

SYSTIMAX®
SOLUTIONS

Updated Cost analysis of MMF variants

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Purpose and background

- Examine alternatives for short reach objective (i.e. at least 100 m on OM3) from a cost perspective
- Consider SDM and WDM technologies
- Project total channel cost (i.e. installed media + 2 PMDs) as a function of time of deployment
- Derive typical channel cost by convolving with distance distribution of Kolesar_01_0906
- Provide insight to guide PMD selection for optimal economic feasibility

Interesting solutions near 850 nm

<u>Configuration</u>	<u># Chan</u>	<u>Coding</u>	<u>Rate</u>	<u># λs</u>	<u># fibers</u>
10 SDM	10	64/66b	~10Gb/s	1	20 of 24
5 SDM x 2 WDM	10	64/66b	~10Gb/s	2	10 of 12
12 SDM	12	8B10B	~10Gb/s	1	24 of 24
6 SDM x 2 WDM	12	8B10B	~10Gb/s	2	12 of 12
4 SDM x 3 WDM	12	8B10B	~10Gb/s	3	8 of 12
10 WDM	10	64/66b	~10Gb/s	10	2

Solutions in bold font are examined in cost models

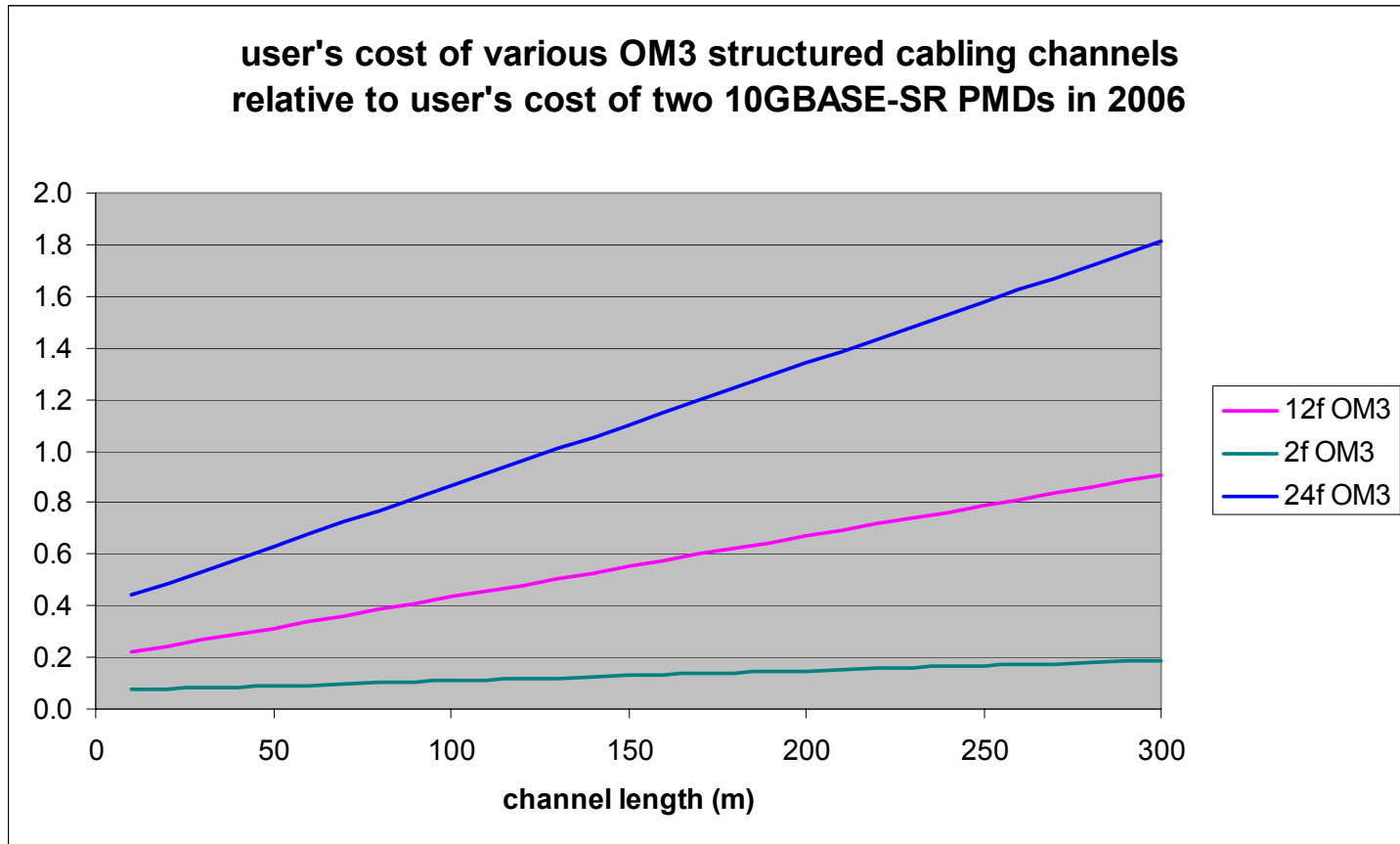
What's changed since January?

