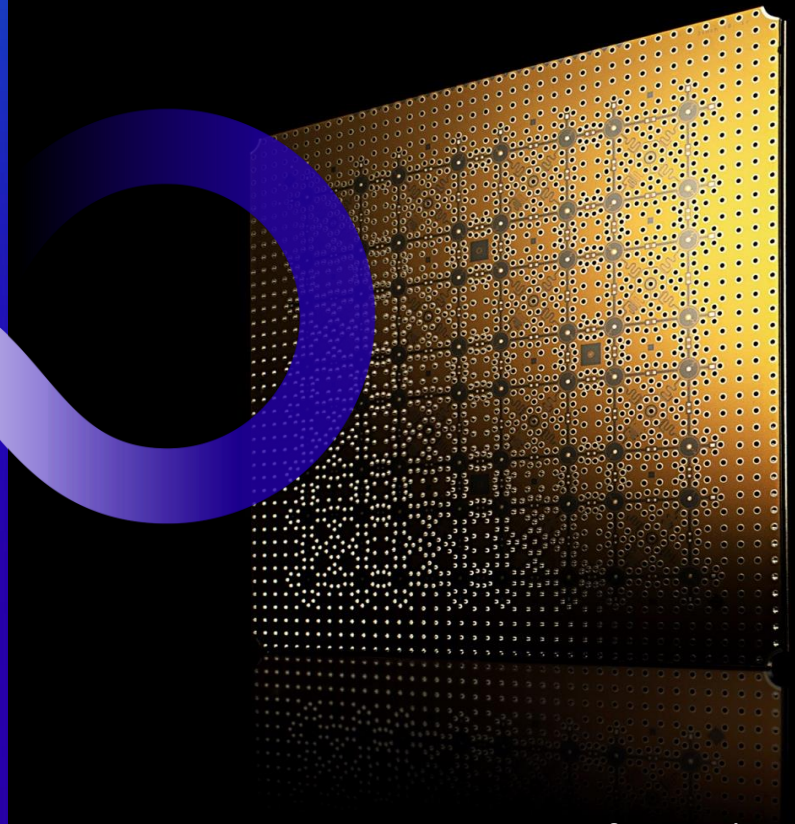
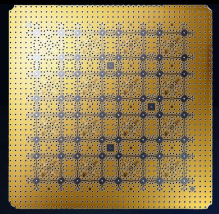
Welcome to the world of ”Quantum Computing”



Release of a 64-qubit System (Oct. 5, 2023)

