

Quantum Computing – Prospects and Challenges

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The field of quantum computing has evolved into a large interdisciplinary community where significant resources are invested worldwide. As a result, accelerated progress is achieved and we are at the beginning of a new age of computation, developing programmable quantum systems towards universal quantum computers. Quantum computers promise to solve certain mathematical problems that are intractable to classical computers.

Quantum computing systems are built from the bottom up reaching the limits of what can be classically simulated. The IBM Quantum Development Roadmap describes our vision of creating a quantum computing ecosystem delivering quantum applications through the cloud. This requires developing the entire quantum computing stack starting from the qubit and quantum processor technology, control electronics to software, algorithms and applications for quantum computing, implemented in the cloud and integrated with high performance computing.

In this presentation the recent developments of our quantum computing systems and the scientific advances that enabled scaling superconducting quantum processors to 127 qubits and beyond are presented. Besides scale, also quality and speed will be discussed building the key metric for measuring the performance of quantum computation. Examples of applications where the computational power of quantum computing could make a difference are provided.