Fiber optic cabling models for 400G SMF PMDs

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Introduction

- Considerable progress has been made over the last few meetings around building consensus on MPI penalty for SMF PMDs.

- To complete this work and finalize the MPI penalty values in the specification, we need to get (confirm) agreement on the following:

  - Fiber optic cabling model for each PMD

  - Connector and MDI return loss specifications

  - MPI analysis methodology

- This presentation addresses the first of these:

  - *"Fiber optic cabling model for each SMF PMD"*

Why is a fiber cabling model needed ?
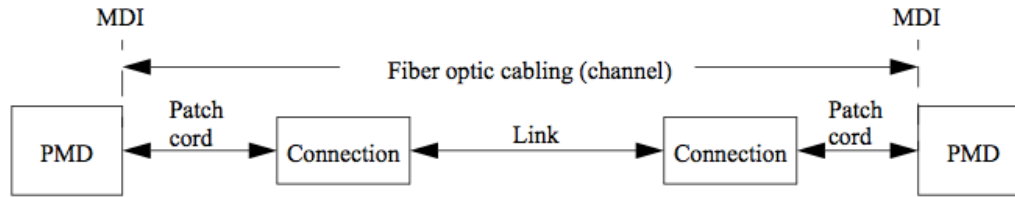
Ref: 802.3bs_D1p1

Figure 123–3—Fiber optic cabling model

- PAM4 is more sensitive to reflections (MPI) than NRZ.

- MPI is heavily dependent on both the number and return loss specifications of the connectors in the end-to-end link.

- Current fiber cabling reference models (above) are too simplistic to be used for PAM4 (primarily because they don't include the number and type of connectors in the link).

- Just as channel models became critical for copper links (e.g. backplane) as speeds increased, so they are now starting to become critical for optical links.

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Goal of this presentation

- The goal for the remainder of this presentation is to come up with a consistent cabling reference model for each of the SMF PMDs (DR4, FR8 and LR8).

- The majority of the data in this presentation has been taken from:

    - http://www.ieee802.org/3/bs/public/14_05/kolesar_3bs_01_0514.pdf

- kolesar_3bs_01_0514 has been cited as a reference for fiber cabling models by many of the presentations on MPI analysis.

- It is also important to remember that a cabling model never dictates deployment (a point that Pete correctly keeps hammering home!)

