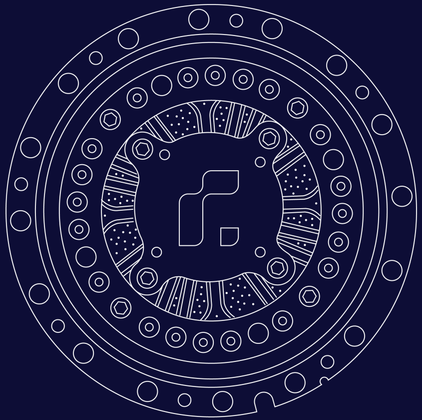

Superconducting Quantum Computing:

Building on Decades of Semiconductor Innovation for Transformative Computational Power

Dr. Subodh Kulkarni
CEO, Rigetti Computing
July 10, 2024

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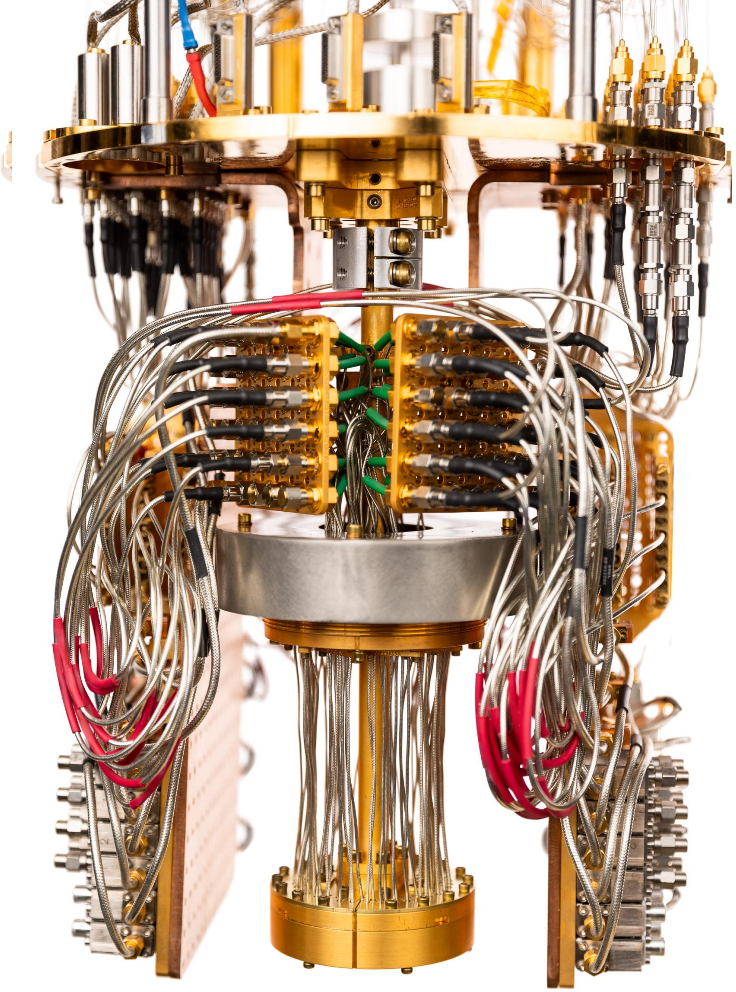
Why Quantum Computing?

We believe quantum computing has the potential to

- Enable computing power (2^N) magnitudes higher than classical systems ($2*N$)
- At significantly less energy
- Solve problems that are unsolvable with classical systems



