

# Qaptiva as QC Middleware in HPC

## From Single User to Exascale



### myQLM – Cloud Access to Qaptiva & QPU

Free and Powerful Quantum Programming Environment

- simulate a noiseless quantum computer on your laptop
- study with a large number of Jupyter notebook tutorials
- access Qaptiva platform
- access different QPU backends



### Qaptiva – Quantum System Management Platform

- interface concept for external components:
  - external HPC scheduler as substitute for Qaptiva internal FIFO
  - circuit optimizers
  - compilers
- Qaptiva job accounting database for e.g. customer billing
- security, ssl keys, Django, ACLs
- installation and administration tools



[plugin concept and workflow diagram](#)

### User Workflow

- access to emulated QPUs (noisy and noiseless)
- access to real QPUs
- identical workflow for any scenario



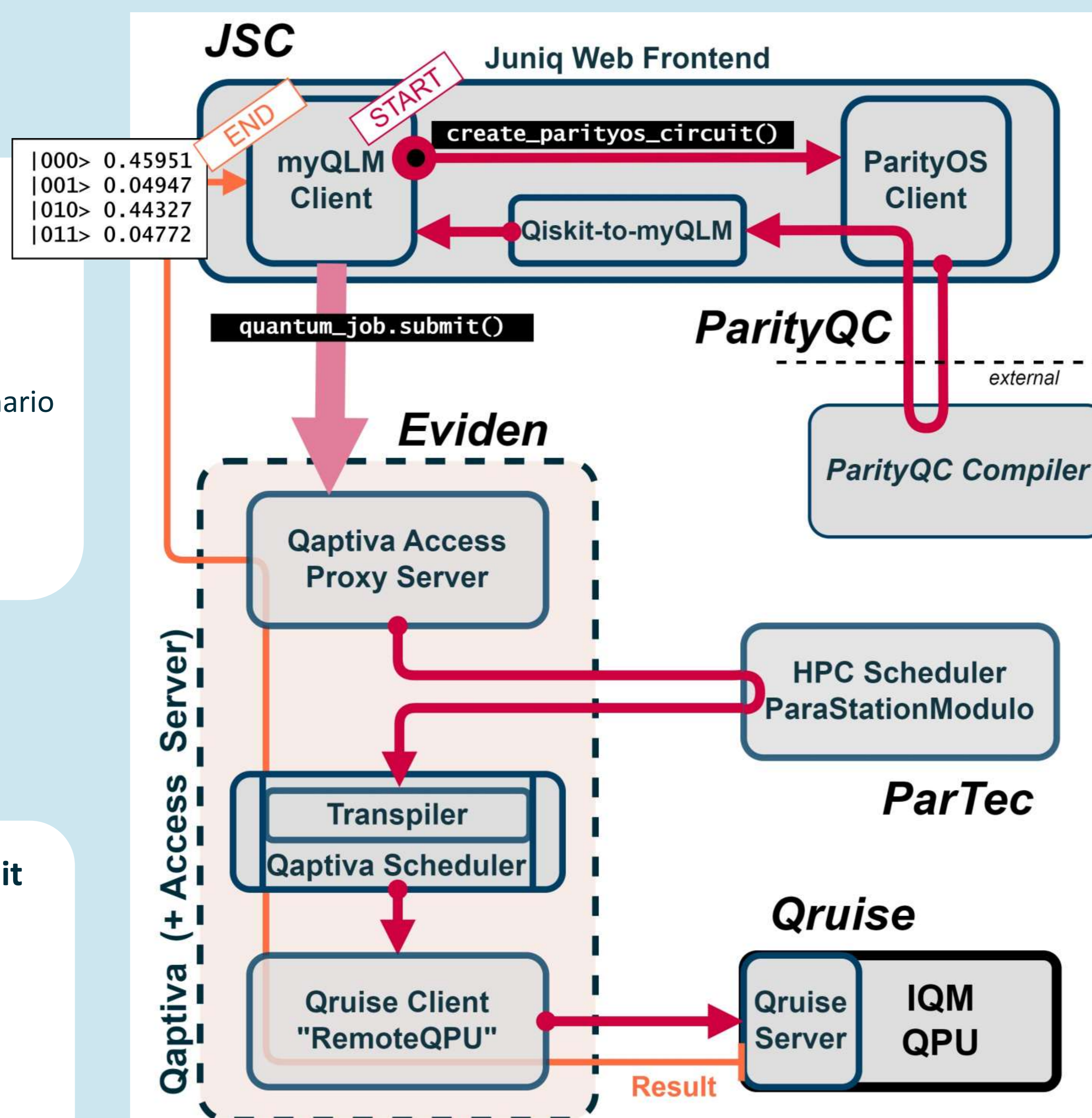
[code example](#)

