Op-Ed | THE VALUE OF QUANTUM COMPUTING TODAY

A FUNDAMENTALLY DIFFERENT COMPUTATIONAL POWER

Climate change, fusion energy, quantitative finance, drug development, materials science, and AI -- these are just some of the critical areas where quantum computing could have a tremendous impact.

By leveraging quantum mechanics, quantum computers process information in fundamentally new, more powerful ways compared to classical computing. When scaled, we believe quantum computers will enable society to address problems that have long been untenable.

A widely known challenge of quantum computing is overcoming qubit errors. Qubits are particularly sensitive to noise and other environmental factors. For quantum computing to be a valuable computational resource, we believe that we'll need a system with hundreds to thousands of qubits with a 99.7+% 2-qubit gate fidelity. Once achieved, we will have a computational resource that is impossible or very difficult to simulate classically -- a necessary step on the road to fault tolerant quantum computing (FTQC). The lower end of that spectrum is beginning to show up in the industry, and Rigetti's roadmap has us confidently in that range within 2 years.

At Rigetti, we believe that the time is now to prepare for FTQC. The only way we will get to this era is by engineering systems with an eye towards the earliest possible use. The systems we are building today are incredibly valuable research tools for understanding how to build the fault tolerant systems of the future -- and we believe that this is well within reach.

WHY WE CAN'T WAIT TO INVEST IN QUANTUM COMPUTING

Governments are beginning to recognize the importance of quantum computing technology, unsurprisingly given the role that quantum could play in national security. According to McKinsey, $42B of government investment in quantum technology has been announced to date and just in 2022 we saw a 50% increase in public investment.

There aren't many people who know how to build and program quantum computers. According to McKinsey, less than 50% of quantum jobs will be filled by 2025 -- underpinning the importance of bolstering the quantum workforce. We need to do everything we can to support the academic institutions and national labs preparing our next generation of quantum computing end users -- including allocating funding to enable on-premises quantum computing.

What we can do to prepare for fault-tolerance

Companies like Rigetti are making great strides in developing scaling technology needed to build larger, higher performing quantum computers. In 2021, Rigetti introduced the world's first modular chip architecture, unlocking the ability to tile multiple chips together to build a large-scale quantum processor. When fault tolerant quantum computers are a reality, we'll need algorithms and applications for these systems. We partner with leading researchers across academia and government to deepen our understanding of the requirements of quantum algorithms. Examples include our work on quantum optimization problems with thousands of variables to prepare for larger and more powerful quantum computers, and comparing quantum and classical machine learning algorithms to address the classification of probability distributions.

Though we are still in the early days of realizing its enormous potential, the time is now to prepare for the transformative change that quantum computing promises to deliver.

Dr. Subodh Kulkarni has served as President and CEO of Rigetti since December 2022. Dr. Kulkarni is a seasoned public company CEO with thirty-plus years of experience in the semiconductor industry and a track record of success in scaling and commercializing cutting-edge technologies. Prior to joining Rigetti, Dr. Kulkarni was President, CEO, and member of the Board of CyberOptics Corporation. He held these roles from 2014 until CyberOptics was acquired by Nordson Corporation in November 2022. Prior to CyberOptics, Dr. Kulkarni was CEO of Prism Computational Sciences. He received his B.S. in chemical engineering from the Indian Institute of Technology, Mumbai, and later obtained a M.S. and Ph.D. in chemical engineering from MIT

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