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Munich Quantum Valley

Q-DESSI

The Munich Quantum Software Stack

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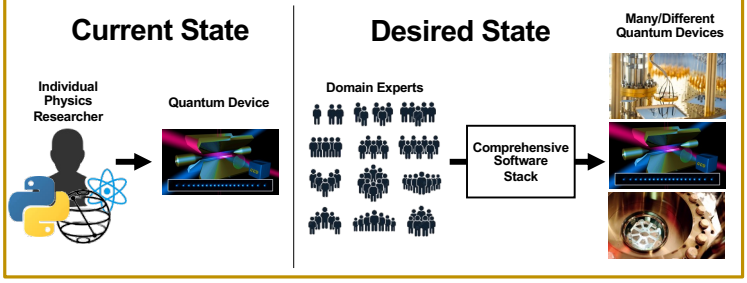
Enabling Efficient Access and Tool Support for Quantum Computers

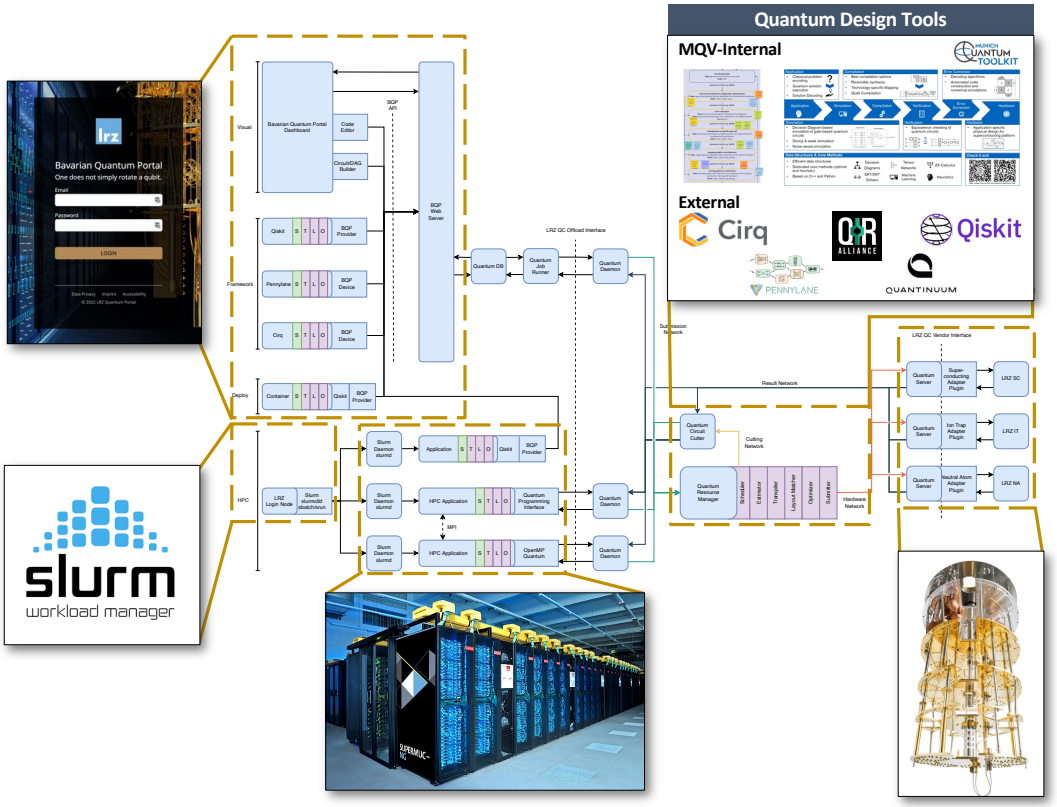
Abstract

As quantum computing systems mature and move from laboratories to production computing environments, the needed software environments must be considered. In particular, expected use of quantum systems as HPC accelerators requires a deep integration with the existing and widely deployed HPC software stacks. Additionally, new requirements such as dynamic compilation and new challenges for tools and programming models must be considered. We tackle these challenges in the Munich Quantum Software Stack, a comprehensive initiative to offer a flexible, efficient and user-oriented environment for the MQV and beyond. In this poster, we describe the core components and workflows, and how they will enable this transformation from quantum experiments to quantum accelerators.

Motivation: Software for Quantum Computing



Proposed Software Stack



Challenges

Need to broaden application areas
- Several core domains exist
- New (domain) users
- Need for new quantum algorithms

Need for better programming
- Easier access for an user
- Higher levels of abstractions
- Implicit optimizations

Quantum systems need HPC
- Workloads are very targeted/limited
- Applications are mostly hybrid
- Scaling QC requires massive compute power

Need for integrated systems
- Single system accessed via HPC
- Offload programming models
- Components matching HPC SW stack

Need for Design Automation
- Most tasks are non-trivial/complex
- Require efficient data-structures and core methods
- Experience from classical design automation can be utilized

QUANTUM.LRZ.DE and HPCQC.ORG

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