- **Relative to kolesar_01_0107 the following has changed in this updated analysis:**
 - **Revised cost factors upward for WDM technology**
 - Based on discussions with transceiver experts
 - Wide disparity in views expressed. Middle ground used.
 - **Revised cost factors down for 100 vs. 10G PMD cost**
 - Based on presentations from Dudek and Jackson
 - Show 3x and 4x relative cost in this revision

What's not changed since January?

- **Relative to kolesar_01_0107 the following have not changed in this updated analysis:**
 - **Cabling costs**
 - **Cost trends for PMDs, Cabling and Labor**
 - **The length of a typical channel**

Cabling costs



Short length delta
driven by connection cost:
duplex vs. array

Long length delta
driven by fiber cable cost:
duplex vs. array

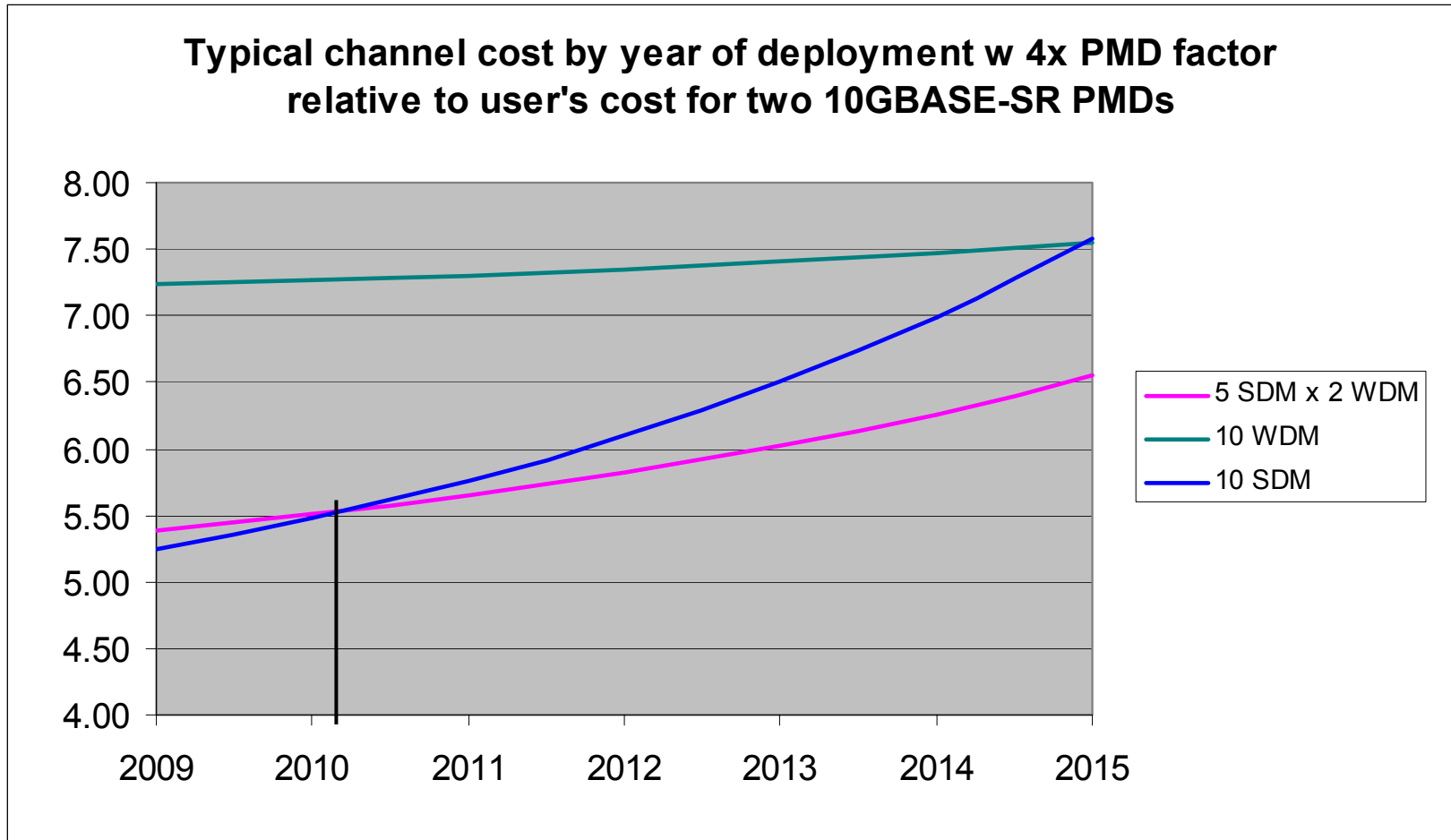
Channel costs and trends

- **Includes installed media and optics (PMDs) on each end to form complete simple structured cabling channel (PMD-cord-cable-cord-PMD)**
- **Assumptions on cost directions:**
 - Labor rates increase 3% / year
 - Cabling costs decline 3% / year
 - 100G optics costs decline 18% / year
- **Costs are relative to 10GBASE-SR cost**
 - Cost of 10GBASE-SR declines 18% / year