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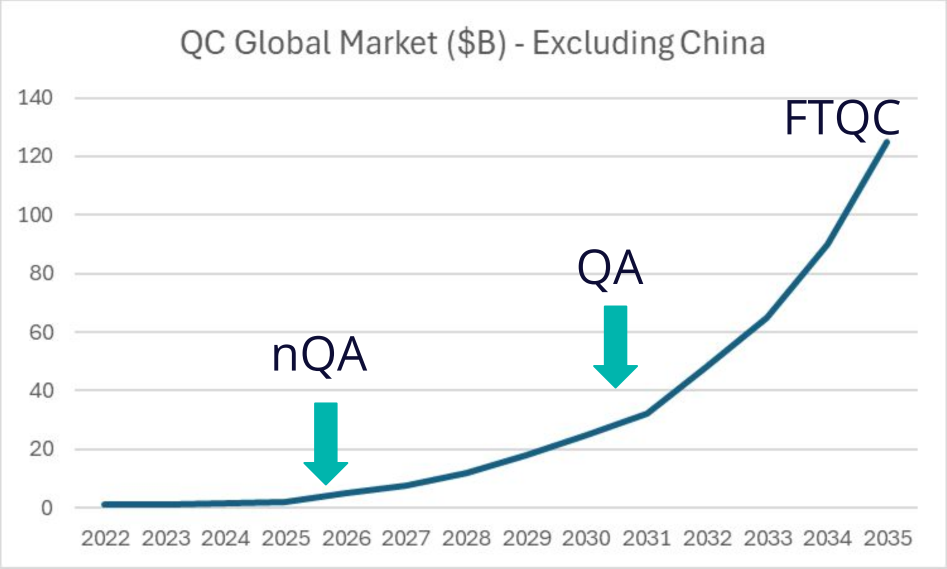
Quantum Computing Market Potential

- Expected to grow from $1.1 billion in 2022 to $7.6 billion in 2027[1] - Mostly government spending (excludes China)
- Beyond 2035, quantum computing is expected to become fault tolerant (FTQC) and $100+B market[2] - Mostly commercial customers
- **Key inflection points**
  - narrow Quantum Advantage (nQA) when quantum computers are better in performance/cost for some practical applications - in 2-3 years
  - QA when quantum computers are better for most practical applications - in 6-8 years



Data compiled using external analyst reports [1, 2, 3]

[1] IDC Worldwide Quantum Computing Forecast, 2023–2027: Surfing the Next Wave of Quantum Innovation
[2] BCG, "What Happens 'If' Turns to 'When' in Quantum Computing", July 2021
[3] McKinsey, Quantum Technology Monitor, April 2024

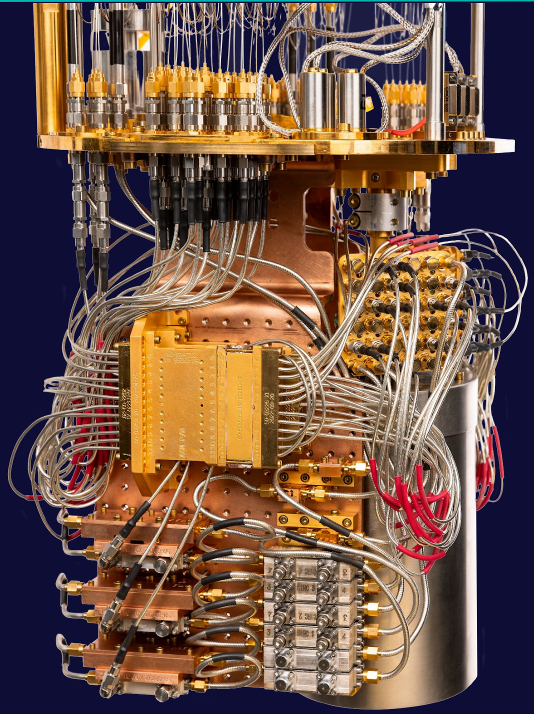
Today’s Quantum Computing Market

Governments are treating quantum computing as critical for national interests

$42B total government investment announced in 2024 — 26% increase from 2023[1]

Examples of government funded quantum computing programs

- **US:** National Quantum Initiative Act ($968M requested budget in FY 2024)
- **UK:** National Quantum Technologies Programme (£2.5B over 10 years)
- **India:** National Quantum Mission ($740M USD over 8 years)
- **European Union:** Quantum Technologies Flagship (€1B over 10 years)



Such programs foster innovation, collaboration with academia & industry, and workforce development

[1]McKinsey, Quantum Technology Monitor, April 2024

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Today's Quantum Computing Market

Early adopters in industry

Industry Use Cases

Finance → Optimize returns and risks for large financial portfolios; predicting recessions, etc.

