

The Munich Quantum Software Company: Developing Production-ready Quantum Computing Software

Robert Wille, Marcel Walter, Simon Hofmann, Patrick Hopf, Marc Messing, Lukas Burgholzer
Munich Quantum Software Company (MQSC), Garching near Munich, Germany
{robert, marcel, simon, patrick, marc, lukas}@munichquantum.software

Abstract—Quantum computing is becoming a reality. Superconducting, ion traps, neutral atoms, etc.—the hardware is getting there! However, software capable of handling complex design tasks is needed to connect end users to these platforms. Unfortunately, software for quantum computing is still in its infancy, and the development of quantum computing software remains a significant challenge. The MQSC aims to create production-ready software tools that provide for quantum computing what we already take for granted in classical IT.

I. OUR MISSION

Electronic devices are ubiquitous in modern life. A major reason for their widespread use is decades of research and development in software, which has yielded powerful tools and workflows for creating complex systems—the foundation of today’s IT-driven world. Now, quantum computing promises to surpass classical systems for crucial problems in domains such as chemistry, physics, finance, drug discovery, machine learning, and more. While quantum computers have long been the subject of basic research, recent years have seen remarkable progress in building real hardware with steadily improving scale and quality. Despite this, the software ecosystem for quantum computing remains rudimentary compared to the sophisticated design flows available in classical computing.

Much of today’s quantum software originates in academia and is often not developed by trained software engineers. As a result, many tools demonstrate impressive conceptual ideas but are limited to proof-of-concept implementations that lack performance, robustness, and maintainability (cf. left-hand side of Fig. 1). In contrast, production-ready quantum software requires comprehensive implementations with continuous integration and deployment workflows, extensive testing, quality assurance, UI/UX/DX refinements, toolchain integration, and thorough documentation (cf. right-hand side of Fig. 1).

The *Munich Quantum Software Company* (MQSC) builds on decades of research, more than 15 years of expertise in quantum computing, a strong international partner network,

and numerous research projects led by our team. With this foundation, we are establishing state-of-the-art software for quantum computing. Our solutions have already demonstrated substantial potential and attracted significant interest from hardware vendors, end users, HPC centers, and the broader quantum community. More precisely, we offer practical, production-ready solutions, including:

- *Software Stacks*: Software stacks connect end users to the platforms. We are contributing to the development of comprehensive software stacks such as the *Munich Quantum Software Stack* (MQSS, [1]), and others.
- *Compilation Frameworks*: Mapping quantum algorithms and circuits to specific platforms involves solving complex design and optimization problems. We develop and implement advanced solutions to translate high-level programs into executable instructions; as provided, e.g., by the *Munich Quantum Toolkit* (MQT, [2]).
- *HW/SW Interfaces*: Effective quantum computing relies on seamless hardware/software integration. Our interface solutions such as the *Quantum Device Management Interface* (QDMI, [3]) reconcile conflicting requirements, bridge heterogeneous technologies, and provide precise figures of merit and constraints to guide system design and compilation.
- *Application Demos*: Conceptualizing and validating practical use cases is key for advancing the real-world impact of quantum computing. We support this through application design, demonstrators, circuit generation, and targeted benchmarking as, e.g., provided by *MQT Bench* [4].

Finally, MQSC positions itself as an open-source company dedicated to building sophisticated, high-quality software for quantum computing. Together with partners worldwide, we proactively develop tools that will eventually equip end users with the same level of software quality and reliability they are accustomed to in conventional IT. For more information about the MQSC, visit <https://munichquantum.software> and follow us on LinkedIn: <https://www.linkedin.com/company/mqsc>.



Fig. 1. Mission of the MQSC

REFERENCES

- [1] L. Burgholzer *et al.*, “The Munich Quantum Software Stack: Connecting End Users, Integrating Diverse Quantum Technologies, Accelerating HPC,” in *HPCAsia*, 2026, pp. 55–67.
- [2] R. Wille *et al.*, “The MQT Handbook: A Summary of Design Automation Tools and Software for Quantum Computing,” in *QSW*, 2024.
- [3] R. Wille *et al.*, “QDMI - Quantum Device Management Interface: Hardware-Software Interface for the Munich Quantum Software Stack,” in *QCE*, vol. 02, 2024, pp. 573–574.
- [4] N. Quetschlich *et al.*, “MQT Bench: Benchmarking Software and Design Automation Tools for Quantum Computing,” *Quantum*, vol. 7, p. 1062, 2023, MQT Bench is available at <https://mqt-bench.app/>.