https://pr.fujitsu.com/jp/news/2023/10/5.html

- Collaboration with Prof. Nakamura



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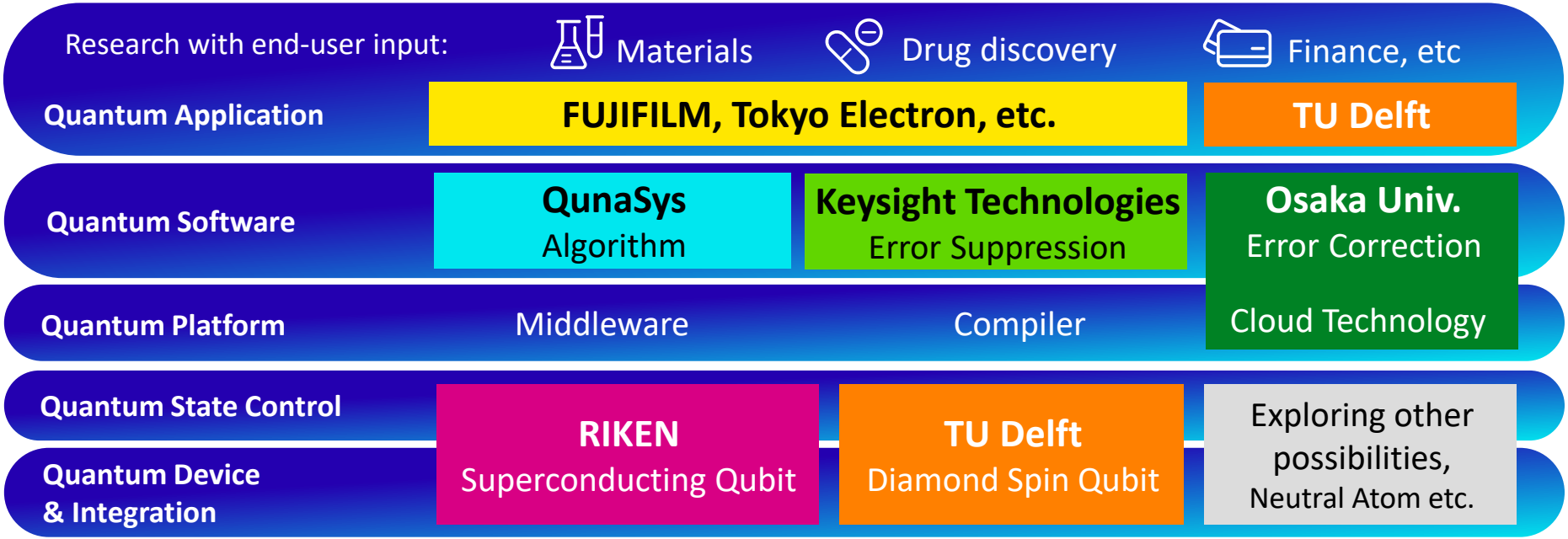
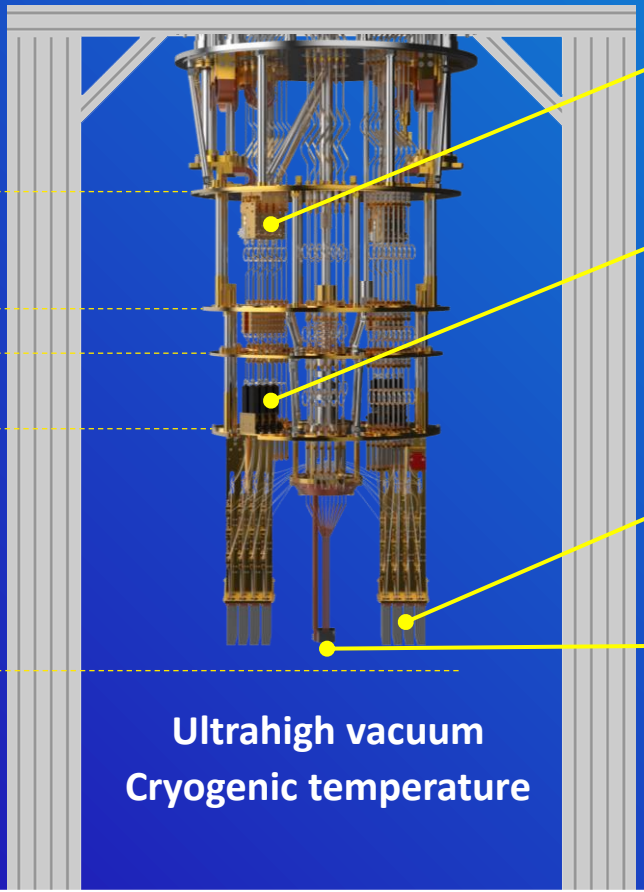
- Developed Japan's second domestic quantum computer at RIKEN RQC-Fujitsu Collaboration Center
- Plan to develop applications with end users mainly in the industry using this system

Fujitsu's Strategy for Quantum Computing

- Cover all the technology layers with the world's leading research institutions
- Put emphasis on software technologies, while working on several types of hardware
- Utilize Fujitsu Hybrid Quantum Computing Platform to develop applications with early input form end users



FUJITSU



50K

4K

1K

100mK

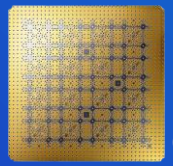
20mK
(Colder than space)

HEMT amplifier

High frequency filter

Cryogenic amplifier

Superconducting
Qubit Chip



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Ultrahigh vacuum
Cryogenic temperature

