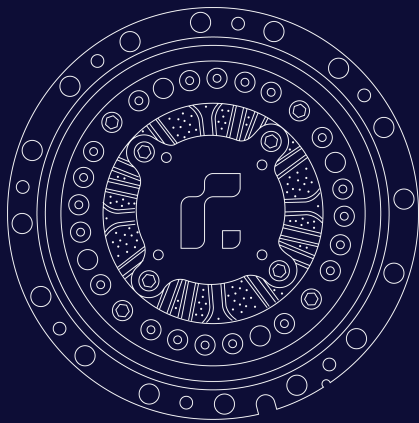


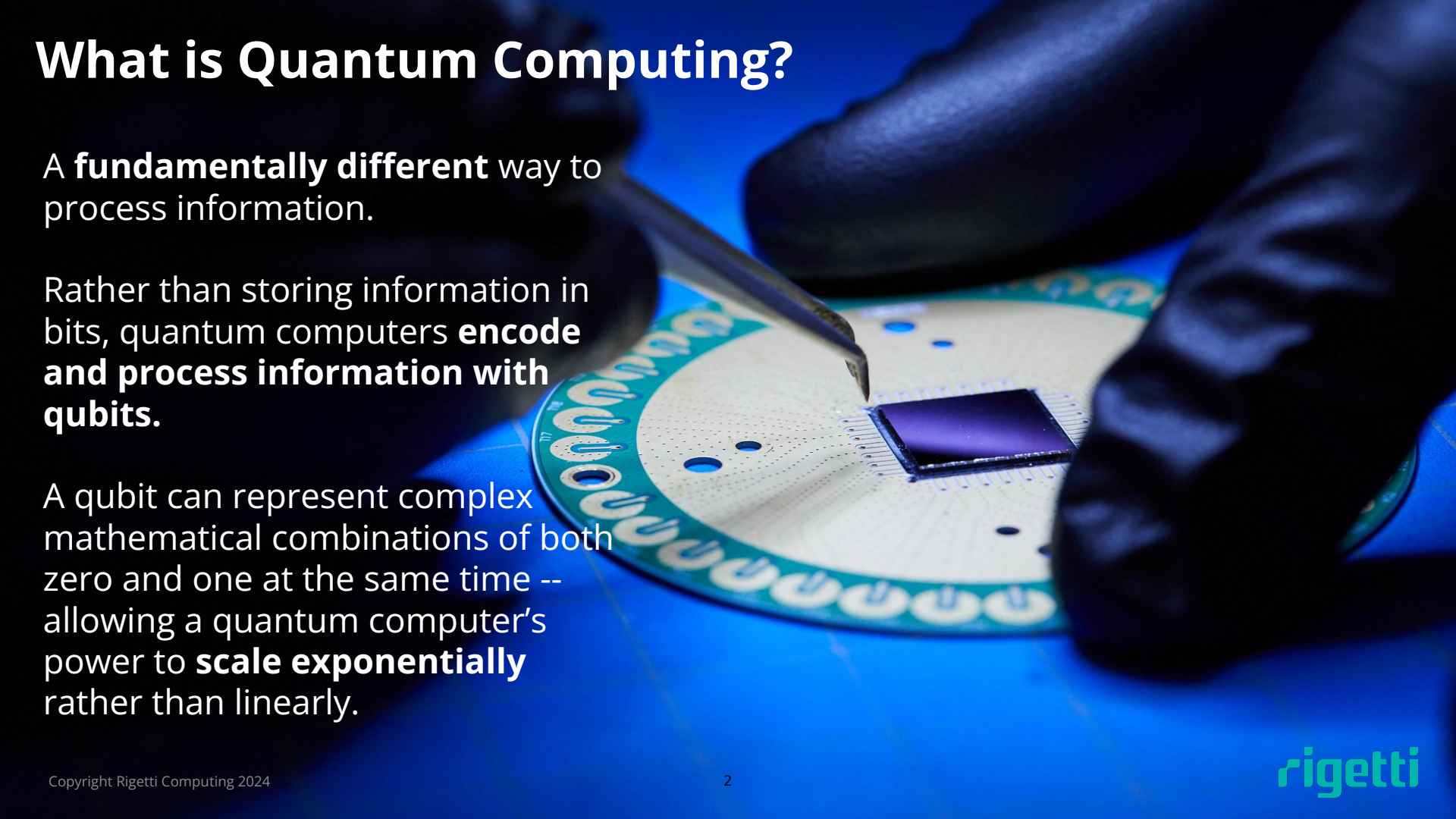
Superconducting Quantum Computing: Building on Decades of Semiconductor Innovation for Transformative Computational Power



