Coherent Feasibility and Interop

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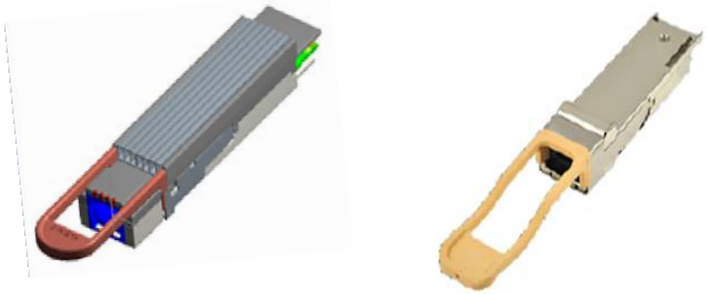
Supporters

- Keith Conroy, Acacia
- Vasu Parthasarathy, Broadcom
- Mark Nowell, Cisco
- Gary Burrell, Elenion
- Ilya Lyubomirsky, Inphi

The OIF 400ZR Project

- **Implementation agreement (IA) for pluggable digital coherent optical (DCO) modules**
  - **Amplified short-reach DWDM applications with distances up to 120 km**
  - **Passive single channel ZR (80km)**
- **Single-carrier 400 G, coherent detection and advanced DSP / FEC algorithms.**
- **Operates as a 400 GbE PMD compatible with 400G-AUI.**
- **Other formats could be considered in the project as well.**
- **Supporters from more than 34 companies, including end users, system and component suppliers. Unanimous support for start of project**



