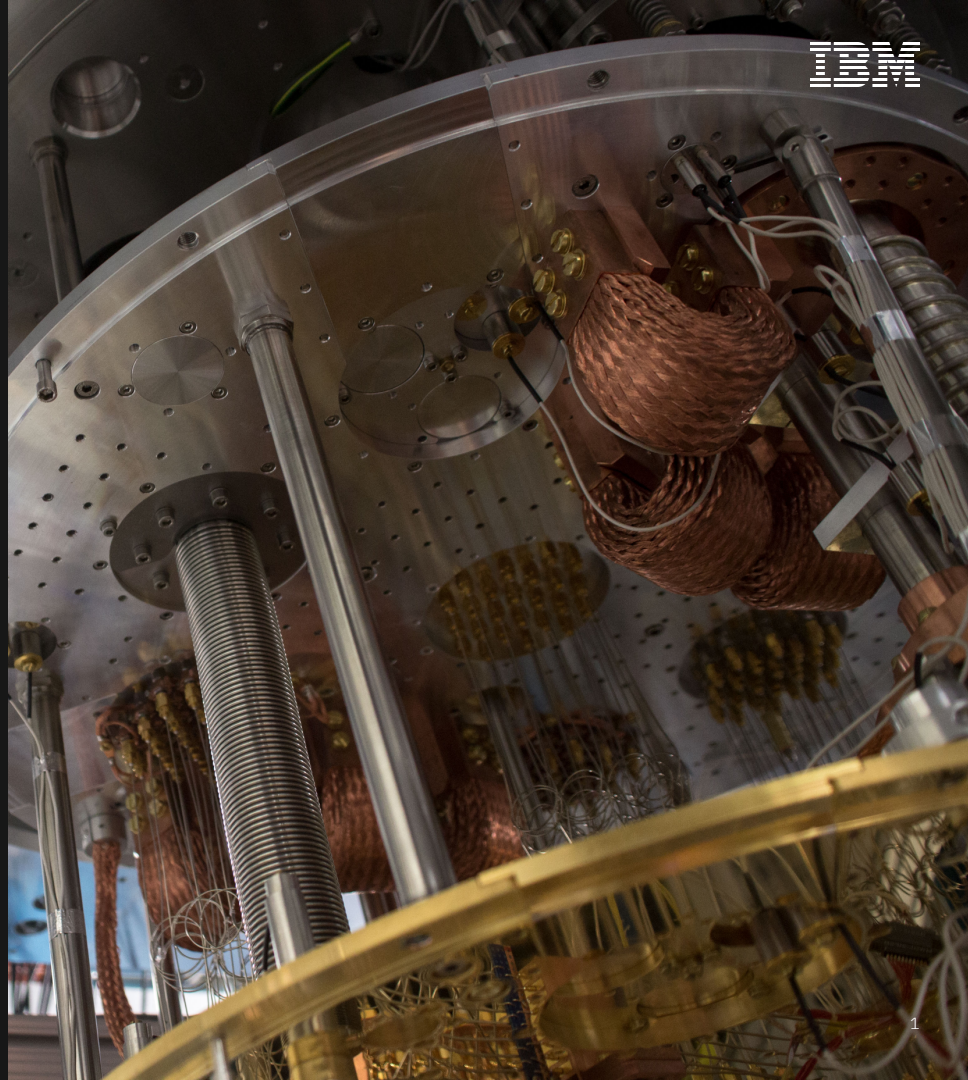
Quantum Computing

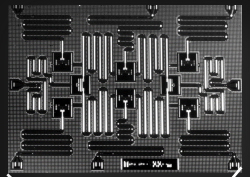
Federico Mattei

IBM Quantum Ambassador

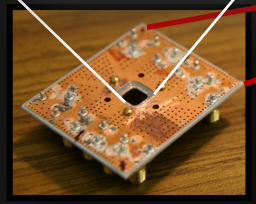


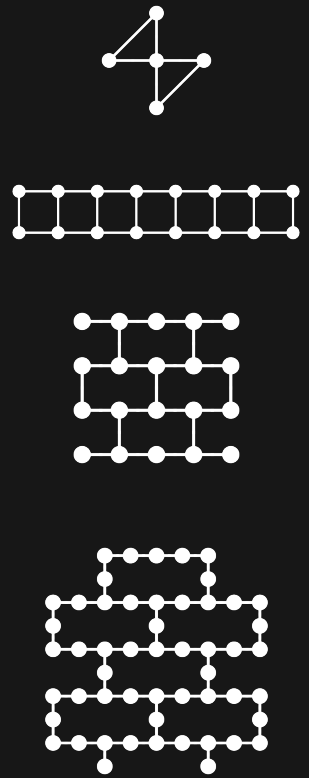
Inside an IBM Q quantum computing system

