10 GbE CX

- Short Haul Copper -

IEEE 802.3 HSSG copper ad hoc - Montreal, PQ

Rich Taborek - Transcendata, Inc.
Ed Cady - FCI-Berg

General Direction

- Link should be significantly cheaper than optical at max distance
  - Link includes 2 transceivers and a jumper cable
  - Distance goal: 10 meters minimum
- Leverage 1000BASE-CX PMD spec (Clause 39)
- Leverage PAM5 PHY proposed for SX, LX, EX for 10 GbE
  - Enables the use of low cost technologies: CMOS, twin-ax jumper cable
- Simple Single Channel controls cost/complexity
  - Eliminates link skew issues, reduces logic, lowest cable cost/bulk
- Coding techniques offset PAM SNR loss, provide transition density, synchronization, special codes
- Introduce Auto-Negotiation for speed

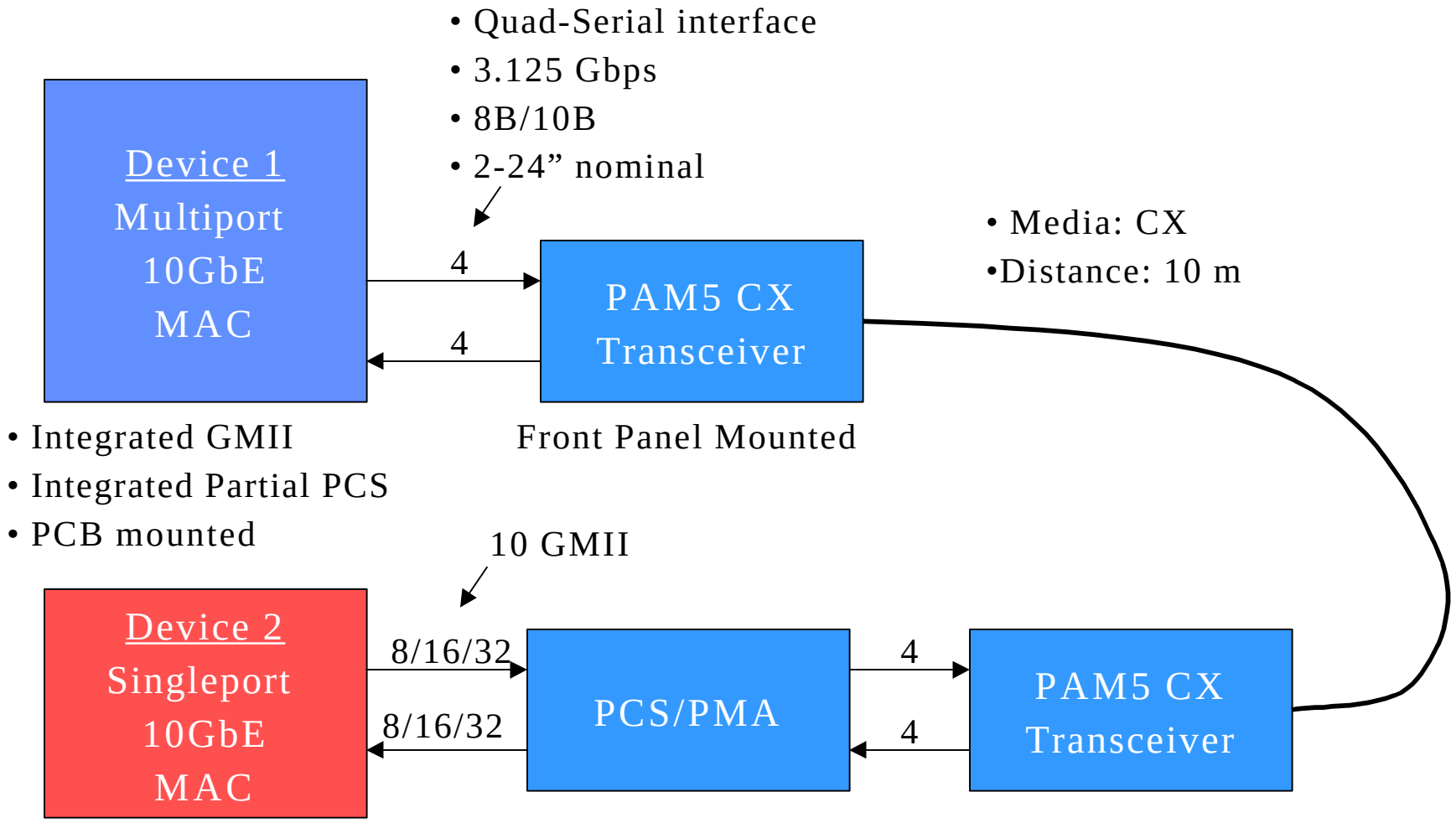
Jumper Cable Assembly

- Consists of a continuous shielded balanced cable (twinax) terminated at each end with a polarized shielded plug.
- 2.2 GBaud FC, 2.5 GBaud NGIO CX (same) cable available
  - Production cables available from multiple sources
  - Performance verified to 10 m without equalization
  - Performance verified to 20 m with passive equalization
- 10 Gbps PAM5 = 5 Gbaud = 2 × existing cable performance
  - Connector Technology
    - Ongoing work: Existing connector technology modeled to 5 GBaud
    - Measuring now to determine limits
  - Cable Technology
    - Modeled successfully: 10 m, 22 awg, no equalization @ 5 GBaud
    - Measuring now to determine limits

PAM5 CX Transceiver

- Hot-Pluggable
- Common transceiver interface for CX, SX, LX, EX variants
  - Supports all 10 GbE early proposals
    - PAM5, Serial TDM, Parallel Optics, WWDM, combos, others?
  - Quad Serial interface per Frazier / Quackenbush Montreal proposal
    - Needed to support significant distance to MAC / PCS
  - Suggest staying with 8B / 10B coding on this interface

PAM5 CX Transceiver System



Auto-Negotiation

- New for CX
- Same as proposal presented in Coeur d'Alene for optics
- PAM5 is the ONLY 10 GbE PHY proposal capable of running at both 1 GbE and 10 GbE
- Provides functional parity with Ethernet UTP variants
- Enables early sales, simpler migration strategy
- Link Calibration establishes 'perfect' Tx/Rx levels
  - Optimizes link SNR/BER, Potential distance extension