Quantum Computing: Moving Out of the Lab?

November 2021

Bob Sorensen

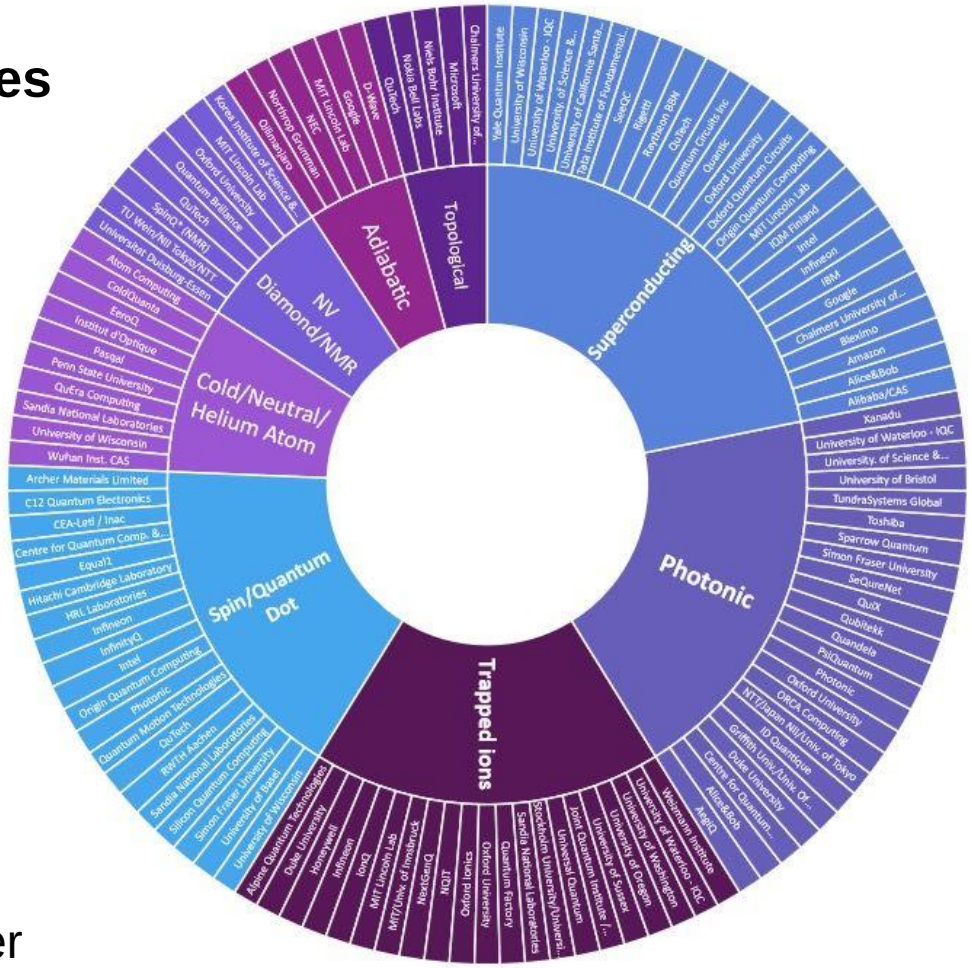
www.HyperionResearch.com
www.hpcuserforum.com

Currently, the Promise of QC is Substantial

- **QC systems have the potential to exceed the performance of conventional computers for problems of importance to humankind and businesses alike in areas such as:**
  - Physical Simulation
    - Materials science
    - Chemistry
    - Pharmaceuticals
    - Oil and gas
  - Machine learning
  - Optimization
- **And the list grows longer each day**

Broad Range of Contenders

- **Hardware-wise, several competing quantum modalities under development**
  - Superconducting
  - Photonic
  - Trapped Ions
  - Spin/Quantum Dot
  - Cold/Neutral/Helium Atom
  - NV/Diamond/NMR
  - Adiabatic
  - Topological
- **Each offers their own unique strengths and weaknesses**
  - There may not be a clear winner
  - And the ultimate winner may not be here



