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Quantum Computing

The Genie in a Bottle for Technological Advancements

By the end of 2022, the global enterprise quantum computing market is estimated to be over **\$2.7 billion** and is projected to reach about **\$11 billion** by 2027. This blog will discuss the differences between quantum and traditional computers, the benefits, and challenges, how they will affect data center infrastructure, and explore the critical global industry players making their mark in the world of quantum computing.

Quantum computing focuses on developing computer-based technologies centered around the principles of quantum theory. **Quantum theory** is the relationship between nature and the behavior of energy and matter on an atomic and subatomic level. Quantum computing uses subatomic particles like electrons or photons. Quantum bits, or **qubits**, allow these particles to exist in more than one state at the same time.

Traditional computers use bits that are either 0 or 1. Quantum computers use qubits that can be set at both 0 and 1 simultaneously. That is the equivalent of one person — you — sitting on both sides of a sofa at the same time — which is not physically possible but, in the world of quantum computing, is a genuine possibility.

Traditional computers can't keep pace with quantum calculations. What makes a quantum? Different rules of probability. Quantum computing solves problems that are too large and complex for traditional computers. They run and solve multi-dimensional quantum algorithms with the capacity to do billions of years' worth of computing over the course of a few days. Speed and computation capabilities are the key differentiators between traditional and quantum computing.

Benefits

Pharmaceutical

Scientists need the speed quantum computing provides to develop pharmaceuticals that diagnose patients earlier and provide them with customized treatment plans. Quantum computers will allow scientists to simulate molecules for testing, decreasing the research and development time — thereby bringing it to market more quickly.

Finance

Algorithms are the name of the stock market game. Algorithmic trading calculates market efficiencies and identifies patterns to mitigate risk when buying shares. While lenders use algorithms to estimate the risk associated with loans for individuals and companies, affecting the mortgage, loan amount, and interest rate.

Climate

Today traditional computers are used to predict the weather, which takes time and is not as concise. The poignant data from quantum computing will enable extreme weather changes to be calculated quickly. This will affect how resources are allocated to an event in an affected area, transportation, and even food production.

Challenges

Security

All new technological advancements open the gateways to security and privacy challenges. Quantum computers will surpass the cryptographic algorithms currently used for encryption in traditional computers. There will be an imminent need to create more complicated encryption to secure sensitive data.

Error

Qubits are sensitive to environmental changes like temperature, dust, and are prone to errors. Quantum error correction was created to solve this issue, but unfortunately, millions of qubits are needed for it to work. Currently, the most advanced processor is the **Eagle**, unveiled by IBM in late 2021, with 127 qubits. The more qubits a system has, the more difficult for it to remain stable.

Software

Quantum computers, like traditional computers, will need applications, systems, drivers, and programming software. Modern applications in traditional computers include graphics, database and management programs, browsers, and communication platforms.

Quantum Strategies for Data Centers

As the need for these computers grows, data centers and colocation services need to adapt their infrastructure. Quantum computers have speed and computation capabilities that require a higher power capacity; power equates to heat. Data centers must have a solid cooling system for storing data. Although, the real change lies with quantum computer manufacturers creating smaller computers that are connected, which will increase their power and fit rack-mounted devices within data centers.

Networking and security are vital components that will reshape data center infrastructure to accommodate quantum computers. Quantum computers will not replace traditional computers but will complement them. Data center operators need to understand this to remain competitive in the landscape.

It is not unusual for industries to forge ahead with new technological advancements without taking into consideration security measures. Quantum computers need enhanced security within the infrastructure and additional solutions focused on network and other security requirements. Data centers without a quantum strategy will be behind the curve when quantum computers ignite the market.

Global Industry Key Players

A few key players in the quantum computing market are Google, IBM, Microsoft, and AWS.

Google offers **Quantum AI**, a leading player in full-stack capabilities in quantum computing. Its goal is to advance the state of quantum computing by developing tools for researchers.

IBM released **Quantum Composer** and the **Quantum Lab**. These online platforms provide public and premium access to cloud-based quantum computing services, including IBM's prototype quantum processors. The service allows users to run algorithms, experiments, and create simulations.

Microsoft's **Azure Quantum** is an open cloud quantum computing ecosystem that lets users create and run algorithms for multiple platforms while adjusting algorithms for specific systems.

Amazon's **AWS Braket** is a managed computing service created to speed up scientific research and software development.

The Takeaway

Although quantum computing is at its best in its experimental or infancy stage, there is little doubt that the applications for quantum computing run wide and deep. Researchers think of quantum computing not as a tool that completely replaces traditional computing but as one that complements it. The speed and computational capabilities will undoubtedly touch all industries and impact the world we live in today and the world and technologies we can only imagine in the future.

Networking and security will reshape data center infrastructure to accommodate quantum computers. Data Centers like Netrality understand the importance of keeping up with technological advancements by creating strategies that will evolve and support innovations.

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