

# 400Gb/s PMD Objectives Considerations

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# 400Gb/s PMD Objectives

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1. 100m MMF objective
  - Will address same market as 100GbE-SR10
  - Extension of 100GbE-SR4 technology
2. Duplex SMF (pair) PMD
  - Does the initial volume (market potential) justify development in this project?
  - Any solution will have large R&D and high initial cost
  - Major factor in determining the SMF PMD objective set
3. SMF objective alternatives:
  - 2km only
  - 10km only
  - 500m & 2km
  - 500m & 10km
4. Cu objective?

# 400Gb/s Duplex SMF PMD Considerations

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- Is parallel SMF, for example four duplex 100Gb/s over four SMF pairs, and/or parallel 8 or 16 SMF pairs, sufficient for initial low volume market?
- Duplex SMF PMD alternatives:
  - 8x50Gb/s NRZ
  - 8x50Gb/s PAM4
  - 4x100Gb/s PAM4
  - 4x100Gb/s QAM16
  - 4x100Gb/s DMT
- Any higher order modulation approach should be compared against 8x50Gb/s NRZ baseline; technically feasible extension of conventional technology
- Why?

# Communication Interface Observations

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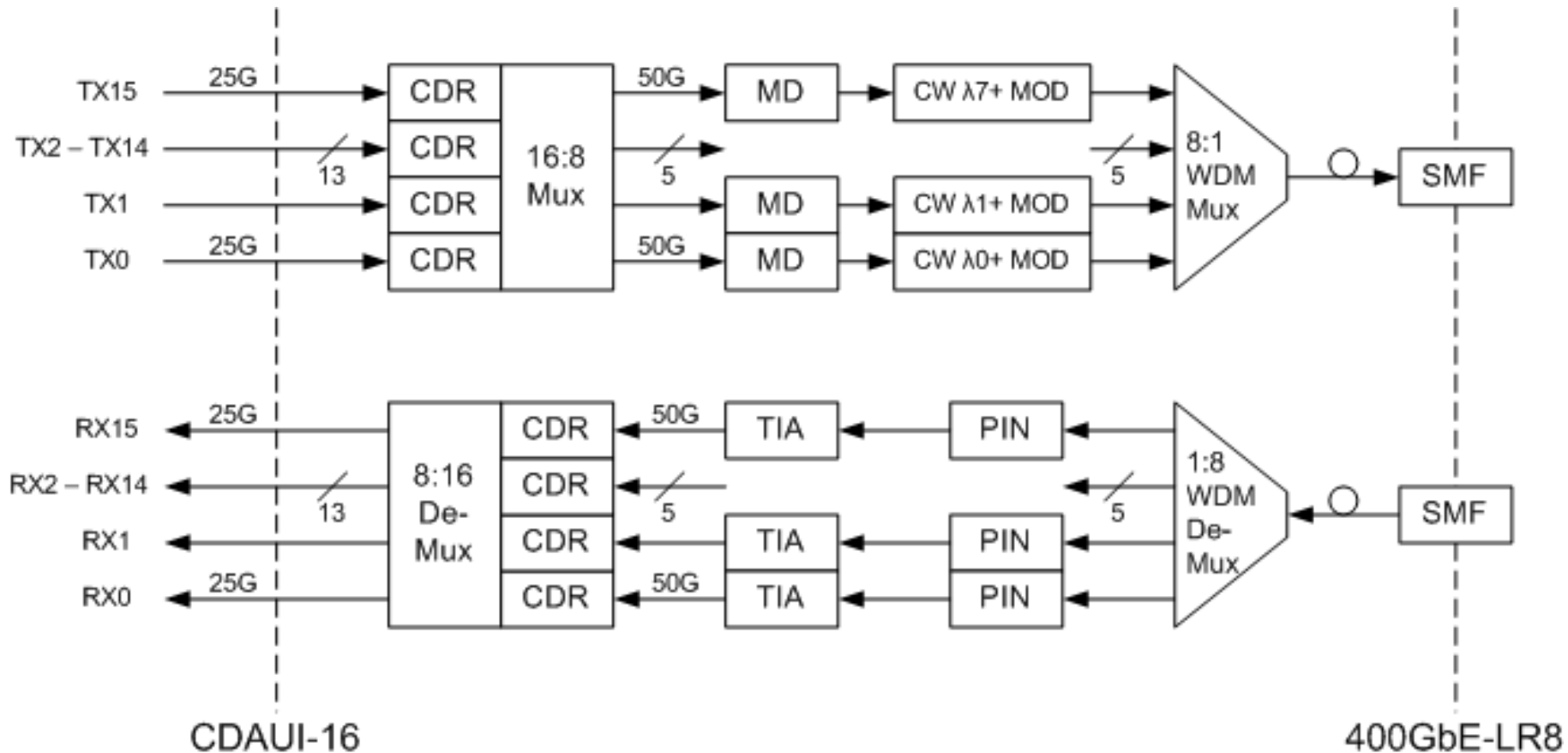
- $\text{bits/sec} = \text{no. channels} * \text{mod. order (bits/symbol)} * \text{mod. rate}$
- communication interfaces have started with:
  1. one channel
  2. simple modulation (1bit/symbol)
  3. bit rate = mod. rate
- no. channels (physical and/or freq./wavelength) and mod. order have historically been increased only when mod. rate hits one of two fundamental limits:
  1. channel limit(s)
  2. technology limit(s)

