Equalization - Overview and Potential

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Endorsements

- O. Agazzi, Broadcom
- D. Alderrou, nSerial
- K. Azadet, Lucent
- M. Bennett, Lawrence Berkeley National Lab
- S. Bhoja, Lucent
- P. Bottorff, Nortel Networks
- G. Brown, NSWC, U.S. Navy
- X. Chen, Marvell
- J. Dallesasse, Molex
- S. Dreyer, nSerial
- J. Ewen, IBM
- J. Goergen, Force10 Networks
- D. Hanson, Tripath
- J. Jewell, Picolight
- D. Kabal, Nortel Networks
- P. Kelly, Intel
- D. Kesling, Intel

- K. Kota, Cicada Semi.
- R. Marsland, New Focus
- D. Martin, Nortel Networks
- N. Nazari, Marvell
- S. Oh, Lucent
- R. Patterson, Picolight
- P. Pepeljugoski, IBM
- A. Phanse, National Semi.
- S. Raghavan, National Semi.
- L. Rennie, National Semi.
- C. Simoneaux, Picolight
- D. Sorensen, Broadcom
- R. Taborek, nSerial
- B. Tailor, Gennum
- V. Telang, Cicada Semi.
- S. van Doorn, Infineon
- N. Yousefi, Broadcom
- N. Zayed, Intel

What is this proposal about?

- Equalization, deployed with 802.3ae links, may be a globally optimum solution over the long life of 10G Ethernet.
- Equalized links can be backward compatible with, and extensions of, 802.3ae links.
- We should begin the work of examining its feasibility immediately.
- We believe that an ad hoc committee of IEEE P802.3ae is the ideal forum.

Will this disrupt the 802.3ae schedule?

- No.
- We commit to fully support the P802.3ae time-line.

What is the plan?

- Authorize an Equalization ad-hoc at this meeting.
- The Equalization ad-hoc will present a feasibility report by 802.3ae WG Ballot.
- If 802.3 deems appropriate, the ad-hoc will do a “call for interest.”
- The objective is to be interoperable with P802.3ae links and to work with P802.3ae to ensure interoperability.

What can equalization do for 802.3ae links?

- Several interesting possibilities ...
- Extend the distances of 1310, 1550 Serial links.
- Eliminate offset jumper in 1310 WWDM links.
- Support 1310 Serial and 850 WWDM over 300 m installed MMF.
- Support 850 Serial over 100 m installed MMF.

Isn’t this solution overly complex?

- No. This solution will be far simpler than 1000Base-T. We propose no changes to transmitter codes – the system will remain binary, digital. Only the receiver amplifier will get added functionality. No start-up protocols required. Equalization will be automatic, one-way, and transparent.
- A single chip, SiGe and/or CMOS implementation, is highly feasible.
- You will hear from the following experts (brief introduction.)

But fiber optic links are not very linear!

- It doesn't matter as much in this case. Binary OOK is more tolerant to nonlinearities than are multi-level schemes. Equalization can overcome "ugly" distortions of binary digital signals, with high tolerance for non-linearity. Techniques like non-linear cancellation are also possible, and will be one of the options examined by the ad-hoc.

How do we know it will overcome DMD of multimode fibers?

- We don't know it won't, and we think it will. Non-linearity or split pulses are not challenging. As long as time variance is slow, equalization will work.
- We have simulations and analysis to suggest that it can, and we will take experimental measurements.
- Remember that the benefits of equalization are not limited to multimode fiber links. Singlemode links will also benefit – and there is enough implementation data to support that assertion.

What will be the size and power consumption of this IC?

- We have estimates based on one possible architecture; other architectures are also good candidates.
- 200,000 gates, 0.25 micron SiGe/BiCMOS.
- 1.5 Watts.

Recommendations

- Authorize an Equalization ad-hoc to present a feasibility report by WG Ballot time.