POETICS

CoPackaging of Terabit direct-detection and coherent Optical Engines and switching circuits in mulTI-Chip moduleS for Datacenter networks and the 5G optical fronthaul

OUR VISION

POETICS is a H2020 Research and Innovation project funded by the European Union aiming to bring the optical interconnect technology with all performance, functionality and cost credentials and allow the Datacenter (DC) networks to scale and the 5G wired infrastructures to grow.

Motivation

The rapid adoption of cloud computing in today's economies has fueled an explosive traffic growth in Datacenters (DC), estimated at >25% CAGR, that will result in global annual DC traffic greater than 20 ZB by 2021. To support the emerging workloads and cope with the bandwidth demand, DC operators have followed a combination of two approaches: i) upgrading existing network switches and optical interfaces inside the DC to increase capacity ("scale up") and ii) adding new network equipment and optical interfaces to the DC ("scale out"). Although, both approaches were successful in allowing the Cloud DC infrastructure to grow to hyperscale, it is certain that they will eventually become bound by power and real-estate constraints.

POETICS CONCEPT

Concept - Objectives

POETICS comes as a Research and Innovation project aiming to develop novel Terabit optical engines and optical switching circuits and co-package them with digital switching chips to realize Multi-Chip Modules (MCM) for next generation switching equipment with Tb/s capacities and very high energy efficiency that fit into the roadmap of vendors.

Enabling Terabit capacity optical interconnects requires a paradigm shift in the packaging approach. The electrical interconnect distance between the optical engine and the digital switching chip must be minimized and signal conditioning chips and unwanted components that are required and inevitably lead to increased power consumption and reduced signal integrity, should be removed. It also requires the right combination of photonic and electronic technology to be integrated in order to deliver high performance, low-cost and energy efficient optical engines. This approach has the potential to remove the optical interconnect bandwidth bottlenecks and allow DC networks and the 5G wired infrastructure to grow.

Factsheet

Call identifier: H2020-ICT-2019-2

Contract No: 871769

Timeline: 1 January 2020
31 December 2022

Overall budget: € 5 999 498,88

EU contribution: € 5.999.498,75

Project Website: ict-poetics.eu

Consortium: 8 Partners
(5 EU countries & 1 associated country)

https://www.photonics21.org/

POETICS project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under G.A No 871769 and it is an initiative of the Photonics Public Private Partnership

Concept - Objectives (cont.)

In order to achieve this, POETICS is relying on a photonic integration technology based on a silicon nitride platform, optical polymers, InP electro-absorption modulated lasers (EMLs) and external cavity lasers, and on high-speed electronics based on BiCMOS technology.

Specific targets in POETICS are:

- MCM with 1.6 Tb/s OEs and PolyBoard with parallel SMFs on par with the PSM/DR spec for intra-DC connectivity
- MCM with 1.6 Tb/s OEs and 3D PolyBoard with duplex MCFs for 5G optical fronthaul applications
- Low-power-consumption 3D Benes Optical Switch
- MCM coherent 64 Gbaud OEs with up to 600 Gb/s capacity for DC interconnect applications

POETICS will develop for the first time in SiGe BiCMOS, monolithically integrated arrays of analog multiplexing and driving circuits for the transmitter and monolithically integrated arrays of TIA and analog demultiplexing circuits to deliver up to 100 Gbaud PAM-4 signals. 8-fold InP-EMLs arrays with very high bandwidth and ability to operate at elevated temperatures will be developed and combined with PolyBoard motherboard using automated processes to form the basis for direct-detection transceivers up to 200 Gb/s per lane for a total capacity of 1.6 Tb/s over parallel SMFs, for intra-DC connectivity of 500 m-2km. The same EML array will be coupled to a 3D PolyBoard motherboard for the first time to realize a forward looking 1.6Tb/s optical engine with the 3D PolyBoard acting as a MCF interposer, for increased bandwidth density in intra-DC links or delivering 8x200Gb/s in point-to-multipoint links in the 5G optical fronthaul.

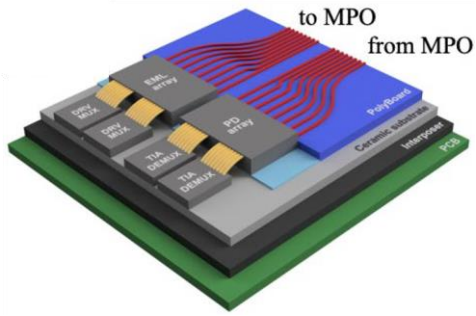

Figure 1. Artistic layout of the 1.6 Tb/s MCM optical engine with parallel single mode fibers

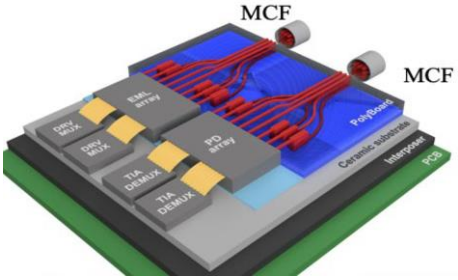

Figure 2. Artistic layout of the 1.6Tb/s MCM Optical Engine with MCFs using a 3D Polyboard motherboard.

POETICS will introduce for the first time a novel 32x32 3D Benes optical switch in 3D PolyBoard, offering a reconfigurable, non-blocking and low power optical switching device that eliminates waveguides crossings and can scale gracefully.

The project invests also on the complementarity of the TriPleX and PolyBoard platforms to realize for the first time a cost-efficient 64Gbaud coherent transceiver with up to 600Gb/s capacity for DCI links within 80-120km.

Impact

The project has been conceived with the strategic objective to develop the underlying technology in Europe for the development of MCMs comprising digital switch ASICs and optical interfaces. The competitive advantages in terms of performance, energy efficiency and reliability are based on the use of the multifunctional components and the hybrid electronic-photonic integration approach which allows for global optimization of the system. The advantages in terms of manufacturability and costs on the other hand are based on a straightforward plan for the development of advanced integration methods and automated assembly processes with simple and reliable steps, high fabrication yield and compatibility with high volume fabrication runs.

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