BIG PIPES

Broadband Integrated and Green Photonic Interconnects for High-Performance Computing and Enterprise Systems

BIG PIPES Broadband Integrated and Green Photonic Interconnects

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Timeline
Start Date: 01/11/2013
End Date: 31/10/2016

Budget
Overall Cost: 4 897 558 EUR
Funding: 3 240 000 EUR

Project Partners

- Integrated Photonics Laboratory RWTH Aachen University, DE
- III-V Labs, FR
- Laboratoire de Photonique et de Nanostructures (LPN), Centre National de la Recherche Scientifique (CNRS), FR
- Institut für Photonik und Quantenelektronik (IPQ), Karlsruhe Institute of Technology (KIT), DE
- Radio and Optical Communications Laboratory, Dublin City University (DCU), IE
- Mellanox Technologies Ltd., IL
- Pilot Photonics, IE

Vision & Aim

Big Data requires Big Pipes. Driven by mobile devices, cloud computing and machine-to-machine Internet, the amount of data processed by data centres continues to grow with a steep progression. Ongoing trends in server virtualisation and green computing morph the data centre architecture and place increasing constraints on the interconnect technology. To meet the need for increased bandwidth, transceiver compactness, reduced power consumption and cost effectiveness for the next generation of data centre and campus-wide communications systems, we are going to develop Broadband Integrated and Green Photonic Interconnects for High-Performance Computing and Enterprise Systems (BIG PIPES).

BIG PIPES will reach the industry target of 400 Gbps transceiver modules with a highly integrated technology aiming at aggressively extending the limits of compactness, power consumption (<30mW/Gbps) and cost-effectiveness, with the objective of providing an optical engine for future 12x25 Gbps CXP and 16x25 Gbps CFP4 modules. To deconstrain the switch board architecture, we will package these optical engines in mid-board optical modules.

High campus-wide data throughput is expected to be pivotal in supporting growing data-centre dimensions, as well as modularity in data centre architectures. To enable ultra- broadband transceivers optimally utilising a single integrated light source, we will develop spectrally efficient links reaching 1 Tbps and above.

The developed communication system technologies will leverage integrated, mode- locked comb sources to allow both compactness and novel system architectures. The research project will comprise the development of tailored comb sources, the exploration of novel system architectures, as well as the development of photonic devices and assembly technologies enabling system integration.

A research intensive SME and the market leader in the high performance InfiniBand segment complement the expertise of several leading European photonics laboratories and will keep the project focused on an industrial roadmap.

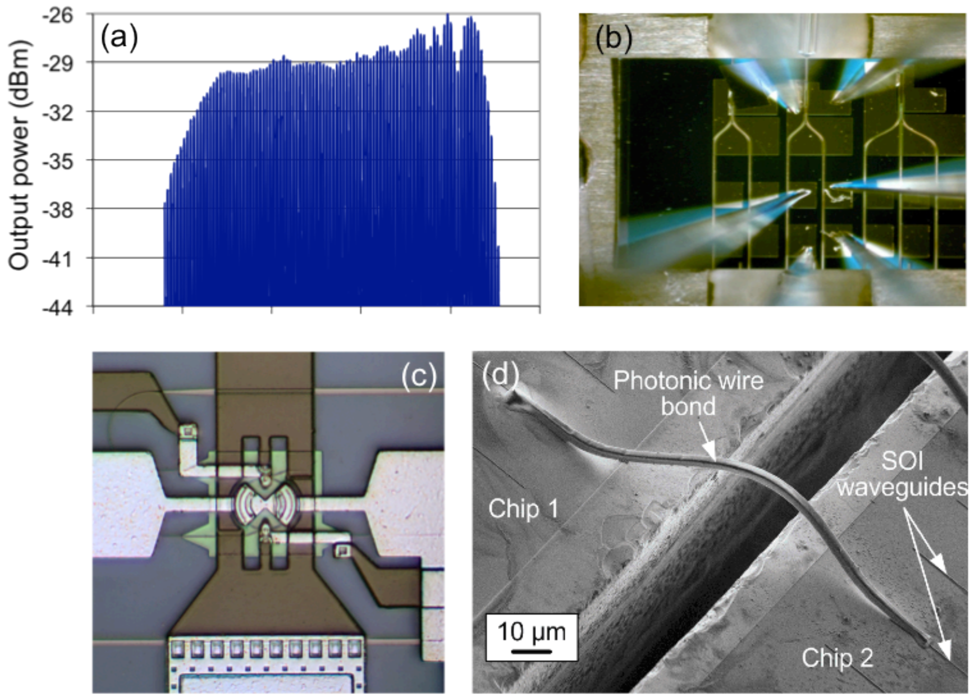

Figure 1: (a) Spectrum of a mode locked comb source (b) micrograph of a multiplexer / amplifier chip developed by Pilot Photonics targeted towards comb laser based communication systems (c) micrograph of a ring resonator based Silicon Photonics modulator and (d) assembly technique based on photonic wirebonds developed within BIG PIPES. We are exploring a number of modulation schemes ranging from On-Off Keying to coherent detection and Nyquist WDM in order to maximize the performance metrics of comb source based integrated communications systems. Silicon Photonics modulators specially tailored to the requirements of these system architectures, such as ring based phase modulators and silicon-organic hybrid (SOH) linear Mach-Zehnder modulators, are also being developed within the project. Courtesy of (a) III-V Lab, (b) Pilot Photonics, (c) Integrated Photonics Laboratory of the RWTH Aachen, (d) Institute of Photonics and Quantum Electronics of the Karlsruhe Institute of Technology (KIT).