

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:

MCMit: Mid-circuit Measurement Error Mitigation

Emmanouil Giortamis, Felix Gust, Yanbin Chen, Xiaorang Guo, Benjamin Lienhard, Martin Schulz, Pramod Bhatotias

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%

Qonductor: A Cloud Orchestrator for Quantum Computing

Emmanouil Giortamis, Francisco Romão, Nathaniel Tornow, Dmitry Lugovoy, and Pramod Bhatotia

The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC) '25;

Acceptance Rate: ~21%

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 Kirmemiş, 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

MCMit: Mid-circuit Measurement Error Mitigation

Emmanouil Giortamis, Felix Gust, Yanbin Chen, Xiaorang Guo, Benjamin Lienhard, Martin Schulz, Pramod Bhatotia

Invited talk at the ACES research group, led by Prof. Poulami Das

MCMit: Mid-circuit Measurement Error Mitigation

Emmanouil Giortamis, Felix Gust, Yanbin Chen, Xiaorang Guo, Benjamin Lienhard, Martin Schulz, Pramod Bhatotia

Invited talk at the QUEST research group led by Prof. Swamit Tannu

**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