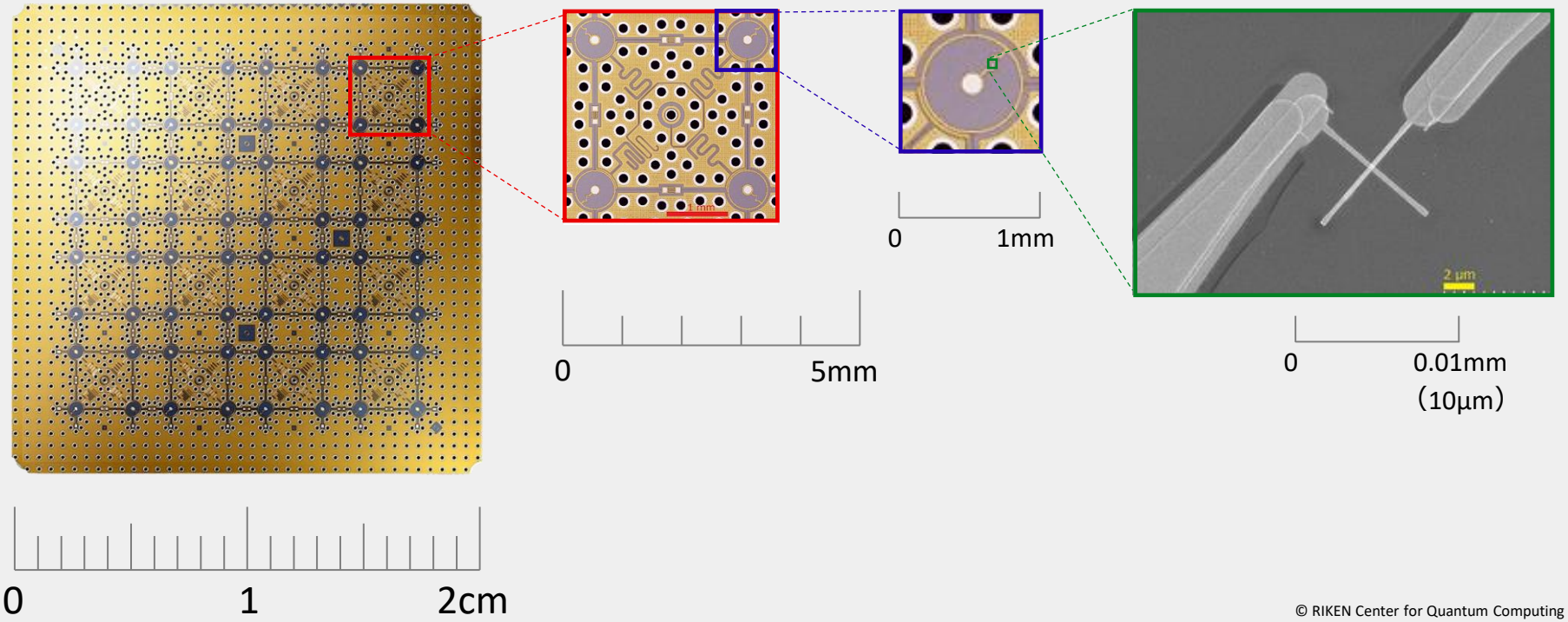
275cm

175cm

8 x 8

= 64 Qubit

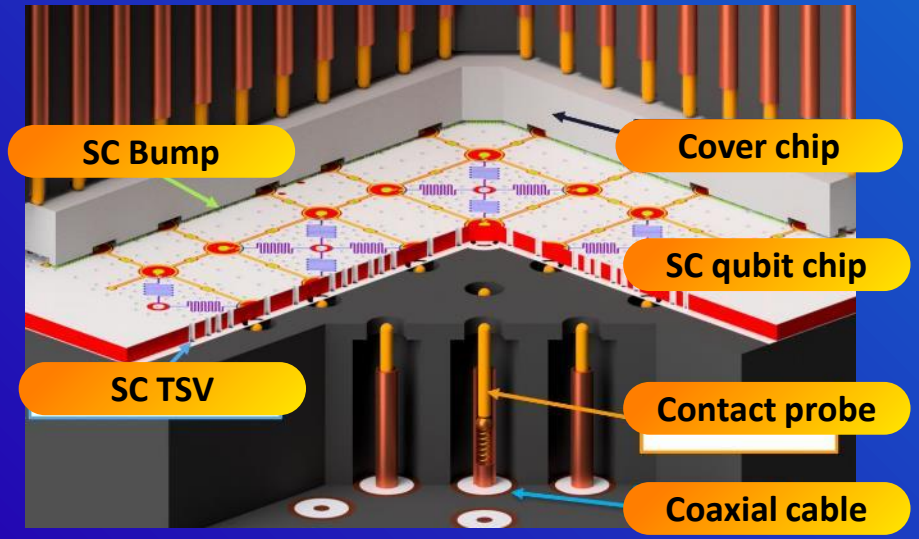
1 Qubit



Superconducting Qubit Technology: Scalable Qubit Chip Design

RIKEN QUANTUM COMPUTING FUJITSU

3D Contact structure



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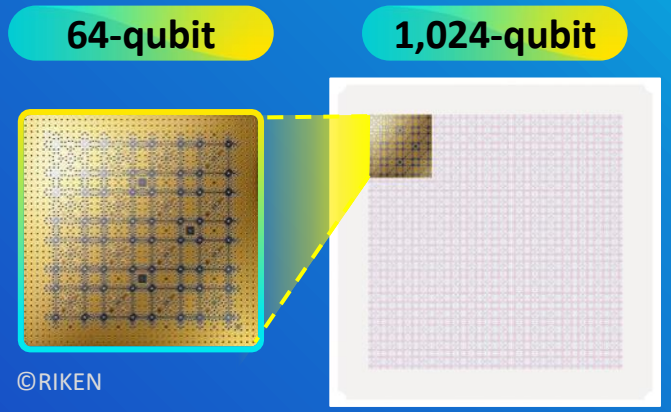

