



# Fujitsu on: Computing

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## Overview

- Society, business, science, and the systems that support all these are becoming more complex. They rely on ever-greater computing power and technical levels to provide essential analysis, insight, optimization, and control. The process is symbiotic — greater complexity demands greater computing power. In turn, this enables even greater complexity.
- This interrelationship is why Fujitsu believes that advances in computing can help society address the existential challenges defined in the United Nations' Sustainability Development Goals (SDGs).
- Within its computing portfolio, Fujitsu offers solutions for supercomputing, a quantum simulator, quantum-inspired Digital Annealing, and quantum computing. Fujitsu is a world leader in several of these technologies. To underline this claim, Fujitsu and the Japanese research institute RIKEN jointly developed the world's fastest supercomputer [Fugaku](#).
- The demand for ultra-scale computing is now spreading beyond universities and well-funded research labs. Ultra-scale computing, delivered as-a-service in the cloud, democratizes access to the world's most powerful computing.
- Quantum computing remains mainly lab-based at this point. However, advances are accelerating, and commercial applications are not far away. As well as continuing to develop "true", gate-based quantum computing, Fujitsu is already a world leader in quantum-inspired computing. This applies algorithms developed for quantum computers on purpose-built digital processors and is available commercially today.

## Industry Trends in Brief

- Driven by complexity, demand for computing power continues to rise. The supercomputers market, for example, is expected to register a compound annual growth rate (CAGR) of 9.5% between 2022 and 2027, with one of the significant drivers being the increasing use of cloud technology.<sup>1</sup>
  - However, in the face of global heating and mandates worldwide to achieve net-zero carbon emissions, the power consumption of high-performance computers is increasingly in the spotlight. Vendors are responding with new, lower-power technologies that meet these demands.
  - Historically, the most advanced forms of computing were typically encountered in public, university, and commercial research environments, where modeling and analysis stretched computing to its limits. Today, it is
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<sup>1</sup> <https://www.businesswire.com/news/home/20220217005848/en/Global-Supercomputers-Market-2022---2027-Increasing-Demand-for-Higher-Processing-Power-to-Drive-the-Market-Growth---ResearchAndMarkets.com>

applied in almost every industry, from manufacturing and biotechnology to nuclear physics and the discovery of oil and gas. In addition, enterprises with vast amounts of data to manage and process are increasingly looking to leverage advanced computing to analyze this data and aid their decision-making.

- Today, access to ultra-scale computing is undergoing a process of democratization, available for delivery as a service through the cloud, with different types of computing resources automatically identified and optimized for different workloads. This enables researchers and organizations to solve complex optimization problems and simulations, plus large-scale machine learning with high speed and convenience.
- As-a-Service advanced computing accelerates innovation across a wide range of fields. These include developing new medicines, reducing and preventing natural disasters, developing new materials, enabling manufacturing without the need for prototyping, resolving societal issues, progressing cutting-edge research, and boosting business competitiveness.
- Alongside better access, supercomputers are steadily becoming more versatile. To be widely used, they must be fast and user-friendly, with a wide range of software available from an extensive ecosystem. Supercomputing software's "look and feel" is increasingly indistinguishable from ordinary computer software.
- Going forward, the development of supercomputers will face two significant challenges. One is the need to expand bandwidth further. Without this, many applications will hit the ceiling. The other is the end of [Moore's Law](#). If transistor size cannot be reduced further, computing power will also hit a ceiling.
- To overcome these limitations, quantum computers are a hot research topic. Operating on different principles, they can process significantly larger data sets than conventional computers for specific problems and solve complex challenges such as quantum dynamics calculations at very high speed. For other applications, supercomputers will likely remain more relevant for some time.

### Fujitsu and advanced computing

- Fujitsu's technology strategy focuses resources on advances in computing as one of five priority areas (alongside networks, AI, data and security, and converging technologies)
- Fujitsu has a long-standing history in supercomputing. RIKEN and Fujitsu developed the supercomputer Fugaku, the world's No. 1 supercomputer in the Top500 list for two years, from June 2020 until May 2022. In the results [announced](#) at the ISC2022 High-Performance Computing Conference in Hamburg, Germany, Fugaku retained the top spot in multiple other high-performance computing rankings.
- Fugaku is a parallel computer with nearly eight million CPU cores. The A64FX CPU combines the properties of both vector and scalar processors to deliver vastly superior energy efficiency compared with standard memory devices, thanks to high-speed HBM memory, as featured in the state-of-art GPUs.
- Fujitsu is actively engaged in joint research into quantum technology with various academic research institutes and partners, including the joint development of a superconducting quantum computer with RIKEN. Fujitsu plans to deliver quantum computing for research projects jointly with Riken starting in 2023.
- Fujitsu has also developed [the world's fastest quantum computer simulator](#), which runs on HPC infrastructure. It is also working with partners to develop practical applications that exploit the superpower of quantum technology. One of Fujitsu's key strengths is that these R&D activities are conducted worldwide, at sites in Japan, North America, Europe, China and beyond – working with world-class research institutions.

