

XAUI "Hari" Electrical Update

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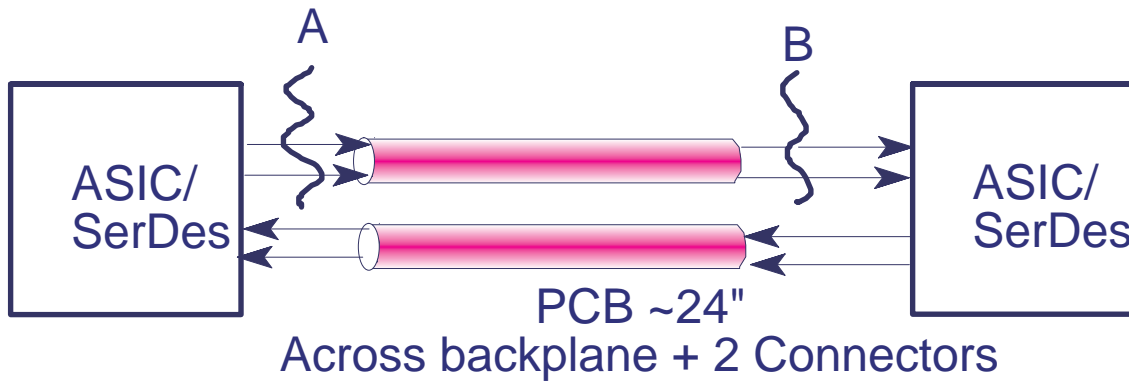
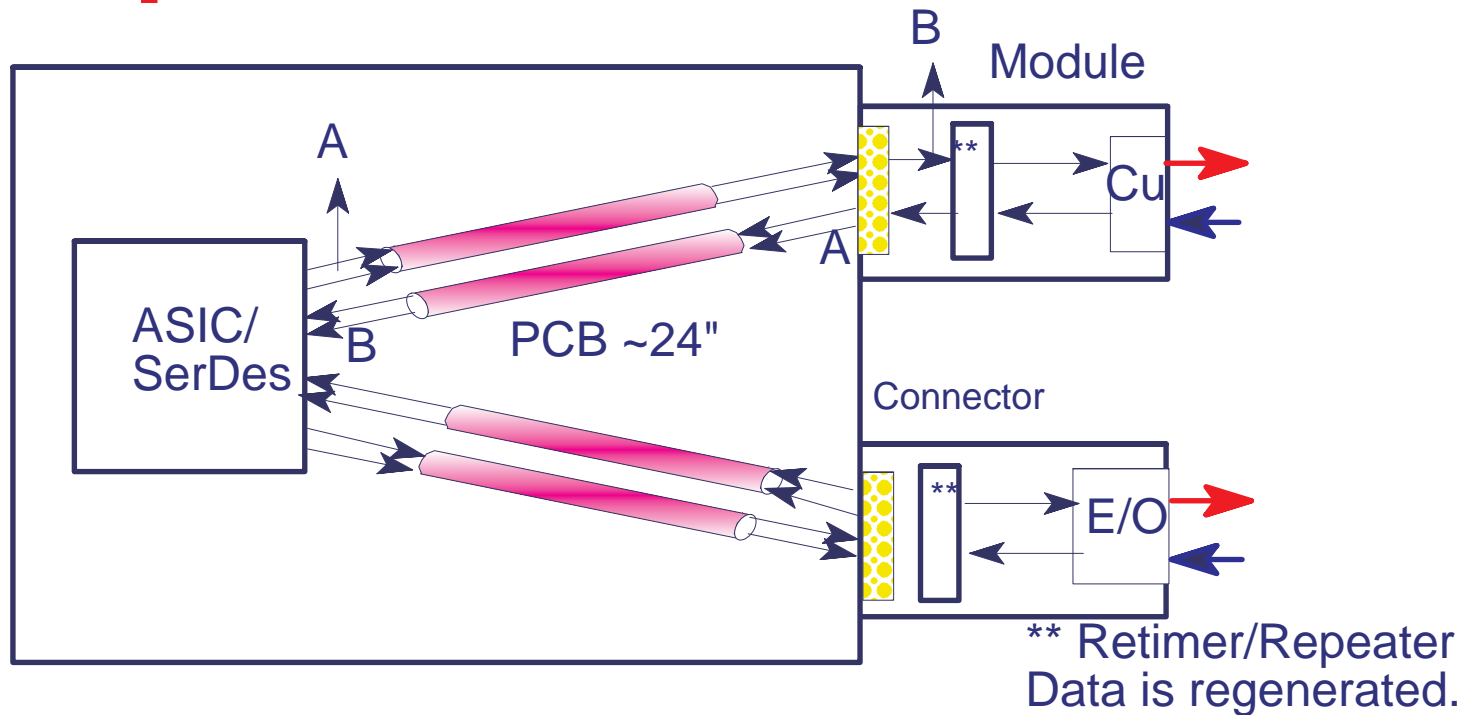


