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TUM

Wednesday, April 17th 2024, 15:00-16:30

Applications of integrated High Performance Quantum Computing

15:00 –15:45   Dr. Luigi Iapichino (Leibniz Supercomputing Centre – LRZ)

Initial services and applications in the Quantum-accelerated Supercomputing Ecosystem

15:45 –16:30   Dr. Marco De Pascale (Leibniz Supercomputing Centre – LRZ)

Initial Comparison of HPC performance of simulators on representative QC use cases

Abstract 1 (Dr. L. Iapichino) - The integration of quantum computers within the High Performance Computing (HPC) ecosystem is of key importance not only to operate the current NISQ devices, but also to offer a broad resource environment to the users for their research. In this talk I will provide an overview on the initial service offering in QC for the LRZ users, and how it aligns with the needs needs and requirements of the research community. In particular, the status of the operation of quantum hardware at LRZ and insights on early applications will be described. For simulating quantum algorithms on HPC resources, a portfolio of different software simulators is under deployment on the LRZ HPC computing resources. Finally, the team of LRZ specialists in QC and HPCQC applications has started interacting with the local user community and a number of research collaborations and other support activities, including training events, have been initiated. We expect in this way to strengthen the role of middlemen between the LRZ computing infrastructure and our QC users.

Abstract 2 (Dr. M. De Pascale) - Simulations of quantum computing circuits are a valuable tool to develop and evaluate QC algorithms. Because of their memory footprint and of complexity of the circuits with growing number of qubits, this problem requires HPC computational resources to be addressed. In this talk we perform a characterisation of some of the most used software simulators (including Qiskit,Pennylane, Intel-QS, among other ones) in terms of their HPC performance. The tests probe both the thread performance (vectorisation, memory access) and the parallel efficiency when scaling on larger computing resources (using MPI and OpenMP), on use cases of relevance for NISQ hardware in the fields of molecular dynamics and optimisation. The simulations have been performed on the HPC systems available at LRZ and are aimed at formulating recommendations to our QC user community, which can get access to a growing portfolio of HPCQC resources.

TÜV SÜD Stiftung

Bayerisches Staatsministerium für Wissenschaft und Kunst

Federal Ministry of Education and Research