



# Application Space of CAUI-4/ OIF-VSR and cPPI-4

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Sept 15 2011

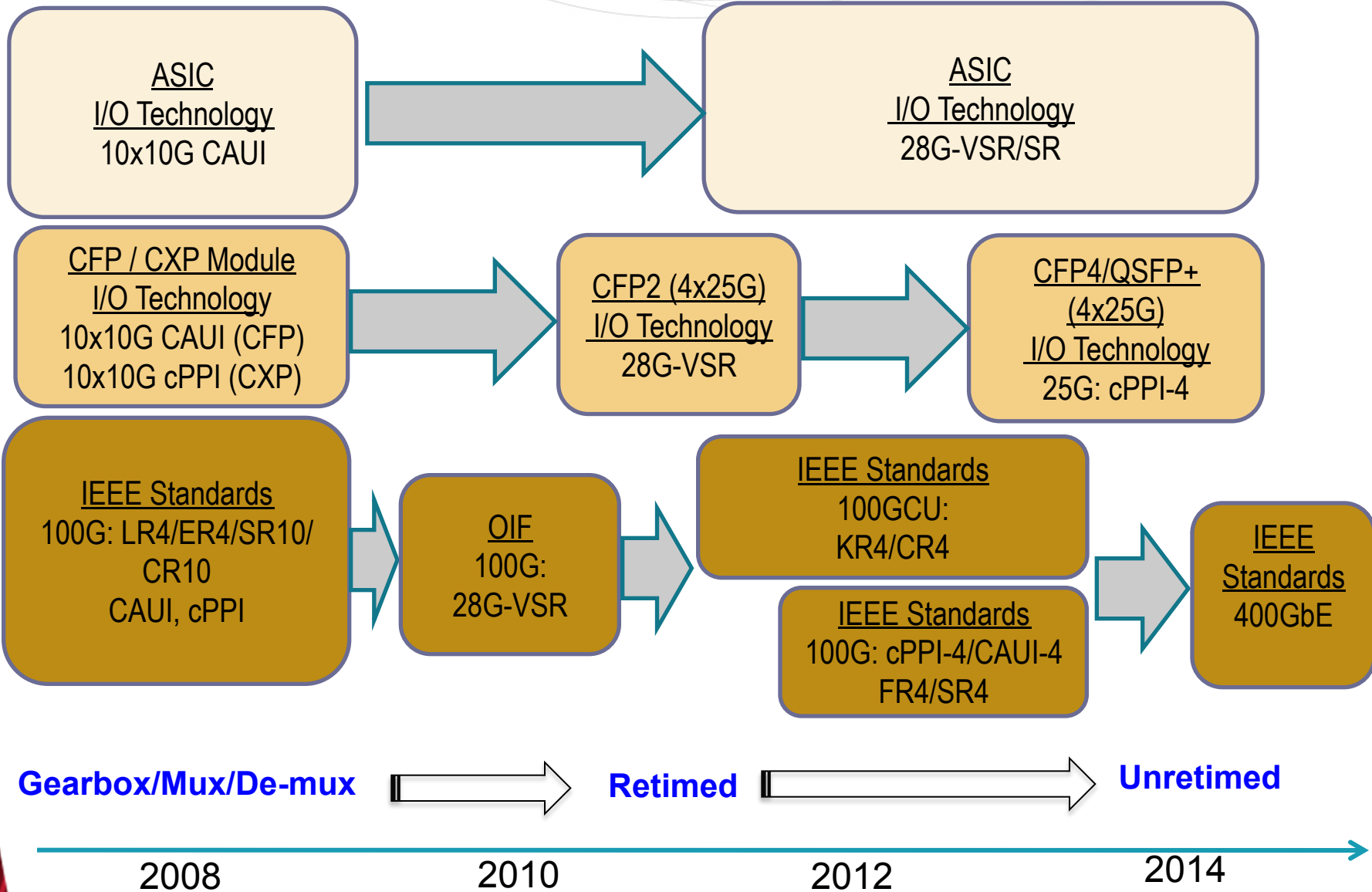
IEEE 802.3 100GNGOPTX Study Group

Chicago

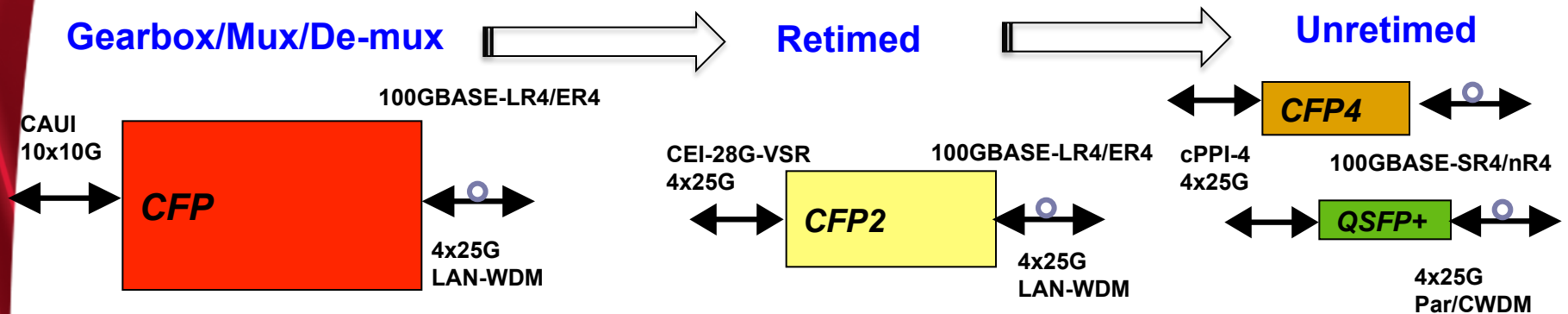
# Overview

- I/O Trend
- Module evaluation
- VSR/CAUI-4 application model
- cPPI-4 application model
- VSR loss budget
- Possible CAUI-4 loss budget