Overview

- Overview of XAUI Implementation
- Symbol skew introduction by SerDes TX.
- Symbol skew introduction by Retimer.
- Power allocation.
- Skew allocation for PCB.

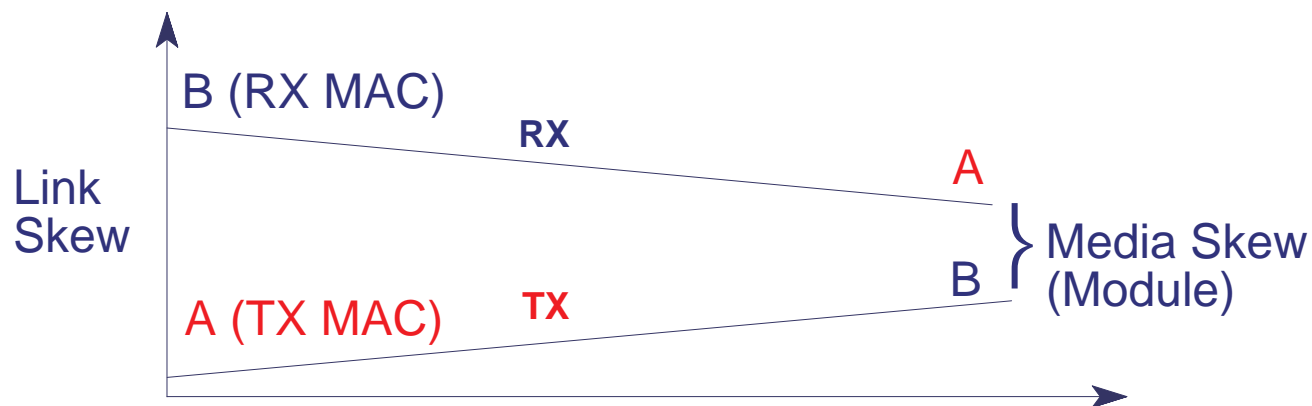


Example of XAUI Interconnect



