Emmanouil Giortamis

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Research Interests

My research interests lie in the field of quantum software systems, i.e., I bring systems software abstractions and mechanisms into quantum computing for improved programmability, performance, and scalability. In particular, I focus on compiler and OS mechanisms that address the low fidelity, heterogeneity, under-utilization, and significant queuing times of quantum resources. To achieve this, I design systems that leverage quantum error mitigation, circuit cutting and knitting, multi-programming, and hybrid quantum-classical resource estimation and scheduling.
Previously, I worked in the distributed systems area, specifically in distributed shared logs, hardware-assisted replication protocols, and the implementation of *fast* reads in asynchronous replication protocols.

Education

Ph.D. in Computer Science (Sept 2021 -)
TU Munich, Germany
Thesis: Systems Software for Scaling NISQ-era Quantum Computing
Advisor: Prof. Dr. Pramod Bhatotia

M.Sc. in Computer Science (Sept 2019 - July 2021)
University of Crete, Greece

B.Sc. in Computer Science (Sept 2015 - July 2019)
University of Crete, Greece

Employment

TU Munich, Germany, Sept 2021 -
Scientific Employee

Responsibilities: conducting research, teaching assistant.

ICS-FORTH, Heraklion, Greece, July 2018 - Sept 2018
Research Internship

Responsibilities: experimental analysis of large-scale graphs on multiprocessor architectures.

ICS-FORTH, Heraklion, Greece, July 2017 - Sept 2017
Research Internship

Responsibilities: developing a concurrent, shared-page memory allocator in C.

Honors and Awards

Distinction DEPROFOIT, University of Crete, Greece, Sept 2018
Undergraduate teaching assistant based on overall grades.

Ph.D. Dissertation (ongoing)

Topic: Systems Software for Scaling NISQ-era Quantum Computing
Supervisor: Prof. Dr. Pramod Bhatotia

In the context of my Ph.D., I break and build systems that increase the scalability of Noisy, Intermediate-Scale Quantum (NISQ) era quantum computers, focusing on operating systems and compiler mechanisms that improve execution fidelity as well as the users' and the quantum cloud operator's objectives, i.e., better Quality-of-Service and higher resource efficiency, respectively. Such mechanisms include circuit compilation and optimization, error mitigation techniques, hybrid performance estimation, multi-tenant program execution (multi-programming), and hybrid multi-objective scheduling.

Active Research projects:

Orchestrating the Quantum Clouds with Qonductor
Emmanouil Giortamis, Francisco Romão, Nathaniel Tornow, Dmitry Lugovoy, and Pramod Bhatotia
[Arxiv pre-print];

Realistic Benchmarking of Quantum Error Correction Codes on Mid-Term Quantum Devices
Aleksandra Świerkowska, Jannik Pflieger, Emmanouil Giortamis, and Pramod Bhatotia

MultiQ: Efficient Multiprogramming on Neutral Atom Quantum Computers
Francisco Romão, Emmanouil Giortamis, and Pramod Bhatotia

Quantum-Classical Computing via Tensor Networks
Nathaniel Tornow, Emmanouil Giortamis, Christian B Mendl, and Pramod Bhatotia

Recipe: Hardware-Accelerated Replication Protocols
Dimitra Giantsidi, Emmanouil Giortamis, Maurice Bailleu, Manos Kapritsios, and Pramod Bhatotia
[Arxiv pre-print];

Publications

Conference publications:

QOS: Quantum Operating System
Emmanouil Giortamis, Francisco Romão, Nathaniel Tornow, and Pramod Bhatotia
USENIX Symposium on Operating Systems Design and Implementation (OSDI) '25;
Acceptance Rate: ∼17%

QVM: Quantum Gate Virtualization Machine
Nathaniel Tornow, Emmanouil Giortamis, and Pramod Bhatotia
ACM Programming Language Design and Implementation (PLDI) '25;
Acceptance Rate: ∼28%

Weaver: A Retargetable Compiler Framework for FPQA Quantum Architectures
Oğuzcan Kırmemiş, Francisco Romão*, Emmanouil Giortamis, and Pramod Bhatotia*
ACM/IEEE International Symposium on Code Generation and Optimization (CGO) '25
Acceptance Rate: ∼32%

The LAW theorem: Local Reads and Linearizable Asynchronous Replication
Antonios Katsarakis, Emmanouil Giortamis*, Vasilis Gavrielatos, Pramod Bhatotia, Aleksandar Dragojevic, Boris Grot, Vijay Nagarajan, and Panagiota Fatourou*
International Conference on Very Large Data Bases (VLDB) '25;

