10Gb/s on FDDI-grade MM Fiber Study Group

Building the Business Case

Chet Babla
Phyworks Ltd.
The 5 PAR Criteria

- Compatibility with IEEE 802.3
- Distinct Identity
- Technical Feasibility
- Broad Market Potential (BMP)
- Economic Feasibility (EF)

This presentation aims to highlight important - solution agnostic - considerations that must be addressed by the Study Group (SG) to satisfy the BMP & EF PAR criteria.
The New PHY (10GBASE-X*)

850/1310nm Laser

Tx Mode Condition

62.5/50um MMF

Rx Mode Condition

PIN Rx & TIA

Serial LAN PHY

Potential new PHY elements

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Recap – Why support the installed MMF fiber?

- Links up to 300m represent ~75% of the installed base of the intra-building backbone & MMF is the installed base
- Enterprise customers are reluctant to pull new fiber to deploy 10GbE
- To date, LX4 has not met its BMP: a new ‘plug & play’ -X* PHY that enables 10G over installed MMF will stimulate [lower cost] 10GbE deployment

These form the basis of Broad Market Potential, BUT…………..

Chris Dominico, IEEE Fiber Optic Cabling Survey, 1997

* Length Distribution of Intra-building Backbone
* Installed Backbone Survey

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Broad Market Potential

• **Technical Feasibility** alone will not ensure the success of -X*
• The **Business case** rests on:
  - **Cost** - \([-\text{SR Cost}] \leq [-X^* \text{ Cost}] \leq [-\text{LR Cost}]\)
  - **Vendors** - Multiple vendor support, particularly the module vendors.
  - **‘Similarity’** - to existing 1GbE/10GbE solutions which already have demonstrated BMP success (e.g. encoding scheme, single λ, test gear).
  - **Applicability** - coverage in terms of customers with links up to 300m on MMF, and who aren’t covered by 10GBASE-SR / SMF
-X* Economics - New PHY vs New Fiber

- Does the SG need to address the question:

“Is -X* more cost effective than pulling new fiber?”

Yes:
Because the fiber guys may argue that they have deployed X metres of OM3 at small incremental cost to 10GbE port deployment, and the SG must pre-empt this.

No:
Because we should leave the fiber guys to make their own case for not giving the customer the choice.
-X* Economics - Choosing the Right PHY Solution

• Future cost target - [3x - 4x 1GbE]

• Known costs - All solutions may not be equally cost effective, even in high volume.
- The economics of 1GbE are well understood (i.e. optics, electronics & package/test costs) and -X* should leverage this.

• Module ‘agnostic’ - Competition between MSAs has driven down costs; the -X* PHY should not preclude this.

• New technology - -X* should allow the benefits of future cost saving technologies but not depend on these (e.g. 1310nm VCSELs)

• Economic ‘laws’ - -X* should leverage existing industry ‘laws’ (e.g. Moore’s law, Metcalfe’s law)

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### -X* Economics - PHY Comparison Checklist

<table>
<thead>
<tr>
<th></th>
<th>LX4</th>
<th>LR</th>
<th>-X*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser</td>
<td>4 x 3.125G 1310nm</td>
<td>1 x 10G 1310nm</td>
<td></td>
</tr>
<tr>
<td>Passive Optics</td>
<td>Tx combiner, Rx CWDM splitter</td>
<td>Single mode lensed launch</td>
<td>We Decide (but leverage -LR, -SR &amp; 1000BASE-SX)</td>
</tr>
<tr>
<td>Electronics</td>
<td>4 x 3.125G TIAs 4 x 3.125G LA / re-timer 4 x 3.125G LD µProcessor</td>
<td>1 x 10G TIA 1 x 10G LAN PHY 1 x 10G LD µProcessor</td>
<td></td>
</tr>
<tr>
<td>MSA amenable</td>
<td>?</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>Test Equipment</td>
<td>PRBS, BERT, Stressed eye ?, Comms analyser, OSA</td>
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</tr>
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<td>Vendor support</td>
<td>Currently limited</td>
<td>Wide</td>
<td>Hopefully wide</td>
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**Electronics**

- Single mode lensed launch
- 1 x 10G TIA
- 1 x 10G LAN PHY
- 1 x 10G LD µProcessor

**Test Equipment**

- PRBS, BERT, Stressed eye ?, Comms analyser, OSA
- PRBS, BERT, Stressed eye, Comms analyser

**Vendor support (IC, Module, Fiber)**

- Currently limited
- Wide
- Hopefully wide
-X* Applicability

- The -X* solution should achieve acceptable Yield in terms of customer link length distribution
- Is 300m the right number?

- What is the actual link length distribution and how does the deployed fiber (50u / 62.5u / SMF / OM3) map to this?
Possible SG investigations to validate BMP / EF

• Customer link yield:
  - Agreed channel model
  - PHY yield [simulations / measurement]
  - Link lengths & distribution - updated survey?

• Economic factors:
  - Module, Optics & IC costs - compare -X* with LR & LX4?
  - New fiber deployment costs - new pull vs new PHY cost?
  - 10GbE deployment - quantify affect on 10GbE uptake if 300m on installed MMF is not supported by a new 5 PAR compliant PHY?

• Other?

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