Qubits on chip



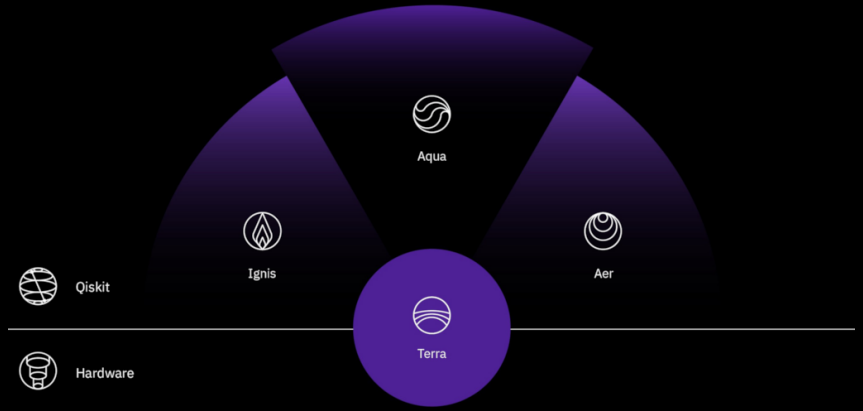
Circuit board





Development of quantum systems since 2016

Advanced programming tools for quantum developers



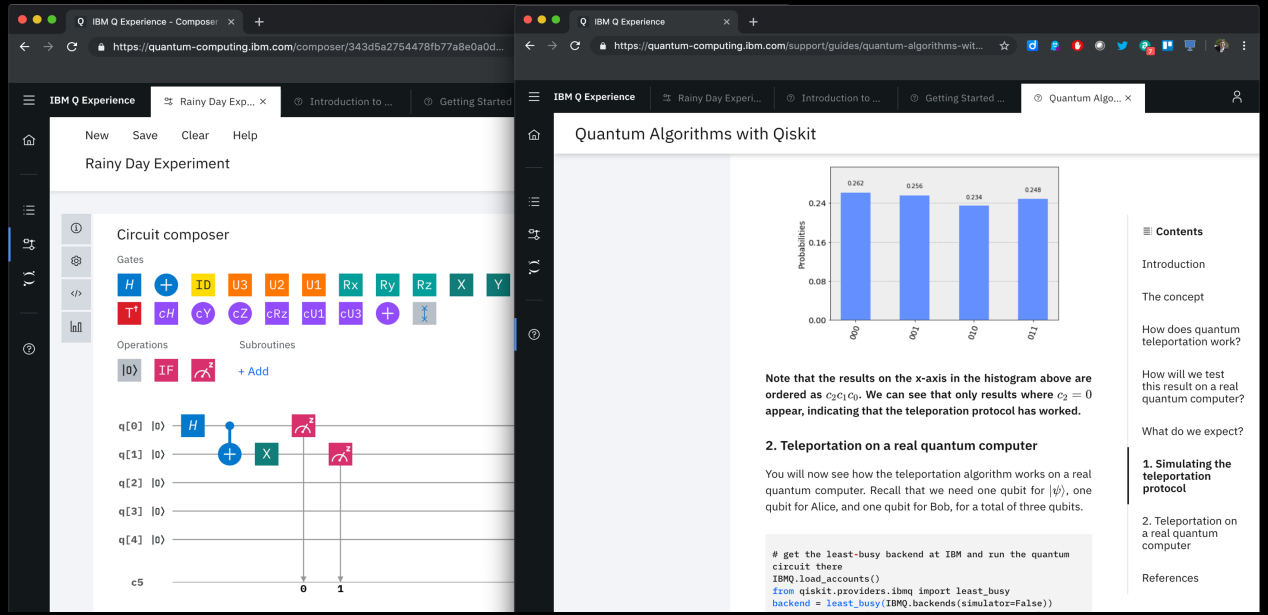
Over 155k users

200 third-party papers

29 million experiments

Graphically build, debug, and run quantum circuits on IBM Q hardware systems and simulators.

Programming with Qiskit is seamlessly integrated into the platform – work is saved in the cloud and tools are automatically updated.



With quantum computers, we can tackle problems in entirely new ways

1. Model physical **processes** of nature
2. Perform significantly **more scenario** simulations
3. Obtain **better optimization** solutions
4. Find **better patterns** within AI/ML processes

Thank you

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IBM Q publications and websites

IBM Q and the IBM Q Experience
http://ibm.com/quantum-computing

Qiskit
https://qiskit.org

Quantum Volume advancement
https://newsroom.ibm.com/2019-03-04-IBM-Achieves-Highest-Quantum-Volume-to-Date-Establishes-Roadmap-for-Reaching-Quantum-Advantage

Open Pulse Development
https://arxiv.org/pdf/1809.03452.pdf

Error Mitigation
https://www.nature.com/articles/s41586-019-1040-7

IBM Q publications (Chemistry/ML/AI/Finance)

Quantum Chemistry
https://www.nature.com/articles/nature23879
https://arxiv.org/abs/1906.10675. (IBM, Keio, and Mitsubishi Chemical)

Quantum Machine Learning
https://www.nature.com/articles/s41586-019-0980-2

Quantum AI