FlexLog: A Shared Log for Stateful Serverless Computing
Dimitra Giantsidi, Emmanouil Giortamis, Nathaniel Tornow, Florin Dinu, and Pramod Bhatotia
ACM High-Performance Parallel and Distributed Computing (HPDC) '23
Acceptance Rate: ∼20%

Posters and Talks:

The LAW Behind ALRs: Redefining Crash-Tolerant Reads
Antonios Katsarakis, Emmanouil Giortamis*, Vasilis Gavrielatos, Pramod Bhatotia, Aleksandar Dragojevic, Boris Grot, Vijay Nagarajan, and Panagiota Fatourou*
EuroSys '25, Best poster nominee

CAP Off: Local Reads and Linearizable Asynchronous Replication
Antonios Katsarakis, Emmanouil Giortamis*, Vasilis Gavrielatos, Pramod Bhatotia, Aleksandar Dragojevic, Boris Grot, Vijay Nagarajan, and Panagiota Fatourou*
EuroSys '24

Beyond reCAP: Local Reads and Linearizable Asynchronous Replication
Antonios Katsarakis, Emmanouil Giortamis*, Vasilis Gavrielatos, Pramod Bhatotia, Aleksandar Dragojevic, Boris Grot, Vijay Nagarajan, and Panagiota Fatourou*
EuroSys '23

**Equal Contribution*

Service

IEEE Quantum Week 2024, Student Volunteer

Open Source Projects

Alpha Programming Language
https://github.com/manosgior/Alpha-Programming-Language

Alpha++ Programming Language
https://github.com/manosgior/A-plus-plus-Programming-Language

User-Space Threads
https://github.com/manosgior/User-Space-Threads

Simple java.util.concurrent
https://github.com/manosgior/Simple-Java-Util-Concurrent

Mortal Kombat Game
https://github.com/manosgior/Mortal-CSD

Teaching experience

Teaching assistant:

— Cloud Software Engineering lab, TU Munich, SS 2022, WS 2023-24, SS 24, SS 25

— Quantum Software Systems seminar: TU Munich, SS 2023

— Distributed Systems lecture, TU Munich, WS 2021-22, WS 2022-23

— Languages and Compilers lecture, University of Crete, SS 2021

— Introduction to Computer Science lecture, University of Crete, WS 2020-21

— Principles of Distributed Computing lecture, University of Crete, SS 2020

— Data Structures lecture, University of Crete, WS 2019-20

Advising:

Real-time and parallel task scheduling for Quantum Computing
Marcin Praski
M.Sc. thesis

Hardware-aware Optimal Quantum Circuit Cutting and Knitting
Thang Tran
M.Sc. thesis

Quantum Circuit Transpilation: Experimental Analysis and Subarchitecture Selection
Zeynep Erdogan
M.Sc. thesis

Scalable Quantum Cloud Scheduling: Optimizing Resource Allocation for Efficient NISQ Computing
Dmitry Lugovoy
M.Sc. thesis

Extensions to QStack: Virtual Qubit Routing and SuperMarQ Benchmarks
Ahmed Darwish
Guided research

A System Stack for Distributed Quantum Computing
Nathaniel Tornow
Guided research

DQS: A Framework for Efficient Distributed Simulation of Large Quantum Circuits
Nathaniel Tornow
B.Sc. thesis

Microservice Architecture in Practice: Debugging the Behaviour of Concurrent Applications at financial.com AG
Jonathan Ryan Wijaya Tumboimbela
M.Sc. thesis

Skills

Languages: C, Python (expert), Unix shell, C++ (competent);

Frameworks: Qiskit, OpenMP, MPI (expert), Cirq, NVIDIA cuQuantum, LLVM (knowledgeable);

Technologies: Superconducting qubits, Neutral Atoms;

Soft skills: Technical/Scientific writing, Leading research projects, Presenting complex ideas to non-experts, Comfortable working under uncertainty (exploratory tech), Mentoring students;

References

Prof. Dr. Pramod Bhatotia
TU Munich, Germany
Email: pramod.bhatotia@cit.tum.de

Prof. Dr. Panagiota Fatourou
University of Crete, Greece
Email: faturu@csd.uoc.gr

Dr. Antonios Katsarakis
Principal Researcher at Huawei
Email: antoniskatsarakis@yahoo.com