Semicon Europa - Future of Computing

Dr. Subodh Kulkarni
CEO, Rigetti Computing
November 13, 2024

What is Quantum Computing?



A **fundamentally different** way to process information.

Rather than storing information in bits, quantum computers **encode and process information with qubits.**

A qubit can represent complex mathematical combinations of both zero and one at the same time -- allowing a quantum computer's power to **scale exponentially** rather than linearly.

Why Quantum Computing?

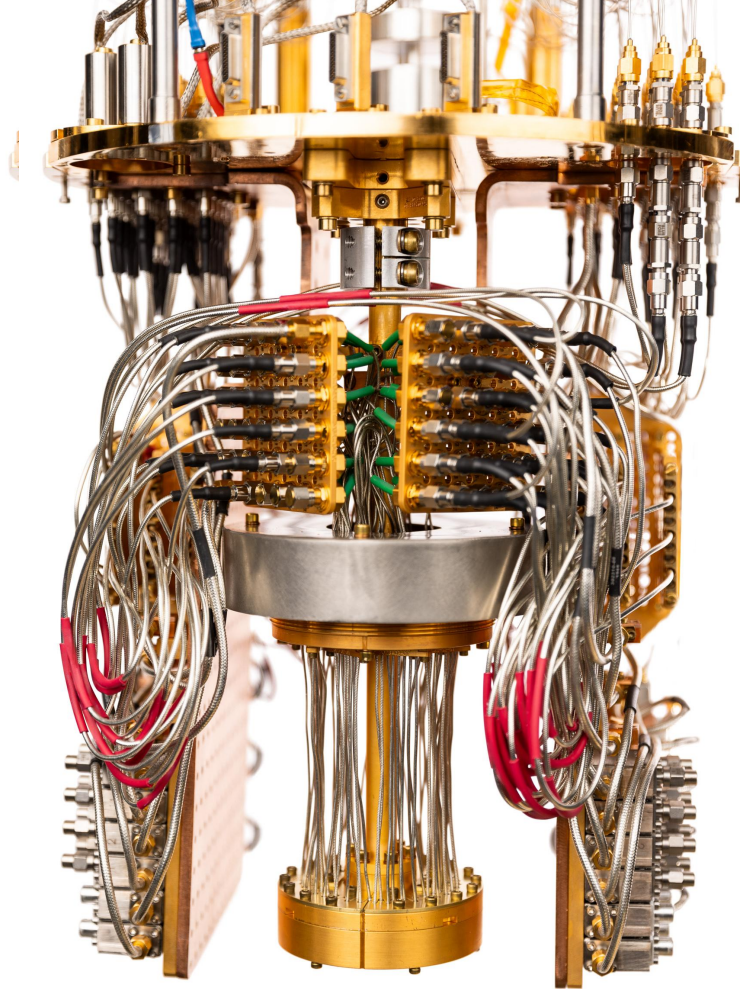
We believe quantum computing holds the potential to

unlock exponential computing power at scale, magnitudes beyond today's classical systems