- Cost and skills shortages remain significant obstacles for many companies and organizations aiming to apply advanced computing technologies. To address this issue, starting in Japan, Fujitsu is rolling out easy access to a range of services under its new [Fujitsu Computing as a Service \(CaaS\)](#) portfolio. These enable users from a wide range of industries to easily tap into the power offered by Fujitsu's advanced computing technologies without the need to commit to substantial, long-term investment.
- Fujitsu has also commercialized the Digital Annealer, which is now available as an optimization service. This uses quantum-inspired technology to solve combinatorial optimization problems at high speed. The Digital Annealer employs an annealing method (algorithm specific to combinatorial optimization problems) implemented on purpose-built hardware based on digital circuit technology (CMOS).

### Fujitsu quotes on advanced computing

- Naoki Akaboshi, SVP, Head of Computing Laboratory Research Unit Fujitsu Limited, says: "The smart society we live in today, underpinned by the advent of the digital age, relies on computers' ability to solve increasingly complex business problems, with a significant impact on processing workloads. The siting of computing power has also shifted fundamentally – moving away from data centers to widely distributed mobile and edge devices. As computing demands grow across every segment of society, faster computers are absolutely critical if these are to be met."
- Vivek Mahajan, Corporate Executive Officer, SEVP and Chief Technology Officer, Fujitsu Limited, comments: "Fujitsu Computing-as-a-Service will provide customers with seamless access to services on the public cloud to meet rapidly increasing computing demands, leveraging Fujitsu's world-leading advanced computing technologies. We look to further expand the portfolio with access to technologies like quantum computing in the future. This move marks an important milestone toward democratizing high-performance and quantum computing and will play an important role in achieving Fujitsu's Purpose – making the world more sustainable by building trust in society through innovation."
- Naoki Shinjo, Deputy Head of the Future Society & Technology Unit at Fujitsu Limited, states: "Fujitsu continues to work on a number of promising initiatives to leverage the potential of Fugaku for the good of humanity, including close collaboration with RIKEN on R&D to explore new fields in the drug discovery process, combining Fugaku with Fujitsu's DeepTwin AI technology, which accurately acquires quantitative characteristics from complex data by unsupervised learning. We look forward to working with RIKEN and others in the global scientific and technology communities to promote research that utilizes HPC technologies to contribute to the realization of Society 5.0, SDGs, and the realization of a decarbonized society."

### Reference customers

- [Fujitsu Japan Embarks on Joint Research for COVID-19 Therapies Using World's Fastest Supercomputer with Researchers of Research Center for Advanced Science and Technology, The University of Tokyo](#)
- [Fujitsu Leverages World's Fastest Supercomputer 'Fugaku' and AI to Deliver Real-Time Tsunami Prediction in Joint Project](#)
- [Fujitsu Quantum-Inspired Optimization Services Cut Traffic Jams and CO2 Emissions at Hamburg Port](#) [Relevant Fujitsu Products/](#)

### Milestones

- [Looking Back on Supercomputer Fugaku Development Project](#)

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### Further reading

- [Transforming Society in the Digital Age with the World's Most Advanced Computing](#)
- [Fugaku and associated technologies help to solve major challenges in the world today](#)
- [Fujitsu Supercomputer PRIMEHPC: High-performance, highly scalable, highly reliable, superior power-saving supercomputer](#)
- [Fujitsu Computing as a Service \(CaaS\)](#)
- [Supercomputer Fugaku retains first place worldwide in HPCG and Graph500 rankings](#)
- [Supercomputer Fugaku CPU A64FX Realizing High Performance, High-Density Packaging, and Low Power Consumption](#)

- [One researcher's quest for life-saving breakthroughs in tsunami flooding prediction using supercomputer Fugaku and AI: FUJITSU BLOG – Global](#)
- [Taking on the challenge of COVID-19: The birth of six-dimensional interconnect technology for the supercomputer Fugaku \(part 1\): FUJITSU BLOG - Global](#)
- [Supercomputer Fugaku: Fujitsu Global](#)
- [Documents – Supercomputer Fugaku: Fujitsu Global](#)
- [How supercomputer technology is improving everyday life: FUJITSU BLOG - Global](#)

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