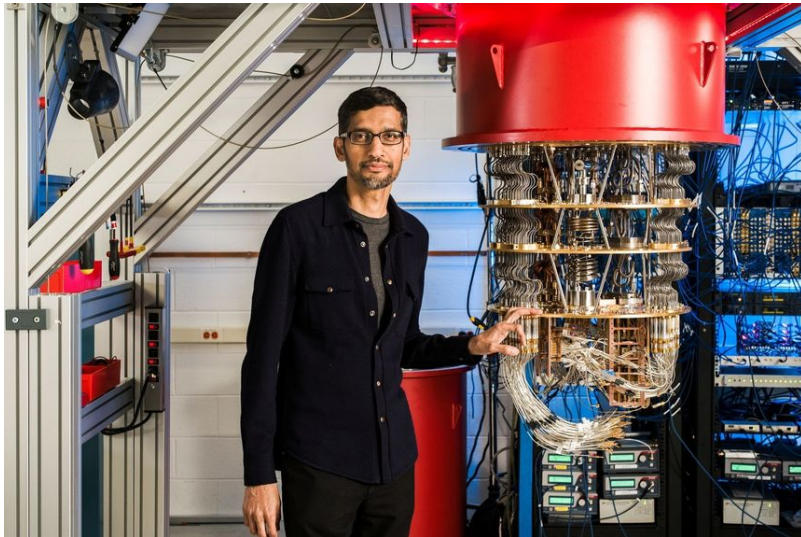


CIO JOURNAL

# Google Claims Breakthrough in Quantum Computing

Others, including IBM, dispute the science behind Google's experiment



Google CEO Sundar Pichai with one of the company's Quantum Computers in its Santa Barbara lab. PHOTO: GOOGLE/REUTERS

*By Sara Castellanos*

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SANTA BARBARA, Calif.—Researchers at Alphabet Inc. 's Google say their latest quantum-computing experiment helps usher in a new era of next-generation computers. The business impact, however, is small.

The company said Wednesday that its quantum computer generated about 1 million random strings of numbers in roughly three minutes, a task that would have taken the world's fastest conventional supercomputer 10,000 years. Scientists at International Business Machines Corp. , which is working to commercialize its own quantum computer, disagreed, saying the task could be handled by a traditional computer in 2½ days.

By harnessing the properties of quantum physics, quantum computers have the potential to sort through a vast number of possibilities in nearly real time and come up with a probable solution. While traditional computers store information as either zeros or ones, quantum computers use quantum bits, or qubits, which represent and store information as both zeros and ones simultaneously.

The calculation by Google's 54-qubit machine, called Sycamore, represents a benchmark by which to measure future quantum-computing experiments, the company's researchers said. The fact the machine could do the calculation with a low error rate means it should be possible to handle tougher calculations by adding more qubits, while still keeping errors low, they added.

"It's really good news for the field that if we make more complicated systems, everything should work," said John Martinis, Google's chief scientist of quantum hardware. He and several researchers spoke to about a dozen journalists about the

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significance of their experiment at the company's lab 300 miles south of its Mountain View, Calif. headquarters.

The lab comprises about 35 researchers and hundreds of millions of dollars worth of quantum-computing equipment. The staff is expected to move into a bigger lab in Santa Barbara in about six months, where more engineers and physicists will be added to the team, Mr. Martinis said.

A so-called random number sampling is useful for generating passwords in near-real-time because randomness is a key component of modern security. But a commercial-grade quantum computer that could, for example, discover new drugs for diseases or new environmentally-friendly materials, could have as many as 1 million qubits.



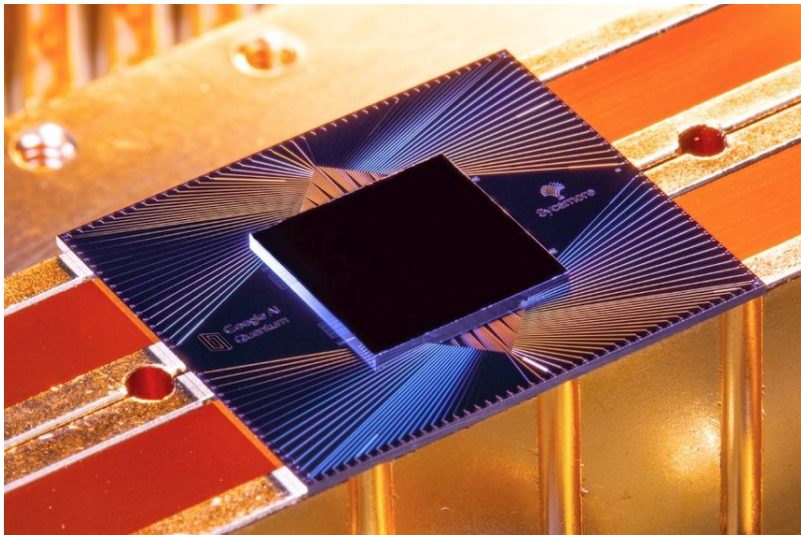
John Martinis, Google's chief scientist of quantum hardware. PHOTO: SARA CASTELLANOS/THE WALL STREET JOURNAL

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building such a machine because it will have to contend with several hardware challenges related to things like wiring and making components much smaller.

Its research was met with mixed reaction from industry experts and competitors.

Google's experiment "is proof we are making forward progress...but from the end-user standpoint it's a nonevent," said Matthew Brisse, an analyst at technology research and advisory firm Gartner Inc. who specializes in data-center and cloud infrastructure.



Google's Sycamore processor. PHOTO: ERIK LUCERO/GOOGLE

Competitors ranging from Microsoft Corp. to venture-capital-backed startups such as IonQ Inc. are working to commercialize quantum computing using other scientific techniques that involve light and small particles. It is yet to be determined whether Google's approach is the right one, some experts say.

"There are so many more technological challenges on the

road ahead that it's quite possible that other platforms for doing quantum computation may in the long term overtake it," said Paul Warburton, a professor of nanoelectronics at University College London.

The Trump administration has made quantum computing a priority with the authorization of \$1.2 billion over five years for quantum-related activities across the federal government.

The global enterprise quantum-computing market is expected to reach \$5.85 billion by 2025, up from \$650 million in 2017, according to Allied Market Research.

By 2023, 20% of organizations, including businesses and governments, are expected to budget for quantum-computing projects, up from less than 1% in 2018, according to Gartner.

Hartmut Neven, an engineering director at Google and founder and manager of the Quantum Artificial Intelligence lab—a joint initiative of the company, the National Aeronautics and Space Administration and the Universities Space Research Association—compared the experiment to the beginning of a new computing era.

“Sputnik didn’t do much either. It circled around the Earth and beeped,” Mr. Neven said. “That’s all it did, and that was the start of the Space Age.”

—*Steven Rosenbush contributed to this article.*

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