

Re-consider 1310nm CWDM PMD as one cost-effective and scalable upstream option

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Introduction

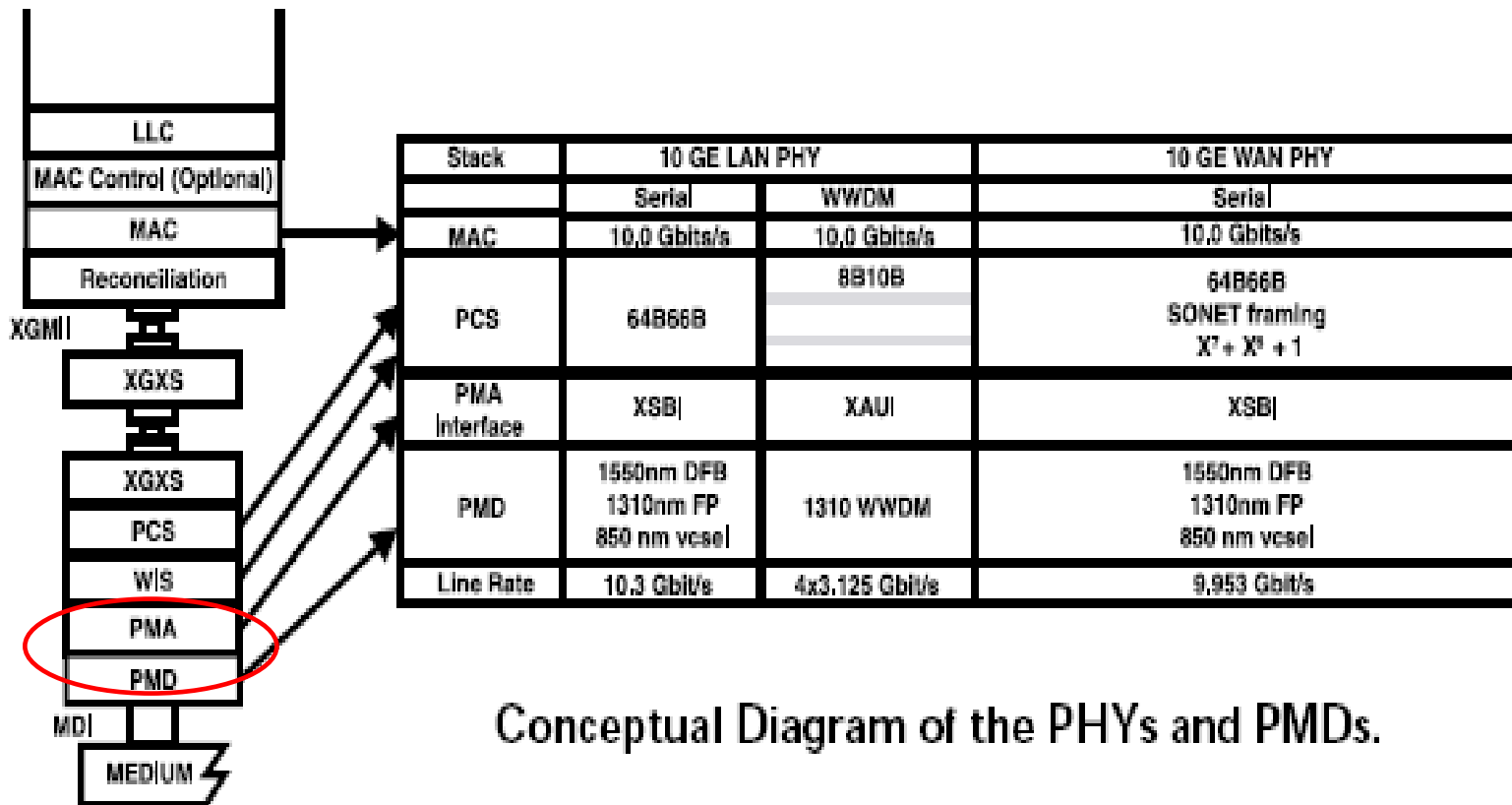
- Burst-mode reception for 1G/10G 2-bit-rates coexistence is under consideration within Ad-hoc.
 - Existing technical and implementation risks.
 - Hard to meet aggressive Class B++ budget.
- 10GbE still primarily an aggregation technology, years after its standardization, because it is still too expensive for volume servers.
- This presentation proposes the option to reconsider 1310nm CWDM approach as bandwidths and design variants when choosing alternatives that impact speed/sensitivity.
 - An option for immediate deployment for future runaway hit just like 1G EPON.

Technical challenges of serial 1G/10G coexistence upstream

- Issues with current 1G/10G TIA circuit
 - Hard to implement precision filtering function into TIA
 - Low-cost TIA required to fit into To-can type packaging
 - Optimizing 1G/10G BW is not sufficient
 - Actual sens affected by TIA gain, phase/delay response, low cut-off freq., LimAmp stage etc.
 - Circuit implementation penalty
- Challenging 10G burst-mode integrated circuits
 - Burst receive TIA, LimAmp;
 - Burst receive CDR/SerDes;
 - Demonstrated so far using over-sampling and FPGA.
 - Burst LDD driver
- Many already proposed needing over 3-4 yrs to study upstream 10G/s feasibility.
 - Market reqs of 10G upstream not justified.