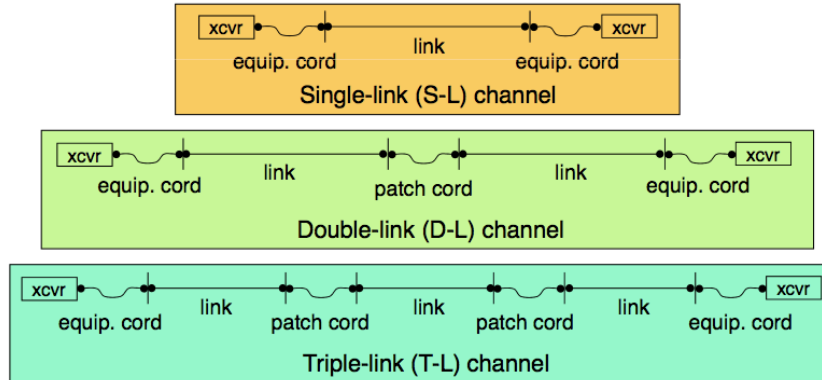# Recap - kolesar_3bs_01_0514

Cabling Terminology

<u>Cords:</u> used to administer temporary connectivity from:
1. equipment (transceivers) to patch panel, called equipment cords
2. patch panel to patch panel, called patch cords
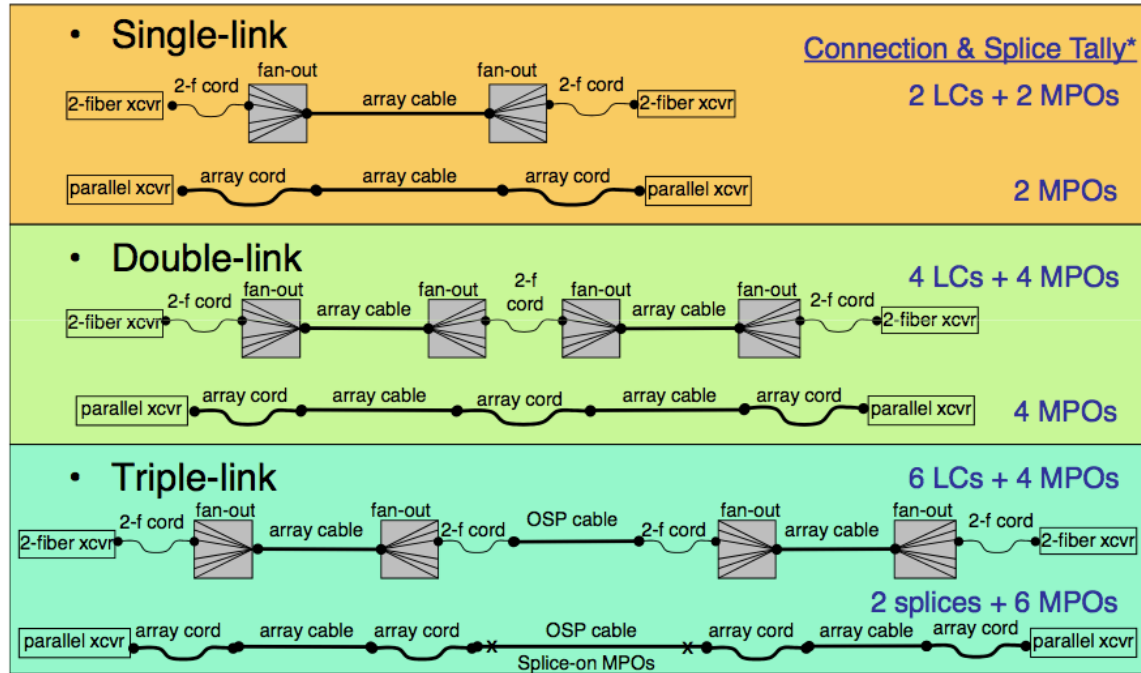
<u>Links:</u> permanent cabling between two patch panels

<u>Channels:</u> complete end-to-end connectivity between equipment, consisting of concatenations of (temporary) cords and (permanent) links
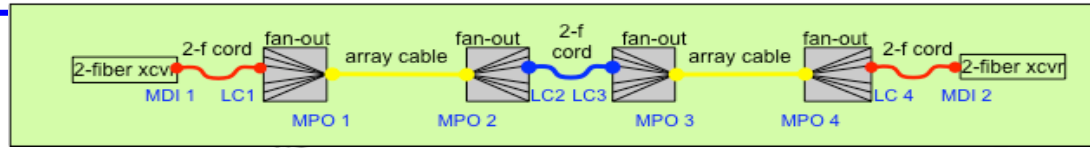
Recap - kolesar_3bs_01_0514

Common Channel Implementations
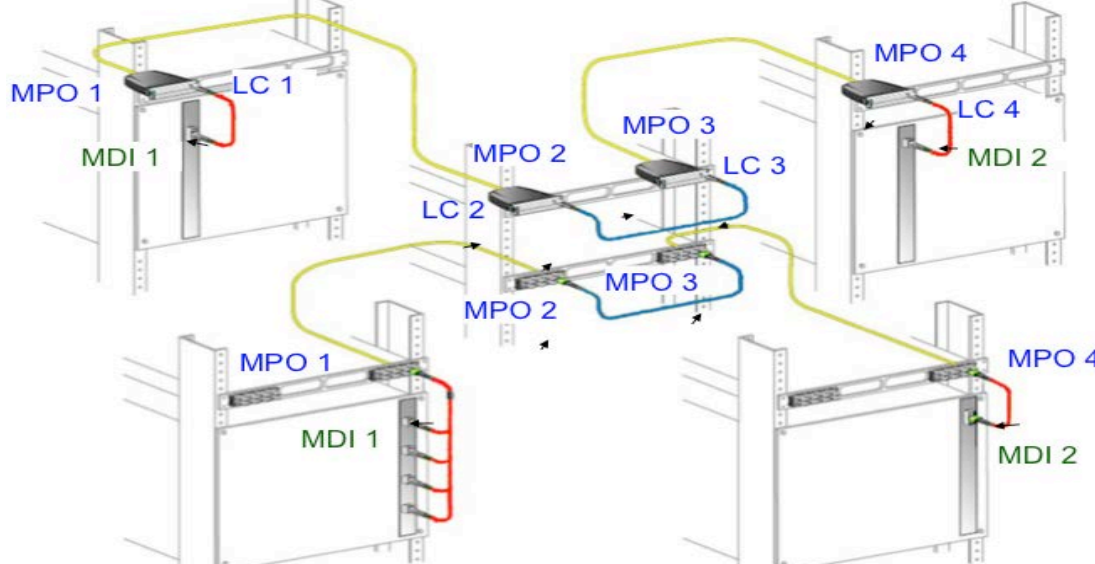### (both 2-fiber and parallel transceivers)