# 100GbE I/O Trends



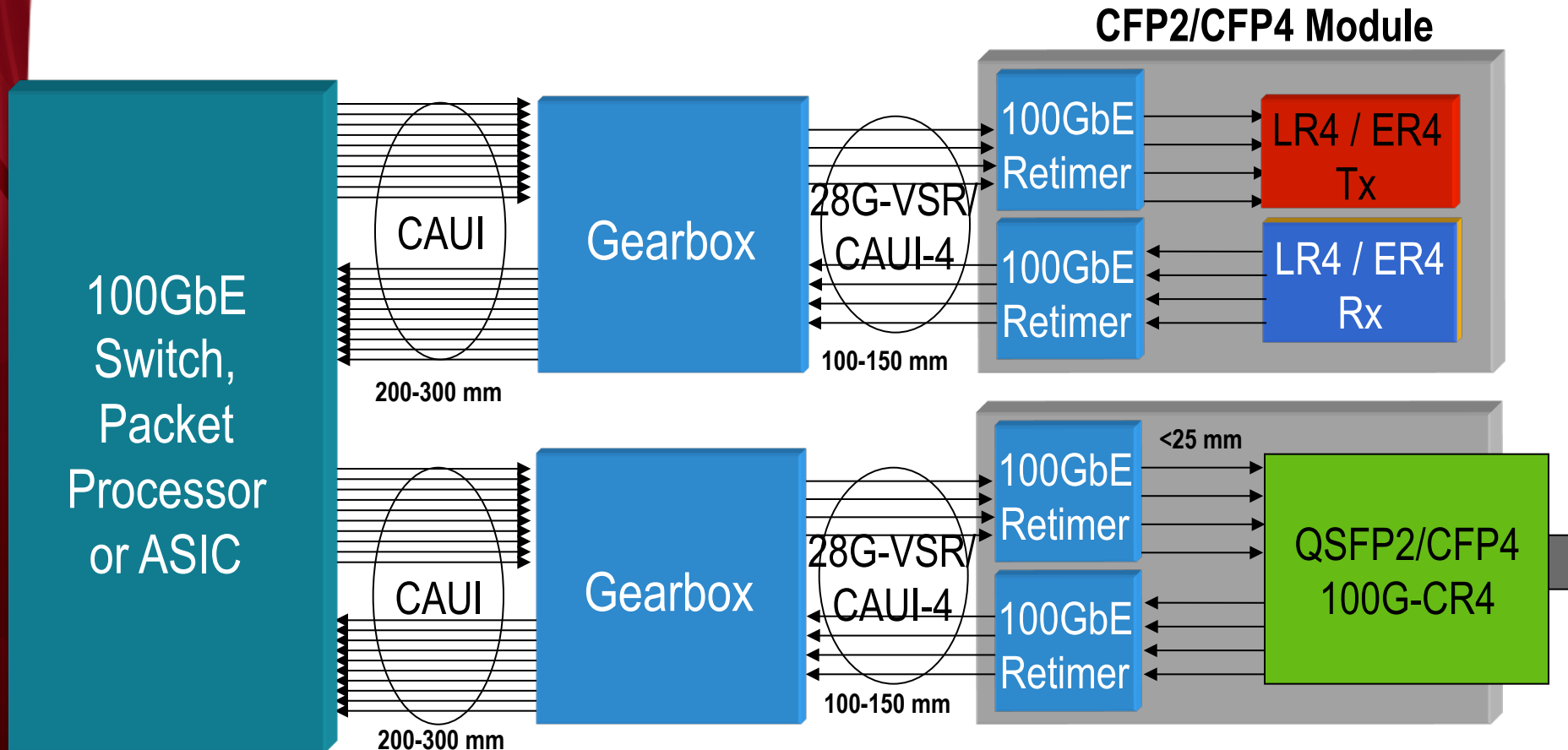
# 100G Module Roadmap



Module Characteristics	CFP	CFP2	CFP4/QSFP+
Optics	Discrete/hybrid: · LR4/ER4	Hybrid/integrated: · LR4/ER4 · Could support FR4/SR4/CR4	Integrated: · SR4/FR4/CR4 (New PMDs) · May not support LR4/ER4
