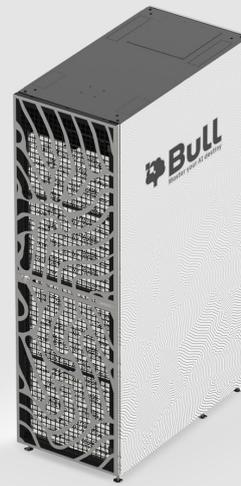# Bull

Qaptiva™ HPC

Enabling quantum emulation in high-performance computing through dedicated software

With years of expertise, Bull is dedicated to designing and delivering custom HPC solutions tailored to the specific needs of computing centers. Reinforcing its commitment to innovation and market foresight, Bull has developed the Qaptiva HPC solution — a revolutionary platform for integrating quantum technology into existing infrastructures.

Qaptiva HPC is groundbreaking licensed software that offers a full programming and emulation environment specifically designed for high-performance computing (HPC) environments. This innovative solution significantly boosts simulation capabilities, resulting in remarkable improvements in computing speed, efficiency, and capacity and opening up exciting new avenues for research and development. It allows for the emulation of over 40 qubits, with capacity limited only by the cluster memory, significantly reducing emulation and simulation processing time from days to hours. The computation is performed in double precision (64-bit).

Capabilities and key benefits

Built on distributed memory HPC hardware architectures (Message Passing Interface), Qaptiva HPC aims to enhance the capabilities of traditional HPC clusters by incorporating quantum emulation. This will enable computing centers to leverage cutting-edge technology while optimising their existing resources.

Qaptiva HPC offers a linear algebra (LinAlg) emulator that:

- Enables direct execution of a quantum task on a high-performance computer to model and understand quantum systems.

- Provides enhanced performance for large-scale linear algebra calculations, essential for quantum emulation by

  - Performing quantum simulations on an HPC cluster by leveraging the distributed architecture (CPUs and memory).
  - Simulating a large number of qubits by aggregating the memories of different nodes in the cluster.
  - Accelerating processing by using the cluster's CPUs together, thus optimising resources and performance for faster and more accurate results.

Experience exceptional performance

With Qaptiva HPC, benefit from impressive capabilities in quantum computing thanks to its outstanding number of qubits!

GPU mode:

GPU model	GPU memory	Max # qubits
NVIDIA A30	24 GB	31
NVIDIA A100	80 GB	33
NVIDIA H100	80 GB	33
AMD MI200	64 GB	32
AMD MI250X	128 GB	33
AMD MI300	192 GB	34

Distributed CPU mode:

Total cluster memory (RAM)	Max # qubits
1 TB	36
2 TB	37
4 TB	38
16 TB	40
128 TB	43
256 TB	44

- Facilitates the efficient development of quantum algorithms:

  - Vector representation of qubits.
  - Quantum gate operations using matrices.
  - Provides support for developing quantum algorithms that rely on linear algebra, such as Shor's and Grover's algorithms

- All programs developed with myQLM freeware or the Qaptiva appliance are compatible with and can run on Qaptiva HPC. Qaptiva customers will be able to run their quantum programs in their HPC environment using Slurm batches.

The Qaptiva HPC emulator is built in C++ with a Python API, enabling seamless integration and usability. Designed for multi-node operation, it is fully compatible with Slurm scheduling. This emulator leverages Qaptiva's advanced capabilities, particularly through compilation plugins, and is meticulously optimised for HPC execution. By utilising gate processing to compile tasks for HPC execution, it delivers exceptional performance and efficiency.

Why Bull

Pioneering since **2016**	Proven **expertise and experience**
Leader in HPC/QC **hybridisation**	**20+** international research projects
96+ Quantum computing patents	**Global trusted partner** for your quantum journey

Quantum accelerators for writing and optimising quantum algorithms.

Comprehensive quantum solution that caters to diverse needs in terms of capabilities and access.

Successful strategic partnerships with the leading quantum computer providers.
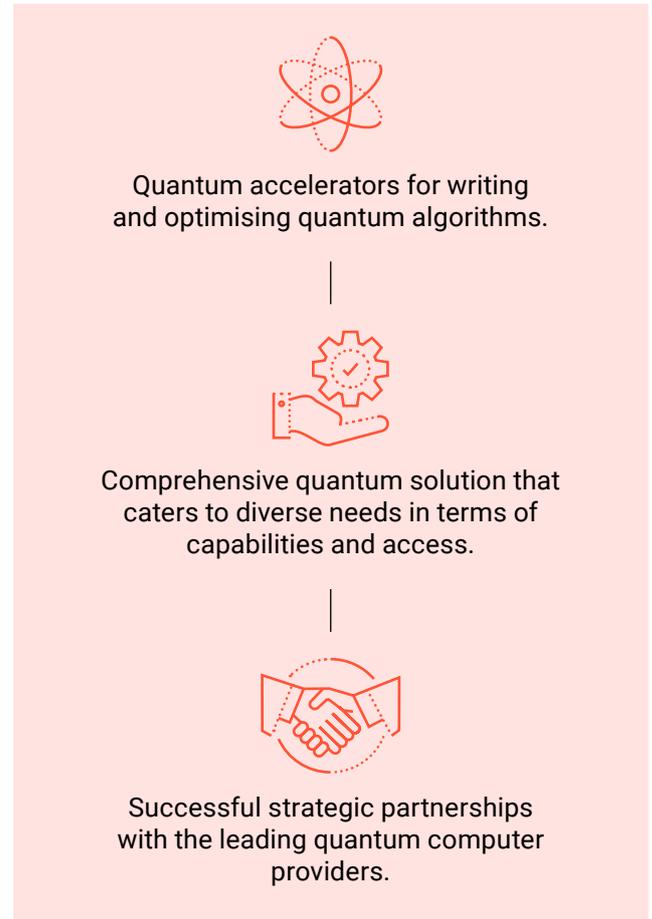
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