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10 GbE CX

- Short Haul Copper -

IEEE 802.3 HSSG - Montreal, PQ

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General Direction

- Link should be significantly cheaper than optical at max distance
  - Link includes 2 transceivers and a jumper cable
  - Distance goal: 10 meters
- Leverage 1000BASE-CX PMD spec (Clause 39)
- Use PAM-5 signaling to reduce signaling rate to 5 Gbps
  - Enables the use of monolithic CMOS
- Leverage same PHY proposed for SX, LX, EX for 10 GbE
- Simple Single Channel controls cost/complexity
  - Eliminates skew, reduces logic, lowest cable cost, low bulk
- FEC techniques offset PAM SNR loss, provide transition density, synchronization, special codes

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Jumper Cable Assembly

- Consists of a continuous shielded balanced cable (twinax) terminated at each end with a polarized shielded plug.
- Early vendor information shows FC and GbE CX cables and connectors can support signaling at 2.5 GHz.
- 2 Gbps FC CX cables available
- Back of the envelope calculations
  - GbE CX capable of 1.25 GBaud at 25 meters
  - PAM-5 requires 5 GBaud for 10 Gbps
  - 25/10 meters x 1.25 GBaud = 3.125 GBaud
  - If 2 Gbps FC CX cable/connectors are twice as good, 3.125 x 2 = 6.25 GBaud, well exceeding the 5 GBaud requirement of PAM-5

Existing CX system is in the right ballpark!

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Transceiver Proposal

- Hot-Pluggable
- Common interface for CX, SX, LX, EX PMD variants
- Support all 10 GbE early proposals
  - MAS, Serial TDM, Parallel Optics, WWDM, combos, others?
- Need to support significant distance to multi-port MAC
  - Serial interface required
  - Use PMA to PMD interface per HP - Richard Dugan proposal
    - http://grouper.ieee.org/groups/802/3/10G_study/public/june99/dugan_1_0699.pdf
  - 4 serialized, differential channels at 3.125 Gbps each, 8B/10B coded

System Requirements

- Grounding
  - Support only homogenous ground applications
    - For example: between devices within a cabinet or rack, or between cabinets interconnected by a common ground return or ground plane.
    - This restriction minimizes safety and interference concerns caused by any voltage differences that could otherwise exist between equipment grounds.

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Other Tricks

- Compensation / Equalization to increase distance, provide extra margin at 10 meters.
- MAS synchronization establishes 'perfect' TX / RX levels
  - Optimizes link SNR / BER
- Auto-Negotiation between GbE and 10 GbE
  - MAS is the only proposal capable of running at both speeds
  - Provides functional parity with Ethernet UTP variants
  - Provides 1 / 10 migration strategy, enables early sales

MAS 10 GbE Technology Basis