Pharmaceutical → Aid drug discovery

Energy → Develop synthetic enzymes and catalysts for energy production

Logistics → Reduce fuel costs by optimizing vehicle routing

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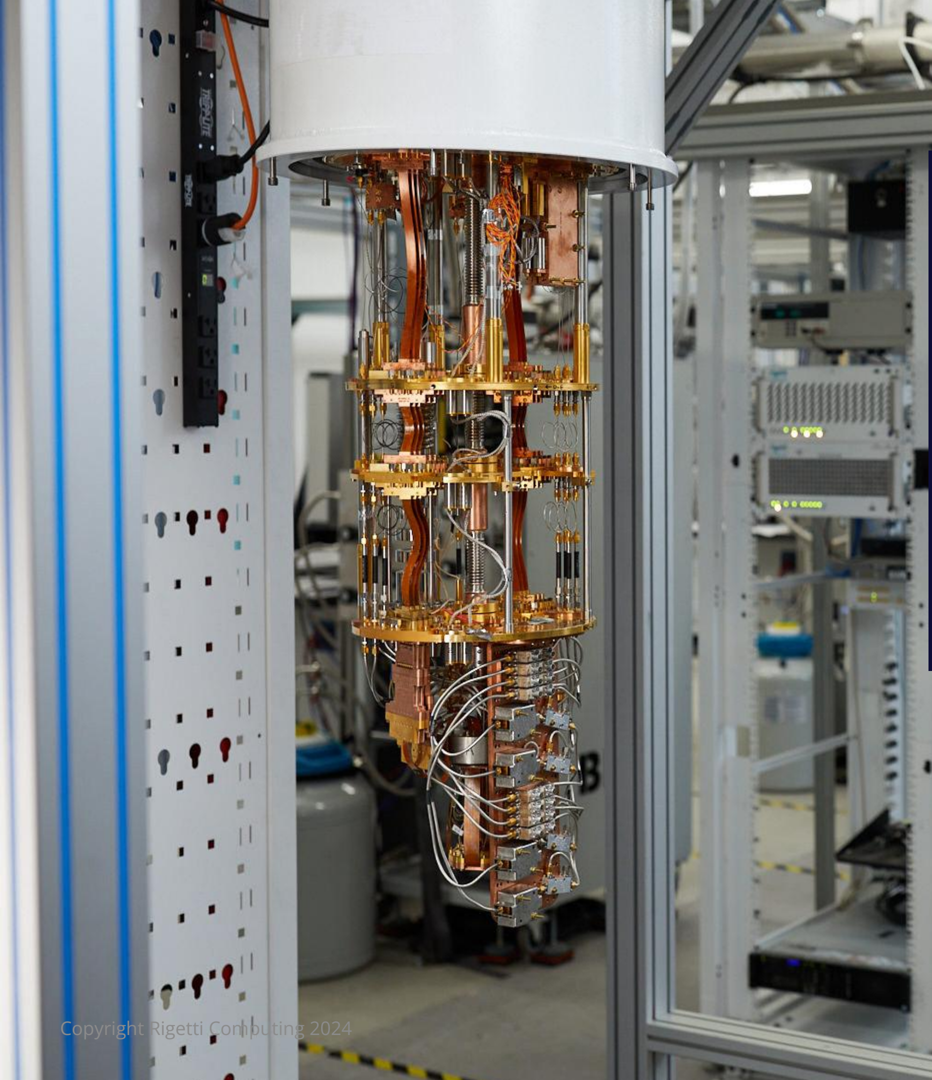
Multiple Modalities for Quantum Computing - We Believe Superconducting Modality is the Leader

