INTEGRATION OF QUANTUM DEVICES INTO THE MSA

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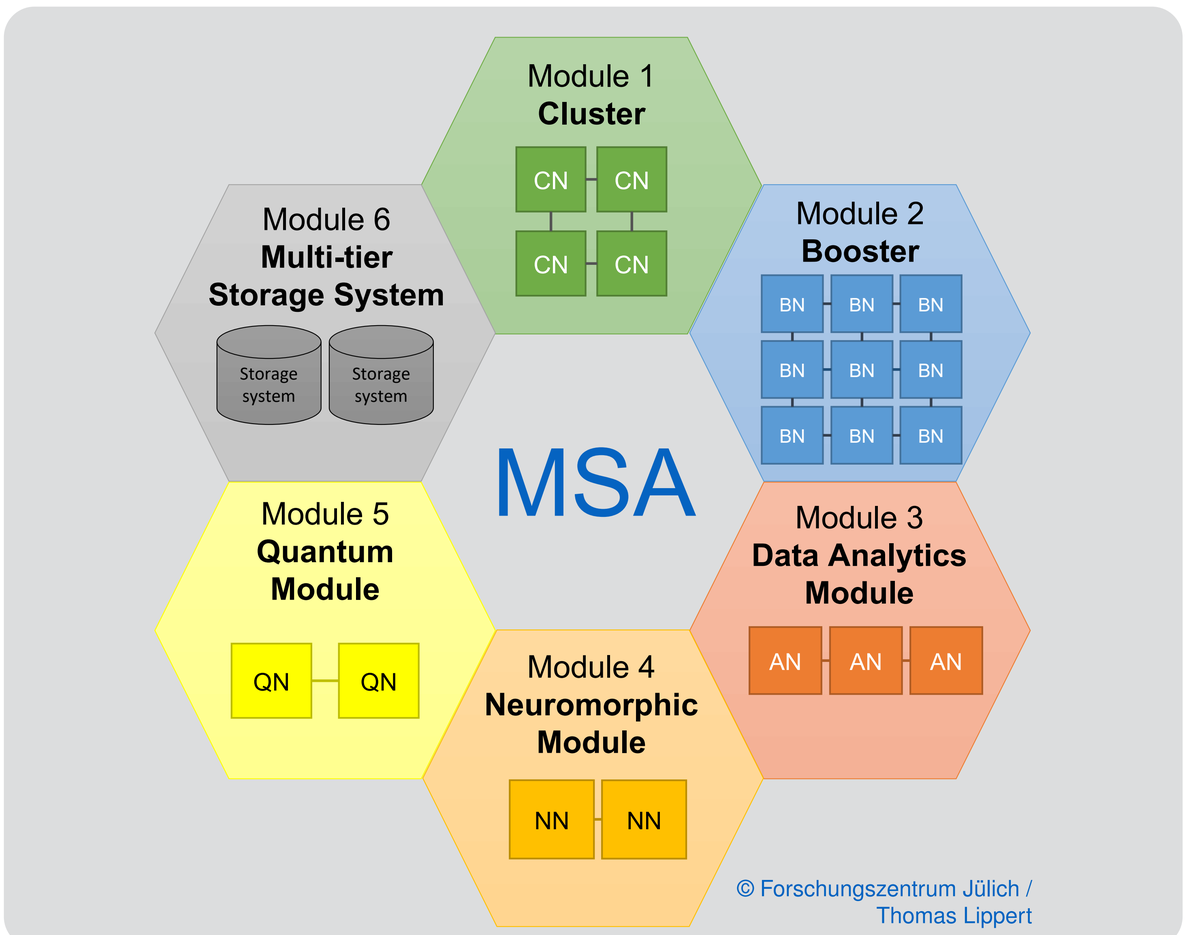
OVERVIEW

High-performance Computing (HPC) is a modern, yet well-established discipline dealing with answering extremely difficult, scientific as well as socially relevant questions. Quantum Computers (QPUs), on the other hand, represent a comparatively new technology that is currently emerging within HPC as another very significant pillar for the future.
The tight integration of QPUs into an existing HPC infrastructure is one of the main goals of QSolid. This enables the simultaneous use of the quantum hardware via a web portal as well as via the system-wide resource management of the HPC environment. This is indispensable to enable application scenarios that go beyond their classical use (e. g., quantum-hybrid workflows that include quantum hardware in addition to traditional HPC resources and tightly-coupled simulations that benefit from efficient data exchange). Additionally, complex and parallelisable pre- and post-processing steps that are required for the QPU itself may leverage the HPC resources as well.

