Slowly but surely, Quantum Computing will transform industry and society

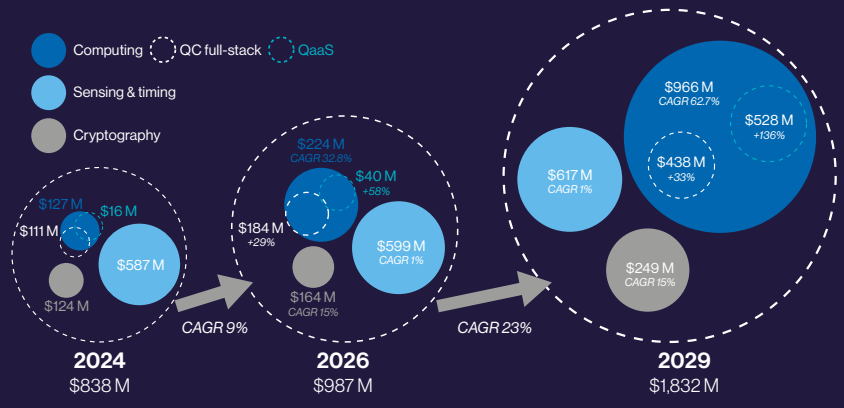
Dr. Eric Mounier of Yole Group talks about both the market potential and supply chain challenges to be overcome to see the successful launch of Quantum Computing Services in the next decade.

In recent years, there has been significant excitement surrounding quantum technologies. Quantum effects can be harnessed for various applications, including ultra-sensitive sensors like gravimeters and atomic clocks, and ultra-secure communication (cryptography). However, the application that garners the most attention and funding, both from private and public sources, is quantum computing. The primary advantage of quantum computers lies in parallelization, enabling simultaneous calculations that offer substantial time and energy savings, along with enhanced computing power.

The potential applications of quantum computing span various sectors, including finance (for anticipating financial risks), healthcare (reducing the time and cost of discovering new drugs, which currently takes 10+ years and billions of dollars), optimizing materials for electric vehicle batteries, and, of course, defense. Consequently, quantum computing has become a strategic priority for countries worldwide, leading to significant investments in research and innovation. Global investments in quantum science and technology currently approach $30 billion, with notable contributions from the USA, China, and Europe (about $5 billion each).

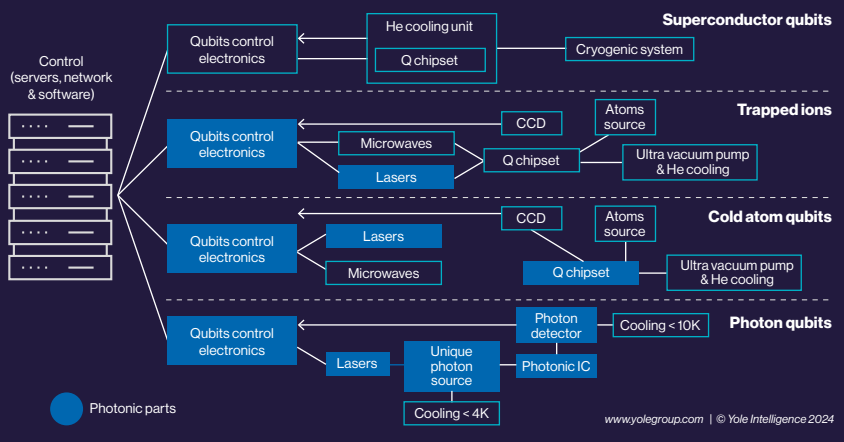
2024-2026-2029 Quantum Technologies Forecast

