Feasibility Study for 40GE SMF 10km

- 40GbE on SMF Ad-hoc -

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Optical Transceiver for 40GE SMF 10km Architecture Alternatives

- WDM Architecture for Optical Interface
  - Optical source: DML or EML (Cooled, Semi-cooled or Un-cooled), CWDM or LAN WDM (800GHz grid), 1310nm band or 1550nm band
  - Line rate: 4x10G or 2x20G (2x20G may require MUX/DEMUX IC)
  - 4x10G would be the most feasible architecture in terms of cost, power dissipation and size
- Serial Architecture for Optical Interface
  - Proven distance with NRZ coding is up to 2km on SMF
  - New coding scheme will be required for 10km
  - Architecture may not be conducive to lower cost
- Parallel Architecture for Optical Interface
  - Duplex solution may be required
  - Parallel architecture is not a good option

Line Data Rate and Optical Source Alternatives in WDM Architecture

	10km at 1310nm band	10km at 1550nm band
10G DML	Yes (Commonly used for 10G 10km non-WDM)	Yes (Used for 10G application)
10G EML	Yes (Used for 10G application)	Yes (Commonly used for 10G 40/80km non-WDM and DWDM)
20G DML	Yes (Need new DML)	Maybe (need new DML)
20G EML	Yes (Need new EML)	Yes (Need new EML)

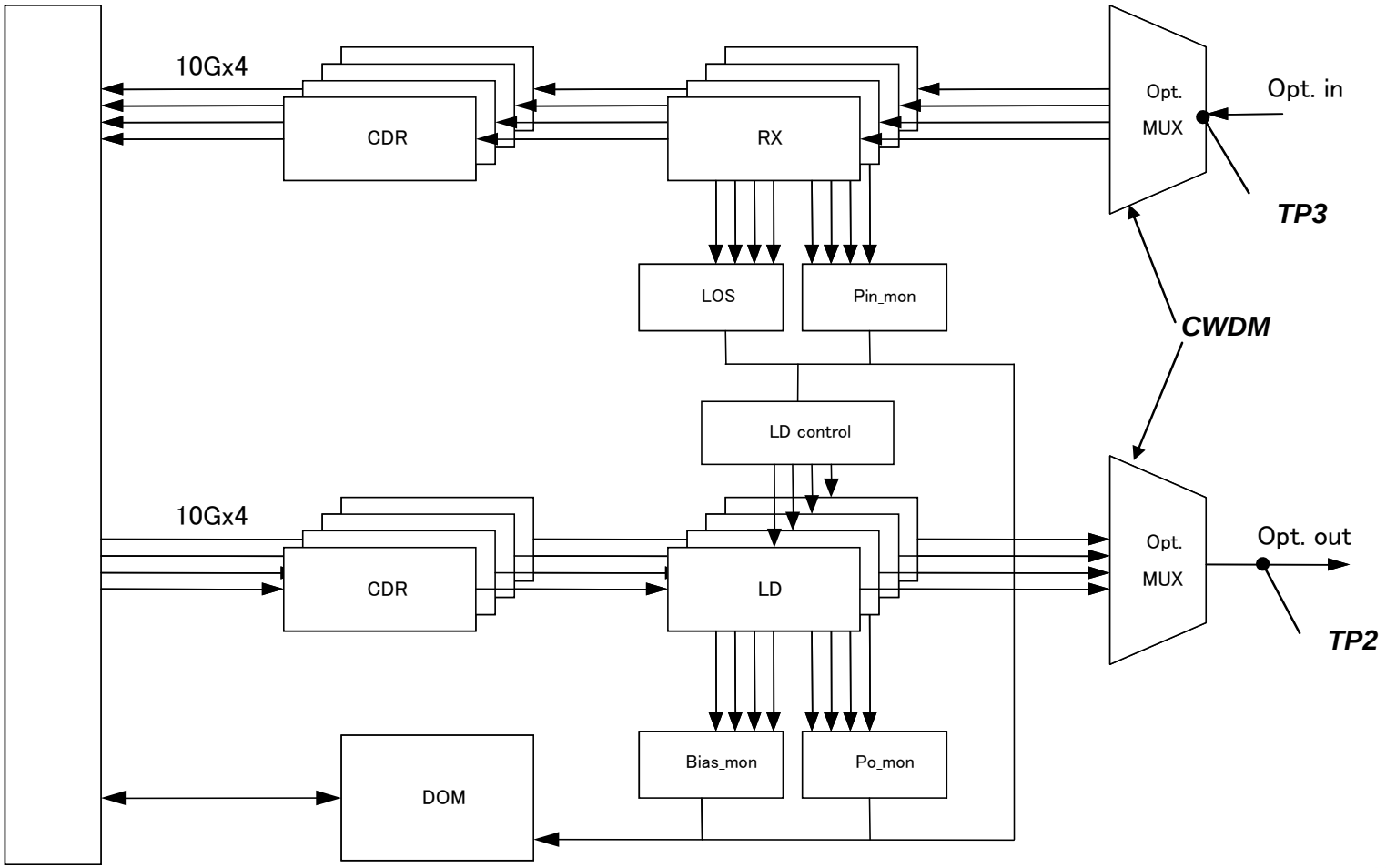
4x10G could be realized by minor design modification of existing 10G device.

Comparison between CWDM and LAN WDM in 4x10G Architecture

	10km by CWDM	10km by LAN WDM
10G DML	•Low cost •Low power dissipation •Small size	•Medium cost (TEC) •Medium power dissipation (TEC) •Medium size (Larger LD module size)
10G EML	•Medium cost (EML+(TEC)) •Medium power dissipation (Additional power for EML bias even though un-cooled) •Medium size (Larger LD module size)	•Medium cost (EML+TEC) •A little bit larger power dissipation (TEC and additional power for EML bias) •Medium size (Larger LD module size)

4x10G CWDM with DML has advantages against other solutions.

