SAS 6 Gbps Proposal
Based on OIF CEI 6G

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Q: Why not simply adjust the 3Gb/s spec values to create the 6Gb/s specification?

A: Because the virtually closed eye at 6G requires a fundamentally different approach.
Objectives

• To propose a framework based on the structure of the OIF CEI
• To begin to identify elements common between OIF CEI and SAS 1.0
• To begin to identify elements not common
  – To justify these differences as desirable or necessary due to the higher speed
Introduction (1 of 3)

• Where it’s going: OIF CEI is becoming the basis for a number of standards
• Where it’s from: OIF CEI appears to have evolved from a number of existing standards
  – As witness, the snippet of OIF CEI “genetic code” to the right obviously came from Fibre Channel or SAS
OIF CEI 2.0 has an impressive (to me anyway) collection of theoretical and practical appendices.
Introduction (3 of 3)

• OIF CEI 6G-SR (short reach) is a chip-to-chip spec which is insufficient for 6G SAS (up to 8”)
• OIF CEI 6G-LR (long reach) is meant to include legacy backplanes (up to 1 meter)
  – Requires 5-tap DFE in reference RX
• This proposal will be a framework compromising between these two specs
  – All values are, of course, TBD
OIF CEI Reference Model

• Ingress/Egress distinction may be useful in specifying SAS ↔ SATA links
• “Component Edge” will likely be equated to “Separable Connector”
Transmitter

- 800-1200 mVppd (?)
- 1 tap (at least) of emphasis
  - Pre- or post-cursor
- Return Loss (SDD11):
  - “The differential return loss shall be better than $A_0$ from $f_0$ to $f_1$ and better than $A_0 + \text{Slope} \times \log_{10}(f/f_1)$ where $f$ is the frequency from $f_1$ to $f_2$. ”

- Compliant TX: required eye after reference channel + reference RX
Receiver

• Return Loss (SDD11):
  – “The differential return loss shall be better than $A_0$ from $f_0$ to $f_1$ and better than $A_0 + \text{Slope} \times \log_{10}(f/f_1)$ where $f$ is the frequency from $f_1$ to $f_2$. ”

• Compliant RX: required eye after reference TX + reference channel

• “Reference receiver” offers an architecture known to work… *but CEI does not require use of that architecture.*
Some CEI-vs-SAS Issues (1 of 2)

• No framework for OOB specs
  – If OOB data rate does not increase, can keep same/similar electrical specs as SAS1

• Presently, no consideration for 8B10B coding in simulators (including StatEye)
  – Causes too-pessimistic eye closure

• Question about “worst case” RX return loss
  – Should it be minimum (vs. max) resistance?
Some CEI-vs-SAS Issues (2 of 2)

- TX compliance should make use of TCTF (aka “compliance channel”)
  - Allows testing specific to cable or PCB
  - TCTF definition could be expanded to include NEXT & FEXT (near-end & far-end cross talk)
  - Avoids difficulties of near end TX measurements (resonance, fixture effects, …)
Summary

• Methodology of OIF CEI fits the needs (mostly) of 6G SAS
  – Accommodates closed eyes at RX input
  – StatEye (publicly available) & similar proprietary tools support this methodology

• Likely need to interpolate 6G SAS spec between 6G-SR & 6G-LR (short & long reach)