MSA

The Modular Supercomputing Architecture (MSA) provides solutions to these challenges by integrating heterogeneity at the system level. So-called modules are connected by a federated high-speed network to a single system. Here, the QPU is considered as another module of an MSA system, which is closely connected to the existing modules enabling low-latency communication.
In QSolid, ParTec focuses on this integration by leveraging its well-established ParaStation Modulo software suite for the operation of modular HPC systems.



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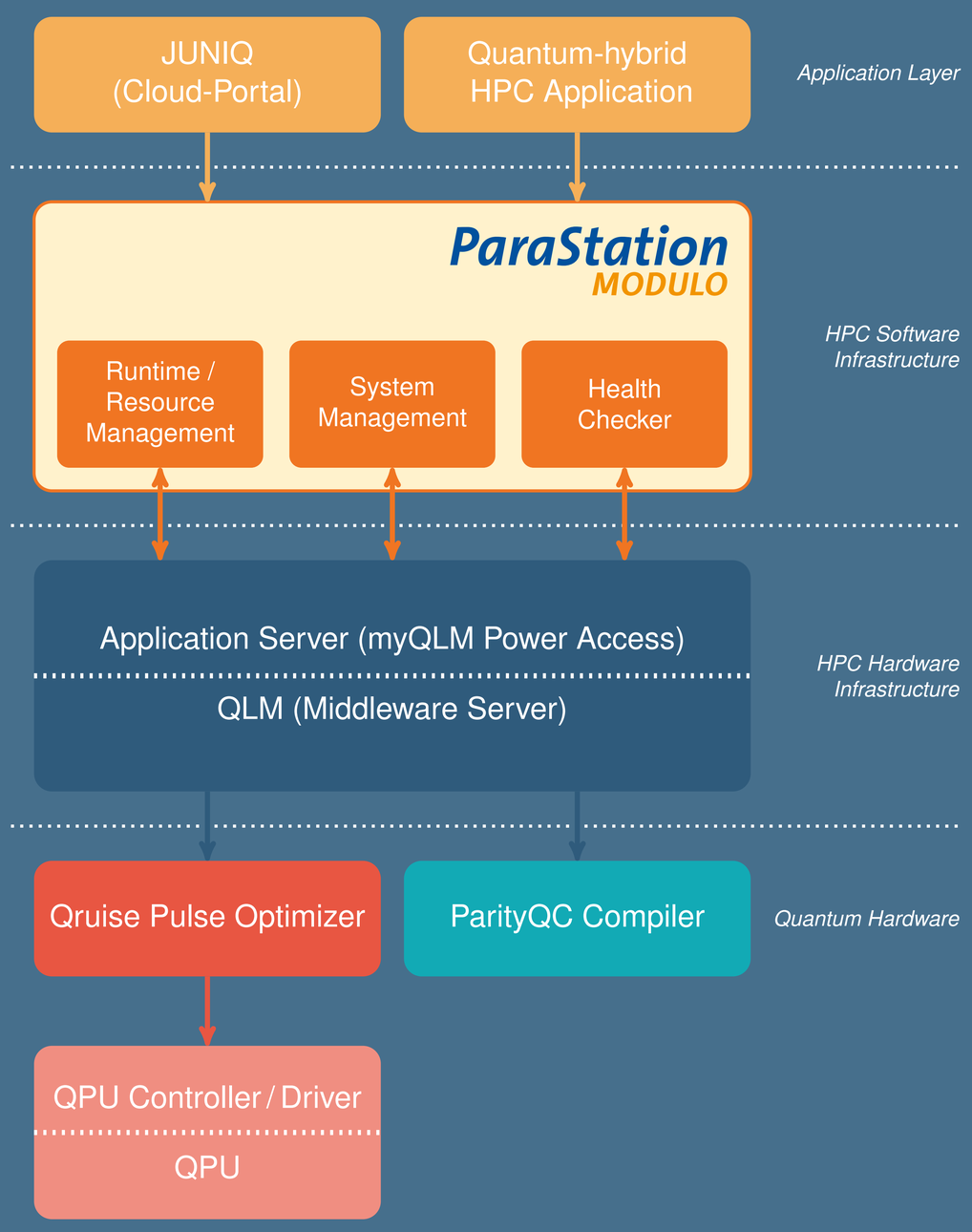
ARCHITECTURE

Joint scheduling enables the efficient utilization of resources. As the QPU is a scarse resource, it cannot be used concurrently by multiple users. Therefore, we implement a pseudo-shared usage model, e.g., based on time slices assigned to the invidual jobs.



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