Cost Reference and Technical Spec. Revision Proposal for 4x25G CWDM Solutions

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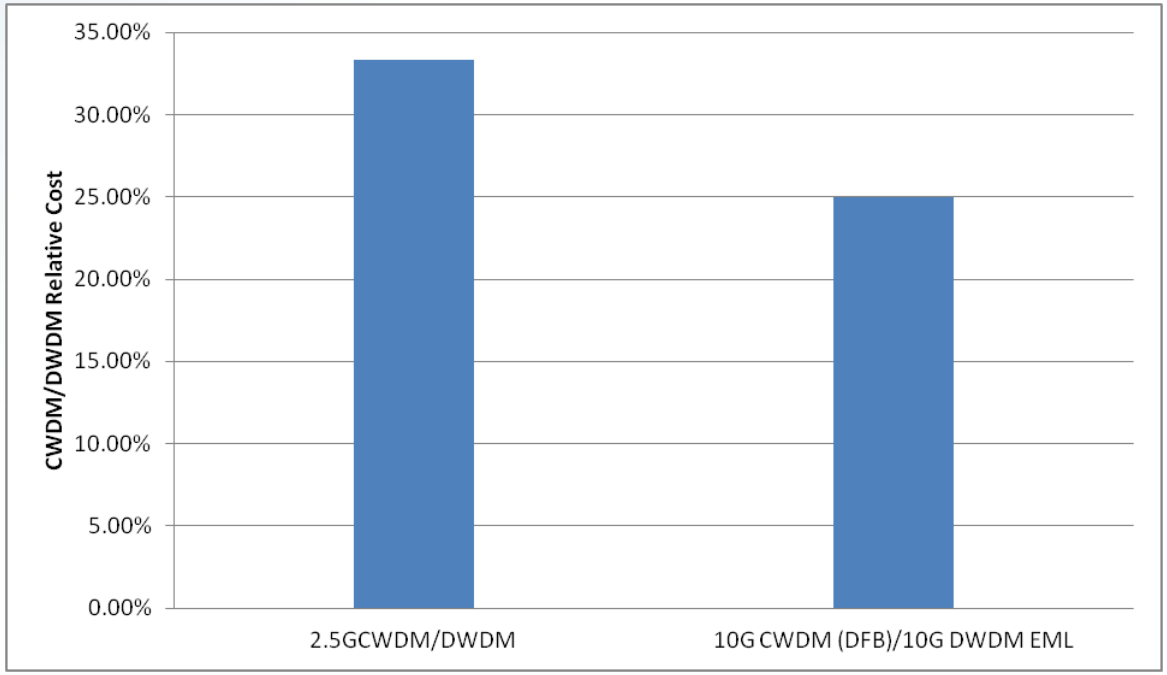
Overview

- 100G CWDM proposed as technical feasible and economical solutions (vlasov_01_0113; shen_01_0113)
- In this contribution, we
  - Provide cost analysis with reference using mature 2.5G/10G CWDM vs. DWDM
  - Propose modification of baseline specification by vlasov_01_0113

2.5G/10G CWDM/DWDM Cost Reference



- **2.5G CWDM/DWDM, 10G CWDM/DWDM products are used as a cost reference for mature product cost comparison, with each type running ~ several 100K/yr**
- **2.5G CWDM and 10G CWDM types are using directed modulated (DM) DFB lasers, while 2.5G and 10G DWDM are with TEC cooled DFBs and EMLs**
- **Uncooled CWDM cost ~ 25% to 35% of cooled DWDM counter parts**

