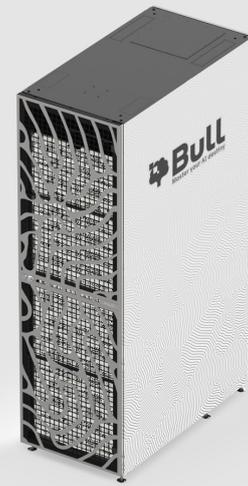# Bull

Qaptiva 800 range

Explore the possibilities of quantum computing and transform theories into practical applications using our all-in-one and best-in-class capabilities

Boost discovery and solve complex business issues by unlocking the power of quantum mechanics

Exploring innovative computing solutions that foster growth and progress is essential in today's world. Quantum computing is a new paradigm that can help solve complex problems and overcome various industry challenges. Quantum Computing revolutionises the digital potential for organisations across various fields, and it promises to dramatically boost supercomputing power, enabling the simulation of intricate problems in seconds.

The world of quantum computing is rapidly advancing, with different approaches for both software and hardware, including superconducting, photonics, neutral atoms, and trapped ions. To stay ahead in the competition, it is essential for businesses and organisations to embrace Quantum Computing technology as soon as possible, without waiting for quantum computers with enough qubits, identify and develop applications, and stay updated with the latest trends.

Qaptiva 800 is a quantum emulator with an integrated environment that allows businesses and institutions to anticipate the availability of advanced quantum computers and implement concrete use cases by leveraging innovation in quantum technology. With its extensive computing capabilities, it facilitates the development, optimisation, and experimentation of quantum algorithms and applications. Its versatility enables users to design custom programs for a wide range of quantum computers.

Business benefits

Accelerate time to insight
Qaptiva 800 offers a robust development environment that aids in creating quantum computing programs and simplifies the programming, emulation, and execution of quantum algorithms and applications for greater ease.

Helps to secure your sensitive data
Increase the confidentiality and privacy of research programs and innovation projects. Qaptiva 800 is a stand-alone appliance that can be installed on your premises and integrated easily with your existing infrastructure.

Spark creativity
Gain detailed insights with Qaptiva 800 and deepen your understanding of your quantum processing unit (QPU) behavior. This will enable you to identify improvement opportunities and optimise the performance of your quantum computer.

Adapt quickly and easily
Choose the best programming paradigms for your needs (gate-based, annealing, and analog) and focus on developing your application and algorithms without being limited by the availability, capacity, and costs of quantum computers.

Future-proof your investment
Simulate various quantum technologies through a software and hardware agnostic platform. Optimise your code and compile it to operate on any quantum computer.

Leverage best-of-breed technology
Bull is a pioneer in quantum computing technology and High-Performance Computing (HPC), and you benefit from a recognised, patented, experienced, and trusted partner.

Qaptiva 800 offers organisations an advanced platform to embrace quantum computing, enabling the optimised design of quantum applications for solving complex problems. This cutting-edge technology paves the way for significant advancements in various industrial sectors, such as chemistry, finance, logistics, operations research, and energy.

Powered by Qaptiva 800 stand-alone appliance
Qaptiva 800 enables clients to swiftly define applications, revolutionising the user experience with its cutting-edge technology and intuitive interface

Choose the suitable category of quantum problems to begin programming your quantum algorithm or application

PROGRAM CIRCUITS

EMULATE

Emulate noise or noiseless logical qubits

Adapt your code to a particular quantum processing unit (QPU)

OPTIMISE CODE

GET READY TO RUN ON A QPU

Use a wrapping plug-in to run on a QPU

Technical benefits

Qaptiva 800 enhances the development of quantum applications with an integrated platform offering unique features and capabilities. It allows for the emulation of various qubit technologies, adapts quantum code to the specificities of a processor, and develops hardware-independent solutions. With the ability to emulate over 100 qubits depending on the algorithm and emulator used, Qaptiva 800 demonstrates the utility of emulators for testing different algorithms.

Maximise your productivity

Improve your work by accessing various programming tools, high-level business application libraries, example or illustrative notebooks, state-of-the-art algorithms, and third-party open-source connectors in one convenient location.

The Qaptiva 800 appliance can be connected to quantum processing units.

Use less memory and run faster

Take advantage of Qaptiva's extensive range of optimisation tools that help to adapt circuits by reducing the gates according to the target QPU's gate set type and prepare it to run on any quantum computer with maximum performance.

Thanks to a wide range of configuration appliances, you can run simulations 2 to 16 times faster by launching them in parallel while enjoying the benefits of a GPU-accelerated appliance.

Run high-performance emulations

With Qaptiva 800, you can run quantum algorithms and circuits using up to 40 logical qubits in the most entangled cases.

This appliance can emulate physical noise, so you can use it as if you were running calculations on an actual quantum computer affected by these noise sources. Using the noise study, you can adapt your program to get the best out of your QPU.

Experience freedom and peace of mind with flexible and secure access

You can access the Qaptiva appliance in two ways: interactively through SSH on your machine or via a user-friendly web interface using the open-source Jupyter Notebook software. Integrate easily with your identity and access management solution for increased security.

High level of extensibility and interoperability.

You can develop your plugin using our SDK and customise the execution stack.

If you choose to, you have the ability to link up to other quantum frameworks that are based on Python and easily import/export codes from other languages.

(OpenQASM, Perceval, Cirq, Pyquil, ProjectQ and Qiskit)

Prepare for the fault-tolerant quantum computation era

Bull takes a step further towards Fault-Tolerant Quantum Computation (FTQC) by introducing Q-Pragma, an environment that helps HPC centers utilize quantum algorithms and implement HPCQuantum hybridization. This agnostic technology allows HPC applications to leverage quantum acceleration and seamlessly integrate existing C++ programs.

