Relative cost estimation of TOSA&ROSA for DMT

IEEE802.3 Phoenix Interim, January, 2013

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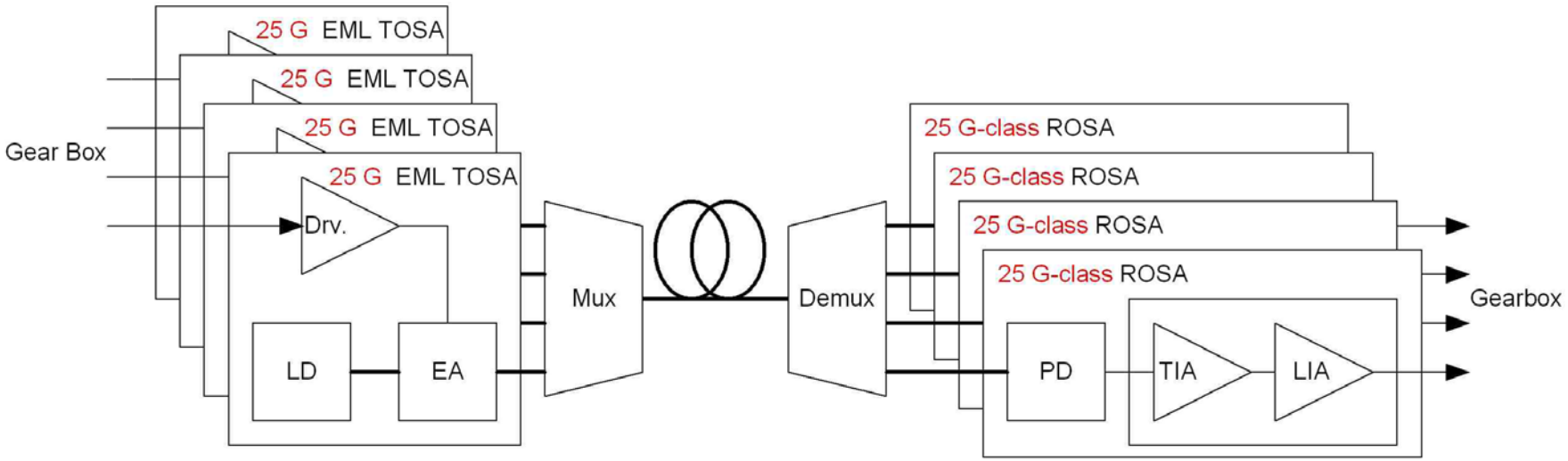
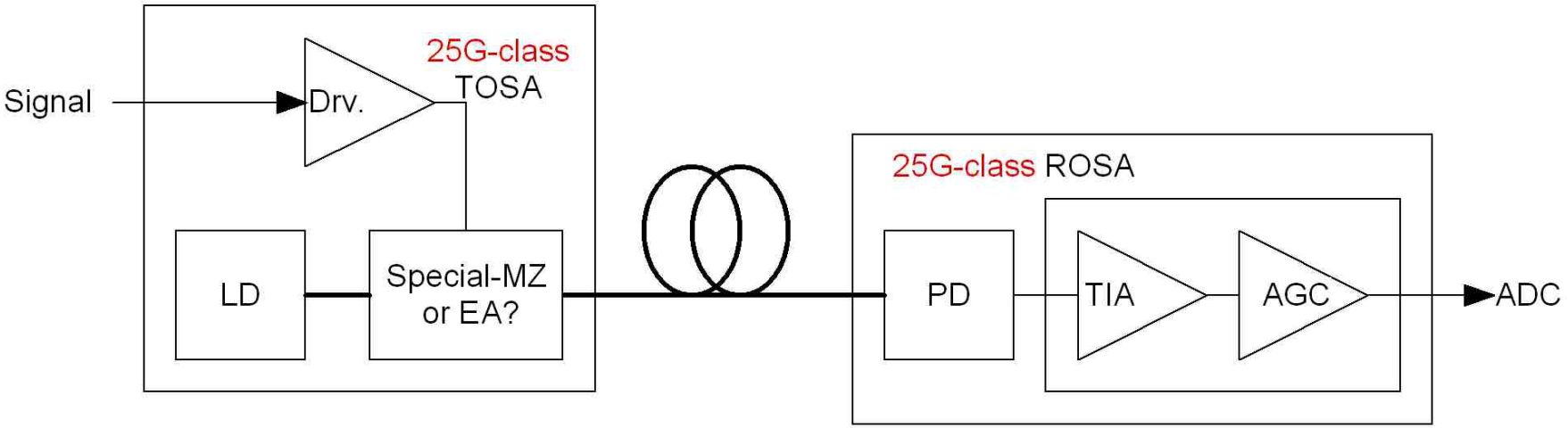
Transmitter and Receiver Configuration of LR4