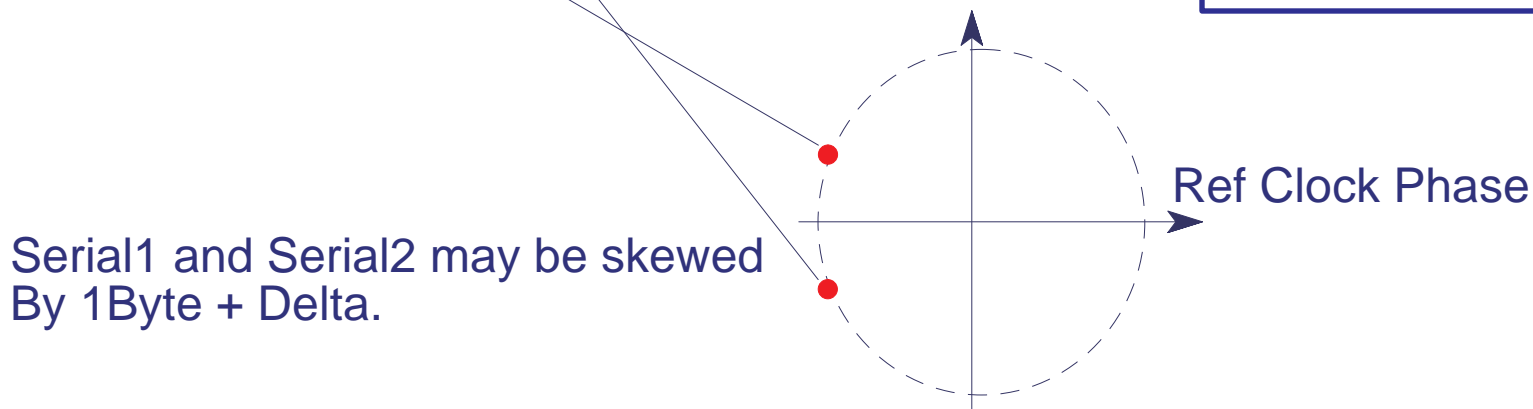
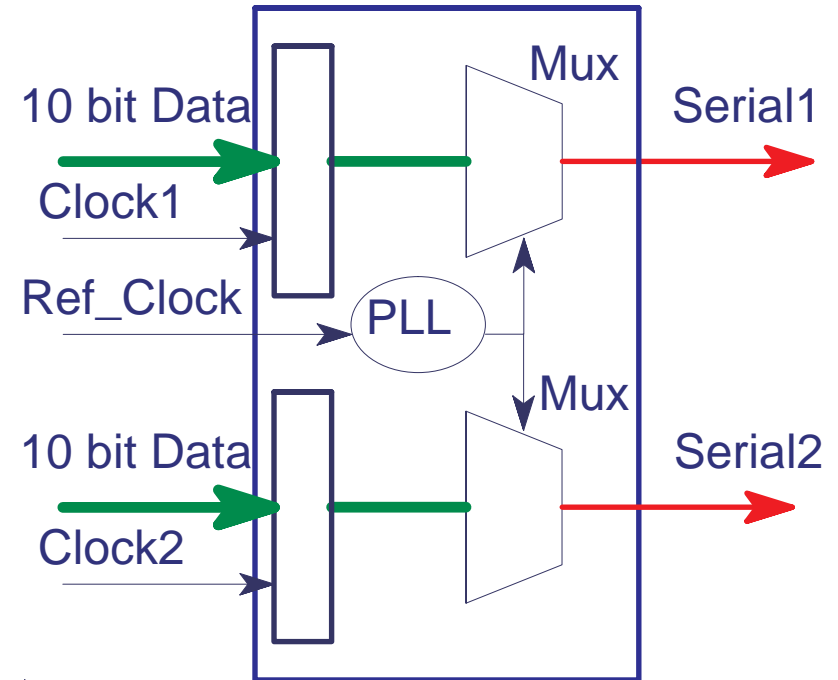
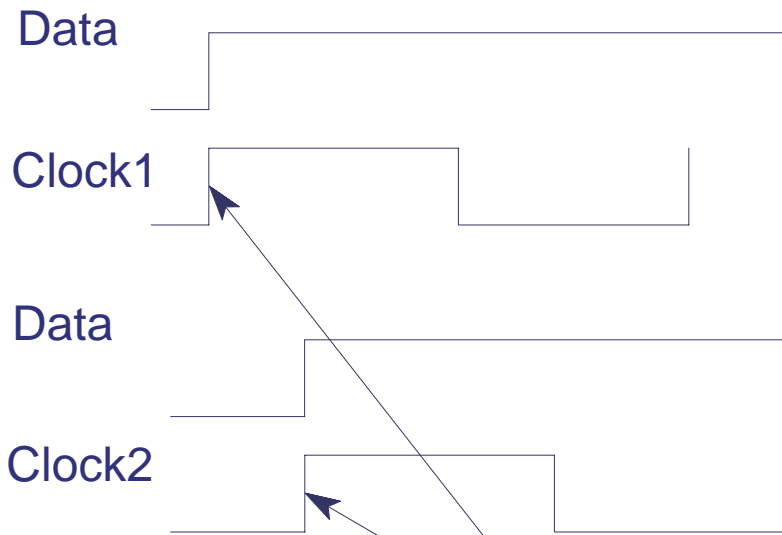
XAUI Link Skew Propagation

- XAUI link intention were for the skew to add and propagate from TX to RX:



- All serial solution you would need to de-skew.