https://arxiv.org/abs/1906.10467 (Keio, Mitsubishi Chemical, MIzuho, MUFG)

Quantum Finance: Risk analysis
https://www.nature.com/articles/s41534-019-0130-6

Quantum Finance: Generative adversarial networks
https://arxiv.org/abs/1904.00043

Quantum Finance: Amplitude estimation w/o QPE (IBM, Keio Univ, MUFG and Mizuho joint paper)
https://arxiv.org/abs/1904.10246

Quantum Finance: Credit risk analysis
https://arxiv.org/abs/1907.03044

Quantum Finance: Option pricing (IBM and JP Morgan Chase joint paper)
https://arxiv.org/abs/1905.02666

Quantum Finance: Portfolio optimization
https://arxiv.org/abs/1907.04769

Quantum Finance: Qiskit finance
https://github.com/Qiskit/qiskit-tutorials/blob/master/qiskit/finance/index.ipynb

IBM Q Expert Insights

“Exploring quantum computing use cases for manufacturing” — June 2019
https://www.ibm.com/thought-leadership/institute-business-value/report/quantum-manufacturing

“Getting your financial institution ready for the quantum computing revolution” — April 2019
https://www.ibm.com/downloads/cas/MBZYGRKY

“Building your quantum capability: The case for joining an ecosystem”” — Feb 2019
https://ibm.co/quantumeco

“Coming soon to your business: quantum computing - Five strategies to prepare for the paradigm-shifting technology”
ibm.biz/quantumstrategy

“Wielding a double-edged sword: Preparing cybersecurity now for a quantum world” — July 2018
ibm.biz/quantumsecurity

“Taking the Quantum Leap: Why now?” — February 2018
https://www-935.ibm.com/services/us/gbs/thoughtleadership/quantumleap/