Note: Connections to transceivers (at MDI) are not included in Connection Tally.
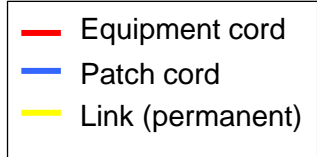
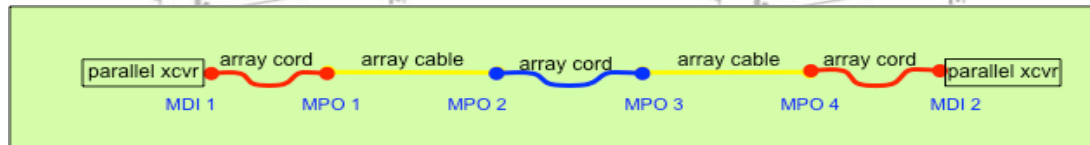# Recap - kolesar_3bs_01_0514 (Example)

2-fiber Double-Link Channel

2x MDI
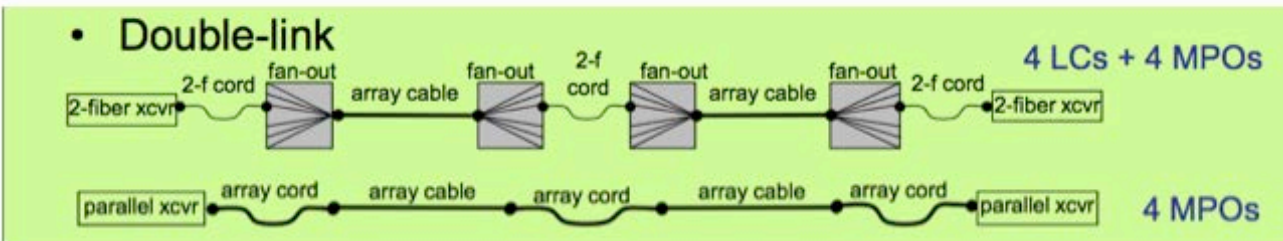4x LC
4x MPO

Parallel-fiber Double-Link Channel

2x MDI
4x MPO

Legend:
- Equipment cord
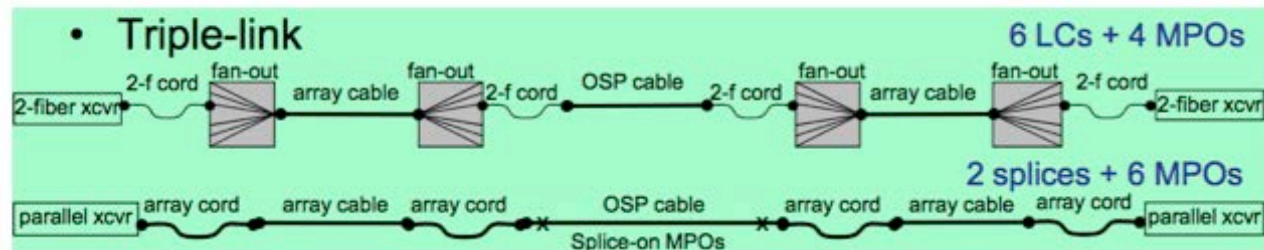- Patch cord
- Link (permanent)

Note: Picture courtesy of kolesar_3bs_01_0514; Graphical enhancements courtesy of J. D'Ambrosia.