- **Superconducting** (Rigetti, IBM, Google, Amazon, Fujitsu, IQM, QuantWare, Government of China, etc.)
  - Scalable - leverages semi experience, but with some new materials/processes
  - Fast gate speeds
  - Challenge - fidelity improvement (similar to early CMOS development)
  - Currently at about 100 qubits, 99-99.5% 2q fidelity, 50-100 ns gate speed
- **Trapped ions** (IonQ, Quantinuum, Oxford Ionics, etc.) and **Pure Atoms** (QuEra, Atom Computing, etc.)
  - High fidelity
  - Slow gate speed and scalability challenges
  - Currently at 25 qubits, 99.5% fidelity, 300-500 us gate speed
- **Photonics** (PsiQuantum, Xanadu, Government of China, etc.)
  - High fidelity and fast gate speed
  - Entanglement challenges
  - Currently at only <10 qubits
- **Spin/Quantum dots** (Intel, Diraq/GF, etc.)
  - Leverages conventional CMOS Fabs
  - Currently at only 10-15 qubits



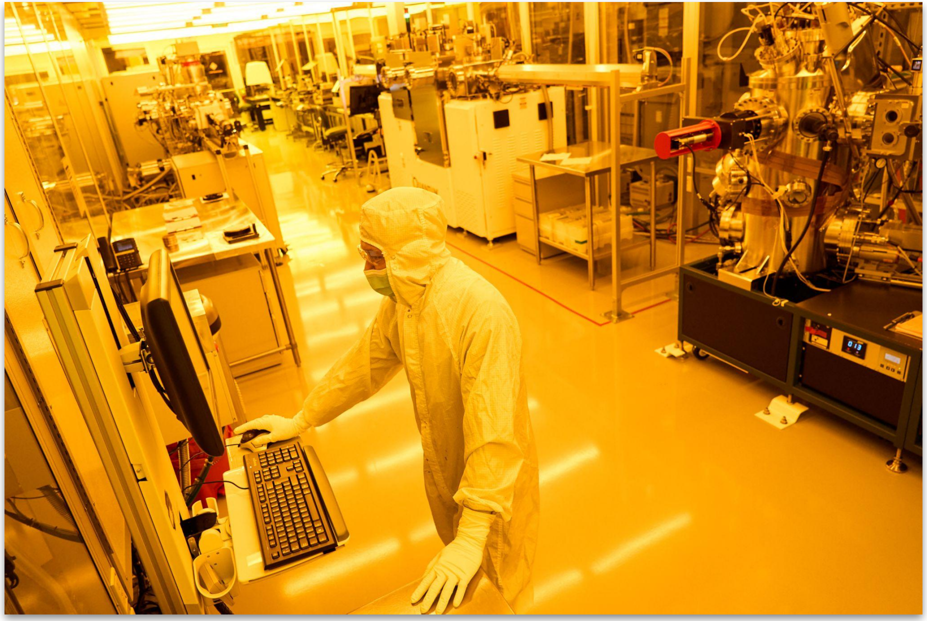
Rigetti's mission

Build the world's most powerful computers to solve humanity's most important and pressing problems

Rigetti Computing

A Pioneer in Superconducting Quantum Computing

Rigetti's quantum data center located in Berkeley, California



Rigetti's Fab-1, the industry's first dedicated quantum foundry, located in Fremont, California

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Pioneering Superconducting Quantum Technology

Rigetti at a Glance

2013
Founded

15
Deployed quantum systems to-date

70,000
Combined sq. ft. of facilities

132
Employees

49
PhDs

~200 patents

Currently at 84Q, 99.9% 1Q fidelity, 98% 2Q fidelity, 70 ns gate speed

Expected 84Q at 99+% 2Q fidelity by end of '24 and 300+Q at 99.x% fidelity by end of '25

- **2013** Rigetti founded as the first full-stack, universal pure-play quantum computing company
- **2014** Patented hybrid quantum-classical co-processor architecture
- **2015** Established Quantum Data Center in Berkeley, CA
- **2016** Rigetti's Fab-1 commissioned as first dedicated quantum chip fabrication facility unlocking vertical integration
- **2017** Rigetti deploys quantum computer over the cloud
- **2018** First hybrid cloud platform with QCS™ launch
- **2019** 32-qubit system launched on Amazon Web Services (AWS)
- **2020** Joins Fermilab's SQMS Center as lead industry partner
- **2021** First scalable quantum chip demonstrated based on Rigetti proprietary modular architecture
- **2022** Commercial availability of Aspen™-M 80-qubit system, the largest quantum computer on AWS
- **2023** Launches the Novera™ QPU, Rigetti's first commercially available QPU
- **2024** Ankaa™-2 achieves 98% median 2Q gate fidelity