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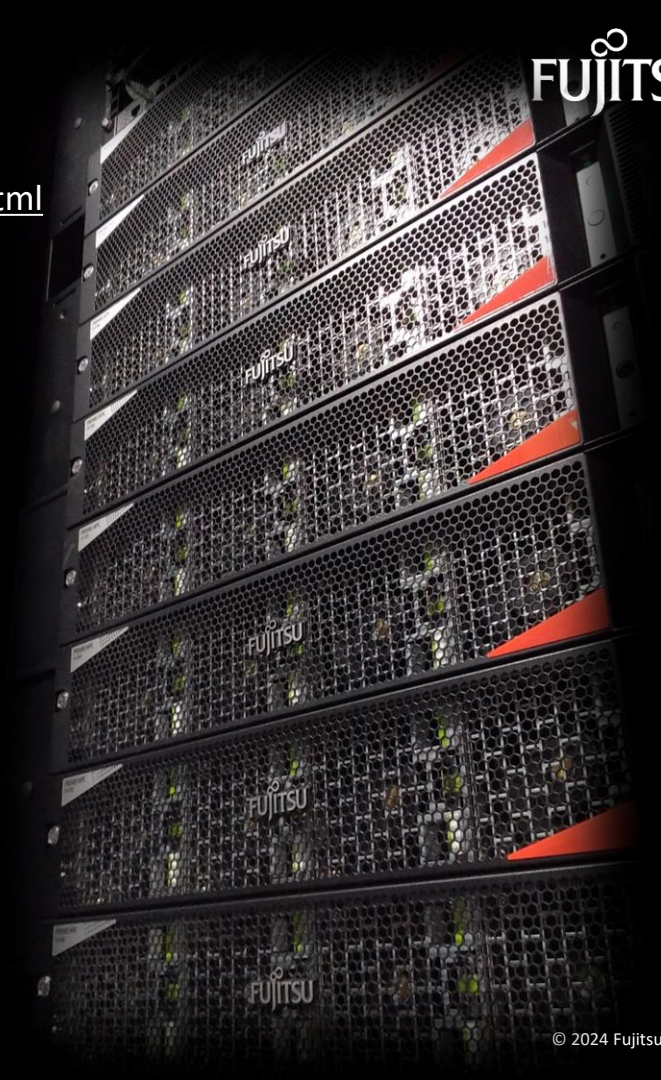
Can scale up by tiling basic units

40-qubit Quantum Computer Simulator

https://pr.fujitsu.com/jp/news/2024/02/19.html

- The world largest-class state vector simulator on PRIMEHPC FX700 cluster as a permanent dedicated system