Source : Michel Kurek https://www.linkedin.com/in/michelkurek/

Substantial Challenges Ahead

In almost every dimension

- **Materials research**
  - Coherency, defect management, power
- **Device and processor development**
  - Gate/logic designs
  - Coherency, entanglement, control, measurement, error rates and error correction schemes
- **Architecture: memory, interconnect, storage**
  - Heterogeneity ahead
  - No cloning theorem, no broadcast theorem
  - Integration and control
  - Error correcting / Error tolerant designs
  - Designs absent applications

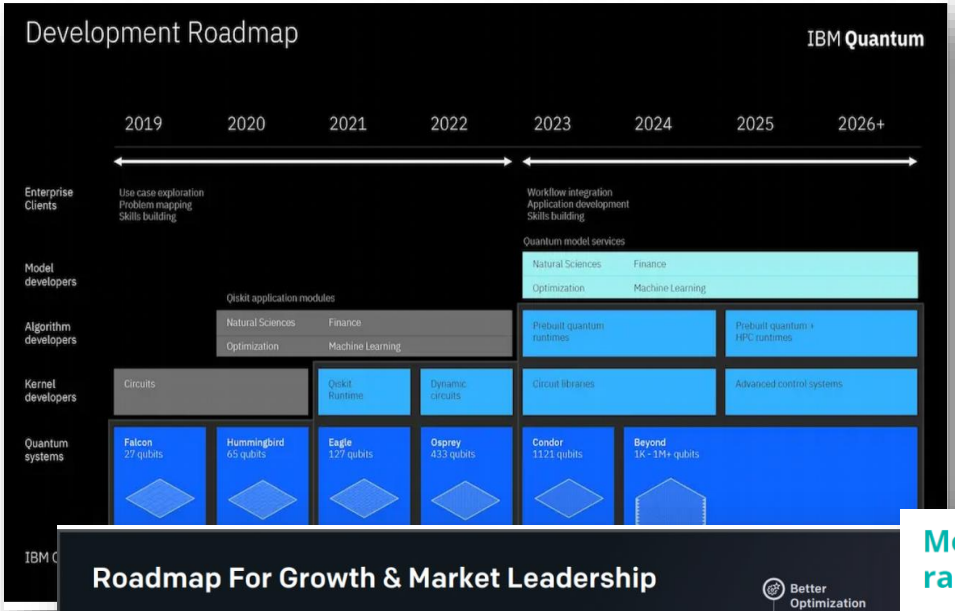
Substantial Challenges Ahead (cont.)