Interface	CAUI	28G-VSR/CAUI-4	cPPI-4
Host PCB	250-350 mm	100-200 mm	50-100 mm
Interface IC	4:10 gearbox	Retimed	Unretimed
Data Rate System/Line Side	10 x 10.3 GBd / 4x25.7 GBd	· 4 x 25.78 GBd/ · 4x25.7 GBd	· 4 x 25.78 / · 4x25.7 GBd

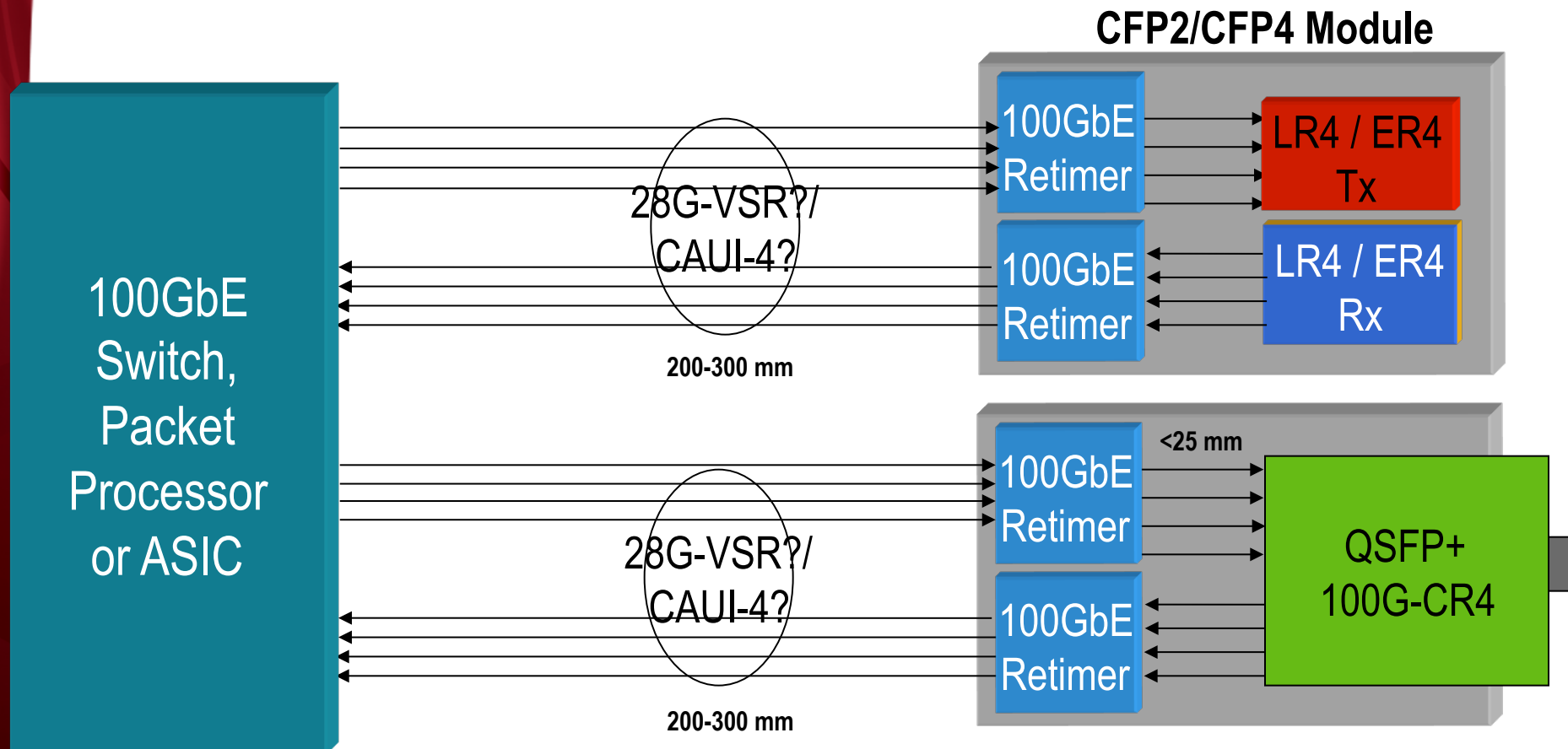
# Current Retimed Applications with "CFP2"

