XACC and Rigetti Quantum Virtual Machine Integration

Achievement: Developed new XACC Accelerator implementation that executes quantum kernels on the Rigetti Quantum Virtual Machine.

Significance and Impact: This work has developed close collaboration ties with a key player in the quantum computing research world. It sets up XACC to offload quantum kernels to an actual physical QPU in the near future.

Research Details:

- Developed the RigettiAccelerator which takes XACC IR and produces an equivalent Rigetti Quil representation, and then executes that string via an HTTPS Post to the QVM server, and reads back virtual measurement results. These results can then be processed for the application.
- Developed detailed architecture documentation and an intuitive tutorial that was publicized by Rigetti via Twitter.

Sponsor/Facility: ORNL LDRD

PI and affiliation: Alex McCaskey from CSMD – Oak Ridge National Laboratory

Team: Alex McCaskey, Travis Humble, Eugene Dumitrescu, Dmitry Liakh

Publication: https://ornl-qci.github.io/xacc/accelerators/rigetti, https://ornl-qci.github.io/xacc/tutorials/rigetti, and https://twitter.com/rigetti/status/877627233984106496

Overview:

Rigetti Computing, Inc (rigetti.com) is a recently founded startup that is focused on developing quantum computing hardware and software and bring it to market. They are working to build a cloud quantum computing platform for AI and computational chemistry. They currently have a QVM simulation server that can be accessed via a REST API with a private API key. Rigetti has also done great work as of late in providing open source programming tools for interfacing with their QVM - specifically, the PyQuil python framework PyQuil.

Recently, the ORNL QCI (quantum.ornl.gov), the XACC project, and the Software and Applications Team from Rigetti have begun collaborating in an effort to expose the Rigetti QVM server and programming tools to XACC and its user community. This article describes the results of that work - specifically, a new XACC Accelerator implementation that executes quantum kernels on the Rigetti QVM server. For a more hands-on tutorial on how to use XACC and the Rigetti Accelerator, check out Rigetti Tutorial.