**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 centers continues to grow with a steep progression. Ongoing trends in server virtualization and green computing morph the data center 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 center 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 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-center dimensions, as well as modularity in data center architectures. To enable ultra-broadband transceivers optimally utilizing 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 a leading supplier 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.

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(a) Spectrum of a mode locked comb source (b) multiplexer / amplifier chip targeted towards comb laser based communication systems (c) ring resonator based Silicon Photonics modulator (d) assembly based on photonic wirebonds. 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 communication 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 III-V Lab (a), Pilot Photonics (b), RWTH (c), KIT (d).