Today's Computers Have Limits: Let's Break Them with Quantum Computing!

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Abstract / Introduction

Today's computer's can only do so much computational work. The transistors on computers are becoming smaller and smaller but they have a physical limit for how small they can be. This idea is known as Moore's Law. which scientist propose to be near 1nm. In most of today's computers, they are approximately 14 nm wide. This causes a great issue for technology advancement. The hardest problem's for today's computers would take years to solve, literally. Some of these problems could however be solved more efficiently with a new form of computing called quantum computing.

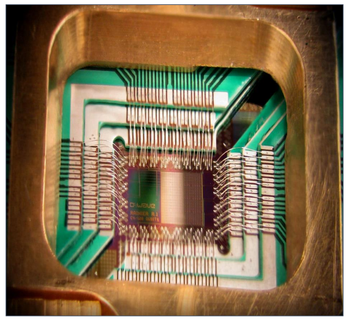

Image taken from Wikipedia.com

An image of the D-Wave 128-qubit processor

What is Quantum Computing?

- A new form of computing, which uses parts of atoms to do its computations.
  - Today's computers use electricity
- Takes advantage of the laws of particle physics to complete advanced problems.
- Allows for the bits to be in multiple states at once.
  - "Schrodinger's cat"
  - The bits in today's computers can be in either 0 or 1. When bits are put together they make data.
- Quantum bits are known as qubits.
  - Parts of atoms that acts as "bits
- Due to this nature, allows for probabilistic problems to be solved much faster on a quantum computer than a "classical computer".
  - Best solution is found to probabilistic problems which have many possible outcomes.

D'Wave Systems

2008: 28-qubit quantum computer

2010: First commercial Quantum Computer (128-qubits)

2013: 256-qubit Computer created

2015: 1000+ qubit Computer announced

D:Wave The Quantum Computing Company™

- D-Wave is a company which works towards the goal of creating a quantum computer.
- They are by far the most advanced in progress in Quantum Computers.
  - We need 4000 qubits for a useful Quantum Computer

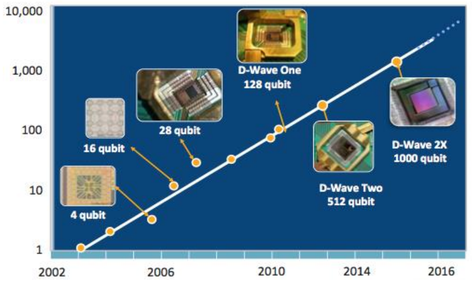

Image taken from dwavesys.com

What Can it Do For Us?

- It can run simulations of hard to predict experiments.
- Has use in many scientific problems that require a large amount of theoretical random situations.
- Can be use for optimizations of the most difficult problems of today.
  - Can lead to efficient machine learning (Better Algorithms for code).
- Can do factorization to solve complex problems in weeks.
  - Would take today's computers years.

Setbacks

- Scientists do not fully understand every aspect of quantum mechanics yet.
- Computations must be done in near absolute zero.
- Some of problems to make one require a Quantum Computer.

Conclusion

- For probabilistic problems, quantum computing is the better tool to use.
- Would not replace the current computers we have today and instead would be used for special purposes.
- More cloud-based computers that solve what our computers cannot
- Present promises for computations for science, media editing, and the economy.
- Will be a while before Quantum Computers can begin to solve useful problems.

Concept Art for a high-tech space station on a distant planet made possible due to Quantum Computing.

Image taken from Kauko Helavuo on youtube.com

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