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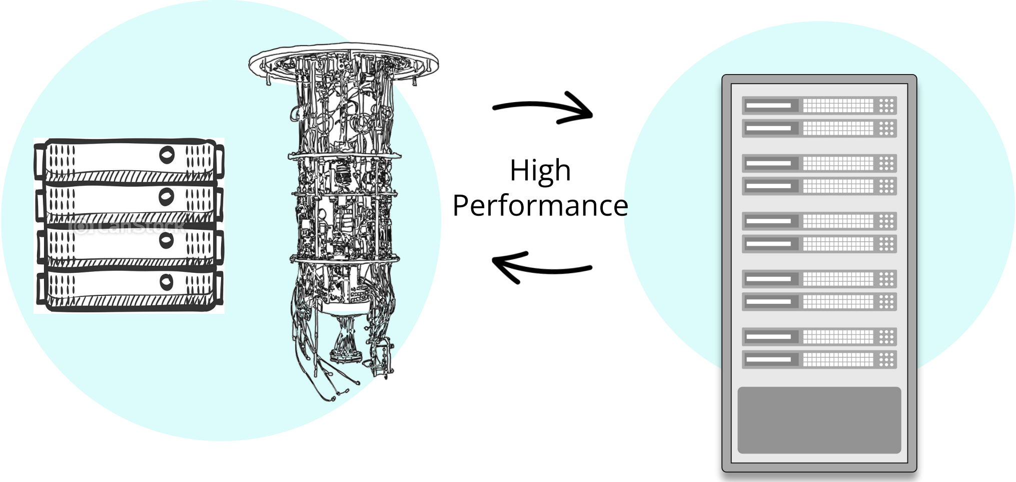
The Power of Hybrid Computing

Quantum computing can augment classical workflows for unprecedented computational power

Quantum Computing System | **Classical Computing System**



- We believe hybrid computing will leverage the best of quantum and classical computing, and is how quantum computers will become commercially successful
- Rigetti - Oak Ridge National Laboratory - Riverlane partnership to develop integration of quantum computers into HPC environments

Collaboration-Driven Approach to Innovation

Our close relationships with experts and leaders in the quantum ecosystem are crucial to **pushing the boundaries** of our technology -- and give us access to resources, use cases, and expertise necessary for **unlocking practical quantum computing**.

- ➔ Quantum **hardware provider of choice** by the UK's National Quantum Computing Centre, Air Force Research Lab, and Fermilab's SQMS Center
- ➔ Collaborating with HSBC, Standard Chartered Bank, ADIA Lab, and Moody's Analytics to develop **practical quantum computing uses cases for finance**
- ➔ Pursuing foundational research funded by DARPA to develop **benchmarks for quantum computing performance** and to develop quantum computers capable of solving complex optimization problems
- ➔ QPUs from Rigetti data centers **integrated into public cloud providers** like AWS, Microsoft Azure, and service providers like Strangeworks and QBraid
- ➔ Rigetti's **QCS® Direct cloud service** used by DOE, DOD, and enterprise customers like Fermilab, ADIA Lab, USRA, and NASA.
- ➔ Through our **Novera™ QPU Partner Program** we partner with leaders across cryogenics (Bluefors), control systems (Quantum Machines, Zurich Instruments), quantum error correction (Riverlane), quantum computing software (Horizon Quantum Computing, Classiq, Riverlane, Strangeworks, Q-CTRL), and integrators & service providers (ParTec, TreQ)

