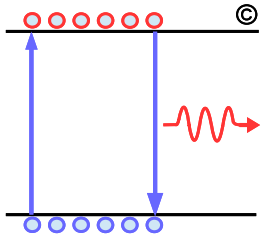

100G C2C Consideration

Ali Ghiasi

Ghiasi Quantum LLC

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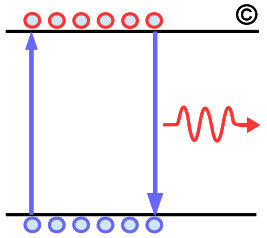
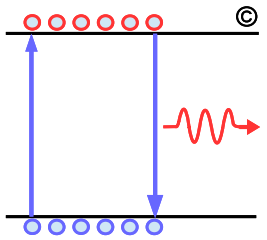
Background



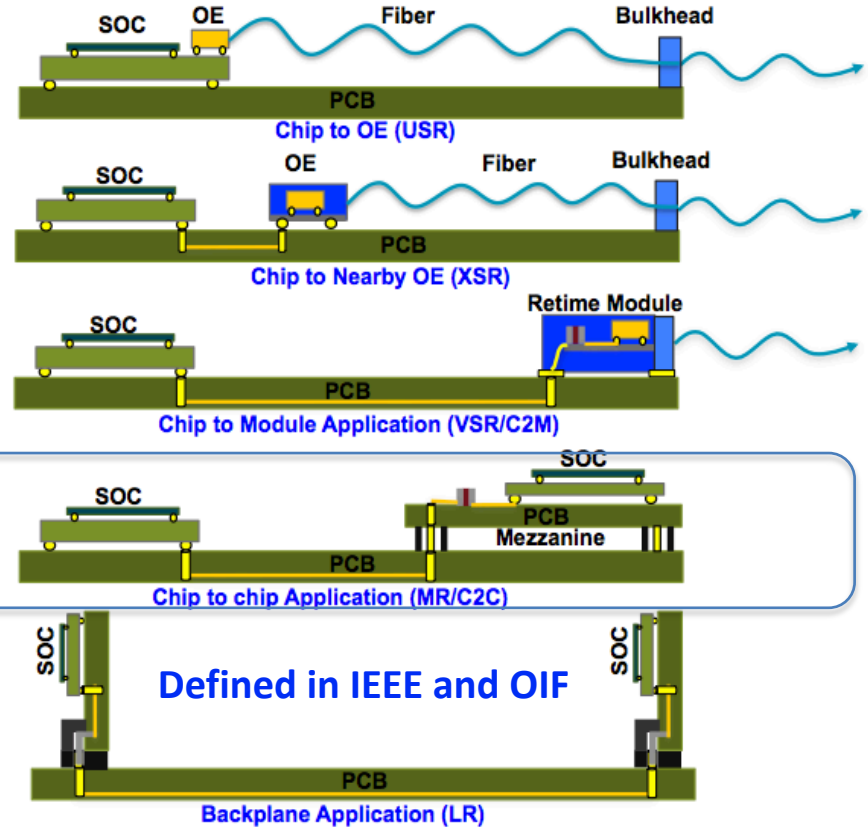
- **Medium reach C2C applications were first defined in OIF by OIF-28G-MR and later in IEEE clause 83D with following attributes:**
  - Indended to be lower power than KR/LR SerDes
  - The interface can operate with 1E-12 or 1E-15 without FEC
  - Supports reach up to ~500 mm with one connector (~20 dB at Nyquist)
  - At 53 Gbd 500 mm application is more inline with KR
- **There is overwhelming support not to change 100GBASE-DR FEC/PCS**
  - Anslow showed that there is some concern with 100 GbE as result of burst error for DFE receiver anslow_3ck_01_0918.pdf
  - Gustlin suggest to use 2 RS (544, 514) interleaved FEC for KR/CR and C2C to overcome the burst error gustlin_3ck_adhoc_01a_100318.pdf
  - Adding interleaved FEC that must be removed prior to transmission on fiber is a unnecessary complexity given that most of the C2C applications retiming front panel signals can be satisfied with 200-250 mm.

