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Quantum Computing vs. Conventional Computing: Near-Term Solution is Smart Distributed Systems

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Introduction

Are we getting to the end of Moore's law????? Moore's law which is held for 50 years tells computer power doubling every 18 months may begin to expire in the next 10 or so years. Imagine you buy a computer having the same power as the last year and the year before last year. Would you buy a new computer? Or upgrade? The present computer model is CPU with I/O's and combination of logical gates, and software which controls these I/O's based on finite automata and Turing machine. Basically the above hard-ware software model manipulates the 0 and 1 bits. That is what we have in computers laptops and cell phones. Quantum computers are not based on only 0's and 1's, Turing machine and finite Automata. Quantum computer computes on individual atoms and instead of 0's and 1's which are called bits, there are Qubits in quantum computer which is sometimes 1 and sometimes 0 and sometimes any number between 1 and 0. No longer computing would be just on 0's and 1's, so how would be the conventional programming possible? **It would be very Challenging!!!!!** The operations of quantum computer is incredibly sensitive to vibrations, temperature, electromagnetic radiations and environmental effects and the quantum mechanics is for smallest elements in the universe such as atoms, electrons, photons, and subatomic particles. Nevertheless Quantum Computing is still in state of infancy, and have not started to make useful things, however experiment is getting better and better. So Quantum Computing will revolutionize the way we do computing and will not be the same architecture as regular silicon architecture. A near-term solution might be **Smart Distribution computer communication systems.**

Materials and methods

From theoretical physics and engineering:

Transistor operation, Quantum Mechanics, Quantum tunneling, Quantum teleportation, Quantum entanglement, Schrodinger equation

From mathematics:

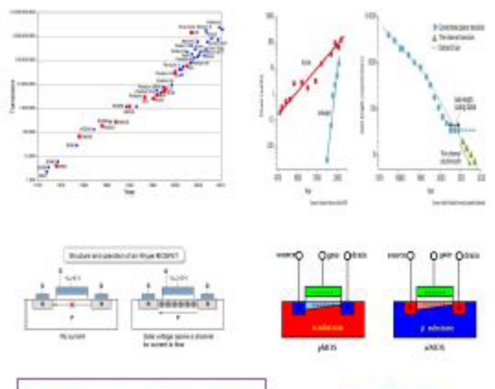
Geometric topology, Algebra, Computational geometry, Discrete algebraic topology, Discrete Morse theory

Results

Every day we see more evidence which Mathematics will get more involve and more dominate in all areas of Engineering, Physics, Computer Science and so many other Sciences, and probably this trends will get more stronger for another quarter of century. And field of Mathematics rapidly expanding applications in areas of Geometry and Topology and Algebra. Recently, techniques and models borrowed from classical algebraic topology have yielded a variety of new applicable models for computer science problems. Techniques and models, borrowed from classical algebraic topology, represent a promising new approach to the theory of distributed computing. I was particularly interested in making the mathematical concepts applicable to the computer science community. M.P. Herlihy and N. Shavit [10] were the first to use simplicial complexes to model decision tasks, and to formulate properties of decision tasks in terms of simplicial homology. It is intriguing to speculate whether some kind of topological classification of protocol complexes might yield a useful computational classification of objects. The problem of coordinating concurrent processes remains one of the central problems of distributed computing. Coordination problems arise at all scales in distributed and concurrent systems. Coordination is difficult because in modern multiprocessor systems: processes may be delayed without warning for a variety of reasons. Because the processes are asynchronous, a protocol cannot distinguish a failed process from a slow process; a program that solves a decision task is a protocol. Decision tasks are intended to model reactive systems such as databases, file systems, or flight control systems. An input value represents information entering the system from the outside world, such as a character typed at a keyboard, a message from another computer, or a signal from a sensor. An output value models effects on the outside world, such as a decision to commit a transaction, to dispense cash in banking system, or to launch a missile. The mathematical modeling of a sample task would be as follows:

Suppose we are given a set of n + 1 sequential processes. This set of processes could be a set of n+1 sequential threads of control communicate by applying operations to objects in shared memory. Each process starts out with a private input value (A simplicial complex of initial configurations). The processes communicate for a while, then each process chooses a private output value (A simplicial complex of final configurations), and then halts. Examples of shared objects include message queues, read/write variables, test-and-set variables, or objects of arbitrary abstract type. A set of d+1 mutually compatible initial or final process states is modeled as a d-dimensional simplex. A decision task for this set of processes is given by a triple (I,O, Δ), where

- I is an input complex(A simplicial complex of initial configurations)
- O is an output complex(A simplicial complex of final configurations)
- Δ is a simplicial map from I to O: a map carrying each input n-simplex of I to a set of n-simplexes of O.



Conclusions

The final question is:

1 - What kind of Hardware we will have for quantum Computing and when?

2 - What kind of programming tools and software and environment we need for this new revolutionized world of Quantum Computing and when?

But Near term and doable solution is:
Smart Distributed Systems

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