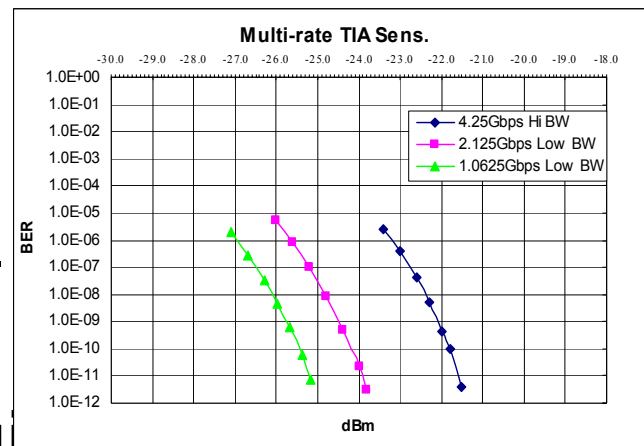
1310nm CWDM Approach

- From lower PMD/PMA layer



1310nm 4x ~2.5G CWDM benefits

- Multirate 1G/2G/4G receivers exist today
 - In ramping volume by fibre channel.
 - Mostly based upon serial PMD circuit via rate-select pin.
 - Typical extra 7-9dB Rx sens over 10G.
 - 2.5G share same IC/optics as 1G.
- Only 2.5G upstream would be quick and easy way to develop for all IC cases.
 - 5G or perhaps 10G CDR could be done using FPGA and over-sampling - none cost-effective solution today.
 - Significant ASIC development time for 10G burst-mode Rx.
 - Current PLL not yet optimized for burst mode
 - Promising circuits in delay-lock loop (DLL) and Gated VCO



1G/2.5G CWDM module choice

- Parallel CWDM optics still prevailing for 10G and above.
 - For 10GbE LX4; Infiniband 4x SDR/DDR; PCI-E 4x; Fibre Channel 1/2/4G.
 - Cost-effective modules for increased port density and system cost saving.

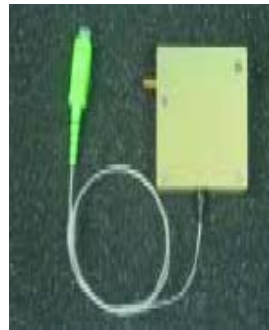
**SFF CWDM/
Diplexer**



**SFP CWDM/
Diplexer**



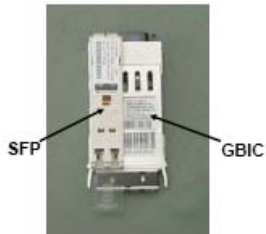
GPON Triplexer



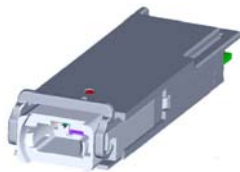
10GbE LX4 – X2



GBIC CWDM



QSFP

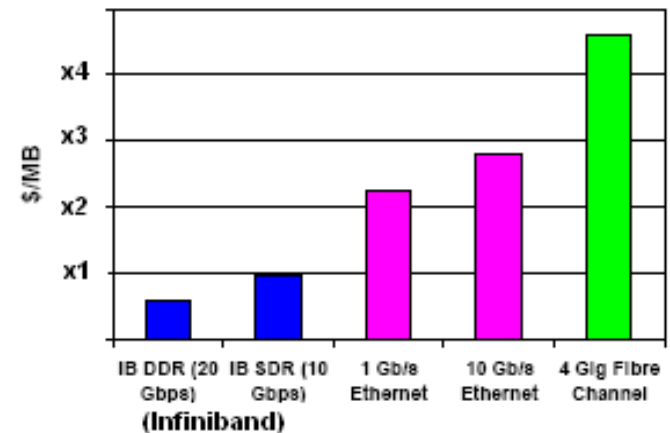


SNAP12



(12 Optical Fibers in MPO (Infiniband 12x Tx and but only 8 are used) Rx module)

Cost per Megabyte



Report from Infiniband using parallel optics
http://www.silverstorm.com/pdf/ddr_white_paper.pdf

Conclusions

- We suggest re-considering 1310nm 4x CWDM alternative as one option for upstream 1G/10G coexistence.
 - Today available, cost-effective, and scalable solution
 - This belief based upon difficulties of 10G bursty circuit
 - Serial 1G/10G coexistence hard to meet aggressive B++ 29dB IL budget.
- CWDM ready for immediate deployment for future runaway hit just like 1G EPON.
 - Min. cost premium if upgrading optics from 1G to 2.5G.
- The only impact on lower PMD/PMA layer
 - Easily fit into the feasible 10G link budget.
 - Upgrade path for upstream 2.5G, 5G and 10G.
 - Who needs 10G upstream by 09/10?
 - The problem is not we consider it or not, it may happen anyway — example of 10GbE defer to Fiber chan and IB