Symbol Skew on SerDes Transmitter is Possible



Serial1 and Serial2 may be skewed
By 1Byte + Delta.

Retimers may Introduce Symbol Level Skew

- Some retimers implementation may advertently add symbol level skew due to race condition .
- One of the possible implementation to avoid extra skew is to first de-skew all the lanes.
- We should evaluate trade off between more flexible retimer designs vs limiting total skew.



Current XAUI Skew Budget and Additional Possible Skew

Hari Skew for	Current XAUI	XAUI
TX ASIC / SerDes	1 UI	11
TX PCB	1 UI	1
TX Retimer	?	10*
Media Skew	16 UI	16
RX Retimer	?	10*
RX PCB	1 UI	1
SerDes RX/ASIC	20 UI	21
Total Link Skew (UI)	39	70
Total Link Skew (ns)	12.48	22.4

Notes: *Retimer symbol level skew can be avoided with the right implementation.

New proposal allocates 2 UI of skew as a result of electrical imperfection on the transmit and receive.

Current XAUI SerDes RX has 20 bits of logical skew without any electrical skew allocation.

Comparison of the HS I/O and XAUI Interface

Item	PECL	LVDS	XAUI
Transmitter			
V _o Diff(max) _{p-p}	2000 mV	800 mV*	800 mV
V _o Dif(min) _{p-p}	1200 mV	500 mV	500 mV
V _{oh}	AC	1475 mV	AC
V _{ol}	AC	925 mV	AC
I _{out} nominal	16 mA	6.5 mA	6.5 mA
Receiver			
V _{in} (max)	2000 mV	800 mV	1000 mV
V _{in} (min)	200 mV	200 mV	175 mV
Loss 50Ω	15.56 dB	8 dB	9.1 dB

* Corrected from the Nov. Presentation.



