Quantum Computing – Colloquium 11/13/2014

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* Factorization – Shor’s Algorithm
* Quantum Search – Grover’s Algorith - Osqrt(n) instead of O(n)
* Dwave 2048-bit quantum annealing
* Investment by Google, MS, IBM, govt
* Discussion at CRA Snowbird

1. Universal Quantum Operations
   1. H Gate Hadamard
   2. T Gate
   3. Z Gate Phase-flip
   4. Controlled Not Controlled X CNot
2. Classical Machine (Polynomial) to Quantum Machine (Exponential)
   1. Performance intersect at 1000 years
3. Reliability – Quantum Computing not reliable, short lived
   1. Small systems, short lived
4. Error Correction is critical
   1. Need continuous error correction
   2. Uses a lot of recursion
5. Exponential advantage comes with exponential overhead
   1. Want algorithm to overcome hardware
   2. More speed means more efficiency
   3. Longer time requires more error correction
6. Quantum Teleportation
   1. Transmission of quantum data in instantaneous fashion
   2. Error correction makes it not truly instantaneous
7. Three Axis of Quality: area, speed, reliability (Design Pyramid)
8. Parallelism – Large gains in size efficiency, small decrease in performance (256, 512, 1024 bit)
9. 100,000k speedup for dynamic compilation, 5-10x increase in code size
10. NSF Expeditions: 100bit Quantum Computer Project in next 5 years
11. Quantum Computer for Computer Architects
12. Not energy efficient