Controlling and calibrating quantum devices using the open-source framework Qibo

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Abstract: We present Qibo, an open-source quantum computing framework offering a full-stack solution for efficient deployment of quantum algorithms and calibration routines on quantum hardware.

We present Qibo [1], an open-source quantum computing framework offering a full-stack solution for efficient deployment of quantum algorithms and calibration routines on quantum hardware. Quantum computers require compilation of high-level circuits tailored to specific chip architectures and integration with control electronics.

Our framework tackles these challenges through Qibolab [2], a versatile backend that interfaces with a wide range of electronics -both commercial and open-source- for seamless program execution on quantum devices. Moreover, frequent calibration is essential for maintaining quantum computers in an operational state. Qibocal [3] simplifies this process, providing a hardware-agnostic interface that automates calibration routines across supported platforms, complete with advanced reporting and data processing tools. We will demonstrate our software suite on platforms based on superconducting qubit technology, highlighting performance benchmarks using different electronics. The ease of integrating new hardware drivers makes Qibo particularly valuable for labs aiming to control their own self-hosted quantum systems.

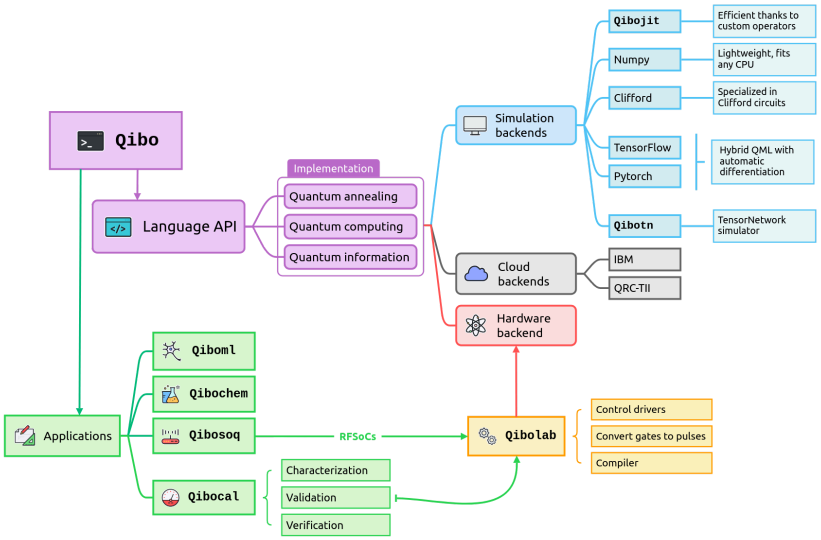

Fig. 1 Schematic view of the modules available in the Qibo framework.

In Fig. 1 we present a schematic view of the modules available in the Qibo framework. There are backends dedicated to quantum classical simulation and modules for quantum hardware control electronics and calibration. This full-stack software solution can be used for the development of quantum applications from quantum machine learning, custom electronics firmware, quantum chemistry, high-energy physics [4] and more.

References

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