

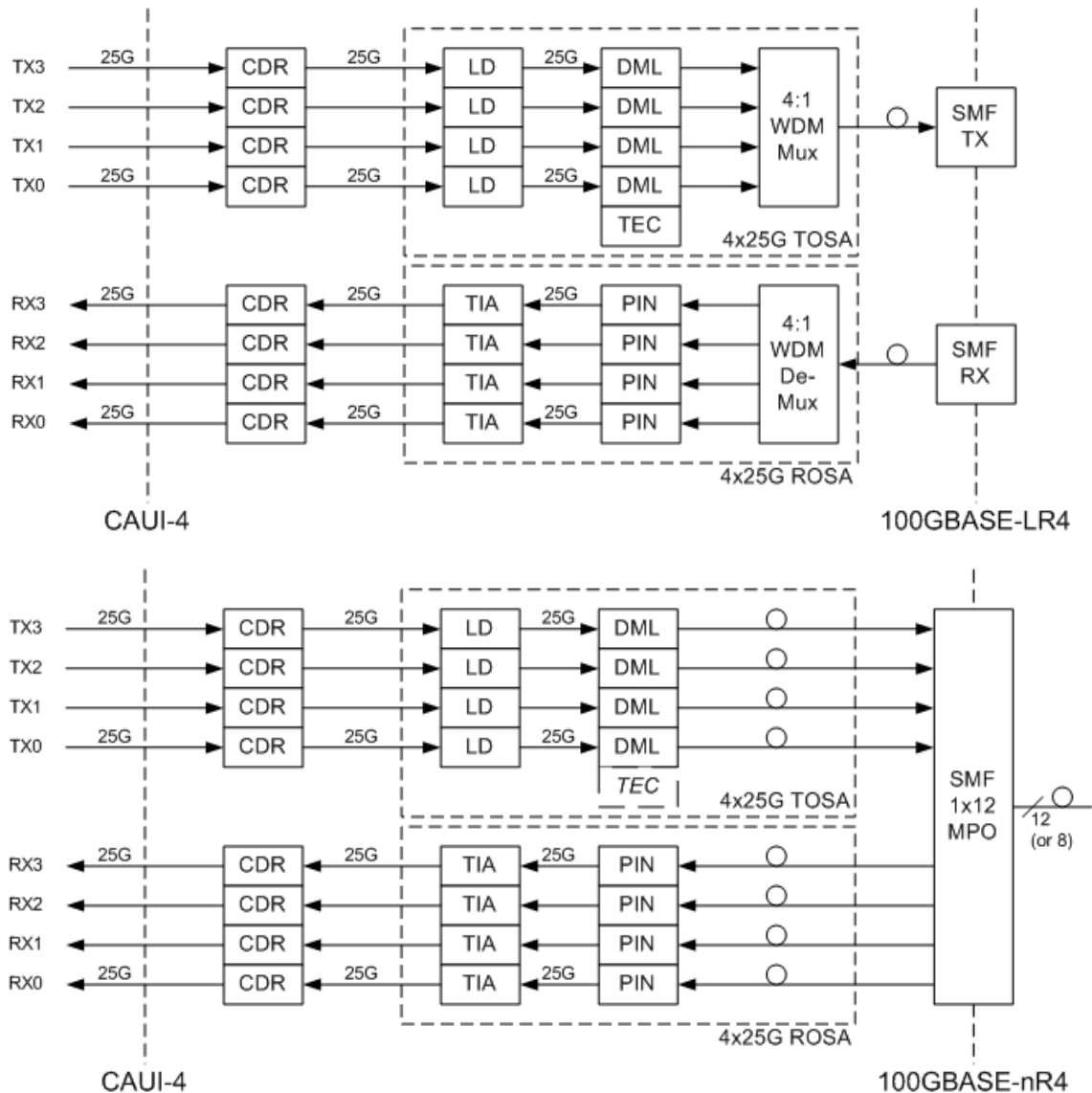
100G Parallel PMD Observations

Next Generation 100Gb/s Ethernet Optics Study Group
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Chris Cole