# Communication Interface Observations, cont.

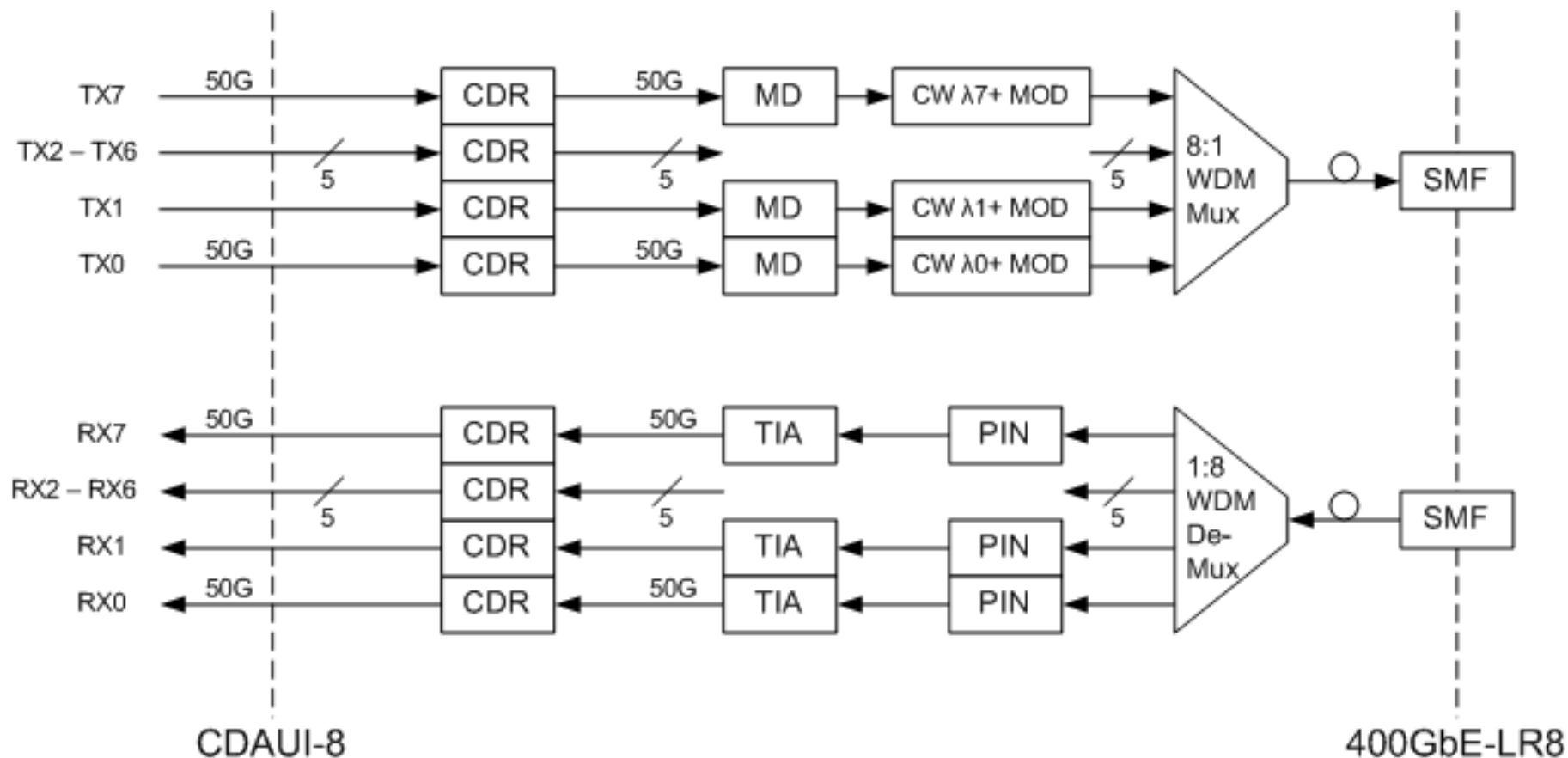
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- 10Gb/s and below optics are one channel NRZ
- 40Gb/s and 100Gb/s mainstream optics today are four channel (fiber pair or wavelength) NRZ
- 40Gb/s single channel NRZ is a technically feasible future low cost 40G alternative
- 2x50G/bs two channel NRZ is a technically feasible future low cost 100G alternative
- $\geq 1$ Tb/s optics will be multiple channels and higher order mod.
- Should 400Gb/s optics transition to higher order mod?
- Only if necessary, i.e. if mod. rate hits a fundamental channel or technology limit

# 400Gb/s 8x50G NRZ Duplex SMF Baseline



# 400Gb/s 8x50G NRZ Duplex SMF Baseline 2



CDAUI-8 Higher Order Modulation (ex. PAM-4) requires HOM electrical RX and TX.

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Thank you