- CFP2 is retimed interfaced designed for LR4/ER4 but could be retrofitted to support 100G-CR4/SR4 as well
- OIF 28G-VSR only supports 4-6" of PCB and not sufficient for general CAUI chip to chip application where OIF 28G-SR is currently targeted



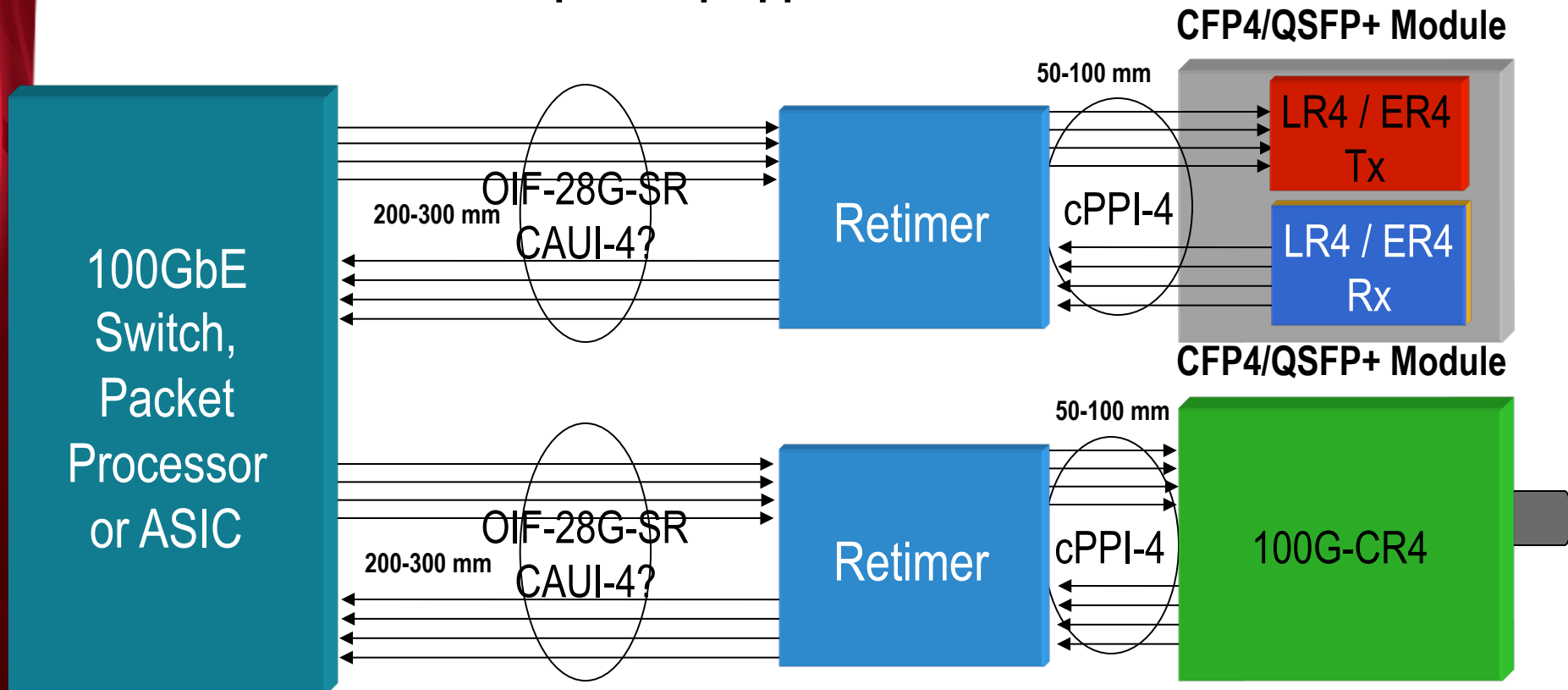
# Possible Applications of CFP2

- The 200-300 mm host PCB with one connector would be required
  - Can VSR 10 loss budget enhanced without substantial power increase
  - The real application for 200-300 mm PCB is for chip to chip applications not to the module
- Application model not compatible with passive Cu!



# Next Generation Implementation Based on cPPI-4

- cPPI-4 is unretimed interfaced will be designed to support LR4/ER4 as well as new PMD's in development 100G-CR4/SR4
- The 200-300 mm is more inline with OIF 28G-SR, can we retrofit OIF VSR to meet CAUI-4 chip to chip application as well?