Proposed usage of reference link models
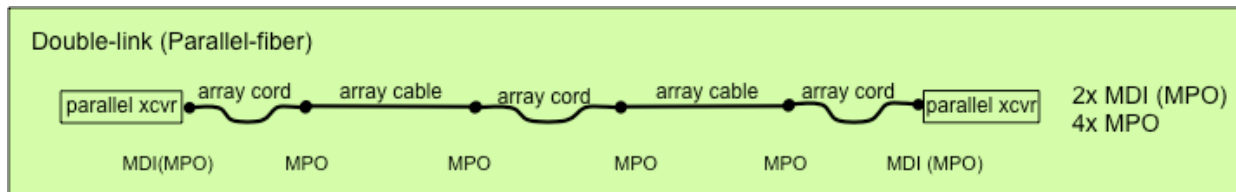

Proposed to use for 2km and below

• Double-link — 4 LCs + 4 MPOs / 4 MPOs

Proposed to use for 10 km and above

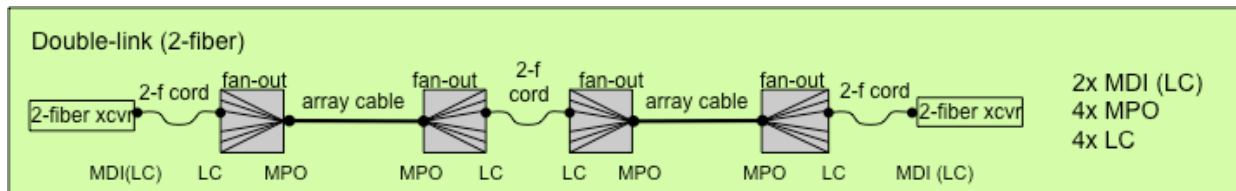• Triple-link — 6 LCs + 4 MPOs / 2 splices + 6 MPOs

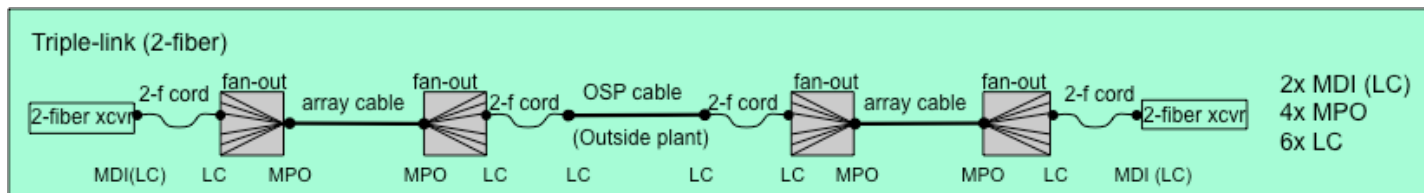# Proposed reference models for 802.3bs

400GBASE-DR4 (500m):

400GBASE-FR8 (2km):

400GBASE-LR8 (10km):

Recommendation

- That the fiber cabling models contained in slide 9 be adopted as the worst case reference models to be used in the calculation of the MPI penalty for DR4, FR8 and LR8 PMDs.

Open Questions

- Should these cabling models be incorporated into the 802.3bs draft spec to replace the current fiber optic cabling models (Figure 122-3 and Figure 123-3), or should they just be used to calculate the MPI penalty ? Perhaps we can leverage from the experience of previous backplane projects here ?

Next Steps

Work and finalize the MPI penalty values. Agreement on:

- Fiber optic cabling model for each PMD
  - This presentation
  - Comments (and supporting presentation) will be submitted against D1.2 based on this presentation and any received inputs

- Connector and MDI return loss specifications
  - Agreement on consistent approach needed

- MPI analysis methodology
  - Final agreement after above is completed