ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

HIGH PERFORMANCE COMPUTING

In the digital age, High Performance Computing (HPC) is at the core of major advances and innovation. It dramatically increases the ability to process large amounts of big data and carry out complex computations, which is critical for a large number of scientific or industrial domains.

The University of Bologna is at the forefront of research in high performance computing and participate as a key contributor to the European HPC strategy covering a wide range of issues:

HPC technologies and systems Hardware Development (Computer architecture, parallel programming models and energy optimization; Co-design for added value HPC systems; Fine-grain telemetry systems for large scale green computing systems management); **Software Development** (Big data processing, Cloud, stream processing; Complex Systems, Analysis Systems, Performance Modeling, High Performance Computing Distributed Systems and Algorithms; Energy-efficiency extension for programming libraries and languages, energy and power-aware run-times; **Data center automation** (Algorithms for multiscale data center modelling and management; AI and fog computing solution for automated data center operation and predictive maintenance; System software for holistic monitoring and management of HPC resources).

HPC Applications Using HPC infrastructure, innovative algorithms have been developed in many fields e.g. chemistry, biology, pharmacology, cosmology, high-energy physics and nano-electronics.

HIGHLIGHTS

The University of Bologna is member of the **ETP4HPC Association** partner of the EuroHPC Joint Undertaking. **The Energy-Efficient Embedded Systems-EEES Lab** designed, in collaboration with **CINECA** and **E4 engineering s.p.a**, the energy awareness and efficiently support of the **D.A.V.I.D.E. supercomputer**, the first IBM OpenPOWER system ranked in the Green500 and Top500 list. **The EEES Lab designed, in collaboration with E4 and IBM**, the energy awareness and efficiency support of the Marconi100 supercomputer ranked 9th in the Top500 list of November 2020. The University of Bologna and ETHZ co-developed **PULP**, the parallel ultra-low power RISC V-based open source hardware platform.

European funded projects

The University of Bologna is member of the consortium to develop Europe's microprocessors for future supercomputer **EPI - European Processor Initiative**. The University of Bologna participates to H2020 **OPRECOMP** - Open transPREcision COMPuting (2017-2020), BonsAPPs - AI-as-a-Service for the Deep Edge (2021-2023) and to several FP7 projects (e.g. **PHIDIAS** and **VIRTICAL**). EEES Lab hosted the **ERC Advanced Grant MULTIHERMAN** (2012-2018) and awarded a Pre-Commercial Procurement contract (**Phase II and III PRACE -3IP**) concerning R&D services on Whole System Design for Energy Efficient HPC. Moreover the University of Bologna successfully participated in the EuroHPC calls to promote R&D of supercomputers with European technology with the two funded projects: REGALE - An open architecture to equip next generation HPC applications with exascale capabilities (2021-2023); The European PILOT - Pilot using Independent Local & Open Technologies (2021-2023) and EUPEX - EUROPEAN PILOT FOR EXASCALE (2022-2025)