Convolving w channel length distribution

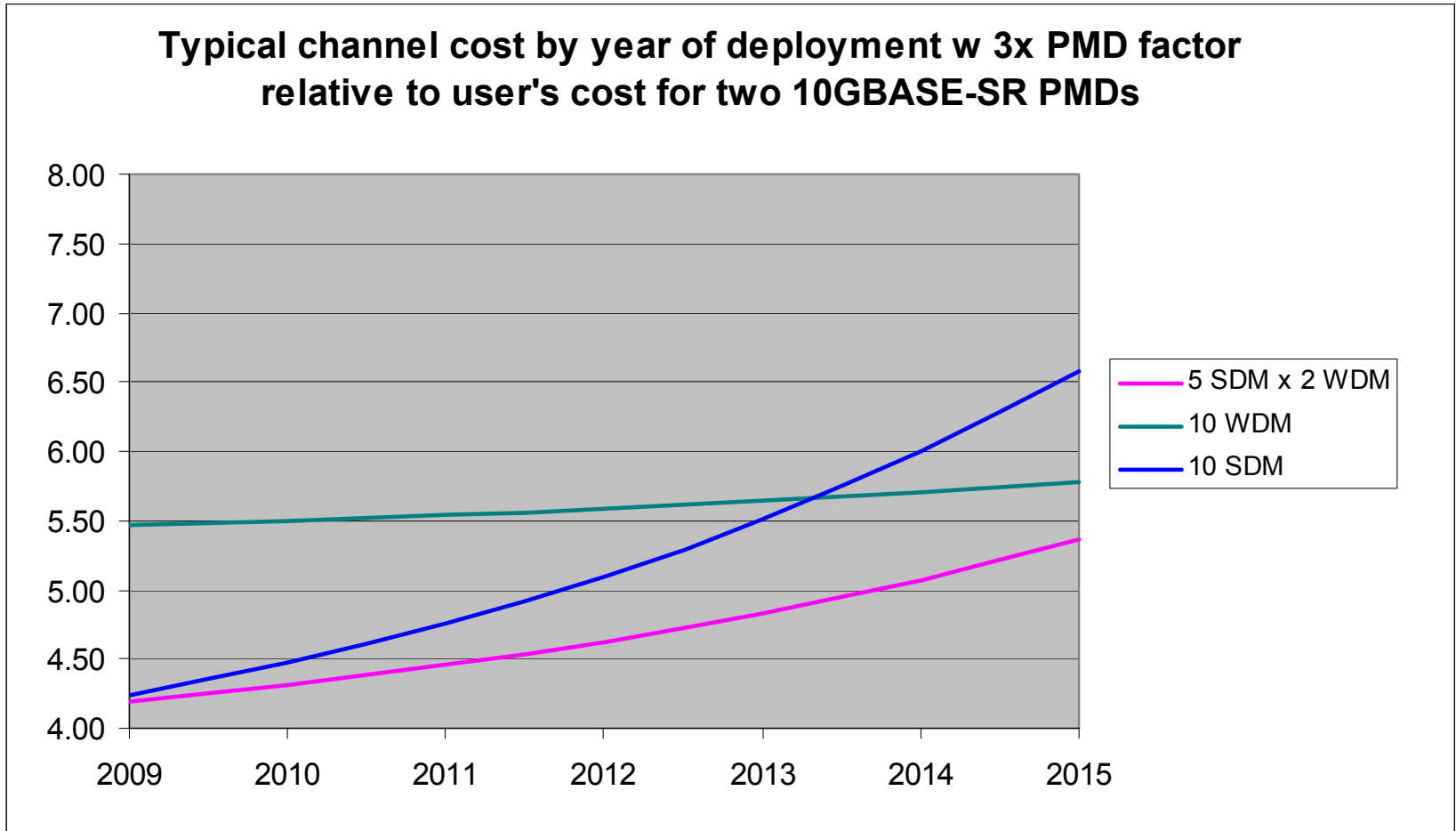
- Derive typical channel cost by convolving with distance distribution of Kolesar_01_0906.
- The weighting effect of the length distribution places the cost of the typical channel near the cost of ~55 m channel.
- The data center channel length distribution from swanson_01_1106 includes 3-trunk topologies that extend the distribution, so would increase the typical channel length and amplify the trends.

Typical channel cost trends: 4x PMD factor*



* 100GBASE-S PMD cost = 4x cost of 10GBASE-S XFP

Typical channel cost trends: 3x PMD factor*



* 100GBASE-S PMD cost = 3x cost of 10GBASE-S XFP

Observations and conclusions

- 5 SDM x 2 WDM attains lowest cost early and maintains it for the critical years of 100G market growth
 - *Best for general Data Center distribution*
- 10 SDM is cost advantaged for non-structured cabling that uses only one 24-fiber cord as channel (analysis not shown, but case is clear since its cabling costs are less than that of 12-fiber cord-cable-cord structured cabling)
 - *Best for Super Computing and Co-located Eqmt.*
- If we define 10 SDM now, will we need to define 5 SDM x 2 WDM later??
 - A PMD proliferation decision
 - Both have their optimal purpose. Which one is best?
 - *Depends on which application(s) we wish to optimize.*