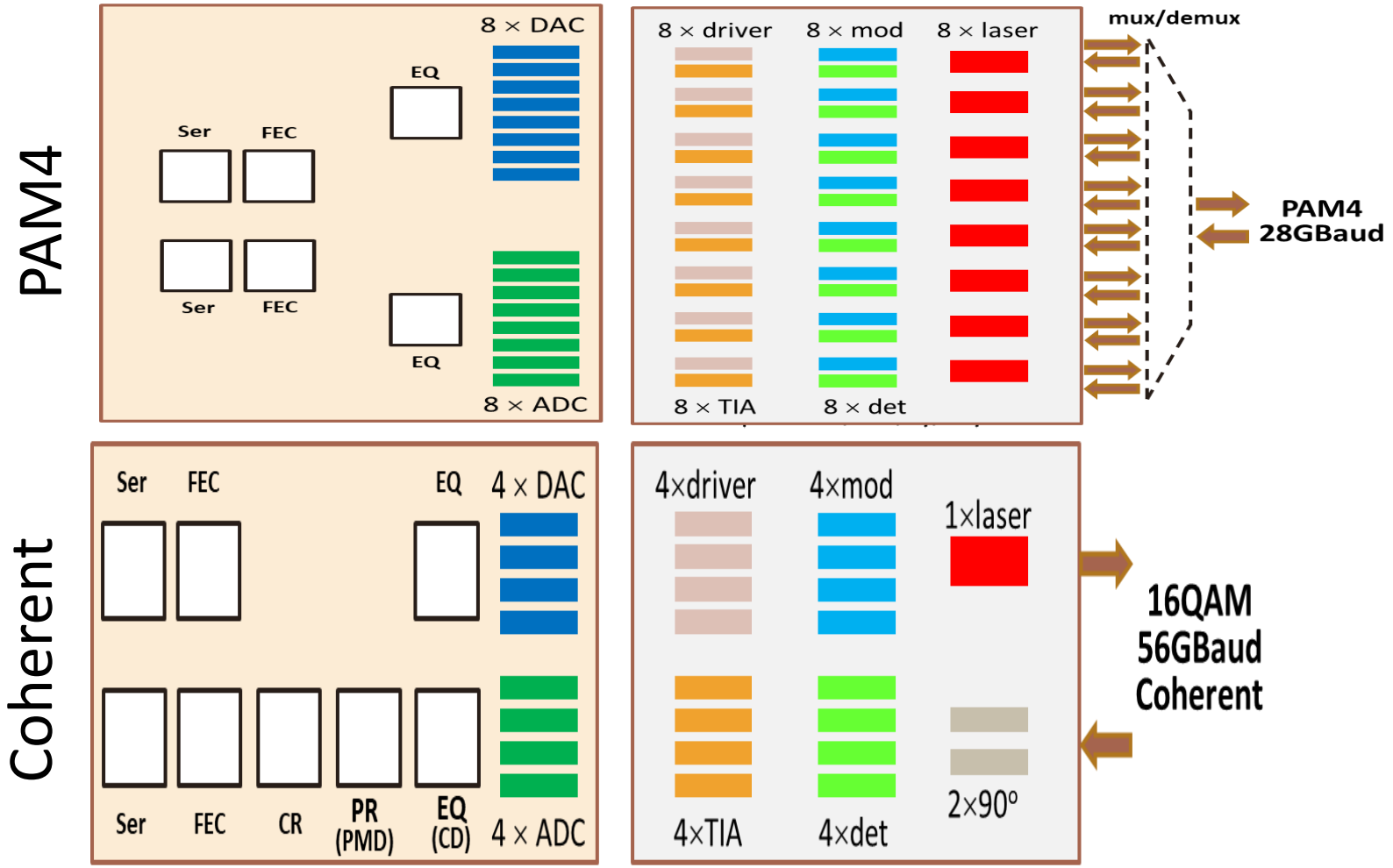
Form Factors

Targeting coherent optics in client pluggable form factors <15W

Assumes tunable λ not required for this application

Source: OIF Liaison to IEEE 802.3, Nov 7, 2016:
http://www.ieee802.org/3/minutes/nov16/incoming/OIF_to_IEEE_802d3_Nov_2016.pdf

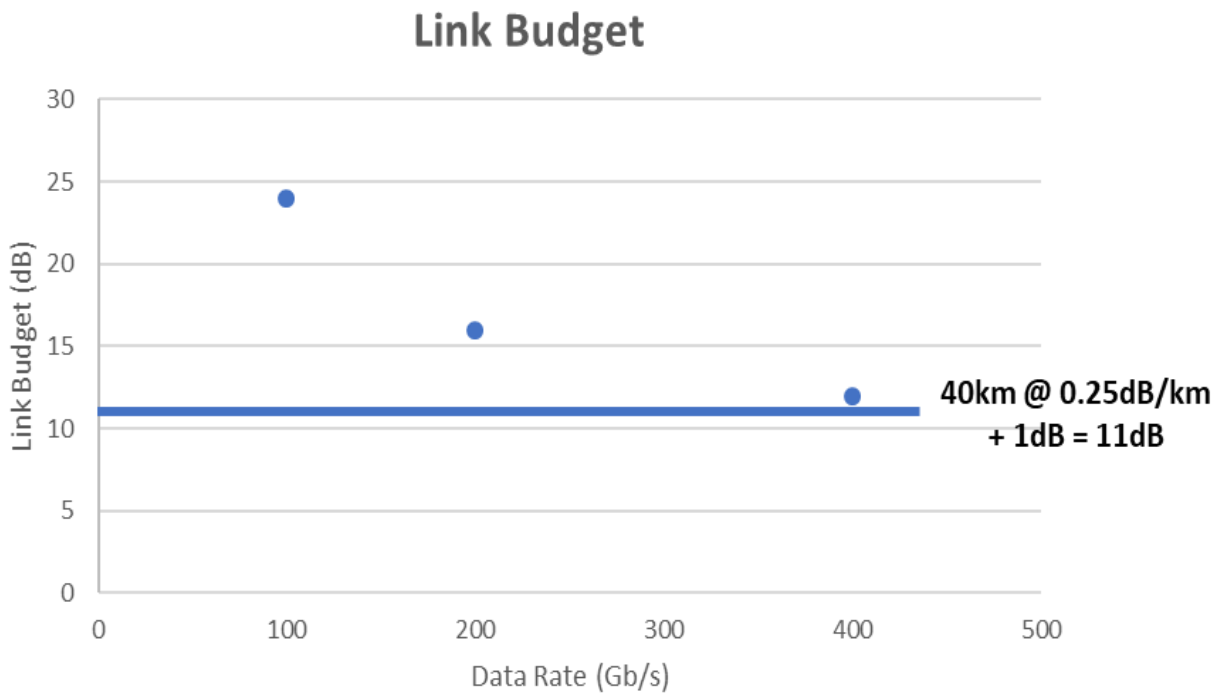
Implementation Cost Considerations



Implementation costs need to be studied –

- **Inclusion of components**
- **Number of components**
- **Operation rate of components**
- **Specifications of components**

