Channel Modeling ad hoc "State of The Model"

IEEE P802.3bq 40GBASE-T Task Force

Brad Booth (Microsoft) and Pete Cibula (Intel)
Channel Modeling ad hoc co-chairs

November 26th, 2013

Goal of the Discussion

- Review the "State of the Model," assess our ad hoc progress, and encourage discussion of future activities and associated contributions
  - Summary of the work to date
  - Review planned future work and suggestions/ requests from the November P802.3bq Task Force meeting
 - Additional considerations from the PHY Proposal ad hoc?

Channel Modeling ad hoc charter and scope/deliverables

- Define a set of channel models for PHY complexity evaluation, including host channel model

- Provide early feedback on key parameters to cabling bodies (Can a parameter be improved? Is a relaxation a cost benefit?)

Starting Point

- ## Initial ad hoc discussions from May 2013 (Victoria, BC) and high-level status

Slide Source: Potential Path Forward for Channel Modeling Ad Hoc, zimmerman_02_0513_40GBTah.pdf
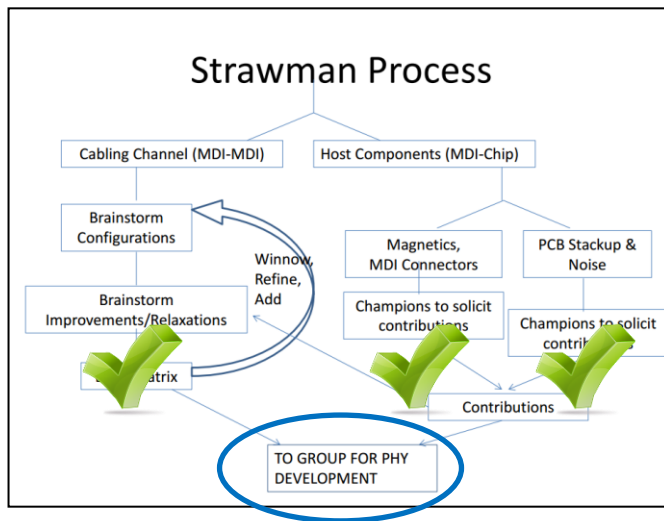
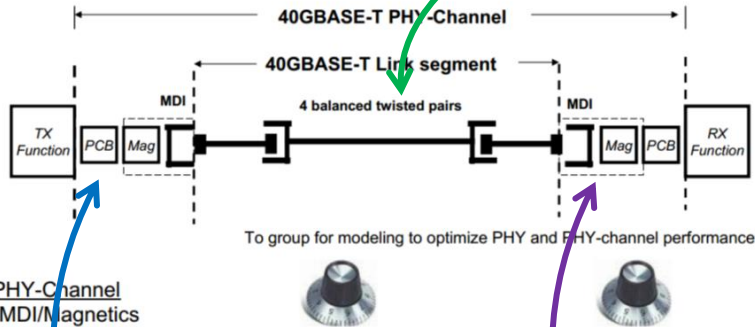

Possible Channel Configurations

- "X-Axis" – Cable classes
  - A: ISO Class 1, up to 30m (x-y-z)
  - B: ISO Class 2, up to 30m (x-y-z)
  - C: TIA Category 8, up to 30m (x-y-z)
    - Can this be merged with A?
- "Y-Axis" – Topologies/lengths
  - D: Short channels
    - 150mm-3m-150mm ("really short") – Worst case reflection #1
    - 0.5m-3m-0.5m ("pretty short") - Worst case reflection #2
    - 3m - Endpoint to TOR
    - 5m TOR-adjacent
  - E: Other target channels
    - 1m-10m-1m (ISO short reference channel)
    - 30m
    - 30m single patch cord (assuming there is one that meets IL...)
    - 30m asymmetric #1 (1m-26m-3m) – Data center configuration #1
    - 30m asymmetric #3 (1m-24m-5m) – Data center configuration #2
- "Z-Axis" Improvements/Relaxations on A, B, C (reference grimwood_01_0513_40GBT.pdf); "What if" scenarios
  - Improvements
    - 2, 4, 6 dB improved RL
    - 2, 4 dB improved PSNEXT (A,C)
    - Coupling attenuation (Example: Class I/Class II – Contributions show that cabling "far exceeds" current specification)
  - Relaxations
    - Bandwidth (1.6GHz vs. 2.0GHz)
    - Others TBD

Possible On Board Elements

- Magnetics, OEM PCBs, etc.
- MDI Connector IL, Crosstalk, RL
- Magnetics Crosstalk, IL, RL
- PCB Passives IL
- PCB trace model
- PCB Noise models
- IC package models

Current Data Set

40GBASE-T PHY- Channel

40GBASE-T PHY-Channel

40GBASE-T Link segment

MDI   4 balanced twisted pairs   MDI

TX Function | PCB | Mag | | | | | Mag | PCB | RX Function

To group for modeling to optimize PHY and PHY-channel performance

PHY-Channel
- MDI/Magnetics
- Host PCB
- Link segment - based upon copper media specified by ISO/IEC JTC1/SC25/WG3 and TIA TR42.7
  - 4 pair, balanced twisted-pair copper cabling
  - Up to 2 connectors
  - Up to at least 30 meters