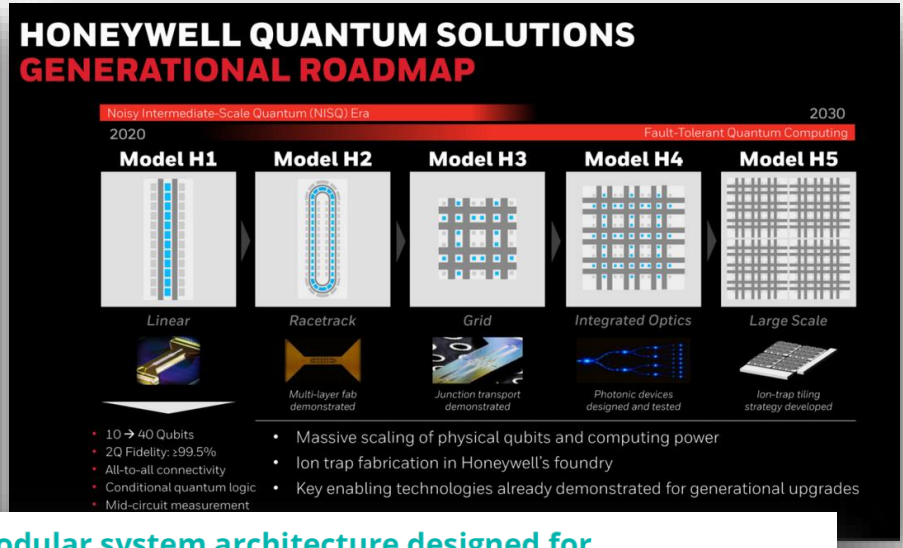
In almost every dimension

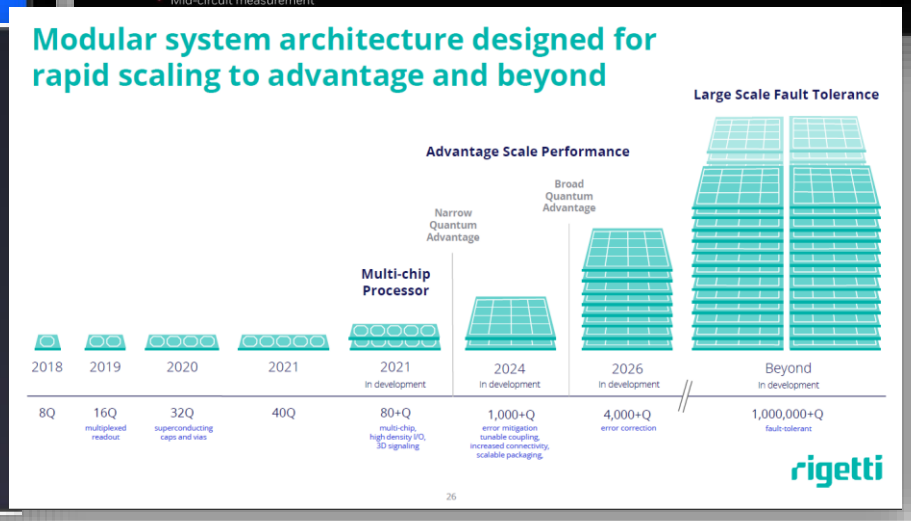
- **Software**
  - QC assembly, instruction sets, programming language and tools
  - QC interfaces to classical systems
  - Validation and verification
- **Algorithms**
  - A wide-open field
- **Despite these challenges, the lure of potential performance is driving a growing perspective within both the supplier and (potential) user base that the technology may soon be coming of age**
  - The shift from research topic to market phenomena is a growing reality

