Quantum Computers

Doug Hunt
Aaron Yeager
Katie Hamilton
Kenny Peck

How Quantum Computers Work

1. Quantum Computers are new kinds of machines that in comparison to the Computers we use can process and solve problems exponentially faster.

In Classical Computing the unit of data used is a Bit. A Bit can be referred to as Zero or One specifically, translating to Off or On in a binary state. When you're typing commands into your computer. Each letter is translated into a unique string of zeros and ones that are being switched on and off to represent your words.

2. The Qubit (Quantum Bit) a very new product in development uses the Superposition aspects of Quantum mechanics in a way so those Bits that could only be a Zero or a One can now be any combination of the two at any point.

A special form of Superposition known as Entanglement gives the qubits an ability to be connected in a way that they can only be understood as a collective. Like the way pairs or groups of particles interact and become correlated in the same concept.

3. With a Quantum Computer you can use this interaction to move Qubits around and interact them with each other in such a way you're able to move information around within your System very effectively when done in a controlled way.

Where is the development at?

IBM

- IBM Q-movement to build commercially available universal quantum computing systems

- Collaboration with fortune 500 companies and academic institutes.

- Publications using quantum simulators.

- Qiskit-modular, open-source programming framework.

- Nov. 2017-IBM announces development of first 50 qubit processor

Where is the development at?

Google

- Worked with NASA to apply quantum computing to artificial intelligence since 2013.

- Unveiled 72 qubit processor Bristlecone predicted to be capable of quantum supremacy.

- Enlisted NASA to help expand Bristlecones capabilities to ensure quantum supremacy "within months".

- Has installed and uses D-Wave quantum computers.

Where is the development at?

Microsoft

- In 2005 established research lab focusing on topological qubits.

- Quantum computer will be part of Azure cloud within 5 years

- Quantum development kit called Katas

- Majorana fermions-yield less error

- Have not been able to create a qubit yet.

Where is the development at?

Intel

- Collaborative relationship with QuTech

- Intel® Quantum Simulator

- 49 qubit test chip named Tangle Lake

- 1,000-qubit quantum computer should be available in about five years, and one million-qubit quantum computers in ten years

- Smallest processor chip about 50 nanometers across.

Problems with Quantum Computers

- Shores Algorithm and Grovers Algorithm require a perfect fault tolerance

- Creating Qubits is very difficult

- Errors in calculations as a result of decoherence

- Creating interactions between Qubits
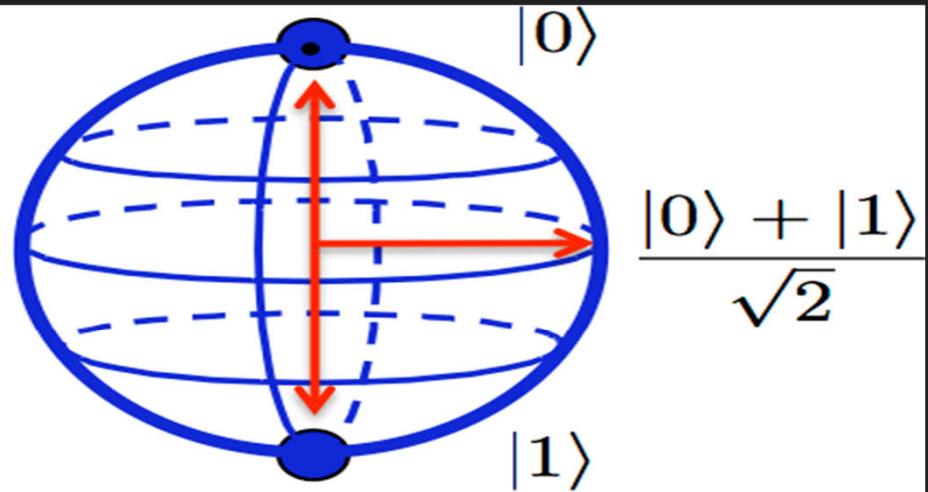
- Understanding the output
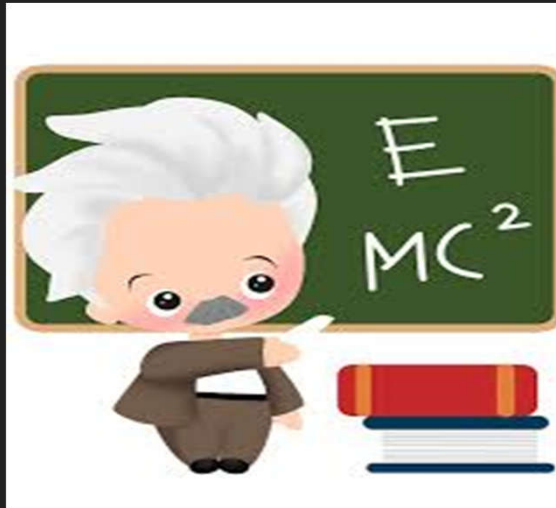

D-Wave Systems Inc.
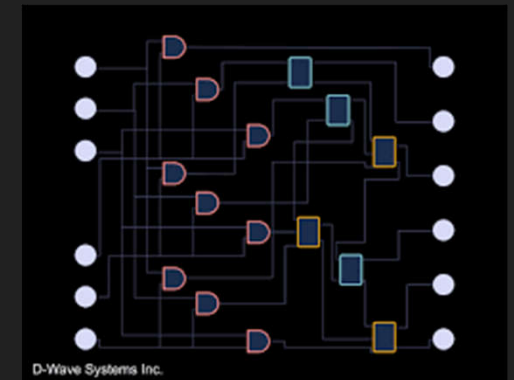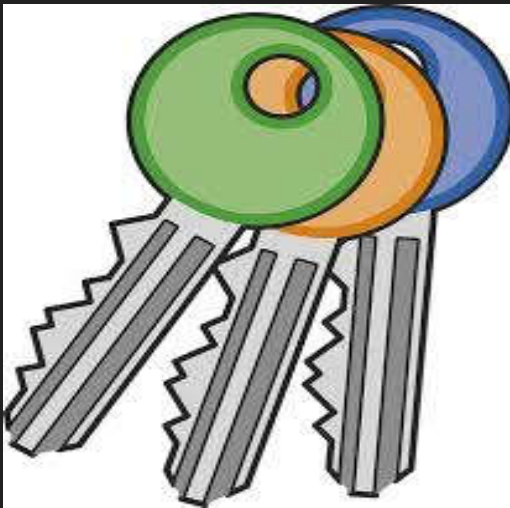
What makes Quantum Computers Special?

Ideology

Quantum computers are the key to solving the mysteries of the universe

Sources

- https://medium.com/scitech/the-difficulty-with-quantum-computers-d0d5c5aed628

- https://www.research.ibm.com/ibm-q/learn/what-is-quantum-computing/

- https://en.wikipedia.org/wiki/Albert_Einstein

- https://www.autodesk.com/products/eagle/blog/future-computing-quantum-qubits/

Sources

- https://www.nasdaq.com/article/quantum-computing-what-it-is-and-who-the-major-players-are-cm939998

- https://www.research.ibm.com/ibm-q/

- https://www.technologyreview.com/s/612381/google-has-enlisted-nasa-to-help-it-prove-quantum-supremacy-within-months/

- https://www.networkworld.com/article/3275385/data-center/who-s-developing-quantum-computers.html

- https://www.techrepublic.com/article/microsoft-inches-closer-to-commercially-viable-quantum-computing/

- https://newsroom.intel.com/press-kits/quantum-computing/

- https://www.tomshardware.com/news/intel-spin-qubits-quantum-chips,37280.html