
Atos Quantum

Key highlights.



Thierry Breton

Chairman and Chief Executive Officer, Atos

Thierry Breton, Chairman and CEO of Atos and former French Minister of Economy, Finance and Industry, has announced his determination to commit his company into the world of quantum information.

"As current technologies reach the physical limits of matter, especially in terms of heating, and speed of light, we must go beyond with a technological breakthrough: the quantum computer emerging post 2030.

For several months, we have assigned teams on the subject. In collaboration with CEA, we are the only ones in Europe, facing IBM, Google and a Canadian team.

Those who claim that we invented nothing since electricity should read about quantum physics! It has already given us the laser, GPS and superconductivity and we are only at the very beginning."

*Feb. 12th, 2016 in "Les Echos" business newspaper

Atos, a global leader

Atos SE (Societas Europaea) is a leader in digital services with pro forma annual revenue of circa € 12 billion and circa 100,000 employees in 72 countries.

Serving a global client base, the Group provides Consulting & Systems Integration services, Managed Services & BPO, Cloud operations, Big Data & Cybersecurity solutions, as well as transactional services through Worldline, the European leader in the payments and transactional services industry.

With its deep technology expertise and industry knowledge, the Group works with clients across different business sectors: Defense, Financial Services, Health, Manufacturing, Media, Utilities, Public sector, Retail, Telecommunications, and Transportation.

Atos oversees all the data processing chain for its customers, by developing its own hardware computing infrastructure (servers and supercomputers that it alone designs and produces in Europe) and software (Big Data platforms) implementing data science algorithms developed by its mathematicians (artificial intelligence), and integrate its own cyber security solutions and services.

Atos is thus able to offer its clients the best that computer science can provide in terms of innovation and value creation, while controlling underlying security risks. In this context, Atos ambition is to be a player in the new quantum revolution.

Quantum revolutions

The first quantum revolution has taken place at the microscopic level and brought major innovations of the 20th century such as the transistor, the laser, the superconducting devices, optical fibers, etc.

The Physicist Richard Feynman reasoning in 1982 marked the start of the second quantum revolution *"Instead of complaining that the simulation of quantum phenomena*

requires tremendous powers in today's computers, use the computational power of quantum to overcome today's computers."

Indeed, with the capacity acquired in recent decades in the understanding and control of individual quantum systems, and following the urging of Richard Feynman, the way is now open to macroscopic achievements in multiple areas: quantum computation, simulation, metrology, communication, etc.

Research has accelerated since 2000, led by Mathematicians and Physicists worldwide. Even if the horizon is sometimes far, everyone is convinced that the second quantum revolution is upon us. Large North American companies have invested heavily in fundamental or applied research.

Europe is not left behind since Commissioner Oettinger announced in early 2016 the launch of a quantum initiative with a budget of one billion euros.

Advancement in mathematics are extensive and demonstrate the reality of the fabulous opportunities for accelerating calculations that together allow quantum superposition and quantum entanglement, as illustrated by Peter Shor and Lov Grover in the 90s.

The physical implementations clash against decoherence difficulties on the number of entangled qubits and on the duration of entanglement, but their diversity and the infinite field of experimentation make optimistic: ions trapped systems, photonic qubits with high stability, qubits embedded in superconducting circuits, quantum dot nanostructures, or topological qubits based on quantum braids. Who will be the best?

In parallel, coding techniques are being developed according to quantum laws (non-cloning principle, for example) to produce stable logic qubits.

Finally, these discrete qubits based approaches (for which calculations are clocked as in traditional IT) can hybridize with continuous approaches that suggest the application of the adiabatic theorem.

Atos Quantum

It is a professional responsibility to its customers to prepare the future view of quantum information for its opportunities it brings (quantum neural networks for example) or to the new risks it raises (collapse of asymmetric cryptography for example).

This is why Thierry Breton decided to launch Atos Quantum, erecting strategic priority for the group. Atos Quantum is part of the European initiative, natural extension of its strategy of investing in the hardware and software infrastructure computing, and cybersecurity.

The objectives of Atos Quantum results directly from Atos position in the calculation and security: use of conventional supercomputers in simulating quantum phenomena and quantum computing algorithms, finding new quantum algorithms, development of quantum programming, studying post-quantum cryptography, partnering with scientists to understand and identify the most promising physical implementations to optimize the corresponding algorithms and prepare the industrial integration.

Atos Quantum has been initiated with the creation of an R&D laboratory in the Paris region, the recruitment of a team of researchers, and the development of academic partnerships (research centers, universities) mainly in Europe.

A key element of Atos Quantum is that its scientific governance will use an international Advisory Board of high level.

Indeed, there are few areas where scientific guidelines are also essential: a single error of assessment or a lack of discernment can lead to years of delay and much fiscal slippage. The risks are real given the complexity and vastness of the perimeter. This applies to both the mathematical component and the field of physical experimentation, hence the need to confront the greatest minds in both subjects.

The Advisory Board

Chaired by the Chairman and CEO of Atos, the Atos Quantum Advisory Board gathers a group of international experts, mathematicians and physicists authorities in their field. Its main mission is to direct the scientific program long-term, to establish its scientific legitimacy, validate the important partnerships and technological choices, and bring the necessary direction to research teams.

A true collective adventure, human and technological

Through this project, Atos is resolutely geared towards the development of new forward-looking technologies for its customers, and beyond, for the place of Europe in the world of tomorrow. It is in this context that we invite you to a collective adventure, unique in humanity and technology supported by the strong commitment of a world leader and rich through its immense potential.



The Bull sequana supercomputer is designed to match the exascale technological challenges.

About Atos

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Atos is focused on business technology that powers progress and helps organizations to create their firm of the future. The Group is the Worldwide Information Technology Partner for the Olympic & Paralympic Games and is listed on the Euronext Paris market. Atos operates under the brands Atos, Bull, Canopy, Worldline, Atos Consulting and Atos Worldgrid.

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