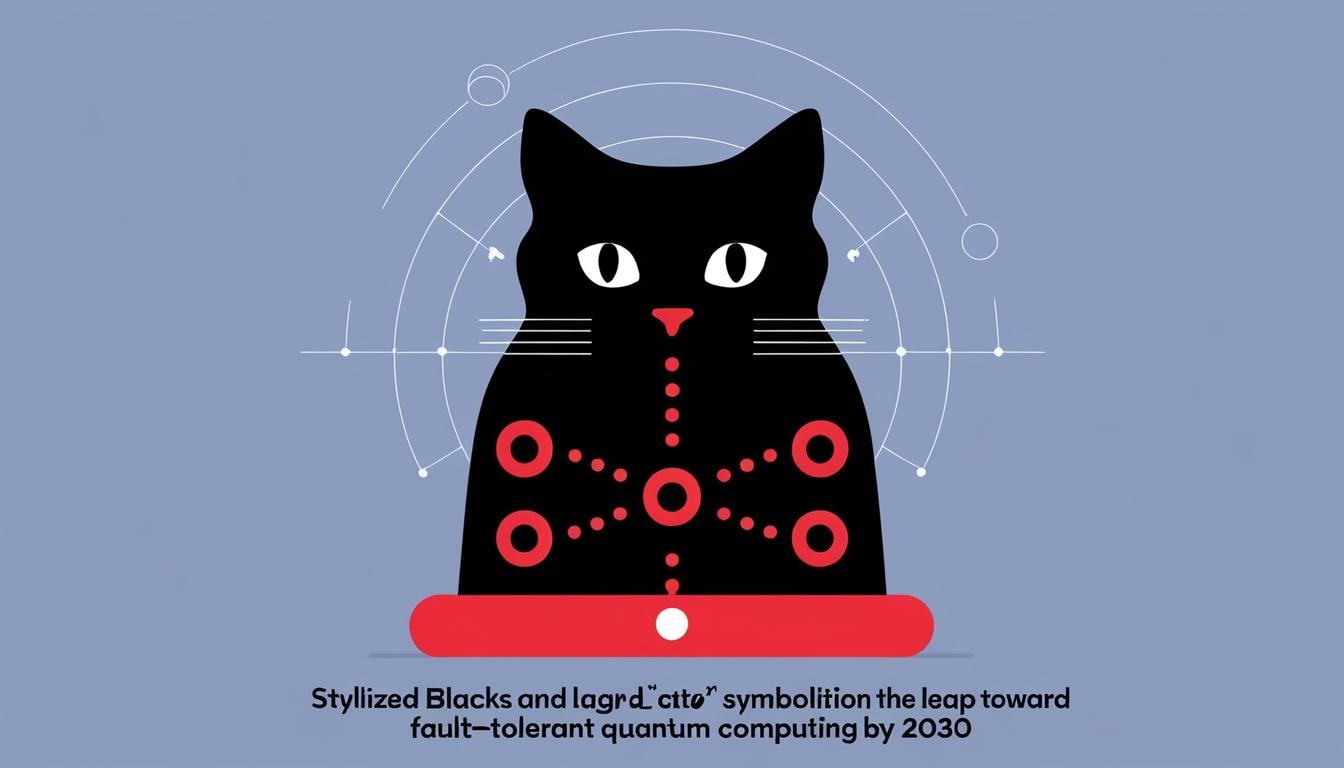
# Alice & Bob outlines roadmap for fault-tolerant quantum computer by 2030



In a significant advancement towards practical quantum computing, researchers at Alice & Bob, a quantum technology company based in Paris, have unveiled a roadmap that could see the arrival of a fault-tolerant quantum computer by 2030. Central to this development is the invention of what is termed the "cat qubit," a novel type of quantum bit inspired by the philosophical Schrödinger's cat thought experiment, where the cat exists in a superposition of states until observed.

The white paper detailing this research emphasizes that, to usher in this new "quantum era," scientists aim to construct a quantum processing unit (QPU) capable of handling 100 logical qubits. Logical qubits serve as a collection of physical qubits that maintain the same information, thus allowing computations to persist even when individual qubits fail. This is crucial because traditional qubits are known to be exceptionally error-prone, failing with a rate of approximately 1 in 1,000, in contrast to classical bits which experience failures at a rate of 1 in a million million.

