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EuroEXA: an innovative and scalable FPGA-based system for extreme scale computing in Europe

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Nowadays, a number of technology R&D activities has been launched in Europe trying to close the gap with traditional HPC providers like USA and Japan and more recently emerging ones like China.

The EU HPC strategy, funded through EuroHPC initiative, leverages on two different pillars: the first one targets the procurement and the hosting of two/three commercial pre-Exascale systems, in order to provide the HPC user community with world-level class computing systems; the second one aims at boosting industry-research collaboration in order to design a new generation of Exascale systems which is to be mainly based on European technology.

In this framework, analysis and validation of the HPC-enabling technologies is a very critical task and the FETHPC H2020 EuroEXA project (<https://euroexa.eu>) is prototyping a medium size (but scalable to extreme level) computing platform as proof-of-concept of an EU-designed HPC system.

EuroEXA exploits FPGA devices, with their ensemble of either standard and custom high-performance interfaces, DSP blocks for task acceleration and a huge number of user- assigned logic cells. FPGA adoption allows us to design European innovative IPs such as application-tailored acceleration hardware (for high performances in the computing node) and low latency, high throughput custom network (for scalability).

The EuroEXA computing node is based on a single module hosting Xilinx UltraScale+ FPGAs for application code acceleration hardware, control and network implementation, and, in a later phase, even a new project-designed, ARM-based, low power multi-core chip.

EuroEXA interconnect is an FPGA-based hierarchical hybrid network characterized by direct topology at “blade” level (16 computing nodes on a board) and a custom switch, implementing a mix of full-crossbar and Torus topology, for interconnection with the upper levels.

EuroEXA will also introduce a new high density liquid-cooling technology for blade system and a new multitrack modular assembly based on standard shipping containers in order to provide an effective solution for moving, placing and operating large scale EuroEXA system.

A complete and system-optimized programming software stack is under design and a number of scientific, engineering and AI-oriented applications are used to co-design, benchmark and validate the EuroEXA hardware/software solutions.

In this talk, we will introduce the main project motivations and goals, its positioning within the EuroHPC landscape, the status of hardware and software development and the possible synergies with HEP computing requirements.

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