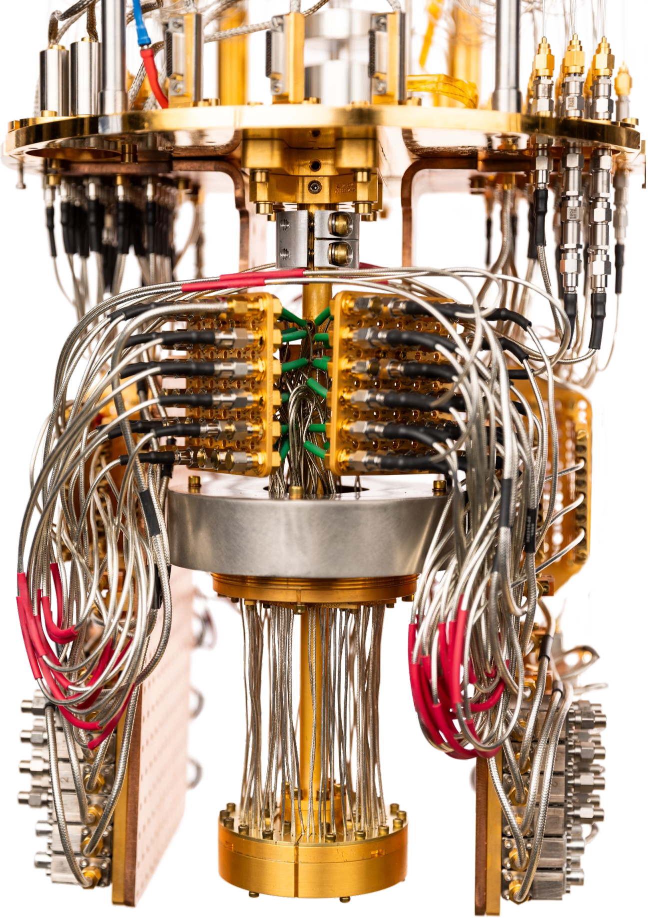
Enabling Hands-on Access to Quantum Technology

Full quantum computing systems

- 24-qubit and 84-qubit count
- Ideal for a flagship system

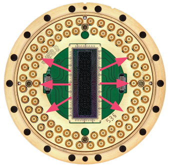
9-qubit Novera™ QPU

- Includes all hardware below the mixing chamber plate of a dilution refrigerator
- Suited for modular assembly with compatible control systems and cryogenics



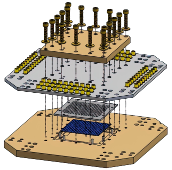
Proprietary Scaling Technology Unlocked by Fab-Driven Innovation

Vertical Signaling



2D
Signals routed laterally

vs

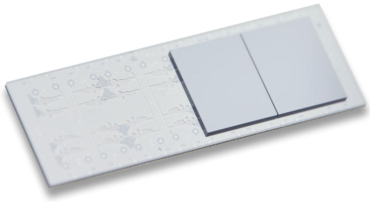


3D
Signals routed vertically

3D signal delivery enables high density, modular processor I/O and removes the need to redesign each new generation to accommodate signal line routing

+

Quantum Chiplet Technology

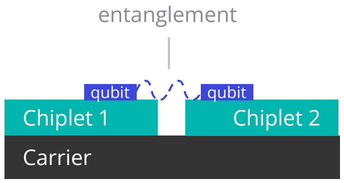


Modular assembly onto a carrier device enables:

- High fabrication yield, improved processor performance
- Potential for heterogeneous integration (specialized chips for processing, memory and networking)

+

Inter-Module Connectivity



(Cross section)

Low-latency connections provide high fidelity quantum entanglement between modules

