INTEL NEWS FACT SHEET

Intel Advancing Quantum Computing from Research to Reality

October, 2017 - Quantum computing is an exciting new computing paradigm with unique problems to be solved and new physics to be discovered. In 2015, Intel established a collaborative relationship with QuTech to accelerate advancements in quantum computing. The collaboration spans the entire quantum system - or "stack" - from qubit devices to the hardware and software architecture required to control these devices as well as quantum applications. All of these elements are essential to advancing quantum computing from research to reality.

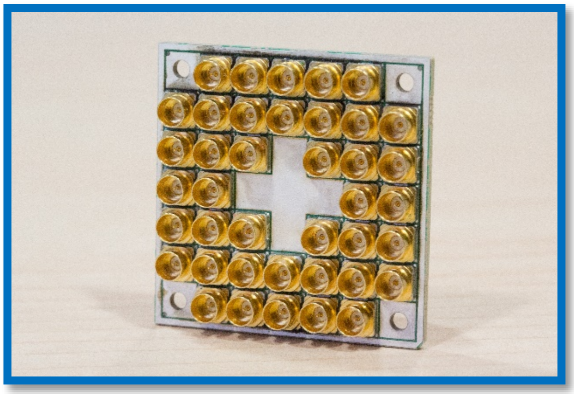
About Quantum Computing: Quantum computing, in essence, is the ultimate in parallel computing, with the potential to tackle problems conventional computers can't handle. For example, quantum computers may simulate nature to advance research in chemistry, materials science and molecular modeling.

How it works: Conventional computers are based on transistors and require data to be encoded into binary digits (bits), which can only exist in one of two states at a given time (0 or 1). But Quantum computers use quantum bits (or qubits), which can exist in multiple states simultaneously. As a result, operations on qubits can amount to a large number of calculations in parallel, which could make certain kinds of computing problems much faster to solve. Four concepts foundational to quantum computing are explained here.

Qubits, however, are tremendously fragile. Any radio frequency noise or unintended observation of them can cause data loss. To eliminate noise, qubits must operate at a temperature of approximately 20 millikelvin—or 250 times colder than deep space.

Quantum Computing meets Intel Engineering:
In October, Intel delivered a 17-qubit superconducting test chip to QuTech that was fabricated by Intel and features a unique design to achieve improved yield and performance. About the size of a quarter (in a package about the size of a half-dollar coin), the new 17-qubit test chip's improved design features include:

- New architecture allowing improved reliability, thermal performance, and reduced radio frequency (RF) interference between qubits.
- A scalable interconnect scheme that allows for 10-100 times more signals into and out of the chip as compared to wirebonded chips.
- Advanced processes, materials and designs that enable Intel's packaging to scale for quantum integrated circuits, which are much larger than conventional silicon chips.



This achievement underscores the importance of material science and semiconductor manufacturing in realizing the promise of quantum computing.

What's next?

Intel and QuTech scientists will test (or "characterize") this 17-qubit superconducting chip while Intel continues to refine the design and scale to a larger number of qubits. Intel is also exploring multiple qubit types, including spin qubits in silicon, which are similar in design and fabrication to the advanced CMOS transistors found in Intel's leading edge microprocessors.

The goal is to ultimately build a commercially viable quantum system, which is expected to require on the order of one million entangled qubits as well as the hardware and software architecture to control these devices and quantum applications with relevance for science and society.

About Intel

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