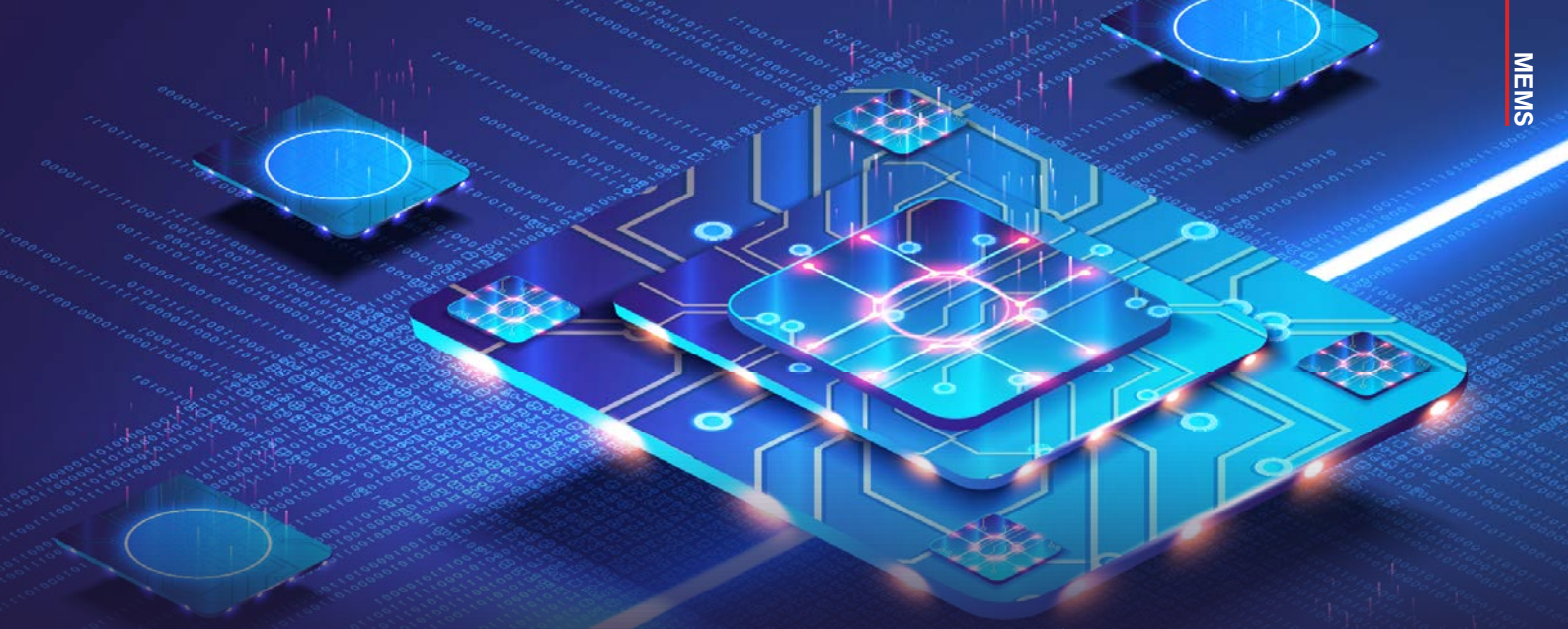
Source: Quantum Technologies report, Yole Intelligence, 2024



The different architectures of Quantum Computers

Source: Quantum Technologies report, Yole Intelligence, 2024





On the supply chain side, the quantum ecosystem is maturing and strengthening through collaborative research projects, the development of patent portfolios, the establishment of startups, and the involvement of semiconductor vendors and equipment makers such as Intel, TSMC, GlobalFoundries, Xfab, and SkyWater. Today, a handful of companies, including D-Wave, IonQ, Rigetti, PsiQuantum, and Xanadu, dominate nearly 70% of global funding in this domain. Each year sees the emergence of numerous quantum startups, primarily in computing, and a complete supply chain is being set up at each level: software, materials, tools, devices, systems, and end-users.

However, the path to achieving quantum supremacy is fraught with challenges. In the quantum world, the equivalent of a bit is a qubit, which can exist in a superposition of both 0 and 1. Qubits are, unfortunately, highly sensitive to errors induced by external factors such as temperature and radiation, necessitating operation in ultra-cold environments. Consequently, quantum computers are highly complex systems with a current price tag of about $15 million. We do not foresee a dramatic cost reduction in the short term.

While practical use cases for quantum computing are still far from being realized, technological developments are progressing well despite the continuous race to achieve the largest number of qubits. We estimate that by 2030, a few dozen quantum computers will be operational worldwide for private use (finance and defense industries are quite eager to have their own quantum computers on-premises for security reasons) and installed at quantum manufacturers' sites that will rent quantum calculation time (QaaS or "Quantum as a Service" business model).

Optimism about the success of quantum technology persists, fueled by significant technological advancements and investments worldwide. Quantum computing hardware is projected to grow from $111 million in 2024 to $438 million in 2029 (26% CAGR). QaaS will increase from $16 million in 2024 to $528 million in 2029 (85% CAGR). Beyond 2030, we forecast the quantum computing market will total $3.74 billion in 2035 (both hardware and service). QaaS (Quantum as a Service) will constitute the major share of this value, with most services running on quantum computers in the cloud. It will grow much faster than quantum computer hardware as we expect to see more use cases being developed for quantum computers before 2030.

About the author

Eric Mounier, Ph.D., is Chief Analyst, Photonics & Sensing at Yole Group.

With more than 30 years' experience within the semiconductor industry, Eric provides daily in-depth insights into emerging semiconductor technologies such as quantum technologies, the Metaverse, terahertz, photonics, and sensing.

Based on relevant methodological expertise and a significant technological background, Eric works closely with all of Yole Group's teams to highlight disruptive technologies and analyze business opportunities through technology & market reports and custom consulting projects.

Eric has spoken at numerous international conferences, presenting Yole Group's vision of emerging semiconductor technologies, markets, and applications. Previously, Eric held R&D and Marketing positions at CEA-Leti (France).

Eric Mounier has a Ph.D. in Semiconductor Engineering and a degree in Optoelectronics from the National Polytechnic Institute of Grenoble (France).