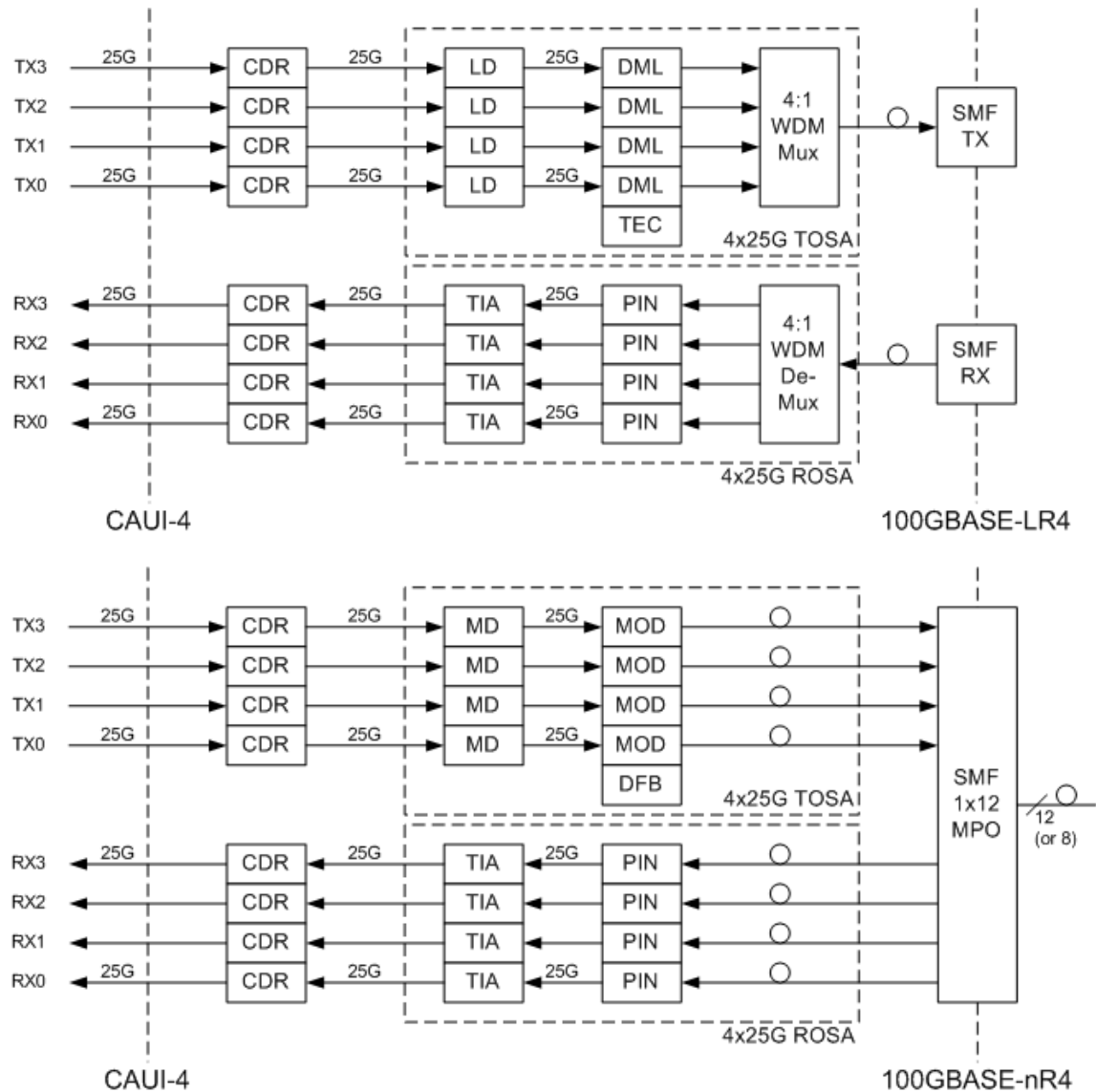
Outline

- 100G LR4 & nR4 Parallel SMF Block Diagrams
- 100G LR4 & nR4 Parallel SMF Cost Comparison
- Conclusions
- Appendix: Recommend Parallel SMF Development