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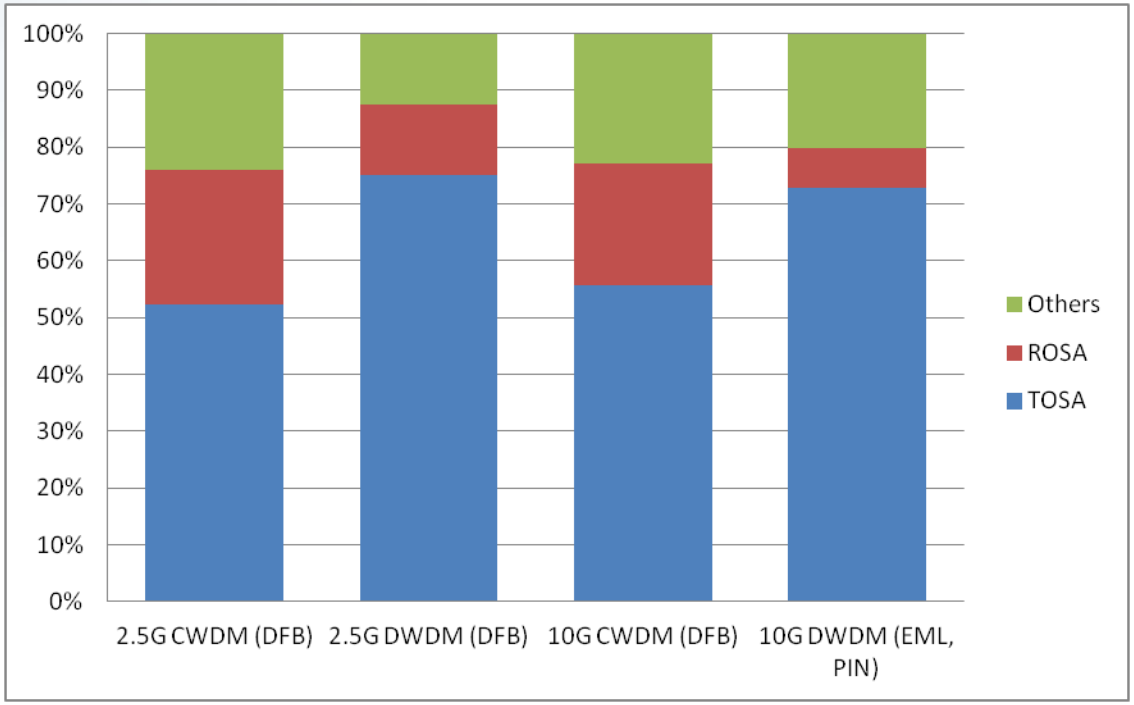
2.5G/10G TOSA/ROSA Cost vs. Other Cost Elements



For relative mature products 2.5G/10G CWDM/DWDM Products

- **TOSA/ROSA cost ~ 75-85% of total BOM cost**
- **TOSA ~ 50% to 75% of total cost**

→ TOSA/ROSA cost reduction most critical in transceiver cost reduction

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Cost Discussion for 4x25G CWDM and L-DWDM

- Difference between 4x25G xWDM vs. 2.5G/10G Optics:
  - Multiple laser elements required
  - Optical Mux/Demux required
  - For reasonable size, cost and density, high degree of integration is required
  - → "Optical element" cost vs. package cost weights higher
- CWDM vs. L-WDM:
  - L-WDM: requires active TEC temperature control, and likely precision temperature regulation for Mux/DEMUX; Electronic ICs likely need to be isolated from the TEC control to reduce thermal load.→ increase cost
  - C-WDM: No active temperature control required, much reduced/eliminated temperature regulation of optical Mux/Demux; Co-Packaing with IC possible → Reduce cost

Proposal for 100G CWDM Baseline Spec.

- We'd like to upport 100G CWDM baseline proposal "Vlasov_01_0113_optx.pdf" as technically feasible with a recommendation for refinement on power budget allocation between Tx and Rx
- Recommend to increase link power budget to 4dB from 3dB, considering connection/splice loss budget for data center applications
- From our cost analysis, Tx cost is the dominant cost for transceiver module (>2x vs. Rx), and also dominant power dissipation factor
- Propose to keep Tx spec., and tighten the Rx sensitivity spec. from -6 to -7dbm OMA
    - 25G InGaAs PIN Rx comply to 100G-LR4 with intrinsic sensitivity better than -11dbm OMA already commercially available
    - Silicon photonics with integrated Ge PD has been demonstrated with comparable sensitivity to InGaAs PIN
    - <3dB optical loss for ROSA integration feasible

    → -7dbm OMA sensitivity is feasible

Recommended Rx Spec. Modification

100GBASE-WDM4 SMF 500m reach receive characteristics

Parameter	IEEE Std 802.3ba 100GBASE-LR4 10km	vlasov011112optx 100GBASE-WDM4 2km	Consensus 100GBASE-WDM4 500m	Unit
Signaling rate, each lane (range)	25.78125 ± 100 ppm	25.78125 ± 100 ppm	25.78125 ± 100 ppm	Gbd
Lane wavelength (range) (nm)	1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Receiver sensitivity (OMA), each lane (max)	-8.6	-6.0	-6	dBm
Receiver 3dB electrical upper cutoff frequency, each lane (max)	31	31	31	GHz
Stressed receiver sensitivity (OMA), each lane (max)	-6.8			dBm

Suggest changed to -7dbm

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Conclusion

- We support 100G CWDM as a viable economical and technically feasible solution to meet P802.3bm objective
- We propose a modification of baseline technical spec. to keep Tx side spec, and tighten spec. on Rx side to increase the total link budget to 4dB

Thank You