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Challenges in Designing 10 GB/S Backplanes

IEEE 802.3ae Task Force

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JIM_TAVACOLI@ACCELERANT.NET

Goal

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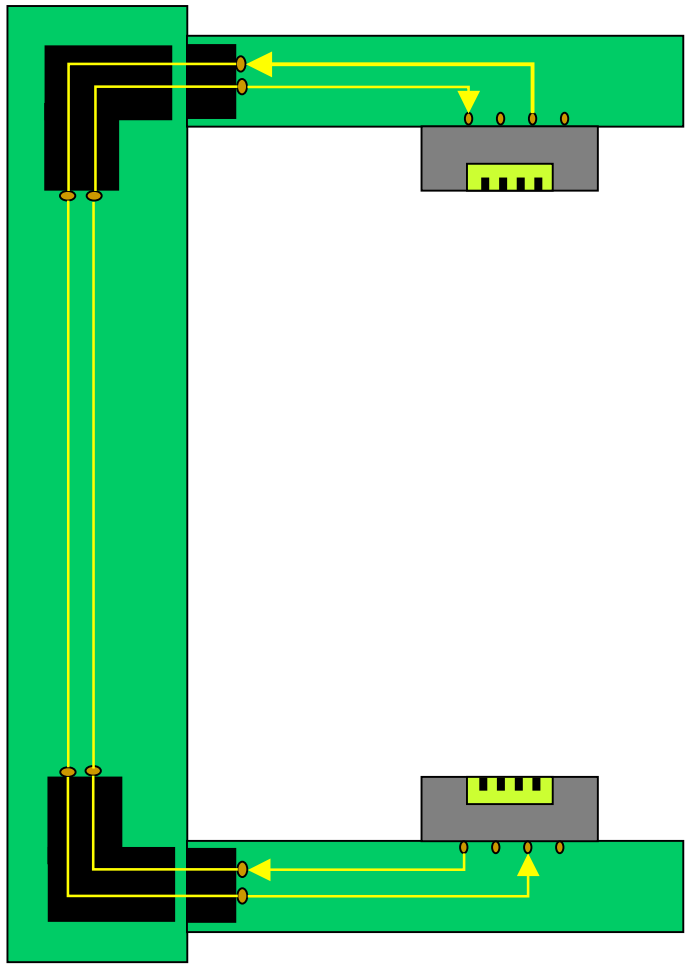
- Share information on design issues in 10 GB/S backplane interconnects
- Make recommendations
- Provide an implementation perspective

Backplane Communication System



Transmitter
Via
Connector
Via
Long Trace
Via
Connector
Via
Receiver

Parameters

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- Total Reflection due to Vias, Connectors, Terminations
- Cross talk
  - Due to vias, Connectors
  - Capacitive and inductive mismatches between differential signals
- High Frequency Loss
  - Differential trace impedance
  - Loss may be a good thing (when alleviating short run reflections)
- EMI
  - Trace configuration will not stop radiation
- Density
  - How close can traces be packed determines cost and aggregate bandwidth