### Support of All Common Circuit Description Languages

Qaptiva Interop Converter



[example of circuit conversion and overview of supported languages](#)



### Job Flow Diagram of Third QSolid Smoke Test

- simple user access to real QPU
- first real life QC/HPC integration ever



[watch recorded video of running job examples](#)

### Compilation and Optimization

- Qaptiva platform supports QPU makers to integrate their own specific compilers & provides an independent compilation library
- QPU makers do not need to rely on compiler components of their competitors



[Qaptiva compiler documentation](#)

### Hardware Agnostic Integration of Real QPUS and Simulations

Today's fully integrated QPU backends:



Further partnerships with other leading QPU manufacturers in progress.

### HPC Center Agnostic Middleware

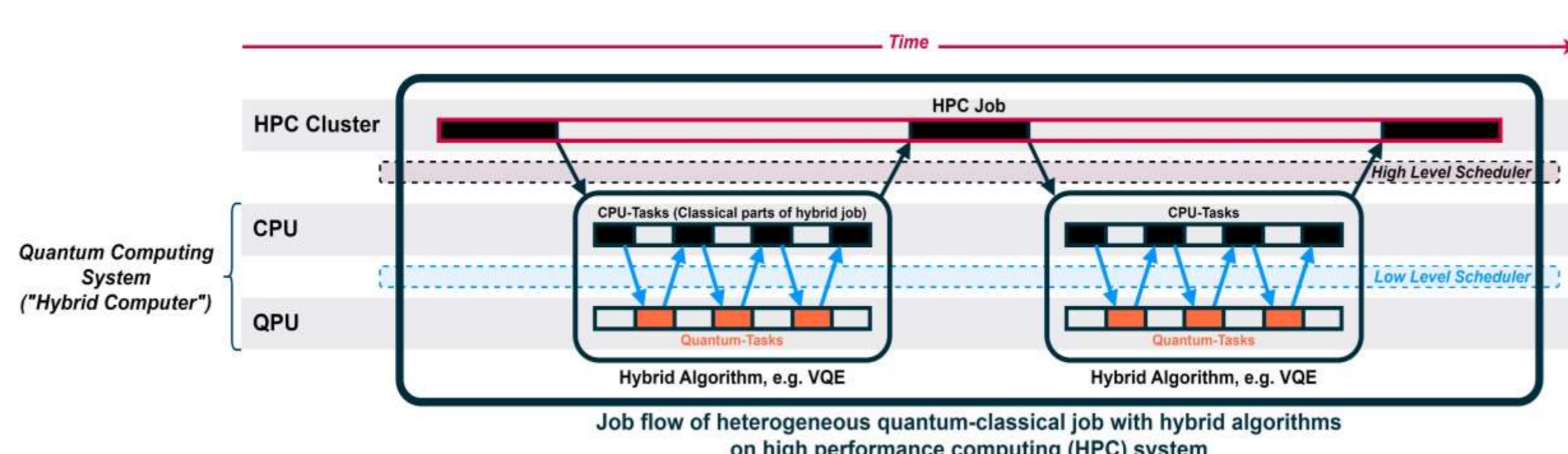
The Qaptiva middleware solution is applied in various setups of other European HPC centers.



[jobflow diagram of HPCQS/CEA France](#)

### Scalable QC HPC Scheduling

Example for Heterogeneous Quantum-Classical Job



[Eviden's LSQ framework QPragma for future fault tolerant QPUs in HPC centers](#)

### Rich Spectrum of Possible Hybrid NISQ Jobs

- pure quantum jobs
- classical HPC jobs with sporadic single quantum jobs
- alternating classical HPC and quantum jobs of similar duration
- variational jobs (→ QC algorithms with classical optimizations)