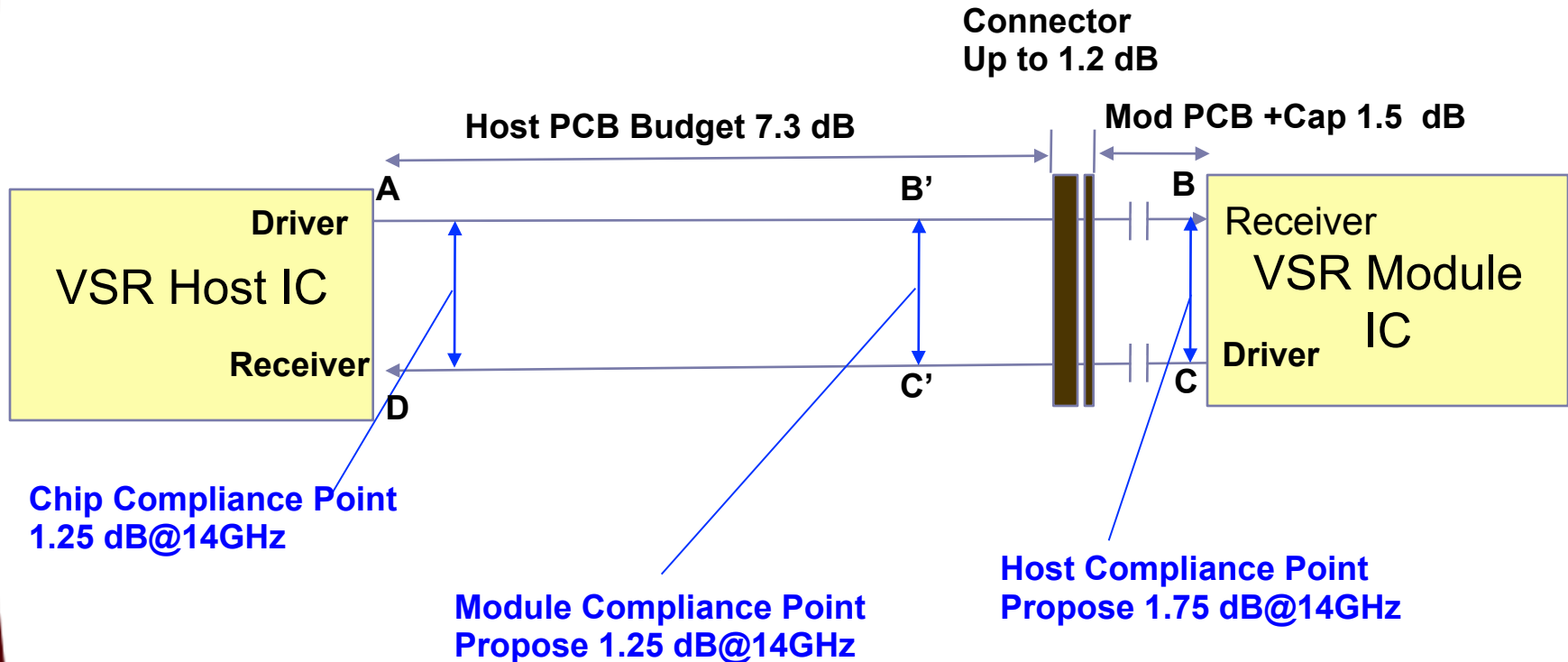
# Highlight of OIF 28G-VSR

- Host transmitter assumes 3 tap FFE with pre and post
- Transmit amplitude of 600 mV
- Host output measured at HCB output with reference CTLE and must meet certain vertical and horizontal opening
- Module transmitter assumes it will deliver certain vertical and horizontal opening at MCB output
- Assume sensitivity at chip ball is 100 mV when measured with software CTLE
- There is no back channel
  - Host will optimize far end eye through reference CTLE by adjusting pre and post
  - The module will utilize its pre/post or peaking filter and faster rise time to deliver min vertical and horizontal opening at TP4 (MCB Output)
- Specification assumes MCB and HCB similar to 802.3ba
- Good starting point for CAUI-4 and it can be tweaked to better fit Ethernet applications.



# OIF 28G-VSR Architecture and Reference Points

- Follows 802.3 CL83B (CAUI)



# VSR Channel Loss Budget Table



- Assumes 10 dB loss from host IC balls to module IC balls
- If the CPPI-4 loss budget is in the 12-13 dB compatibility with VSR could be achieved.

Traces (Rev A.G. 4/7/11)	FR4-6	N4000-13	Megtron 4	Megtron 6
Loss at 14 GHz /in	2.4	1.7	1.4	1.1
Worst Case Connector loss at 14 GHz	1.2			
Loss allocation for 2 Vias in the channel	0.5			
DC Block	0.5			
Max Module PCB Loss	1			
PCB Trace Length Assuming 10 dB Loss Budget	2.8333	4.0000	4.8571	6.1818

