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Towards an open-source hybrid quantum operating system

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Over the last 20 years, thanks to the development of quantum technologies, it has been possible to deploy quantum algorithms and applications that before were only accessible through simulation on real quantum hardware.
The current devices available are often referred to as noisy intermediate-scale quantum (NISQ) computers, and they require calibration routines in order to obtain consistent results.

In this context, we present Qibo, an open-source framework for quantum computing.
Qibo was initially born as a tool for simulating quantum circuits.
Through its modular layout for backend abstraction, it is possible to change effortlessly between different backends, including simulator based on just-in-time compilation, Qibojit.

In order to enable the execution and calibration of self-hosted quantum hardware we have developed two open-source libraries integrated with the Qibo framework: Qibolab and Qibocal.
Qibolab provides the software layer required to automatically execute circuit-based algorithms on custom self-hosted quantum hardware platforms.
It enables experimentalists and developers to delegate all complex aspects of hardware implementation to the library so they can standardize the deployment of quantum computing algorithms in a hardware-agnostic way.

Qibocal is based on a modular QPU (Quantum Processing Unit) platform agnostic approach and introduces tools
that support the calibration and characterization of QPUs on three different levels: development, deployment and distribution. Qibocal provides a code library to rapidly develop protocols for different hardware abstraction layers.
The integration with Qibo allows one to easily switch between hardware execution and high-perfomance simulation.

Significance

This talk will focus mainly on Qibocal and Qibolab as tools for calibrating and characterizing quantum devices.

References

https://arxiv.org/pdf/2303.10397.pdf
https://arxiv.org/pdf/2308.06313.pdf

Experiment context, if any

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