4x10G Transceiver Block Diagram

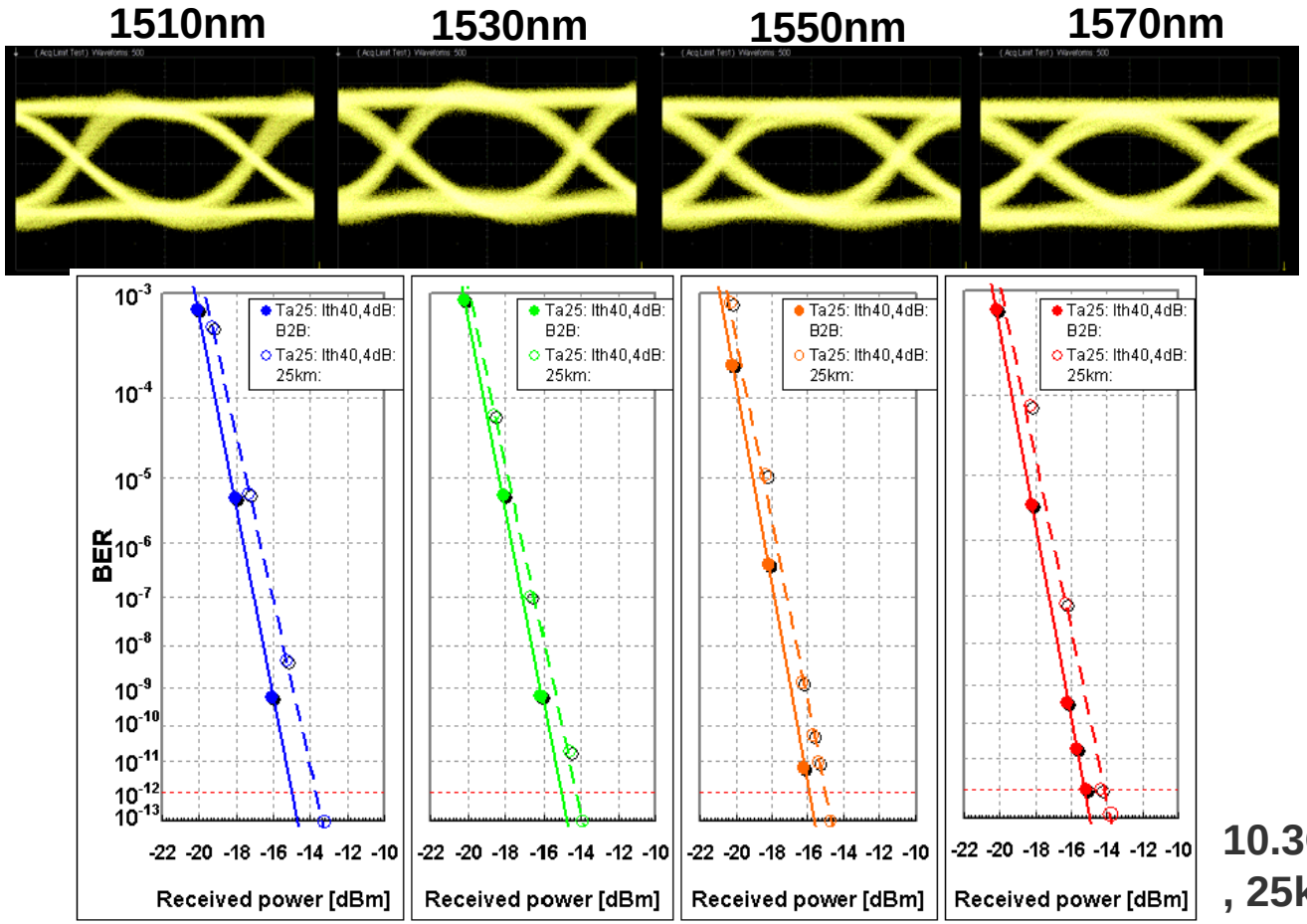


Optical Level Diagram Comparison between different wavelength sets

	CWDM ITU (1271-1331nm)	CWDM ITU (1291-1351nm)	CWDM LX4 (1275.7 - 1349.2nm)	CWDM (1510 - 1570nm)
Optical output before OMUX (dBm @5dB ER)	-1.8	-2.0	-1.9	-2.7
OMUX Loss (dB)	2.5	2.5	2.5	2.5
TP2_min (dBm)	-4.3	-4.5	-4.4	-5.2
Power Budget (dB) (10GEPBud3_1_16a)	7.2	7.0	7.1	6.3
TP3 (dBm)	-11.5	-11.5	-11.5	-11.5
ODMUX Loss (dB)	2.5	2.5	2.5	2.5
RX input (dBm)	-14.0	-14.0	-14.0	-14.0

Both 1310nm band and 1550nm band are feasible.
1550nm band is slightly better in optical output power

4x10G CWDM Feasibility by 1550nm band DML



10.3Gb/s, ER=4dB , 25km SMF

1550nm band CWDM DML is feasible for SMF 10km.
Similar result is expected with 1310nm band CWDM DML.

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Summary

- Feasibility of 40GE SMF 10km is investigated. CWDM grid DML is expected to be the most viable solution
- Both 1310nm band and 1550nm band CWDM are feasible. 1550nm band shows small advantage in optical power output

- Recommend more discussions on wavelength to consider other possible applications:
  - Longer distance support such as 25 or 40km reach on SMF
  - OM3 duplex 100m support with 4x10G CWDM using similar architecture as 10Gbase-LX4