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Twin-Ax Capability for 4x25Gbps

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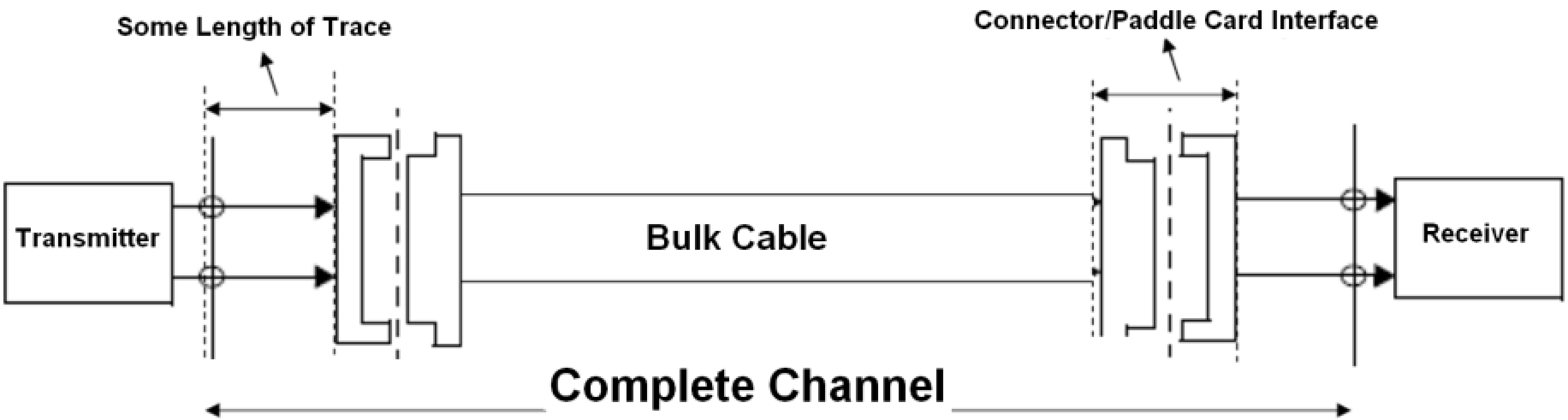
Previous Presentation

- January 2011 802.3 interim presentation showed data from 2 cables, 1 X 3m cable and 1 X 5m cable
- Touchstone files for the cables are available from http://www.ieee802.org/3/100GCU/public/channel.html
- Questions and comments welcome, please keep in mind the data comes from real cables, not simulations so imperfections may exist

Channel Description



- Copper cable assemblies have several areas of loss, these include paddle card termination, paddle card traces and cable.
- Small improvements can be made to paddle cards and termination improvements especially in the areas of cross-talk and impedance
- Generally bulk cable must be improved from previous generations
- This is the primary focus of many cable manufacturers

Testing Setup

- **Device Under Test**
  - 2 X 24 AWG raw cable samples
  - 2 X 26 AWG raw cable samples
  - 3 X 30 AWG raw cable samples

- **Test Equipment**
  - Differential Insertion Loss
    - N5230A Vector Network Analyzer – 4000 pts. 50MHz-40GHz
  - Test Boards
    - Molex raw cable test fixtures, ~1 dB loss per fixture at 12.89GHz

  - Data was calculated from 10m samples of cable. Total insertion loss at 12.89 GHz was measured and fixtures were subtracted. Per meter losses were calculated linearly from the result.

IL Data @ 12.89GHz

Manufacturer	Size	IL per m (dB)	3m Loss (dB)	5m loss (dB)
Vendor A	24 AWG	2.87	8.61	14.35
Vendor B	24 AWG	2.93	8.79	14.65
Vendor C	26 AWG	3.22	9.66	16.10
Vendor D	26 AWG	3.93	11.79	19.65
Vendor A	30 AWG	4.28	12.84	21.40
Vendor B	30 AWG	4.72	14.16	23.60
Vendor D	30 AWG	6.50	19.50	32.50

Example Cases

- Implementer A wishes to use 4 in. of trace with 5m reach for line card or backplane application
- Implementer B wishes to use 8 in. of trace with 3m cable for line card or backplane application
- Implementer C wishes to have lightweight (thin, flexible) cable assembly for short reach ~1-3m for high density IO

How do we define what we need?

- Each case poses a unique issue that requires different loss values in different areas of the channel
- All cases benefit from reduced noise numbers and an enhanced complete channel insertion loss budget
- A suggested solution is expanding total budget ~2 dB to take advantage of new SNR numbers as presented previously.
- The increased insertion loss budget should be divided according to application, but the objectives of the standard focus on cable length
- Why increase the cable/connector budget? – Cable contributes largest portion to noise budget

Example Case 1- Solution

- Implementer A wishes to use 4 in. of trace with 5m reach for line card or backplane application
- 5m 24 AWG cable contributes ~ 14-16dB loss, PCB trace contributes ~8dB, connectors contributes ~1-3 dB = ~23dB – 27dB

Example Case 2 - Solution

- Implementer B wishes to use 8 in. of trace with 3m cable for line card or backplane application

- 3m 26 AWG cable contributes ~9.5-12 dB loss, PCB trace contributes 16dB, connectors contribute ~1-3dB =~ 26dB – 31 dB

Example Case 3 - Solution

- Implementer C wishes to have lightweight (light, flexible) cable assembly for short reach ~1-3m for high density IO with 4 in of PCB trace

- 2m 30 AWG cable contributes ~9-12dB loss, PCB trace contributes ~ 8dB loss, connectors contribute ~1-3dB loss = ~18dB – 23dB

Conclusion

- Raw cable is largest contributor of insertion loss in cable assembly
- Raw cable has improved and continues to do so
- Specifying longer cable enables many cases to be solved by implementers because noise numbers are properly specified for the full system

- Suggested objective

  - Define a 4-lane 100 Gb/s PHY for operation over copper twin-axial cables consistent with length up to 5m molex

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Thank You