The path to advantage with Quantum Centric Supercomputing

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Abstract

Over approximately the last decade, quantum computing has evolved from purely laboratory research to enabling a community of quantum computational scientists with tools for the exploration and development of quantum algorithms and applications. More recently, as quantum systems have become more capable and mature, the technology has started to reach the broad community of computational scientists, with integration of quantum systems in HPC datacenters becoming more and more frequent. This new stage of development constitutes a first step towards our vision of quantum-centric supercomputing: integrated quantum and classical computing resources working together in parallel to run computations beyond what was possible before.

In this talk I will present some of our efforts along that vision and will show you how quantum computing will naturally interplay with classical supercomputing to increase the computational reach on heterogeneous quantum and classical systems. Furthermore, I will show how quantum-centric supercomputing can enable quantum computations hitherto only thought possible in a fault-tolerant scenario. These results open a very promising path towards extracting value from quantum computers before the maturity of quantum error correction. I will discuss not only how quantum computing can help define the next evolution of supercomputing, but also how classical supercomputing can have a critical role at different stages of a quantum computation and how classical developers can already actively engage with heterogeneous workflows in integrated quantum and classical systems.