Overview of 50G/lane Ecosystems



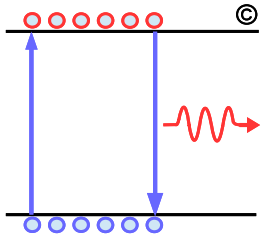
- **OIF defines both NRZ and PAM4 for MR but in IEEE CL120D C2C is defined for PAM4 signaling**
  - Both MR and C2C specifications expected reach are 50 cm plus one connector.

Application	Standard	Modulation	Reach	Loss Ball-ball	Loss Bump-bump
Chip-to-OE (MCM)	OIF-56G-USR	NRZ	< 1cm	2 dB@28 GHz	NA
Chip-to-nearby OE (no connector)	OIF-56G-XSR	NRZ/ PAM4	<7.5 cm[1]	8 dB@28 GHz 4.2 dB@14 GHz	12.2 dB@14 GHz 4.2 dB@14 GHz
Chip-to-module (one connector)	OIF-56G-VSR IEEE CDAUI-8	NRZ/PAM4 PAM4	< 10 cm[2] <20 cm	18 dB@28 GHz 10 dB@13.3 GHz	26 dB@28 GHz 14 dB@13.3 GHz
Chip-to-chip (one connector)	OIF-56G-MR IEEE CDAUI-8	NRZ/PAM4 PAM4	< 50 cm < 50 cm	35.8 dB@28 GHz 20 dB@13.3 GHz	47.8 dB@28 GHz[3] 26 dB@13.3 GHz
Backplane (two connectors)	OIF-56-LR IEEE 200G-KR4	PAM4 PAM4	<100 cm <100 cm	30dB@14.5 GHz 30dB@13.3 GHz	~37dB@14.5 GHz[4] 36dB@13.3 GHz



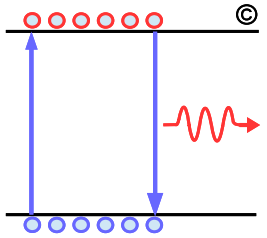
1. OIF XSR definition likely too short for any practical OBO implementation!
2. OIF VSR 10 cm reach assumes 10 cm mid-grade PCB but typical implementation uses Meg6/ Tachyon 100 with ~25 cm!
3. Include 2x6 dB for package loss but 47.8 dB seem beyond equalization capability
4. Include 2x3.5 dB for package loss.