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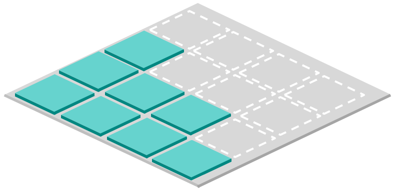
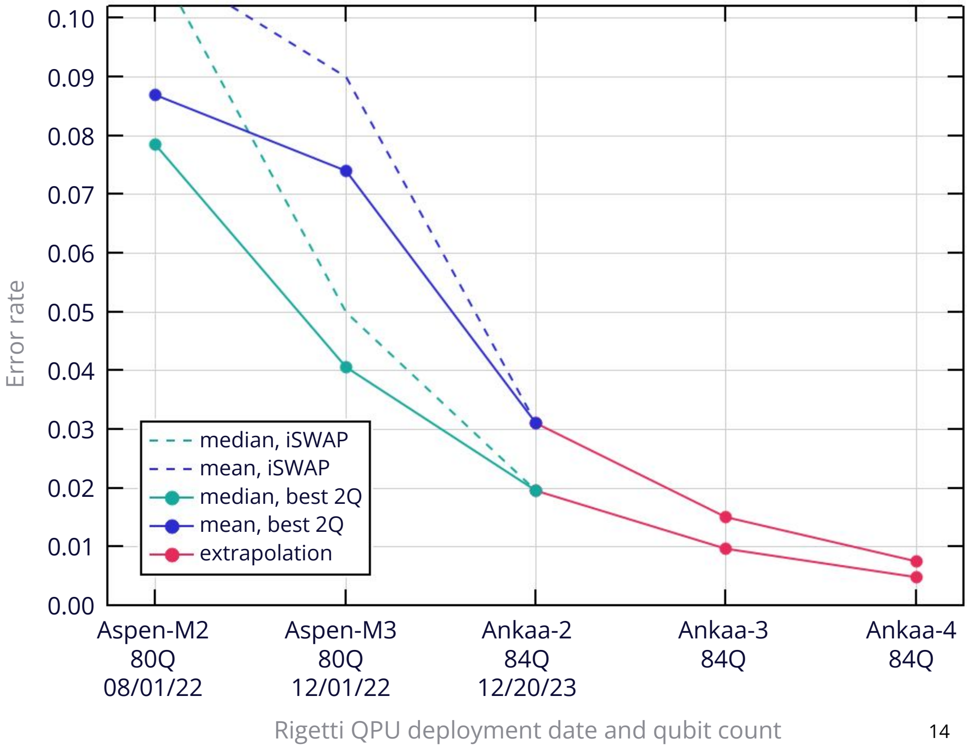
Rigetti's Scalable Architecture



Large-scale processors built from identical tiles provide a directly scalable architecture

Focus on Fidelity

Deployed QPU Performance



Designing high performing Superconducting qubits

Similar to CMOS development in early days

Most challenges are engineering-related and can be addressed with regular pareto analysis and resolution

Rigetti QPU error rates reduced by 2.5X with transition to new chip architecture enabled by Fab-1 capabilities

Transition from fixed couplers on an octagon-shaped lattice to tunable couplers on a square lattice

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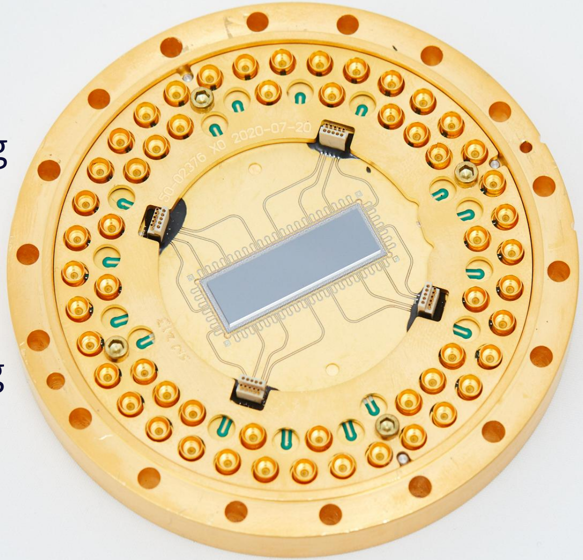
Fabricating Superconducting Quantum Computing Chips

One of the most developed modalities. Superconducting quantum computing chips leverage mainstream semiconductor fabrication techniques such as optical lithography, sputter deposition, and plasma etching.

Unique requirements. Deposition of and processing of superconducting materials, utilization of liftoff processes in conjunction with PVD, and dedicated microwave signaling and I/O connection apparatus.

Necessity for captive foundry. Synchronized design → fabrication → test flywheel is critical to enable performance improvement necessitating either a captive fab or a close foundry relationship.

