

# Dell Technologies Hybrid Quantum Solution + NVIDIA cuQuantum Appliance on Dell XE968



The unparalleled performance anticipated from quantum computing promises to radically change how businesses will solve their most difficult and complex problems. Beyond the financial services industry, quantum computing will be used to address problems in diverse fields such as weather predictions, drug discovery, supply chain optimization, and manufacturing.

To prepare for the emergence of quantum computing, researchers and enterprises need to explore how they might use its capabilities to address these hard problems. To do so, they must develop, test, and validate hypotheses; experiment with new algorithms, and evaluate how quantum operations may be used as they prepare themselves for the coming availability of quantum processing. This means there is a real need for a platform that puts quantum computing's potential within arm's reach, with the hardware and software that provides an environment to empower organizations to explore quantum effectively.

The solution for this platform is Hybrid Quantum Computing, where classical computing handles the heavy processing necessary before and after executing quantum algorithms and provides the virtual Quantum Processing Units (vQPUs) used to simulate quantum computing. The hybrid architecture provides the environment necessary for users to experiment, develop, and test hypotheses today, and be ready to run these on real quantum computers as they mature.

## The Hybrid Quantum Solution

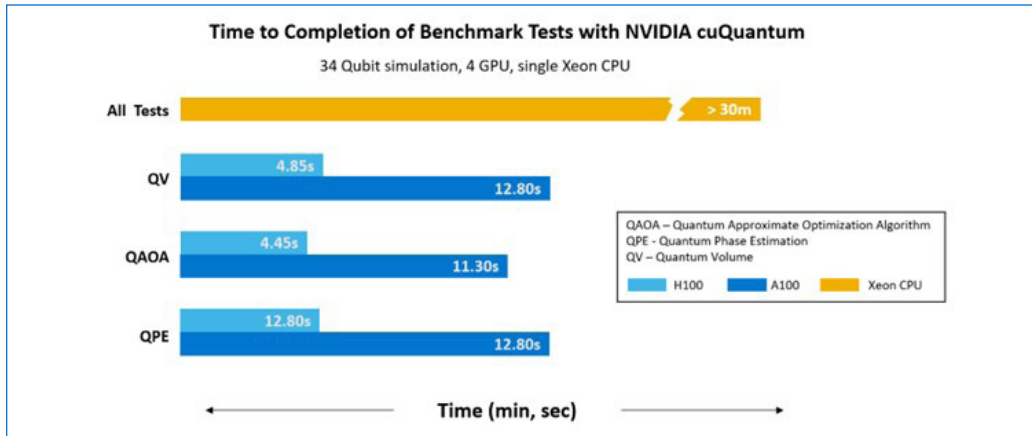
Dell Technologies is taking the lead in hybrid quantum computing, helping its customers to speed time to innovation and discovery.

Previously, Dell Technologies has demonstrated a hybrid solution, joining the PowerEdge R740xd with IonQ's simulation engine and quantum processing unit (QPU), to support integrated classical and quantum simulation workloads running on-premises and connect to remote QPUs when needed. This is described in [The Importance of On-Premises Hybrid Classical-Quantum Computing](#). Now Dell Technologies has allied with NVIDIA, creator of the NVIDIA cuQuantum Appliance, to offer a quantum simulation solution that will help academic and business organizations explore the potential of quantum computing as the technology evolves.

The NVIDIA cuQuantum Appliance is built on the world's most popular AI accelerator—NVIDIA H100—and powered by NVIDIA's containerized cuQuantum software stack. It is a complete quantum simulation solution in a box, allowing users to get up and running quickly.

Key to any solution's success is its ability to deliver results quickly and that means providing the infrastructure necessary to power the workloads. Dell Technologies recently executed benchmark quantum algorithm to check the performance of quantum algorithms on the Dell Technologies + NVIDIA solution; the results are presented here.

The benchmark tests executed on systems running cuQuantum: a PowerEdge XE9680 using 4 of its 8 H100 GPU, and a PowerEdge R740xd, using its full complement of 4 A100s. The algorithms included: a QV algorithm, which is a pure quantum benchmark, QAOA, typically used for optimization problems, and QPE, a fundamental subroutine for chemistry and biology problems. Testing demonstrated the dramatic performance of the GPUs, with the A100 configuration running 140x faster than on a single Xeon CPU, the H100 **up to 400x faster**.



Results based on testing by Dell Technologies, May, 2023. Actual performance may vary.

## Key Benefits of the Dell Technologies + NVIDIA Solution

- **Discover:** Lower the barriers to entry with learning and experimentation.

The cuQuantum Appliance is a breakthrough solution that makes quantum exploration accessible to developers and researchers around the world.

Dell Technologies provides the guidance, documentation, and hardware and software infrastructure, integrated with cuQuantum, for a full hybrid quantum solution that accelerates the discovery, test and validation of key concepts needed to deliver optimized solutions based on hybrid quantum computing.

- **Identify:** Reduce adoption risks by exploring use case and benefits.

Using Dell Technologies' hybrid quantum solution with NVIDIA cuQuantum, businesses can experiment with how they might best apply quantum computing to its most business-critical use cases, to gain a competitive edge. Dell Technologies can also act as your trusted advisor for the tools, expertise and infrastructure needed for success.

- **Deploy:** Choose the right execution environment and achieve real business benefits.

By using the Dell Technologies and NVIDIA cuQuantum solution, enterprises will be able to de-risk future application development with a ready-to-run platform that bypasses the constraint of on-boarding quantum infrastructure when transitioning from a vQPU to a real QPU.



[Learn more](#) about the Dell Quantum Advantage