decouple computing power from energy consumption

create opportunities for profound new knowledge and accomplishments for humanity

drive a paradigm shift for governments, tech leaders, and research organizations

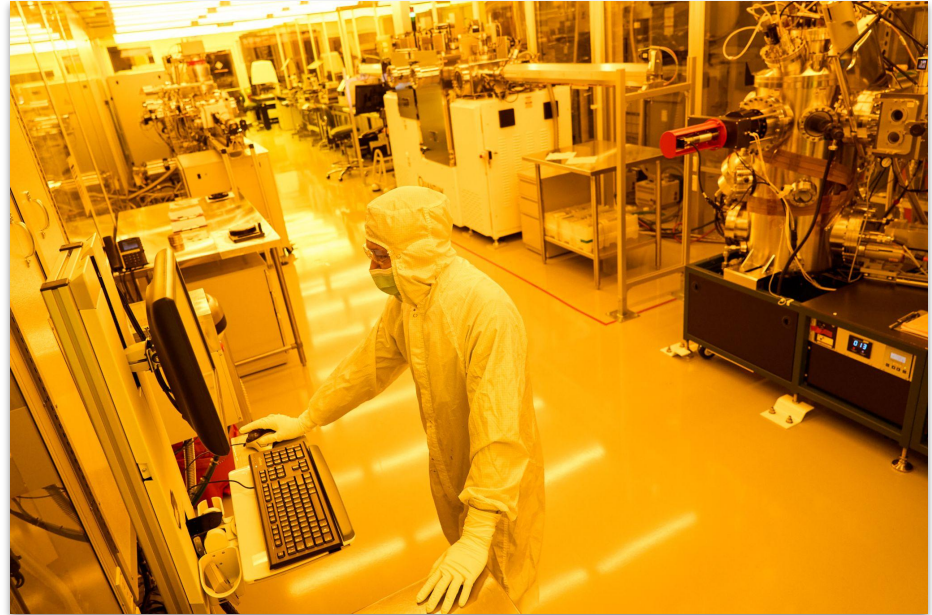


Rigetti Computing

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

Superconducting is the Most Promising Quantum Tech

Superconducting

- Modality of choice for **Rigetti**, IBM, and Google
- Made from superconducting and classic semiconductor materials with microwave signals to effect qubits
- Rigetti was first to demonstrate **modular quantum processor** technology -- our foundation for scaling.

Key technology benefits include:

- **Speed** Fast gates **Rigetti**: 30ns - 80ns, **IBM** 100us - 500us
- **Based on 60 years of semiconductor innovation**
Utilizes key fabrication processes from semiconductor microelectronics
- **Scalability** Clear path to scaling to larger systems with Rigetti's proven multi chip processor technology

Other Modalities

- **Scale**: For general purpose quantum computers superconducting has traditionally been far ahead of other modalities. For publicly available systems; **Rigetti** has a system at 84Q, **IBM** has 133Q. **Quantinuum** has 20Q, **IonQ** has 36Q, and **Intel** has 12Q
- **Gate Execution Speed**: Superconducting will always likely have the upper hand. Rigetti is very fast. Currently we see: **Rigetti**: 30ns-80ns, **IBM**: 100ns-500ns. **Quantinuum**: 10us - 100ua, **IonQ**: 50us - 100 us, **Neutral Atoms**: 100+us (depending on configuration).
- **Fidelities**: Trapped ions and neutral atoms have traditional had better fidelities than superconducting qubits. This is changing rapidly: **Rigetti**: 99.4%, **IBM**: 99.5% **Quantinuum**: 99.7%, **IonQ**: 99.4%, **Diraq**: 99.9% (1Q) **Neutral Atoms**: 99+%

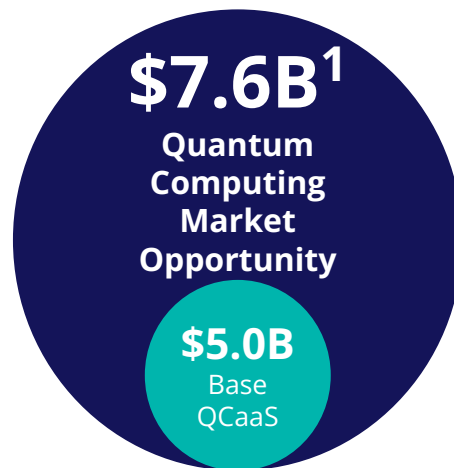
The first **quantum supremacy** experiment ever successfully completed was on a **superconducting** quantum processor¹

