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Information technology — Quantum computing — Vocabulary

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Introduction

For most of computing history, the foundational hardware technology has been binary digital transistor logic. In such digital systems, data and programs represented as binary classical digits (bits) are encoded into physical transistors that have and can switch between two definite internal states: on and off. The field of quantum computing introduces a new approach to the underlying computing hardware by shifting from classical logic ("on" or "off") to a quantum logic where the "quantum bits" or "qubits" (the simplest units of quantum information) are encoded into physical registers that exhibit quantum-mechanical phenomena such as superposition and entanglement.

This shift from the classical digital representation found in today's conventional computers to a quantum digital representation in tomorrow's computers is expected to bring increases in computing power and new, innovative software applications, allowing us to tackle more complex computational problems and carry out powerful analysis of more complex data patterns that are already challenging or impossible for today's technology. Quantum computing holds the potential to revolutionize fields from chemistry and logistics to finance and physics.

However, the increase in power and capability that quantum computing will provide, will also pose an important security threat once quantum computers become large enough (or cryptographically relevant, as it is sometimes described). As strong as today's cryptographic mechanisms have been against conventional computers, almost all cryptographic protocols used are vulnerable to quantum-computing-based attacks with known algorithms. This widely known risk associated with the power of quantum computing is very concerning for governments, institutions and individuals whose encrypted data are safe today, but may become decryptable once quantum computers reach large enough size.

This document aims to assist in the understanding of quantum computing concepts and the exchange of information.

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