XAUI/Hari Loss Budget

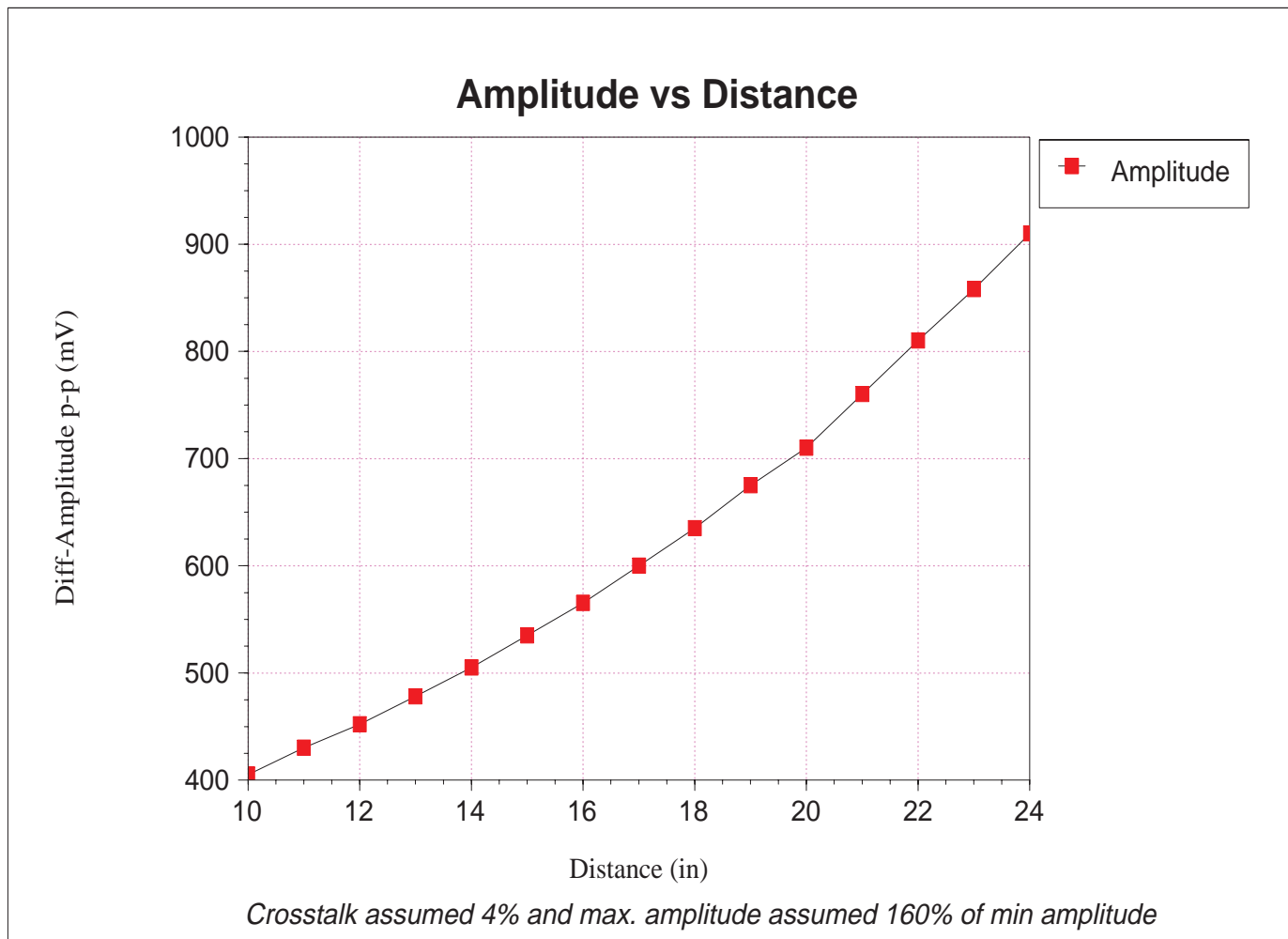
Baud Rate	2.12 Gb/s	XAUI-3.125 Gb/s (Original)	XAUI-3.125 Gb/s (Updated)
2 Connector Loss (dB)	1	1	2
Next+Fext Loss (dB)	0.75	0.75	1.5*
PCB Loss (dB)	7.35	7.35	5.6
Loss Budget (dB)	9.1	9.1	9.1
PCB Condition ¹	Normal/Worst	Normal/Worst	Normal/Worst
MSTL Loss Max (dB)/in	0.22 / 0.29	0.32 / 0.43	0.32 / 0.43
Max Distance (in)	33.4 / 25.3	23 / 17.1	17.50 / 13.02
PCB Condition	Normal/Worst	Normal/Worst	Normal/Worst
STL Loss Max (dB)/in	0.29 / 0.39	0.41 / 0.55	0.41 / 0.55
Max Distance (in)	25.3 / 18.8	18 / 13.4	13.65 / 10.18

* Assumes 4% crosstalk from 800 mV signal.

1. Normal PCB was assumed with loss tangent of 0.22, worst case it was assumed high temperature and humidity 85/85. Better grade of FR4 may reduce the loss by as much as 50%.

2. HP test measurement for 20" line showed 5.2 dB loss or 0.26dB/in based on the eye loss, the loss assumed here is very conservative.

Amplitude Requirement for Driving Distance



Amplitude requirement incorporate 2 connectors (2dB), Stripline with Loss of 0.41 dB/in, and 4% crosstalk.

Conclusions

- SerDes transmitter or a retimer may cause a symbol (10UI) of skew.
- Care needs be taken on design and implementation of SerDes/Retimer or just in case we should allocate more skew budget.
- At 3.125 Gb/s connector loss and crosstalk have greater impact, reducing the PCB distance to 13.6".
- If our goal is driving minimum of 16 to 20" of PCB, we need to increase the amplitude.