¹Arute et al., "Quantum supremacy using a programmable superconducting processor" *Nature* October 2019

Today's Quantum Computing Market

An era of great potential

- **Unprecedented opportunities** for the quantum computing industry to grow across technology R&D, workforce development, and commercialization
- **Growing market:** Customer spend for quantum computing will grow from \$1.1 billion in 2022 to \$7.6 billion in 2027¹
- **Increasing government investment around the world:** 13 countries plus the EU have announced quantum initiatives that span multiple years and will generate billions of dollars for quantum computing research¹



\$38.6B²

Total worldwide government investment in quantum computing announced as of 2023

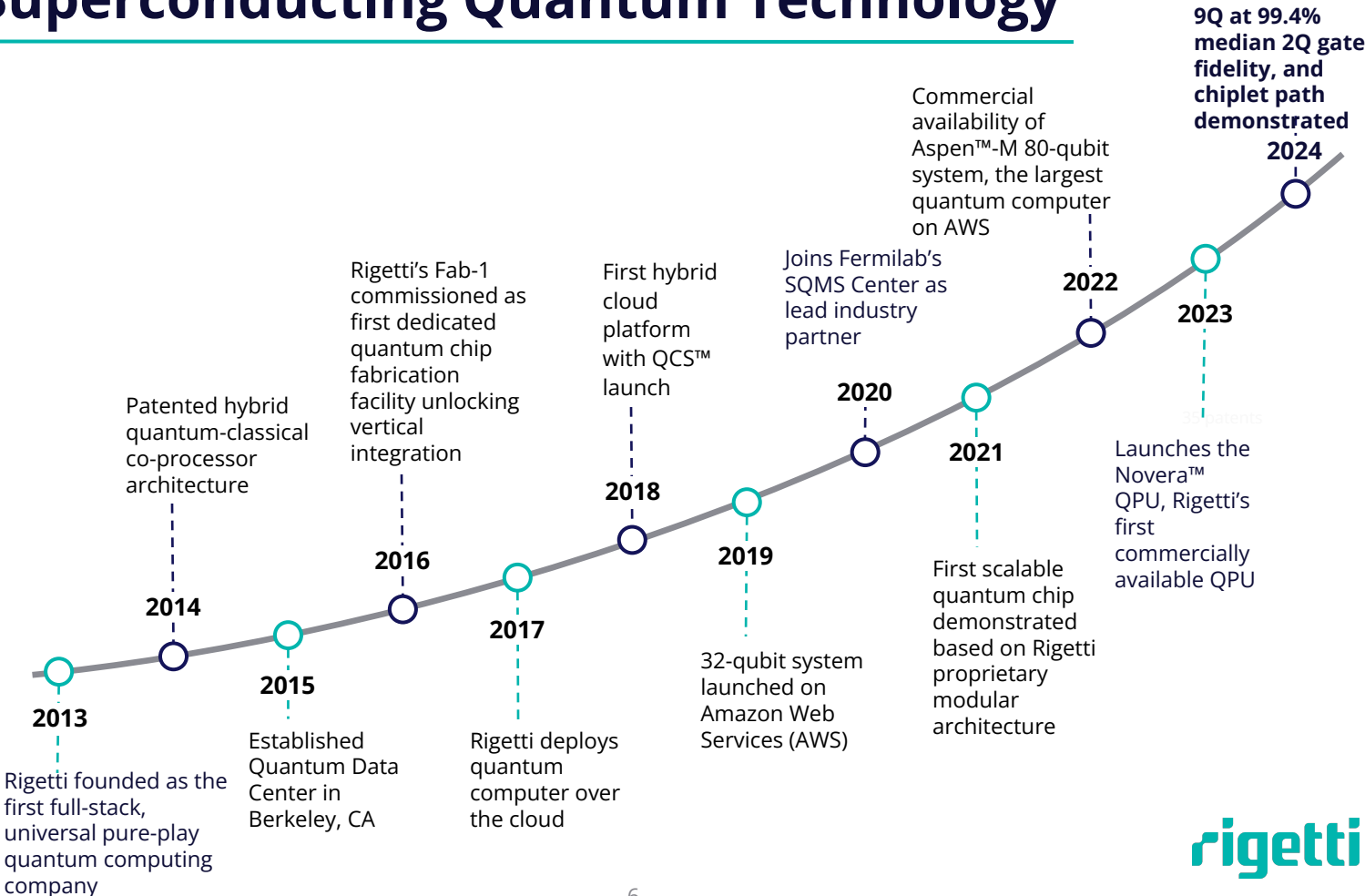
¹ IDC Worldwide Quantum Computing Forecast, 2023–2027: Surfing the Next Wave of Quantum Innovation