Problem

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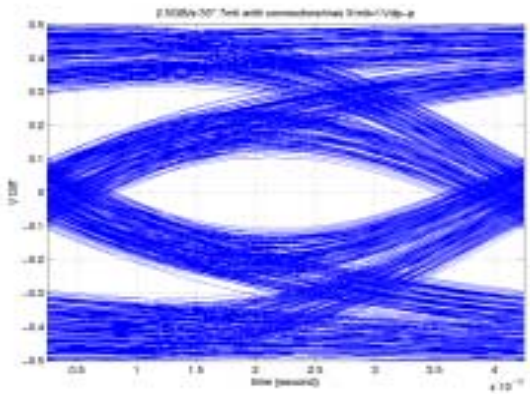
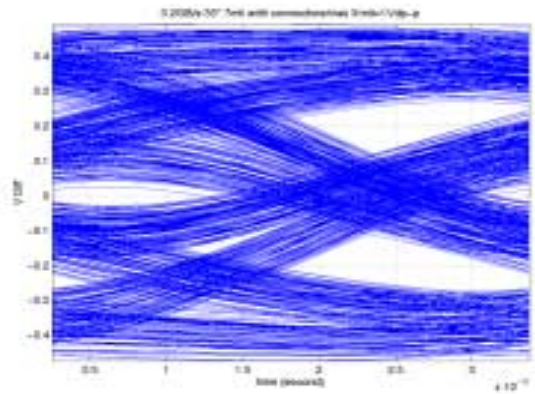
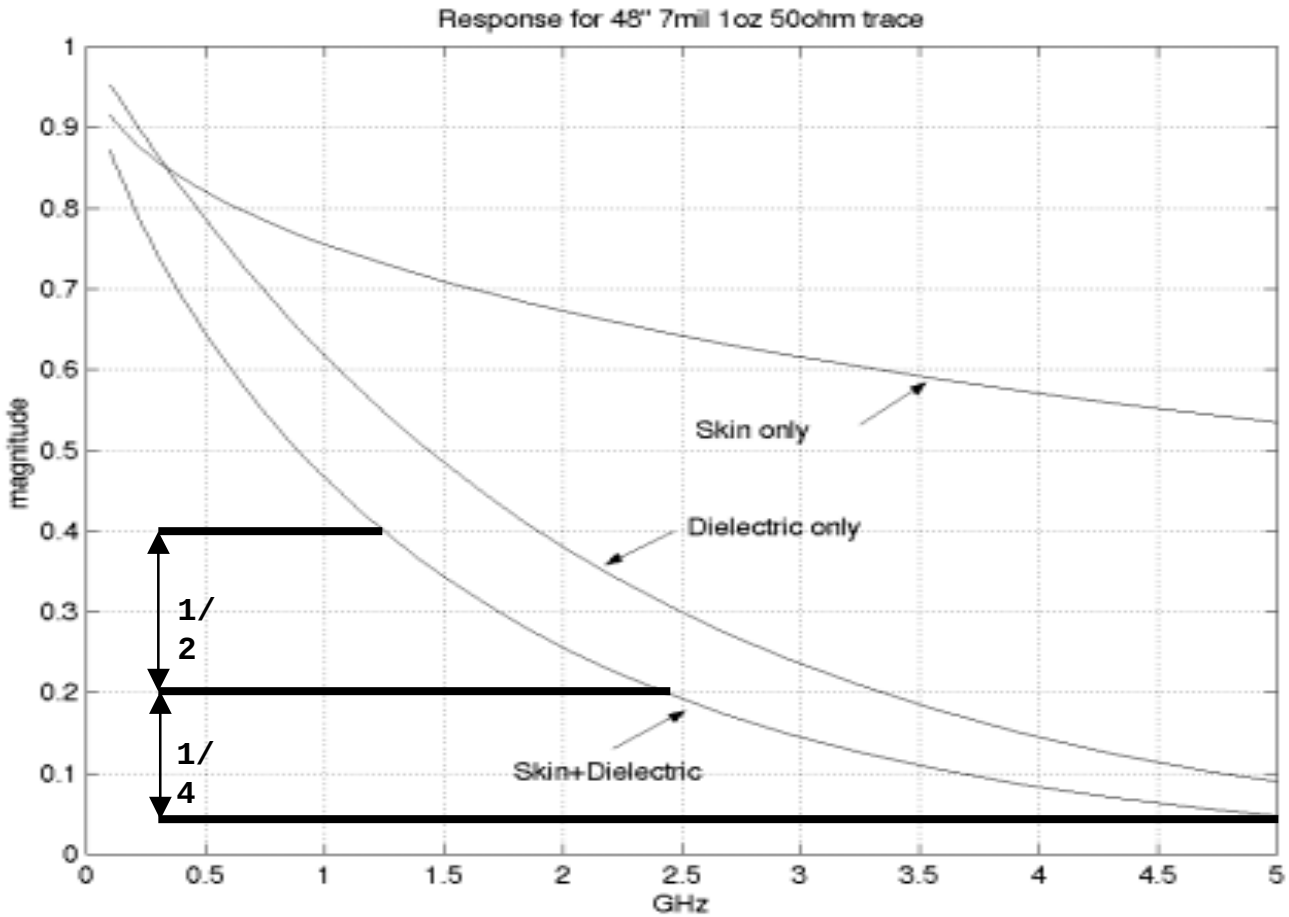
- As symbol rates increase,
  - Amplitude decreases, cross talk increases
- Better PCB material solve one problem, create another
- Variations in dispersion cause a myriad of channel conditions
- How to define, identify and compensate for weakest link





From 1.25GB/S to 5GB/S



Possible Solutions

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- New strategies for system design offer incremental improvements
  - Utilize new PCB material, connectors
  - Challenge the via culprit
  - Optimize trace structures
- New 2.5G or 3.125G SERDES
  - Offering pre-emphasis, post-emphasis
  - Effectiveness in backplanes remains to be seen
  - SERDES are getting better than ever
- Optical backplanes
  - Flexible, high performance but....
  - Cost issues are limiting deployment

Recommendation

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- View Backplane channel as a communication system
- Exploit the transmission media with targeted solutions
- Robust backplane design requires a targeted solution
- Lower line rate and increase # bits per symbol
  - Reduce number of pins per GB/S
  - Reduce signal integrity problems
  - Increase reach

A Targeted Solution

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- A targeted backplane transceiver should:
  - Optimize for performance & density within any backplane construct
  - Work on standard PCB material and connectors
  - Adapt to existing serial backplanes
  - Alleviate Signal integrity problems: Cross talk, Reflections, Dispersion
  - Complement enhancements made to PCB, vias & connectors

Problems and Solutions

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• Reflection	Adaptive Equalization
• Cross Talk	Adaptive Transmit Levels
• Dispersion	Lower Line Frequency
• EMI	Scrambler
• Density	Higher bit rate per Symbol