Coherent Technology – Reach / Rate

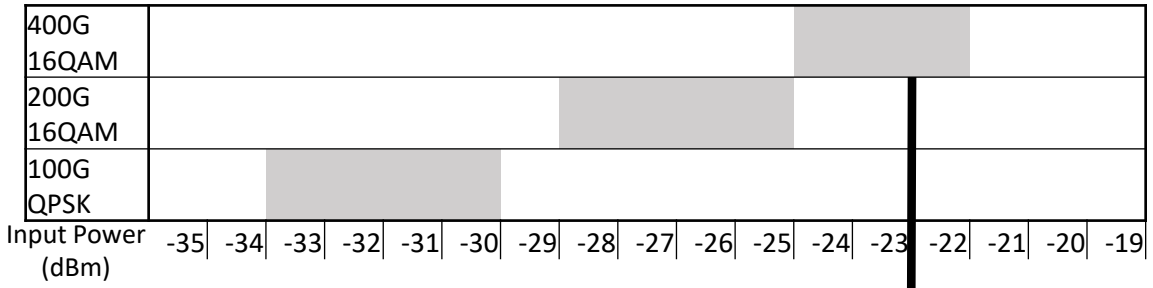


Assumptions

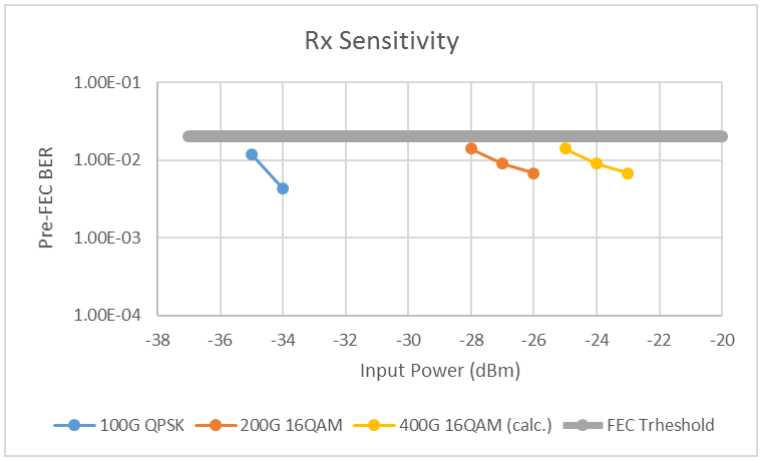
- No transmit SOA/EDFA
- Modulation Format
  - 100G – QPSK @ ~30Gbaud
  - 200G – 16QAM @ ~30Gbaud
  - 400G – 16QAM @ ~60Gbaud
- Tx and Rx power levels achievable with high yield and multiple optical technologies
- Higher link budgets can be supported by hardware variants

Coherent Link Budget Example

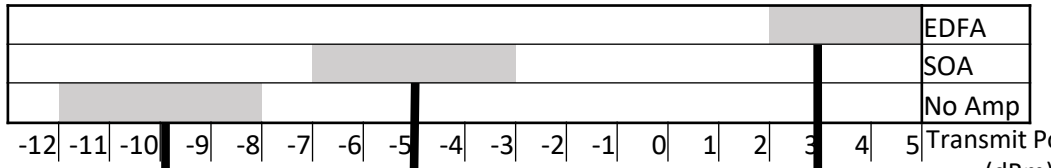
Receiver Sensitivity (max)



Receiver Sensitivity varies by baud rate and modulation format



Transmit Power (min)



13dB Link Budget (~40km)

-10dBm

18dB Link Budget (~60km)

-5dBm

25dB Link Budget (~80km)

-23dBm

+2dBm

Transmit power range depends on use of amplification technology

Beyond 10km Value Proposition

- Comparing relative cost of 40/80km interfaces to shorter reach interfaces at lower data rates can be misleading
  - Relative cost may increase over time due to volume driven cost reductions in shorter reach application
  - Technology trade-offs are different at each data rate
- Adoption depends on market need and relative value compared to alternative solutions, not different reaches
  - Comparison to parallel implementations of lower rate optics are more relevant than shorter reach at the same data rate
  - Each generation creates a new set of solution alternatives

Summary

- The industry is driving toward low power pluggable coherent implementations
  - Solutions supporting both 40km and 80km are technically feasible using optics that are available today combined with next generation DSP technology
  - Can benefit from further CMOS advances over time to further lower cost and power
- Objective should target the lowest complexity solution that can address the market requirement