

# Optical Interconnections: Photonics at Service of Electronics

*Antonio La Porta<sup>1</sup>*

*1. IBM Research – Zurich, Säumerstrasse 4, 8803 Rüschlikon, Switzerland  
e-mail: alp@zurich.ibm.com*

Optical interconnects are an established solution for communication links in high-end computing applications. The lecture will describe the limitation of electrical interconnects and the motivation for the introduction of optical technologies [1]. Several examples of optical interconnects will be described, focusing on the scalability of the technology. In fact, optical interconnect technology provides continued scaling to ultra-high bandwidth architectures though dedicated boundary conditions on the position and integration of the optics is required. This is indicated in the photonic integration roadmap scheme of Figure 1. I will describe the challenges and vision for a tight integration of the electro-optical transceiver with the processing electronics. In line with this roadmap, the second part of the lecture will report on silicon photonics and the integration and packaging technology therefor. Silicon photonics provides a tight chip-level integration of optical and electrical functions on a single silicon die, at the competitive cost-level of CMOS technology [2]. Silicon photonics packaging is a key element for the success and the massive introduction of this technology. Several silicon photonics packaging considerations will be described during the last part of the lecture, with referring to the recent work at IBM Research - Zurich [3].

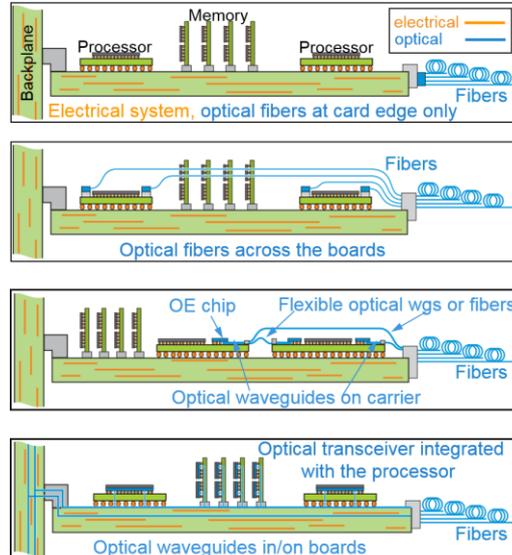


Figure 1. Photonic integration roadmap

## References

- [1] D. A. B. Miller, “Rationale and Challenges for Optical Interconnects to Electronic Chips”, Proceedings of the IEEE, vol. 88, no. 6, p. 728-749, 2000.
- [2] S. Assefa et al., “A 90nm CMOS Integrated Nano-Photonics Technology for 25Gbps WDM Optical Communications Applications”, IEEE International Electron Devices Meeting (IEDM), vol. 33., 2012.
- [3] A. La Porta, R. Dangel, D. Jubin, N. Meier, D. Chelladurai, F. Horst, B. J. Offrein, “Scalable Optical Coupling between Silicon Photonics Waveguides and Polymer Waveguides”, IEEE 66th Electronic Components and Technology Conference (ECTC), pp. 461-467, Las Vegas, NV, USA, May 2016.

*Acknowledgment: Effort sponsored by the European Union’s FP7 project CARRICOOL and H2020 project WIPE.*