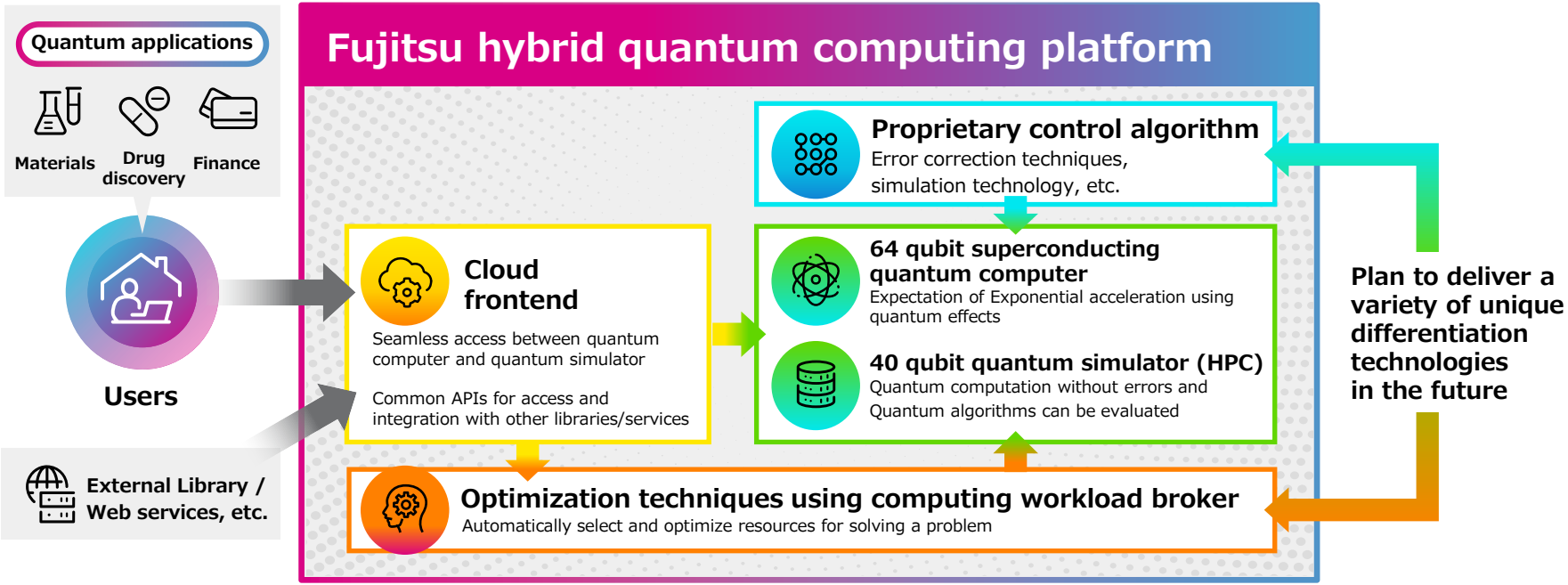
- Research on new-type simulators for larger scale
  - ✓ Tensor Network simulator with Barcelona Supercomputing Center
  - ✓ Decision Diagram simulator with the Univ. of Tokyo



Fujitsu Hybrid Quantum Computing Platform

- Seamless operation between quantum computer and quantum simulator
- Development of computational methods that take advantage of both quantum computers and quantum simulators

https://pr.fujitsu.com/jp/news/2023/10/5.html

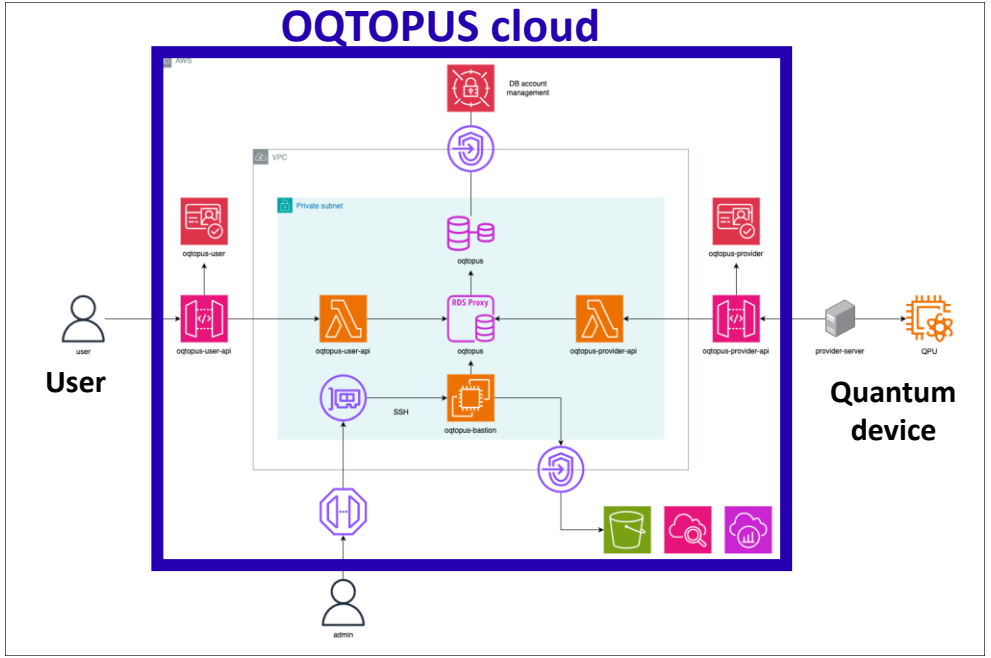


Release of platform software as OSS

- Fujitsu has released Quantum Computing as a Service: QCaaS **“OQTOPUS Cloud”** as open source with University of Osaka.