Features and capabilities

A unique, multi-patented hardware infrastructure with a large memory capacity that can be used by multiple developers simultaneously, with the option to integrate a dedicated GPU for hardware acceleration.

Program circuits

- Provides a universal, hardware and software agnostic, quantum programming model.
- Offers a high-level quantum hybrid programming language built on the widely used Python language. It's tailored for NISQ1 algorithms, in particular variational algorithms.
- Supports gate-based computing, quantum annealing, and analog computing. It offers plugins in various programming languages and an SDK to integrate algorithms seamlessly.
- Exposes an abstraction layer (Atos Quantum Assembly python) for generating a universal quantum assembly programming code (AQASM) and hybrid simulation.
- Allows for the easy creation of gates and sub-programs with reusable sequences of gates within a quantum program.
- A client-server Jupyter Notebook application allows you to view, edit, and execute notebook documents via a web browser. This application comes with an extensive collection of quantum mathematical libraries, algorithms, and pre-built routines, making it easy to start your projects immediately.

Optimise code

- Best-in-class optimisation suite that allows different quantum circuits to be adapted to a particular hardware by creating custom plug-ins, rewriting gate sets, and making it compliant with the physical topology of the quantum hardware.

Emulate circuits or run on a quantum processing unit (QPU)

- Emulation of a quantum program for the vector simulation of the complete state up to 40 qubits for any circuit.
- Emulating noisy QPU with an option to implement the noise models without reducing the available qubits.
  - When simulating physics, various models for quantum noise are utilised. Appropriate noise models are selected to resemble reality closely, depend-ing on the technology used, such as trapped ions, superconducting circuits, or semiconducting silicon.
  - Noise model characterisation

The emulation environment will consist of at least five simulators:

- Linalg
- Feynman
- Stabilisers (stabs)
- Matrix Product State (mps) and Adanced Matrix Product State (qpeg)
- Quantum Multi-valued Decision Diagrams
- Noisy QPU
- Simulated quantum annealing.
- Annalog QPU

It's possible to simulate quantum annealing of at least 30000 variables and up to 50000 spins, with accuracy much higher than all existing annealing hardware.

- Use a wrapping plug-in to run on a QPU.

Technical specifications

Qaptiva 800 appliances	Qaptiva 802	Qaptiva 804	Qaptiva 808	Qaptiva 816
Hardware configuration	CPU: P-8450H (2 sockets) Mem: 2TB RAM Disk E1S: 1.92To Without GPU: • 2 x 28C 2GHz -250W With GPU: • 2 x 20C 1.9GHz - 205W • GPUs option: 2 x Nvidia L40s 48GB	CPU: P-8450H (4 sockets) Mem: 4TB RAM Disk E1S: 1.92To Without GPU: • 4 x 28C 2GHz -250W With GPU: • 4 x 20C 1.9GHz - 205W • GPUs option: 4 x Nvidia L40s 48GB	CPU: P-8450H (8 sockets) Mem: 8TB RAM Disk E1S: 1.92To Without GPU: • 8 x 28C 2GHz -250W With GPU: • 8 x 20C 1.9GHz - 205W • GPUs option: 8 x Nvidia L40s 48GB	CPU: P-8450H (16 sockets) Mem: 32TB RAM Disk E1S: 1.92To Without GPU: • 16 x 28C 2GHz -250W With GPU: • 16 x 20C 1.9GHz – 205W • GPUs option: 8 x Nvidia L40s 48GB
Management interfaces	1 x 1Gb/s (RJ45)	2 x 1Gb/s (RJ45)	4 x 1Gb/s (RJ45)	8 x 1Gb/s (RJ45)
Network interfaces	4 x 200 Gbe/s (QSFP56 MMF)	4 x 200 Gbe/s (QSFP56 MMF)	4 x 200 Gbe/s (QSFP56 MMF)	4 x 200 Gbe/s (QSFP56 MMF)
Power Supply	• 80 PLUS Titanium, up to 96% efficiency • Hot Swap: 2 per 2-socket server module (1+1 redundancy) • Cable: C19-C20, 20 A • 2200 W or 3000 W, according to configuration • 100-120 V / 200-240 V @ 50-60 Hz			
Cooling	12 fans per 2-socket server module (N+1 redundancy)			
Physical specifications	89 mm (2U) x 447 mm (19") x 855 mm	177 mm (4U) x 447 mm (19") x 855 mm	355 mm (8U) x 447 mm (19") x 855 mm	842 mm (19U) x 447 mm (19'') x 855 mm
Weight	Up to 40 kg	Up to 80 kg	Up to 160 kg	Up to 415 kg
Operating constraints	Ambient air temperature: +10°C to +35°C, gradient 20°C/hour Relative humidity (non-condensing): 20% to 60%, gradient 5%/hour Elevation: above sea level and below 2500 m			
Availability and RAS features	**RAS features:** Integrated features to prevent, detect, and correct various memory, CPU, I/O, system, and UPI errors **Serviceability:** Hot swap devices: PSUs, PCIe blades, fans NVMe drives DIMMs and CPUs serviceable without extracting the whole server **Redundancy:** Power Supply Units, fans, NVMe drives with RAID			
Regulations and safety	**Global:** CB, RoHS, REACH, WEEE **Per country:** CE, CSA, ICES-003, FCC, BIS, BSMI (consult Bull sales representative for an exhaustive list)			

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