D-Wave
QUANTUM REALIZED.

D-Wave's Gate-Model Quantum Computing Approach:

BUILT FOR ERROR-AWARE SCALING

For organizations building advanced computing strategies, quantum computing is increasingly part of the plan for addressing computationally complex problems across domains such as optimization, simulation, AI, chemistry, and materials science. D-Wave's dual-platform strategy delivers commercial annealing quantum computing technology today alongside gate-model technology under development. The two approaches are complementary, each suited to different problem classes.

THE D-WAVE APPROACH

Error Detection at the Qubit Level

D-Wave's gate-model quantum computing platform is designed to enable researchers and organizations to explore algorithm development on scalable gate-model quantum systems.

A key element of D-Wave's approach is the dual-rail qubit (DRQ), which is designed to make error detection an inherent part of qubit architecture. This capability is important because detecting errors is a foundational step in quantum error correction, a central challenge in developing fault-tolerant gate-model quantum computers.

By enabling error detection at the qubit level, the DRQ has the potential to reduce some of the overhead associated with quantum error correction. We believe this architecture can provide an efficient and achievable path toward fault-tolerant gate-model quantum computing. Native error detection can also provide useful information to the broader computing system. D-Wave refers to this capability **"error awareness,"** which combines information about detected quantum errors with advanced quantum-classical hybrid tools so that software can respond to errors as part of the computational workflow.

Four Pillars of D-Wave's Gate-Model Approach

D-Wave's gate-model approach is organized around four pillars that connect its dual-rail architecture to high system performance, error-aware programming, and full-stack ecosystem access.

Better Hardware with Dual-Rail

D-Wave's takes a different approach to building and scaling gate-model quantum systems. Instead of treating errors as a downstream challenge, dual-rail qubits embed error detection directly at the device level, making errors detectable during execution.

High Qubit and System Performance

Built on a high-performance superconducting architecture, we believe the system will deliver high-speed operations combined with error detection and 99.9%+ gate fidelities. This combination of speed, fidelity, and consistency provides the performance foundation needed to support meaningful R&D, allowing researchers to move beyond theoretical models and work with real system behavior.

Feature-Rich Programming and Error-Aware Exploration

D-Wave's gate-model quantum computer features built-in error detection and real-time quantum-classical control. Researchers will be able to develop and test error-aware algorithms and quantum error correction techniques natively and begin to explore applications beyond noisy intermediate-scale quantum (NISQ) today.

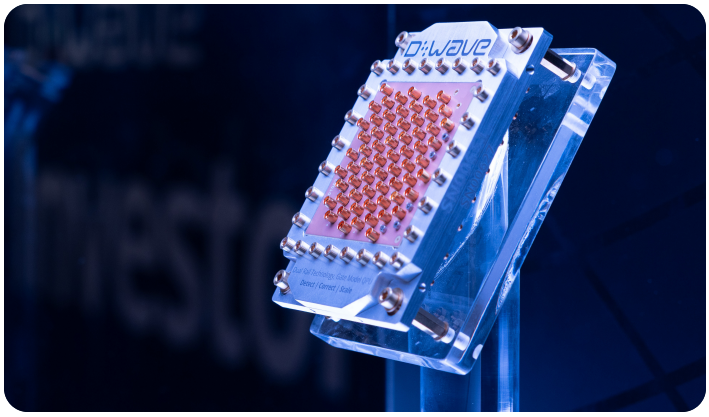
Full-Stack Availability and Ecosystem Access

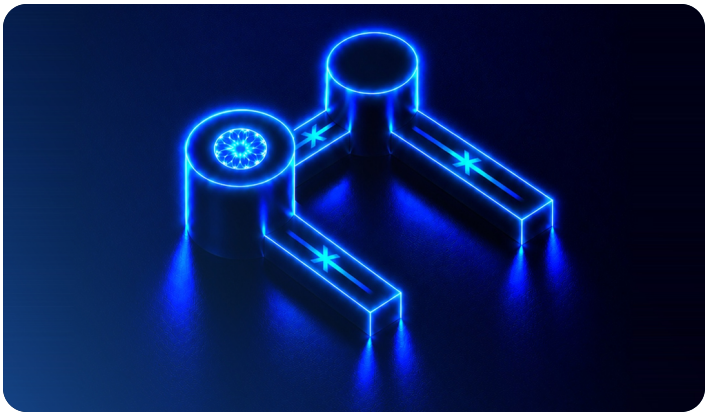
Through D-Wave's Leap™ quantum cloud platform, customers will be able to gain seamless access to simulators, QPUs, and development tools within a unified environment. With forthcoming gate-model capabilities alongside annealing and analog-digital approaches, the platform will expand how developers can engage with quantum computing, offering hands-on exposure to multiple technologies within a single ecosystem.

KEY CAPABILITIES

D-Wave's forthcoming gate-model quantum computing system is designed to bring together:

- A high-performance superconducting architecture, delivering high-speed operations combined with error detection and 99.9%+ gate fidelities.
- Cloud-based access via D-Wave's Leap platform, with a fully featured software development kit (SDK) for developing, running, and managing quantum applications.
- Real-time programming capability that lets quantum programs adapt during execution, with classical operations guiding program flow as it runs.
- An error-aware simulator, featuring error detection, real-time control, and noise modeling.
- A universal quantum gate set with world-class performance and fast throughput.
- Quantum error detection at the hardware (qubit) level, providing visibility into errors during computation.
- Feature-rich programming API supported by D-Wave's Quantum Circuit Description Language (QCDL) for developing and running advanced error-aware quantum algorithms.





Benefits

D-Wave's gate-model architecture is designed to help researchers and organizations explore a more efficient path toward scalable, fault-tolerant quantum computing.

Accelerates progress toward scalable gate-model quantum computing

Error detection at the device level lets researchers explore error correction algorithms and applications beyond what is possible on today's NISQ systems.

Gets more useful compute from every qubit

Built-in error detection and high-speed gate and measurement performance mean more circuits can run successfully, increasing usable compute per qubit.

Provides real-time visibility into errors

Native error detection identifies when and where errors occur at the qubit level, giving customers actionable insight to understand system behavior and respond during execution, opening new approaches to algorithm design.

Improves how quantum systems scale

With built-in error detection capability, D-Wave expects to reduce physical-to-logical qubit overhead by a factor of 10 or more compared to other approaches, lowering the resources required to scale gate-model quantum systems.

Stay Updated

D-Wave's gate-model capabilities are coming to the Leap quantum cloud platform, beginning with our gate-model simulator.

Sign up for gate-model simulator updates today →