JÜLICH Forschungszentrum | JÜLICH SUPERCOMPUTING CENTRE

JSC'S QUANTUM COMPUTING STRATEGY

A quantum computing strategy with four pillars

· Modeling and emulation of quantum computers on supercomputers
· Provision
· High performance computing (HPC) - quantum computing (QC) integration
· Establishment of a hybrid HPC-QC user infrastructure - JUNIQ

Pillar I: Modeling and emulation of quantum computers (QC) on supercomputers

Development of software to
· validate designs for quantum processors;
· investigate the performance of quantum algorithms.

World Record

Emulator JUQCS "Jülich Universal Quantum Computer Simulator"

F. Arute, et al, Nature 574, 505–510 (2019)

Pillar II: Provision strategy

Quantum annealer

Analog quantum computer with super-conducting qubits

Hosting since 2021

Quantum simulator

Analog quantum computer with neutral atom qubits

Hosting planned for December 2024

Quantum computer
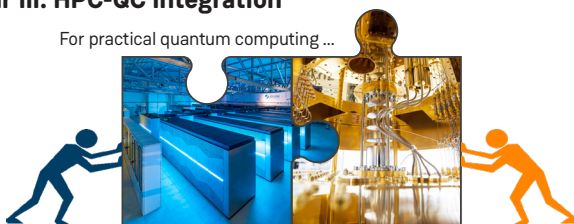
Digital quantum computer with trapped-ion qubits

Hosting and cloud access planned for 2025 - 2026

or superconducting qubits, …

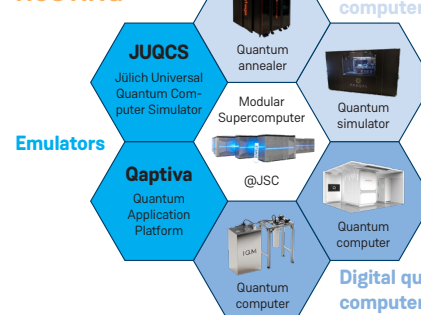Cloud access planned for 2024 - 2026

Pillar III: HPC-QC integration

For practical quantum computing …

the best of both computer technologies must be combined.

CPU Cluster Module · GPU Booster Module · Data Storage Module · Modular Supercomputer @JSC · Quantum Module · Neuromorphic Module · Data Analytics Module

· Pursue the tightest integration of quantum computers in HPC;
· The modular supercomputer architecture is ideal to integrate quantum computer functionality into HPC workflows.

Pillar IV: Establishment of a hybrid HPC quantum computing user infrastructure - JUNIQ

Federal Ministry of Education and Research | Ministry of Culture and Science of the State of North Rhine-Westphalia

HOSTING

JUQCS Jülich Universal Quantum Computer Simulator

Emulators

Qaptiva Quantum Application Platform

@JSC

Analog quantum computers — Quantum annealer, Modular Supercomputer, Quantum simulator

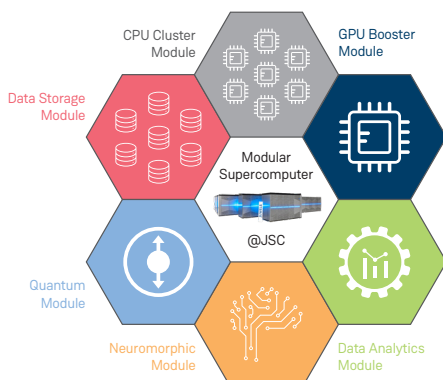Digital quantum computers — Quantum computer, IQM Quantum computer

CLOUD ACCESS

· QC user facility for science and industry;
· Installation, operation and provision of QCs;
· Unified portal for access to QC emulators and to QC devices at different levels of technological maturity;
· Development of algorithms and prototype applications;
· Services, training and user support;
· Modular quantum-HPC hybrid computing.

Rolling Call for peer-reviewed access: go.fzj.de/juniq

Contact: k.michielsen@fz-juelich.de | Website: go.fzj.de/juniq

Member of the Helmholtz Association