# Possible CAUI-4 Loss Budget



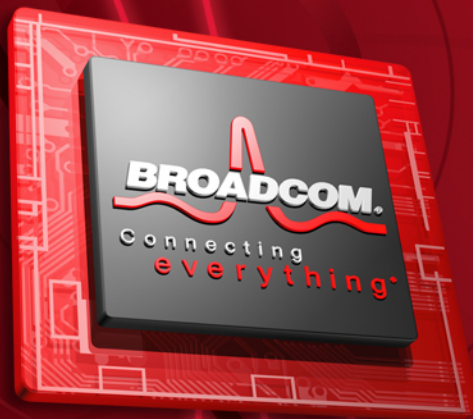
- With 12.5 dB loss budget ~7.5” is possible with N4000-13SI and ~10” with Megtron-6
  - Loss value adjusted for operation at 25.87 GBd

Traces (Rev A.G. 9/12/11)	FR4-6	N4000-13	N4000-13SI	Megtron 6
Loss at 12.85 GHz /in	2.0	1.5	1.2	0.9
Worst Case Connector loss at 14 GHz	1.2			
Loss allocation for 2 Vias in the channel	0.5			
Max Module PCB Loss & DC Blocks/HCB at 14 GHz	1.7			
PCB Trace Length Assuming 12.5 dB Loss Budget	4.5500	6.0667	7.5833	10.1111

\* For 100 GbE operation since the HCB and connector are specified for operation up to 28GBd there will be 0.2-0.3 dB unallocated margin.

# Summary

- In 802.3ba retimed interfaces based on CL83A/83B and unretimed interfaces CL85 (CR4/CR10) and CL86 (nPPI) were defined
- 100GNGTOPTX project also needs to define retimed interface as well as an unretimed which is in sync with 100GCU project
  - The unretimed interface will support Cu, SR4/nR4, and possibly LR4/ER4
- OIF 28G-VSR is a good starting point for CAUI-4 but the loss budget should be increased by as much as 2.5 dB while maintaining compatibility and not drastically increase the CDR power
- CAUI-4 must operate with BER 1E-12 or better without FEC as it must support existing PMDs such as LR4/ER4
  - FEC option must be combine with new PMDs such as 100G-SR4/nR4 and in context of cPPI-4



Thank You