Evolution of Electrical Interfaces

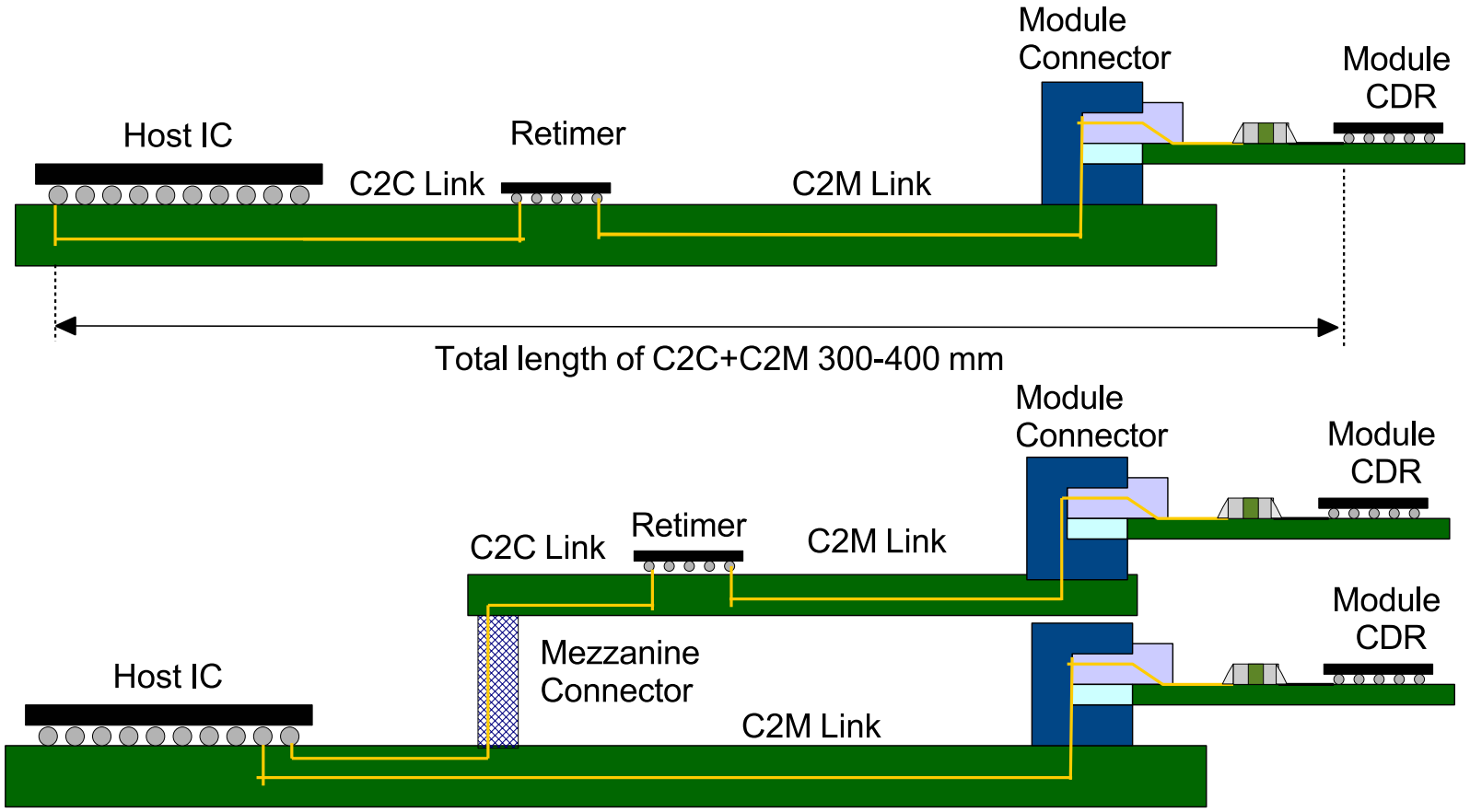


- **Historical KR, CR, and C2M reaches and expected reach/loss at 53 GBd PAM4**
  - KR supported 1 m plus two connector but expected loss at 53 GBd is only 500 mm
  - CR supported cable reach of 5 m but expected loss at 53 GBd is only 2 m
  - C2M with 10.2 dB supported ~10” on Megtron 6, at 53 GBd with ~16 dB can support the same reach on Megtron 7
- **The question is what to do with C2C now?**
  - To support originally envisioned C2C application with 500 mm plus one connector one has to use KR
  - One of the key C2C application are retimers placed between ASIC and front panel
  - These front panel applications are driving optical PMDs where we can’t change the FEC or the PMD BER of 2E-4 as result of burst error on C2C link segment due to heavy DFE
  - A better option is to repurpose C2M with max loss of 16 dB for C2C applications with up to 250 mm
  - Traditional C2C application that require 500 mm anyway one has to use KR.

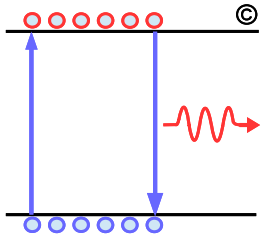
Two Common C2C Applications



- **These common C2C applications can satisfied with 200-250 mm and by repurposing C2M budget**
  - Connecting to far-side of the ASIC IO may require retimer
  - Modules mounted on mezzanine card.



Summary



- **Historical C2C applications with 500 mm plus one connector at 53 GBd is aligned with what the task force defining for KR with 28 dB loss budget from ball-ball**
- **One of the most common C2C application is retiming the front panel signals**
  - Connecting far-side of the ASIC IO to the module
  - Retiming signals where modules are mounted on a mezzanine card
- **Both of the above applications can be satisfied by repurposing C2M 16 dB budget for C2C supporting 200-250 mm with one connector**
- **A light C2C that does not use heavy DFE avoid introducing interleaved FEC that must be removed prior to transmission on 100GBASE-DR links**
- **Proposes to define C2C specifications with up to 16 dB without heavy DFE use in support of channels with up to 250 mm with one connector.**