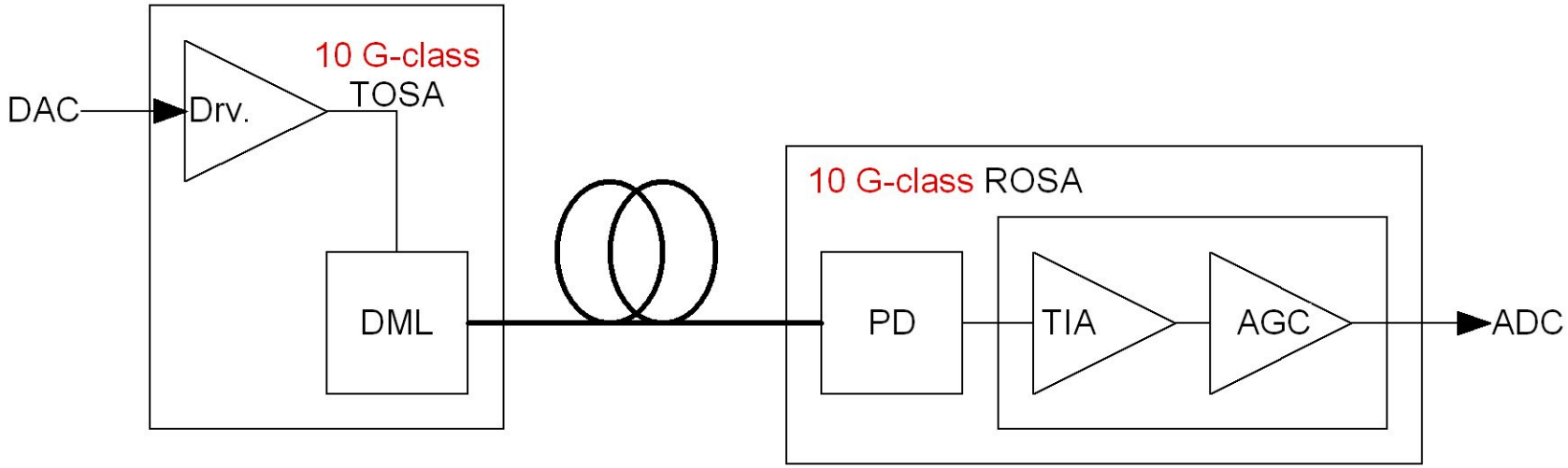
- 25 Gbps high speed 4-ch parallel TOSA & ROSA are required
  - 25 Gbps TOSA & ROSA are expensive
  - 4-ch parallel configuration requires large foot print
- 400 Gbps (16x 25Gbps) is commercially difficult

Transmitter and Receiver Configuration of PAM16



- Special technology will be required for transmitter
  - Special MZ modulator or wide bandwidth EML will be required
  - Single channel solution can achieve small footprint
- Bandwidth requirement will be severe for 100 Gbps transmission
  - Huge number of taps will be required for DFE & FFE at the receiver side to mitigate impairment of real devices

Transmitter and Receiver Configuration of DMT



- Readily available technologies can be used for TOSA & ROSA
  - 10 G-class DML is enough for transmitter
  - 10 G-class receiver technology is enough for receiver
  - Cost effective narrow bandwidth devices can be used
  - Single channel solution can achieve small footprint
- 400 Gbps (4x 100Gbps) is commercially achievable

Comparison

Item	LR4		PAM(16)		DMT	
	Memo	Cost	Memo	Cost	Memo	Cost
TOSA	25 Gbps × 4 (EML)	17a	25 G-class (Special MZ or EA)	3a(*1)	10 G-class × 1(DML)	～1a
Driver Amp.	25 Gbps × 4 (EML)	12b	25 G-class (EA)	↑(?)	10 G-class × 1(DML)	1b
ROSA	25 Gbps × 4 (LIA)	5c	25 G-class (AGC)	2c(*1)	10 G-class (AGC)	1c
Optical Mux	Integrated		Not required	—	Not required	—
Optical Demux	Integrated		Not required	—	Not required	—
Relative cost		10d		～2d (?)		～1d

*1 “Economic Feasibility for NG 100G SMF Objectives”, P. Gavrilovic *et. Al*

- DMT technology can reduce Tx and Rx cost dramatically
  - No special technology required for Tx and Rx
  - DMT effectively utilizes narrow bandwidth devices

Summary

- Proposed DMT approach is cost effective solution for 100GbE and future 400GbE.
- Potentially, 10 G-class device can be used for single channel 100GbE and 4 channel 400GbE solution.

Thank you