100G LR4 & nR4 Block Diagrams



100G LR4 & alt. nR4 Block Diagrams



100G LR4 & SR10 Cost Comparison

- Dec'11 LightCounting 2012 100G LR4 Gen1 (EML CFP) to SR10 (CXP) cost ratio: **16x**
 - ECOC'10 Cole 100G LR4 Gen1 (EML CFP) to Gen2 (DML CFP) (adjusted for same ASIC) cost ratio: **2x**
 - 2012 100G LR4 Gen2 (DML CFP or CFP2) to SR10 (CXP) cost ratio: **8x**
- 100G SR4 (CFP4) to SR10 (CXP) cost ratio: **1.2x**
 - 100G LR4 (CFP2) to SR4 (CFP4) cost ratio: **6.7x**
 - How good is this estimate?
- Dec'11 LightCounting projected 2012 40G LR4 (CFP & QSFP+) to SR4 (QSFP+) cost ratio: **6x**
 - The estimate is pretty good

100G LR4 & nR4 Cost Comparison

- 100G LR4 (CFP2) to SR4 (CFP4) cost ratio: **6.7x**
 - 100G LR4 (CFP2) to LR4 (CFP4) cost ratio: **1.3x to 1.5x**
 - 100G LR4 (CFP4) to SR4 (CFP4) cost ratio: **4.5x to 5x**
- Petrilla_02a_0112 100G MR4 (same as nR4) cost ratios:

	100G SR10	100G SR4	100G MR4 Palkert	100G MR4 Anderson	100G MR4 Petrilla
<u>Relative XCVR Cost</u>	1x	1.2x	1.2x	3x to 4x	3x to 4x

- 100G nR4 (CFP4) to SR4 (CFP4) cost ratio: **2.5x to 3.3x**
(1.2x cost ratio is not factored in as there is zero Si Mod based transceivers deployed to verify this estimate)
- 100G LR4 (CFP4) to nR4 (CFP4) cost ratio: **1.3x to 2x**
- nR4 parallel SMF to duplex SMF cable cost ratio: **2x to 4x**

Conclusions

- Concluding observations from cole_01_0112:
 - Data to support Broad Market Potential for a new SMF standard (in addition to 100GE-LR4) has not been shown in the NG 100G OE SG
 - What has been presented is the desire for significant cost reduction of 100G optics
 - Broad Market for the existing 100G standard is still developing, but we are now proposing to partition it, which will degrade economies of scale
- Additionally, many IDC and Central Office operators have no interest in deploying parallel transceivers
- 100G LR4 transceiver is 1.3x to 2x higher cost than nR4 parallel SMF, and has 2x to 4x lower SMF cabling cost
- This is not sufficiently compelling cost advantage for nR4
- Parallel SMF does not justify a new SMF PMD objective

Appendix: Recommended Development

Step 1: Parallel SMF 4x 10GE-LR port expander QSFP+

- Uses MPO to 4 LC-pair octopus break-out SMF cable
- Complementary to 40GE-SR4 used as parallel MMF 4x 10GE-SR port expander
- ~2x higher front panel density than stacked (DD) SFP+
- Available for 40GE >150m link applications

Step 2: Parallel SMF 10x 10GE-LR port expander CFP4

- Uses MPO to 10 LC-pair octopus break-out SMF cable
- Complementary to 100GE-SR10 used as parallel MMF 10x 10GE-SR port expander
- Requires MLG ASIC
- ~4x higher density than DD SFP+ (~8x belly-to-belly)

Step 3: If 40G parallel SMF links proliferate, then develop 100G parallel SMF 4x25G standard and optics