High Speed Computing with Clustered and Quantum Computers

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What Is Quantum Computing?

Quantum computing covers many concepts, but it is important to first start with classical computing.

Classical Information

In a classical computer it stores information as a 1 or a 0 in what is called a bit.

Some Common Gates

NAND, NOR, AND, OR, XOR $\rightarrow$ Complex structures such as ALUs and data storage.

Circuit Complexity

In circuits it is important to cover the complexity required to achieve certain goals. Complexity is classified in Big O Notation.

Additionally, we can classify these further into P, NP, NP-complete, etc.

Time Complexity Example

A loop of N elements has a time complexity of $\mathcal{O}(N)$.

Theorem 1.0

Any NP complete problem can be solve in polynomial time on a classical computer.

Turing Completeness

Simply, a Turing-complete computer is one that is able to compute any and Turing-computable function.

Definition 1.0

Some computational device is taken as Turing-complete or Turing-equivalent if it is probable that it can compute the values for a function for every function of its argument. ie. A common place computer.

While Turing-complete computers are powerful, they begin to break down at the meta level in cases such as the infamous Halting Problem. (see the LASACS lunch time lecture)

A Single Qubit