QC Supplier Roadmaps Emerging

Designed to build confidence, highlight long-term commitment



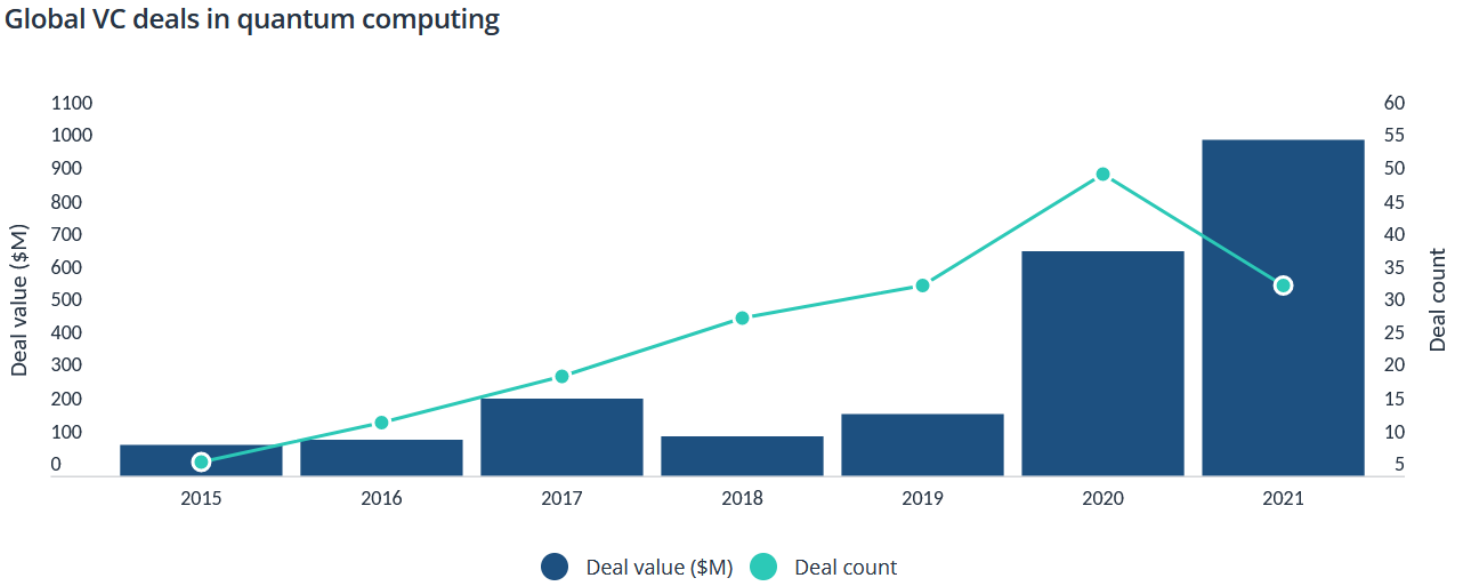




Hyperion Research 2021

Source: IBM, Honeywell, IonQ, Rigetti: 2021

Growing Interest as An Investable Technology Sector…



	Deal Date	Deal Size (millions)	Post-money Valuation (millions)	Select Investors	Company HQ
PsiQuantum	7/27/2021	$450.0	$3,150.0	Baillie Gifford, BlackRock, M12, Temasek	Palo Alto
Xanadu	5/25/2021	$100.0	N/A	Bessemer Venture Partners, Georgian, Tiger Global	Toronto
Rigetti	8/4/2020	$79.0	N/A	Andreessen Horowitz, Battery Ventures, Bessemer Venture Partners, DCVC	Berkeley, Calif.
IonQ	6/16/2020	$62.0	$192.0	Airbus Ventures, Amazon Web Services, Mubadala	College Park, Md.
Quantum Machines	9/6/2021	$50.0	N/A	Battery Ventures, Red Dot Capital Partners, Samsung NEXT Ventures, Valor Equity Partners	Tel Aviv

Source: Pitchbook: Data as of Sept. 8, 2021

...and as a Mainstream Investment Opportunity

- **March 2021: IonQ, first publicly traded full-stack QC company**
  - Merger agreement with dMY Technology Group III, $650 million in gross proceeds
  - Pro forma implied market capitalization of the combined company is approximately $2 billion
- **July 2021: Quantum Computing Inc. listed on Nasdaq**
  - QCI becomes one of a handful of first pure-play quantum software company to list there
- **October 2021: Rigetti plans to go public via a Special Purpose Acquisition Company (SPAC) merger**
  - The combined company is expected to receive approximately $458 million in gross cash proceeds
  - Plans to merge with Supernova Partners Acquisition Company II, Ltd. would value Rigetti at around $1.5 billion

Perhaps More Important, Users are Also Taking an Interest...

- **September 22, 2021: Widespread interest in quantum computing across industry sectors**
  - Majority of U.S. professionals (89.8%) believe that IT departments should have budgets dedicated to quantum computing
  - 61.9% already have budgets for quantum computing, and an additional fifth (21.6%) plan to incorporate quantum computing into their IT planning
  - Source: Classiq, quantum algorithm design platform provider, 2021

- **October 10, 2021**
  - Hyperion Research study for D-Wave: What is the current state of quantum computing activity in your organization?
  - More research on the way

Exploring options and monitoring technology development	47%
Quantum use case analysis and prioritization are being used	35%
Proof of concept research programs underway	33%
Fully funded research efforts are being used	27%
Limited in-house pilot programs underway	23%
Production use of quantum computing for one or more business processes	22%
No current activity but planning to start up activity within the next few years	21%
No activity and no plans to have any activity in the next few years	8%
Don't know/Not sure	2%

So How Does This Play Out?

- **Interest in quantum computing technology and its potential to help accelerate advanced computing workloads is growing, from both supply and demand perspectives**
- **For suppliers, it's going to be less about the technology and more about the end-use and end-users**
  - An early lead in a hardware or software capability could help ensure long-term success, but performance claims need to be realistic, and expectations need to be managed for both potential clients and investors

So How Does This Play Out? (cont.)

- **For users, it's about accelerated or new performance that they can readily integrate into existing and planned IT workloads**
  - Enabling innovation, driving research, and realizing competitive advantage are the performance indicators that increasingly will carry the day
- **Is the current enthusiasm with QC investment a good news or bad news story?**
  - A show of hands, please

HYPERION RESEARCH

QUESTIONS?

Questions or comments are welcome.

Please contact us at:

info@hyperionres.com