Quantum computing is an area of computer science that uses the principles of quantum theory. Quantum theory explains the behavior of energy and material on the atomic and subatomic levels.

Quantum computing uses subatomic particles, such as electrons or photons. Quantum bits, or qubits, allow these particles to exist in more than one state (i.e., 1 and 0) at the same time.

Theoretically, linked qubits can "exploit the interference between their wave-like quantum states to perform calculations that might otherwise take millions of years."1

Classical computers today employ a stream of electrical impulses (1 and 0) in a binary manner to encode information in bits. This restricts their processing ability, compared to quantum computing.

KEY TAKEAWAYS

* Quantum computing uses phenomena in quantum physics to create new ways of computing.
* Quantum computing involves qubits.
* Unlike a normal computer bit, which can be either 0 or 1, a qubit can exist in a multidimensional state.
* The power of quantum computers grows exponentially with more qubits.
* Classical computers that add more bits can increase power only linearly.

Understanding Quantum Computing

The field of quantum computing emerged in the 1980s. It was discovered that certain computational problems could be tackled more efficiently with quantum algorithms than with their classical counterparts.2

Quantum computing has the capability to sift through huge numbers of possibilities and extract potential solutions to complex problems and challenges. Where classical computers store information as bits with either 0s or 1s, quantum computers use qubits. Qubits carry information in a quantum state that engages 0 and 1 in a multidimensional way.3

Such massive computing potential and the projected market size for its use have attracted the attention of some of the most prominent companies. These include IBM, Microsoft, Google, D-Waves Systems, Alibaba, Nokia, Intel, Airbus, HP, Toshiba, Mitsubishi, SK Telecom, NEC, Raytheon, Lockheed Martin, Rigetti, Biogen, Volkswagen, and Amgen.