The introduction of the cat qubit marks a pivotal step forward. Unlike standard qubits, which exist in a single superposition, cat qubits enable a double superposition, allowing them to represent multiple states simultaneously. This attribute significantly reduces the likelihood of "bit-flip" errors — instances where a quantum bit switches from a 0 to a 1 or vice versa — as the number of qubits increases. Moreover, cat qubits exhibit a higher resistance to decoherence, a process where external environmental factors disrupt their quantum properties and the data they carry.

In the pursuit of realising this ambitious goal by 2030, the scientists at Alice & Bob have outlined four critical milestones: developing a logical qubit capable of error correction, creating the first error-correcting logical gate, formulating a universal set of logical gates, and implementing real-time error correction. Each of these milestones is contingent upon the successful completion of the previous one, illustrating the complexity and the long journey ahead, which remains substantial within a five-year timeframe.

It is noteworthy that the roadmap does not address potential unexpected setbacks or "unknown unknowns," which, by their nature, cannot be foreseen. Furthermore, even if researchers succeed in fabricating a chip that can accommodate 100 logical qubits, this milestone alone does not guarantee that the technology will be commercially viable or capable of large-scale deployment.

As researchers continue to explore these advancements in quantum technology, the implications for future business practices and the potential transformation of various industries remain to be seen. The ongoing innovations in quantum computing are set to play a critical role in shaping the technological landscape in the years to come.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

1. <https://thequantuminsider.com/2024/12/04/from-cat-qubits-to-universal-quantum-computing-alice-bobs-2030-roadmap-delivers-high-fidelity-solutions/> - Details Alice & Bob's white paper and roadmap for achieving a universal, fault-tolerant quantum computer by 2030 using cat qubit technology.
2. <https://www.livescience.com/technology/computing/qubits-inspired-by-schrodingers-cat-thought-experiment-could-usher-in-powerful-quantum-computers-by-2030> - Explains the concept of cat qubits, their resistance to decoherence, and the roadmap to achieve a fault-tolerant quantum computer by 2030.
3. <https://techblog.comsoc.org/2024/12/04/quantum-computers-and-qubits-idtechex-report-alice-bob-whitepaper-roadmap/> - Outlines the five key milestones in Alice & Bob's plan to deliver a universal, fault-tolerant quantum computer by 2030, including the use of cat qubits.
4. <https://www.quera.com/glossary/cat-qubits> - Provides a detailed explanation of what cat qubits are, their theoretical foundations, and how they differ from traditional superconducting qubits.
5. <https://thequantuminsider.com/2024/12/04/from-cat-qubits-to-universal-quantum-computing-alice-bobs-2030-roadmap-delivers-high-fidelity-solutions/> - Describes the specific advantages of cat qubits, such as reducing error correction complexity and achieving high-fidelity logical qubits.
6. <https://www.livescience.com/technology/computing/qubits-inspired-by-schrodingers-cat-thought-experiment-could-usher-in-powerful-quantum-computers-by-2030> - Explains the error-prone nature of traditional qubits and how cat qubits mitigate this issue by reducing bit-flip errors.
7. <https://techblog.comsoc.org/2024/12/04/quantum-computers-and-qubits-idtechex-report-alice-bob-whitepaper-roadmap/> - Details the exponential error reduction achieved by cat qubits and their potential to transform industries like finance, healthcare, and cybersecurity.
8. <https://www.quera.com/glossary/cat-qubits> - Discusses the tradeoff between bit-flip and phase-flip error rates in cat qubits and how this tradeoff is beneficial for quantum error correction.
9. <https://thequantuminsider.com/2024/12/04/from-cat-qubits-to-universal-quantum-computing-alice-bobs-2030-roadmap-delivers-high-fidelity-solutions/> - Outlines the milestones for achieving practical quantum advantage, including the development of error-corrected logical qubits and universal logical gates.
10. <https://www.livescience.com/technology/computing/qubits-inspired-by-schrodingers-cat-thought-experiment-could-usher-in-powerful-quantum-computers-by-2030> - Describes the need to build a QPU capable of handling 100 logical qubits to achieve practical quantum computing.
11. <https://www.livescience.com/technology/computing/qubits-inspired-by-schrodingers-cat-thought-experiment-could-usher-in-powerful-quantum-computers-by-2030> - Please view link - unable to able to access data