https://github.com/oqtopus-team/oqtopus-cloud

- ✓ Based on Fujitsu’s and Osaka Univ.’s quantum cloud computing platform
- ✓ Has fundamental capability of user/task/device management
- ✓ APIs for users to submit their task written in openQASM and for quantum device to receive the task and return the result
- ✓ Can be deployed easily on AWS by IaaC (Infrastructure as a code)



Quantum Simulator Challenge

- Competition for the development of quantum applications utilizing a large-scale quantum simulator, conducted from Feb. to Sep 2023.
- Participation of 34 teams from 17 countries
- The winners awarded at “Fujitsu Quantum Day” on Jan. 25th in Delft, Netherlands.

We are holding the 2nd competition in 2024!

https://pr.fujitsu.com/jp/news/2024/01/25.html

https://www.linkedin.com/feed/update/urn:li:activity:7215023650394005504/

Our First Commercial Quantum Computer

FUJITSU

Fujitsu to introduce superconducting quantum computer system at National Institute of Advanced Industrial Science and Technology

First order for commercial quantum computer system as Japanese vendor

Fujitsu Limited

Kawasaki, June 18, 2024

Fujitsu today announced that it has received an order for a gate-based superconducting quantum computer from the National Institute of Advanced Industrial Science and Technology (AIST) on May 15, 2024.

Fujitsu established the RIKEN RQC-Fujitsu Collaboration Center in April 2021 and has been conducting joint research with RIKEN aimed at scaling-up superconducting quantum computers. The new superconducting quantum computer is a system that Fujitsu has put into practical use by utilizing technology cultivated at the RIKEN RQC-Fujitsu Collaboration Center. It is scheduled to be operated by the Global Research and Development Center for Business by Quantum-AI technology (G-QuAT) of AIST in early 2025. This is the first time that a Japanese vendor has received an order for a commercial quantum computer system.

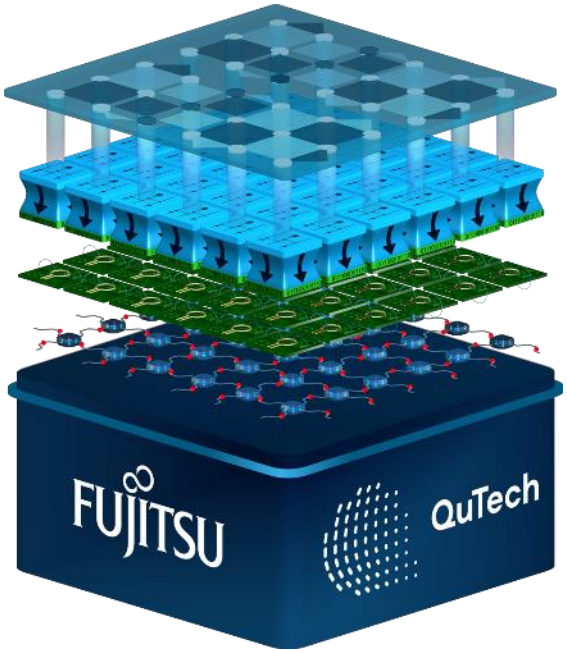
Press release:
https://pr.fujitsu.com/jp/news/2024/06/18.html

