Eviden explores energy advantages in near-term quantum computing systems through research partnerships

Paris, France – March 13, 2024 – A Franco-Singaporean collaboration has been announced to benchmark and optimize the energy efficiency of quantum computing. The partnership includes Eviden, the Atos Group business leading in advanced computing, A*STAR's Institute of High Performance Computing (IHPC) in Singapore, and MajuLab, an international research laboratory in quantum physics. Majulab is a joint laboratory of the Centre National de la Recherche Scientifique (CNRS), Université Côte d'Azur (UCA), Sorbonne University (SU), National University of Singapore (NUS) and Nanyang Technological University (NTU).

In the context of conventional high-performance computing (HPC) environments, energy optimizations are generally achieved through improved hardware architectures and better cooling systems. However new approaches must be set up to optimize energetic consumption in future quantum computers.

Quantum computing leverages fundamental science to solve complex problems much more efficiently than classical methods: this is known as the quantum computational advantage. While the age of large-scale, fault-tolerant quantum computing seems years away, Noisy-Intermediate Scale Quantum (NISQ) devices are already a reality. In such devices, the energy cost to solve a problem on quantum devices could be much less than solving the same problem on a classical HPC system. This offers the possibility that the energy advantage of quantum algorithms may be established before quantum the computational advantage itself.

This research collaboration aims to build a user-friendly framework for accurate benchmarking of energy efficiency in NISQ/near-term quantum computing systems. This framework is based on a novel holistic methodology recently proposed by one of the partners[1], to estimate and optimize energy consumption for the full stack of the quantum computer.

The three partners will conduct research on various options to estimate the performance and energy consumption of various algorithms, supported by Eviden's quantum emulator Qaptiva 800, which can emulate over 100 qubits depending on the algorithm and emulator used. The collaboration will rely on three main work groups: control parameters and energy benchmarking metric; implementation of resource monitoring within Eviden's quantum emulation environment; and application-based benchmarking (VQE).

> **Dr. Cédric Bourrasset, Global Head of HPC-AI and Quantum Computing, Eviden, Atos Group,** said "*While the power for computing keeps increasing, our commitment to decarbonization and sustainability hasn't diminished. For decades, Eviden has been committed to greener technologies, leading the HPC market with its patented Direct Liquid Cooling. The Group is as equally committed to promoting*

[1] Fellous-Asiani, Hao Chai, Thonnart, Ng, Whitney, Auffèves, *Optimizing the energetic efficiency of scalable fault-tolerant quantum computers*, to appear in PRX Quantum

a greener quantum computing, which we know will be at the heart of computing technologies in the coming years."

Dr. Su Yi, Executive Director, A*STAR's IHPC, said "*Sustainable computing is closely tied to the potential of quantum computing where near-term quantum algorithms offer energy-efficiency and problem-solving potential that could drive quantum technology adoption. A*STAR's Institute of High Performance Computing (IHPC) is working together with our research partners to advance this intersection of sustainability and quantum technologies."*

Alexia Auffèves, CNRS Research Director, = Director of the MajuLab, and Co-founder of the Quantum Energy Initiative, said *"The collaboration is aligned with the objectives of the recently launched Quantum Energy Initiative, which aims to keep in check the energy footprint of quantum technologies already at their early stage. It will contribute to set up solid, objectives and figures of merit to really assess if quantum energy advantages can be reached. This kind of work is essential to mitigate the risk of green quantum hype. It directly relates to the new QEI working group P3329 at IEEE, which is currently developing a standard of energy efficiency."*

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About Eviden[2]

Eviden is a next-gen technology leader in data-driven, trusted and sustainable digital transformation with a strong portfolio of patented technologies. With worldwide leading positions in advanced computing, security, AI, cloud and digital platforms, it provides deep expertise for all industries in more than 47 countries. Bringing together 47,000 world-class talents, Eviden expands the possibilities of data and technology across the digital continuum, now and for generations to come. Eviden is an Atos Group company with an annual revenue of c. € 5 billion.

About Atos

Atos is a global leader in digital transformation with c. 95,000 employees and annual revenue of c. € 11 billion. European number one in cybersecurity, cloud and high-performance computing, the Group provides tailored end-to-end solutions for all industries in 69 countries. A pioneer in decarbonization services and products, Atos is committed to a secure and decarbonized digital for its clients. Atos is a SE (Societas Europaea), and listed on Euronext Paris.

The purpose of Atos is to help design the future of the information space. Its expertise and services support the development of knowledge, education and research in a multicultural approach and contribute to the development of scientific and technological excellence. Across the world, the Group enables its customers and employees, and members of societies at large to live, work and develop sustainably, in a safe and secure information space.

About MajuLab

MajuLab is an international research laboratory that includes French partners the Centre National de la Recherche Scientifique (CNRS), Sorbonne University (SU), the Université Côte d'Azur (UCA), and

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[2] *Eviden business is operated through the following brands: AppCentrica, ATHEA, Cloudamize, Cloudreach, Cryptovision, DataSentics, Edifixio, Energy4U, Engage ESM, Evidian, Forensik, IDEAL GRP, In Fidem, Ipsotek, Maven Wave, Profit4SF, SEC Consult, Visual BI, Worldgrid, X-Perion. Eviden is a registered trademark.*

in Singapore, the National University of Singapore (NUS) and the Nanyang Technological University (NTU) as its signatory institutions**.** MajuLab leverages 15 years of successful collaboration between France and Singapore in quantum sciences and technologies, operating as a quantum channel connecting these two vibrant ecosystems. Based at the School of Physical and Mathematical Sciences (NTU) and atq the Center for Quantum Technologies (NUS), MajuLab is structured as an interdisciplinary quantum centre: a compound of basic research and technology developing synergies with computer scientists and quantum physicists, theorists and experimentalists, academia and industry.
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