40GBASE-T Cabling channel MDI-MDI

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IEEE P802.3bq 40GBASE-T Task Force Channel Data

Cable Channels
- 30 meter category 8 channel (3m-24m-3m)
  - readme   July 30, 2013   Chris DiMinico, MC Communications, Panduit
  - s16p file (8MB) July 30, 2013   Chris DiMinico, MC Communications, Panduit
- 4 meter category 8 channel (0.5m-3m-0.5m)
  - readme   Sept 5, 2013   Chris DiMinico, MC Communications, Panduit
  - s16p file (8MB) Sept 5, 2013   Chris DiMinico, MC Communications, Panduit

- wlarsen_11513_3-24-3_long_channel.zip New and improved!   November 10, 2013   Wayne Larsen, Commscope
- wlarsen_long_channel_3-24-3.s16p.rar (old)   August 26, 2013   Wayne Larsen, Commscope
- wlarsen_short_channel_1-3-1.s16p.rar   August 26, 2013   Wayne Larsen, Commscope
- wlarsen_short_channel_dot5-3-dot5.zip   October 2, 2013   Wayne Larsen, Commscope

- MikeGood_3m24m3mCat8MDI.zip   September 27, 2013   Mike Good, Berk-Tek

- Long channel with and without MDI
  - readme   November 10, 2013, 2013   Martin Rossbach, Nexans
  - s16p file no MDI November 10, 2013, 2013   Martin Rossbach, Nexans
  - s16p file with MDI November 10, 2013, 2013   Martin Rossbach, Nexans
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Host PCB Trace Channels
- Preliminary models from 10GBASE-T LOM, 2 inch & 8 inch
  - Overview presentation   September 27, 2013   Dave Chalupsky, Ray Schmelzer, Intel
  - 10GBaseT_PCB_channel_models.zip August 26, 2013   Ray Schmelzer, Pete Cibula, Intel
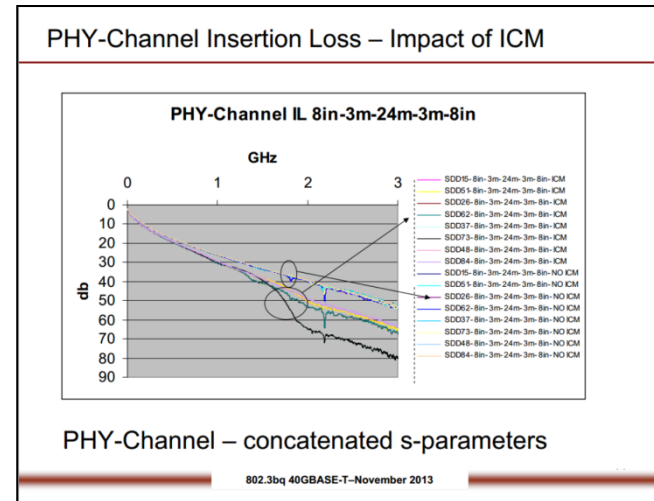
Isolation Channel (Magnetics)
- 40GBASE-T Integrated Connector Module
  - Overview presentation   October 29, 2013   Brian Buckmeier, Victor Renteria, Bel
  - BelICM2.S16P.zip   October 29, 2013   Brian Buckmeier, Victor Renteria, Bel

Return to IEEE P802.3bq 40GBASE-T Task Force Public Area
Last Update: 2-October 2013

Sources: Chris DiMinico, 40GBASE-T_PHY-cabling_ad_hoc6_07_13.pdf,
IEEE P802.3bq 40GBASE-T Task Force Public Area channel data

Model Results

- Channel model elements have been used successfully to create end-to-end channel models to evaluate channel elements and PHY figures-of-merit

- See the following contributions to the P802.3bq task force

  - *Chris DiMinico, 40GBASE-T Channel Models, diminico_3bq_02a_1113.pdf*

  - *Mike Grimwood, PHY Channel Model Updates, grimwood_3bq_01_1113.pdf*

Channel Modeling ad hoc next steps

- Suggest that the Channel Modeling ad hoc has completed the fundamental work outlined in our "Potential Path Forward"
  - Basic elements modeling the host PCB transmission line, MDI & isolation, and MDI-to-MDI cable channels are publicly available
- Is this sufficient to begin evaluating PHY complexity?
  - Request to finalize PCB and ICM budgets (grimwood_3bq_01_1113.pdf, Page 9)
  - Soliciting feedback from the P802.3bq PHY Proposal ad hoc
- Further work for this ad hoc (…or others as directed by our Task Force chair?)
  - Review and refine cable channel definitions
    - Specific activity is TBD
  - Review and refine PCB transmission line & noise models
    - Impedance variations - 90ohm and 110ohm
    - Internal layer routing and structure/geometry (via effects)
    - Investigate host channel impairments
  - Expand MDI and isolation path data set

Thank You!