Contribution ID: **18** Type: **not specified**

A Containerized Quantum Application Software Architecture Framework

Tuesday, 15 November 2022 09:50 (20 minutes)

Starting from the idea of Quantum Computing, conceptualized back to 80s, we come to the present day being able to perform calculations on real prototype quantum computers. Recent technology improvements open new scenarios that quickly lead to the real possibility to integrate this technology into current software architectures. Designing a software on distributed systems is based on essential pillars, such as modularity, openness, and reuse of components. Typically, an application is divided into logical layers allowing targeted interventions on decoupled elements; however, exploiting frameworks that allow computation to be performed on a hybrid classical-quantum backend poses a series of challenges. We present here a scalable and open software architecture that can be reused as a design pattern whenever dealing with similar problems, being able to receive requests from the user, send them to a quantum computer and receive back the result by assuring the ordering and coherence of events as well as the right format; moreover, the aim of the proposed architecture is to bridge the gap between the classical and quantum computation for real problems.
As quantum technology development will continue to reach significant milestones, enterprises and researchers will be likely to use on a daily basis in the near future: an Enterprise would indeed be oriented to a progressive integration of quantum computing in their production architectures, to support and improve existing workloads.
A first attempt to develop a proprietary basilar framework has been proposed in this blog and in this article by the authors of this document, and has been published as disclosure. Now we improved the previous version by creating a new framework leveraging on an Enterprise Cloud technology such as Red Hat OpenShift, to achieve best portability and to exploit the extended number of services that this solution has to offer in terms of data storage, hosting, middleware, and message queue services.
A real implementation of this framework has been put in place as a Minimum Viable Product, that can be downloaded from a public GitHub repository.

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Session Classification: Martedi

Track Classification: Infrastruttura