will be delivered in early 2025

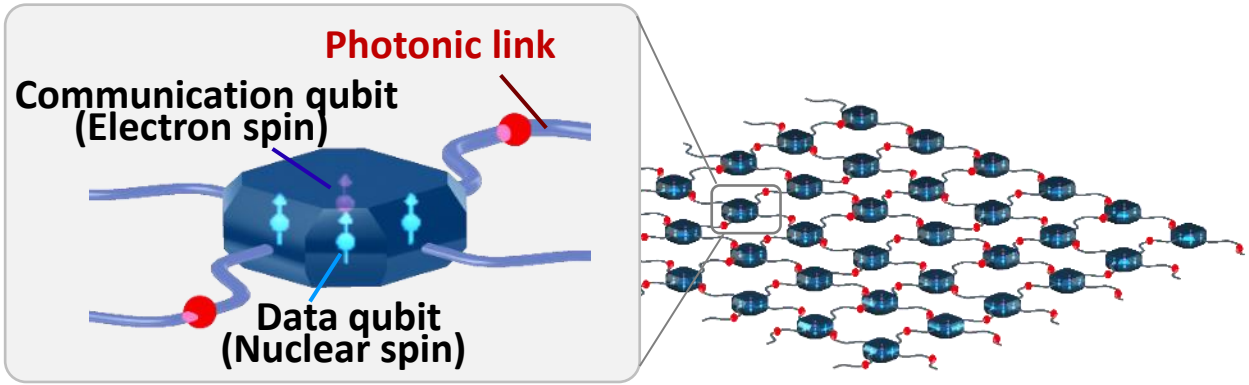
Diamond-Spin Modular Technologies for Scalable Quantum Computer

FUJITSU

- Collaboration research with TU Delft/QuTech
- Diamond-spin modules can be connected with photonic links and operate at relatively high temperature (> 1k), enabling a smaller refrigeration system.
- This approach can offer good scalability.



Modular architecture



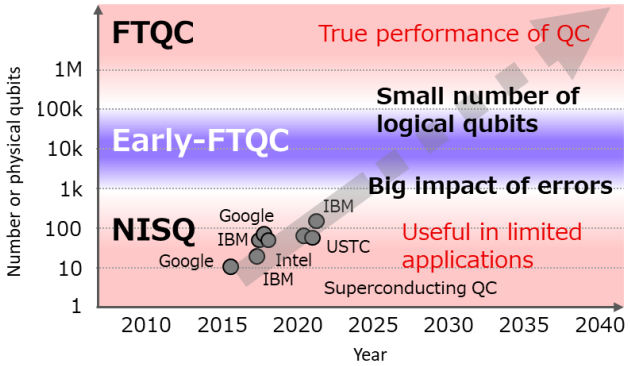
FUJITSU TU Delft Delft University of Technology QuTech

Newly Developed Quantum Computing Architecture

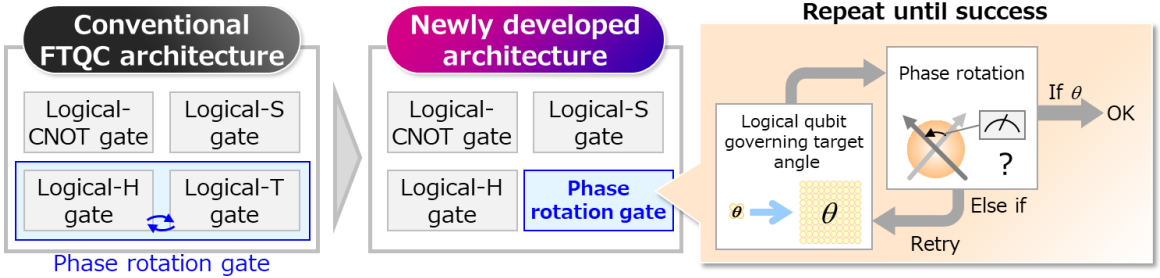
大阪大学 OSAKA UNIVERSITY FUJITSU

https://pr.fujitsu.com/jp/news/2024/08/28.html

- In the early-FTQC era, sufficient performance cannot be demonstrated with current approaches to NISQ and FTQC.
- Introducing a new type of phase rotation gate, instead of conventional T-gate, into a universal quantum gate set



NISQ: Noisy Intermediate-Scale Quantum computer
FTQC: Fault-Tolerant Quantum Computer



Y. Akashoshi, et al., arXiv:2408.14929 (2024).
R. Toshio, arXiv:2408.14848 (2024)

Practical calculation, a material energy estimate, would be possible using only 60,000 qubits!

About the Future

To release large-scale simulators and actual machines successively in order to solve societal problems

2023.7 Released a high-speed and large-scale 40 qubit quantum simulator

2023.10 Released a superconducting quantum computer (64 qubits) at the RIKEN RQC- Fujitsu Cooperation Center

Fault-Tolerant Quantum Computer

2025.3 To release of a larger-scale superconducting quantum computer (256 qubits)

FY2026 To release a superconducting quantum computer with >1000 qubits

FY 2020 — 2030

Thank you