THE PROGRESSION OF COMPUTING

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Introduction

Computation is a concepts that does not have specific meaning because it is constantly evolving. However with a much broad definition, computation is defined as the execution of sequences of halting Turing machines (or their equivalents).This means the perpetuation of algorithms (series of steps) by which the machine in question performs tasks.

Turing machines are abstract mathematical representation of a machine (device that takes input, process and produce output). Any machine embedded with a computational method that follows the principle of a Turing machine is a viable computer and its computing method is said to be Turing complete.

There are many forms of computing that are Turing complete but they can all be classified into two major categories classical and non-classical computation.

The Two Classes of Computation

- The property that distinguish between classical and non-classical computation is the fundamental language that is used in the computation.
- There are many types of non-classical computation but we would only concentrate on the one called Quantum computation.

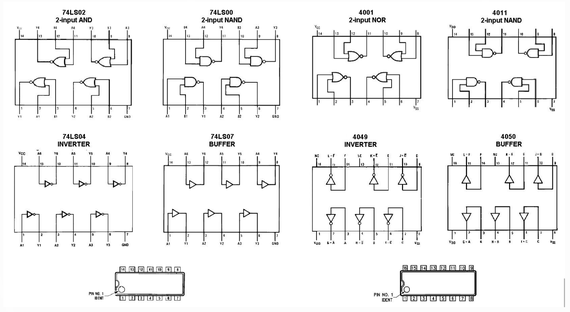
Classical Computation

- This method has been in use since the dawn of the digital age.
- It is what is embedded in our everyday computers.
- Classical computers relies fundamentally on the concept of binary.
- Either something is off or on, either something is one or zero.
- Tinny transistors in a classical processor act as logic gate they get one or two input and produce one output
- input and output are electrical signals of on and off
- gates are arranged in a circuit to produce memory which are then used to program embedded software
- The more transistors the more logic gate

Non-Classical Computer

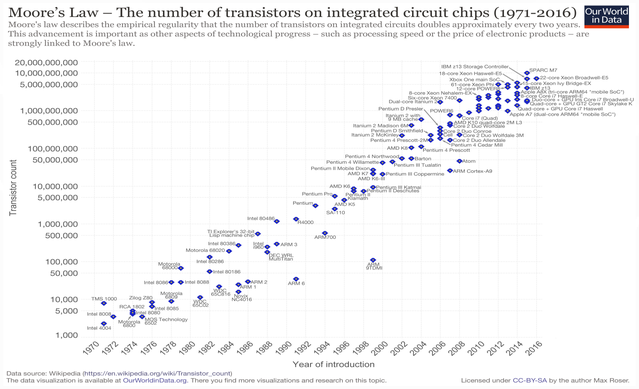
- Non-classical computation are generally theoretical.
- Thee are many method of non-classical computation.
- They include DNA computation, Quantum computation, optical computing etc.
- We focus on quantum computers and compare it to classical computer.
- Quantum computers unlike classical computer deal in qubit (a superposition state of both off , on and anything in between).

Logic Gates In Transistors



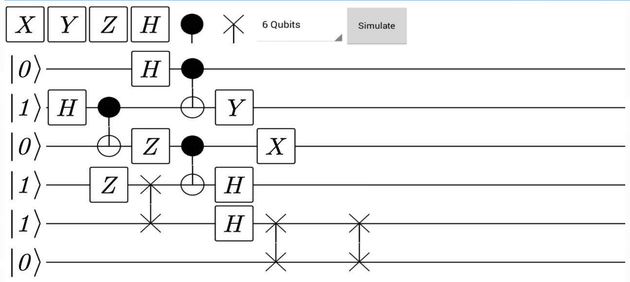
Inside transistors there are logic gates, logic gates are either turned on of off (Boolean functions). When you have a series of logic gate turned on or off you end up with a memory space on the chip that has a virtual representation of 1s and 0s.Logic gates have several types of configuration which take different input and produce different output some examples are NAND, NOR, NOT & AND.

The Number of Transistors Every Year



This is a graph shows of the number of transistors in electronics every year. More's law says the number of transistors on a computer chip would continue to double every year. The graph shows the manifestation of this law.

Quantum Logic Gates



This is a quantum logic gate, it is the fundamental of quantum circuitry. it relies on quantum mechanic concept like superposition and entanglement. Multiple quantum gates are brought together so wave function can collapse into classical computation that provides probabilistic results. A sequence that archives this is known as quantum algorithm.

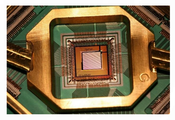
Comparison Between Both Classes

Qubit are similar to bit in the sense that they describe state of being off and on but while bit are give a definitive state at any point in time, qubit give a state of both off and on simultaneously. In binary terms bits put 1 or 0 discretely at any point in time but qubit put of 1 and 0 at the same. This makes quantum computation significantly more powerful method than classical computation because it require smaller chip to be powerful compared to classical computers

Bits	Qubits
1	1 0
110	100
	001
	101

Discursion

Quantum computer may be powerful, they are still far from being the next pc you would have in your house. They are incredibly difficult to maintain and there is still much research being done to adequately program it. Quantum computers require interstellar environment (near absolute zero) to function properly, to achieve this heavy duty thermal cooler is required hence the difficulty in maintenance.



Conclusion

Quantum computation may be able to produce computers that are much more powerful than most computers we have to day, they are very expensive and better suited for cooperate entities and organizations. We believe that future of computation lies on the proper management of all kinds of computation. Classical computers are still the best control systems when it comes to embedded design for machinery, but quantum computers could be a better choice when it comes to the internet of things(cloud computation), data analysis and collection. The future of computation relies heavily on the ability for us to seamlessly connect all kinds of computers with different computation method in a way that would be appropriate.

Sources

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