² "Overview of Quantum Initiatives Worldwide 2023." QURECA, July 2023

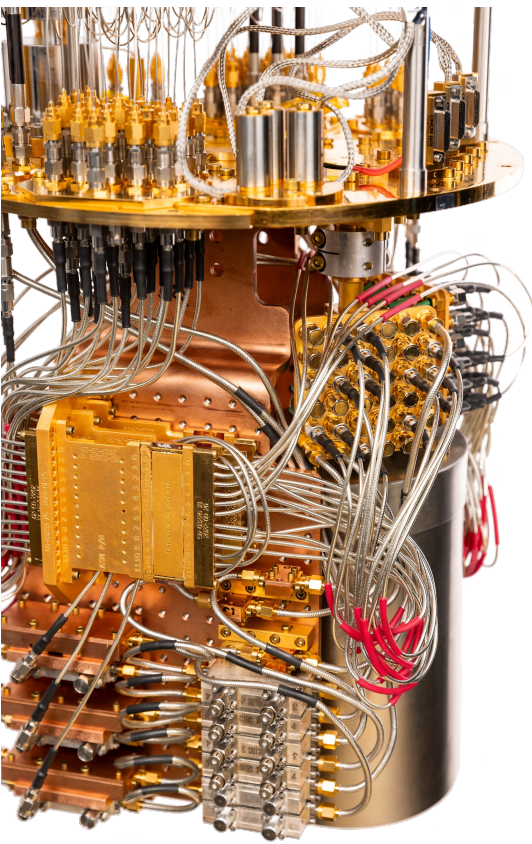
Pioneering Superconducting Quantum Technology

Rigetti at a Glance

- 2013**
Founded
- 15**
Deployed quantum systems to-date
- 70,000**
Combined sq. ft. of facilities
- 140**
Employees
- 49**
PhDs
- 95% - 99+%**
2Q gate fidelity ramp 2022-2025E
- 16 - 336**
Qubit count ramp 2018 - 2025E



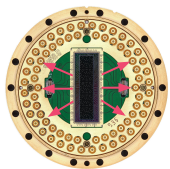
Next Steps for Commercializing Quantum Computing



- Leverage Semi industry know-how
 - ◆ Improve 2Q gate fidelity
 - Getting 99.4% to 99.9% and beyond
 - ◆ Tile chips without losing performance
 - 9Q chipelets - 4x, 9x and beyond
- Enable on-premises QC at research institutions (National Labs, universities, etc.) and cloud deployment
- Develop applications to demonstrate Quantum Advantage in the next 3-5 years

Proprietary Scaling Technology Unlocked by Fab-Driven Innovation

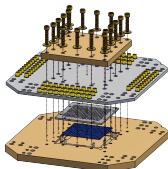
Vertical Signaling



2D

Signals routed laterally

vs

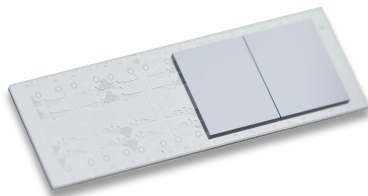


3D

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

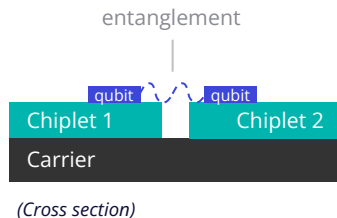
Quantum Chiplet Technology



Modular assembly onto a carrier device enables:

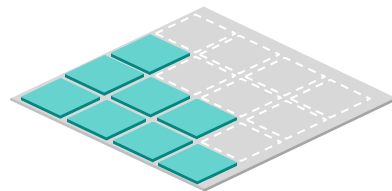
- High fabrication yield, improved processor performance
- Potential for heterogeneous integration (specialized chips for processing, memory and networking)

Inter-Module Connectivity



Low-latency connections provide high fidelity quantum entanglement between modules

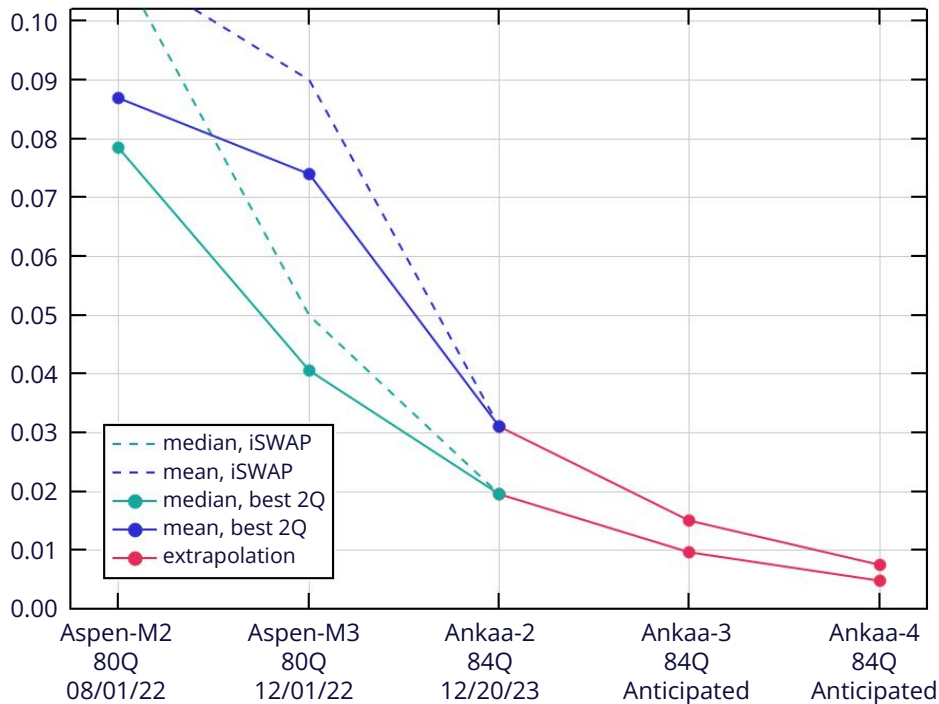
Rigetti's Scalable Architecture



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

Foundation for Larger, Higher Performing QPUs

Deployed QPU Performance



Transitioning from the Aspen to Ankaa architecture enabled us to **reduce error rates by 2.5X** — for the first time a deployed Rigetti QPU achieved a 98% 2-qubit gate fidelity.

The Ankaa architecture will be the **foundation of our 336+ qubit systems**. Underpinned by the critical technology that has proven to demonstrate increasingly higher fidelities:

- Inter-module chip coupling
- Tunable couplers
- Square lattice
- Rapid iterations with Fab-1

Looking to the Future

- Quantum Computing is real and going to be practical in the next decade
 - Supercomputing Quantum Computing, leveraging Semi industry know-how, is most likely to succeed
- Significant business potential, starting with on-premises QCs at research institutions, followed by cloud deployment as useful applications emerge

