  - ***Point-to-point DWDM system, single span, fiber only, no amplifiers, no OADMs.***
  - ***It simplifies the challenges of defining the "DWDM PHY" compared to a more complex DWDM channel that could include concatenated in-line amplification or optical add-drop multiplexors enabling an any-to-any wavelength/fiber reconfiguration to happen.***
  - ***This "limited" topology is anticipated to be the extent of Ethernet "DWDM PHY" specifications***

Impact of statements in nicholl_b10k_01_171212

- ***Point-to-point DWDM system, single span, fiber only, no amplifiers, no OADMs.***
- **In a black link topology, the single channel (T to R) specs are ALWAYS a point-to-point configuration**
- **Single or multiple span impacts whether “tunnel” and OSNR characteristics are more stringent, which is incremental difference between link types 5 and 6.**
- **No OADMs only provides a “wider” tunnel compared to a configuration with OADMs**
- **In both link types 5 and 6 it is irrelevant (from specification principle) where the optical amplifiers are physically located between optical mux and demux. It just impacts the required OSNR value at point R.**

Objective proposals in nicholl_b10k_01_171212

- **The following language options for "DWDM PHY" objectives are suggested in nicholl_b10k_01_171212:**
  - **Define a single-lane 100 Gb/s PHY for operation over single-channel (wavelength) ports on a point-to-point DWDM system which provides an OSNR of greater than X dB.**
  - **Define a single-lane 100 Gb/s PHY for operation over single-channel (100 GHz wavelength spaced) ports on a point-to-point DWDM system which provides an OSNR of greater than X dB.**
- **If the SG decides to include an OSNR value in an objective, then practically a complete specification would need to be developed within the SG period, because OSNR is tightly coupled to choices for modulation format, FEC, reference distance, etcetera.**

Q & A?

Thanks