To realize the full power of quantum computing, continued performance improvement and scaling are needed. For NISQ-era superconducting devices comprising around 100 qubits, cost effective fabrication requires 6 or 8 inch wafer processing tools.



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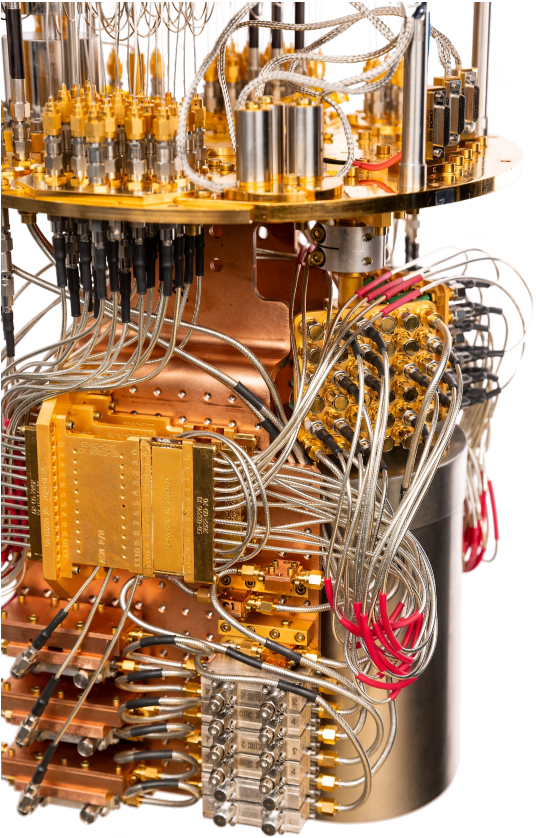
Next Steps for Commercializing Quantum Computing



- → Grow on-premises quantum computing market
- → Workforce development
- → Increased government funding
- → Accelerate industry adoption
- → Diversify opportunities for large-scale quantum computing programs

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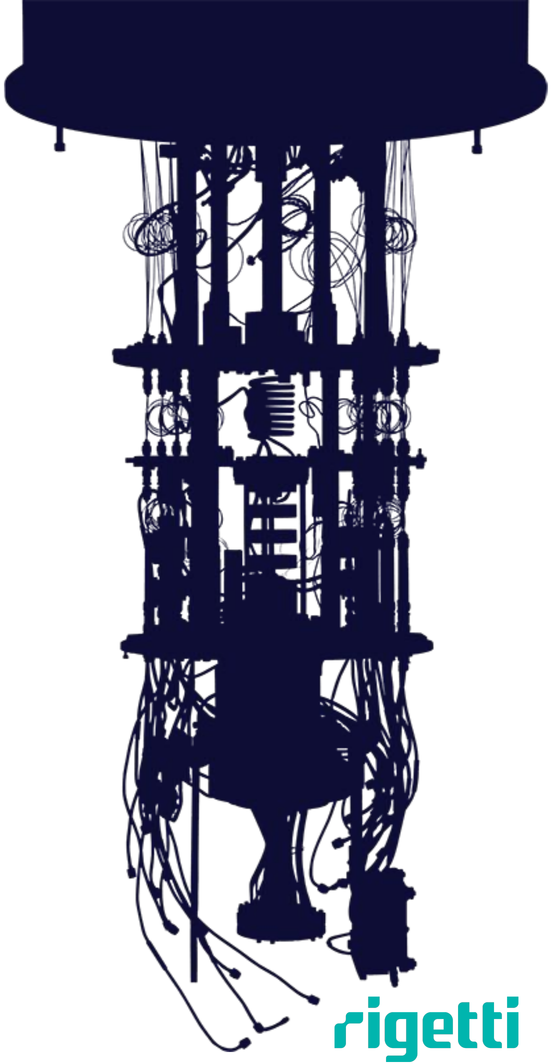
Looking to the Future

Practical quantum computing is poised to happen in the next few years and have significant commercial potential - could be disruptive to those who fall behind

Global governments are treating quantum computing as strategic for national interests and are investing aggressively



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