Emmanouil Giortamis

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Research Interests

My research interests lie in the field of systems software for quantum computing, i.e., I bring systems 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 scalability, heterogeneity, underutilization, and significant queuing times of quantum devices. To achieve this, I design systems that leverage circuit cutting and knitting, spatiotemporal multiplexing (i.e., multi-programming and scheduling), and hybrid quantum-classical resource estimation and management.
Previously, I worked in the distributed systems area, specifically in distributed shared logs, state machine replication (SMR), and 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 investigate and build systems that increase the scalability of Noisy, Intermediate-Scale Quantum (NISQ) era quantum computers, focusing on operating systems and compiler abstractions such as virtualization, resource estimation and management, and performance optimization.

Research projects:

QOS: A Quantum Operating System
Emmanouil Giortamis, Francisco Romão, Nathaniel Tornow, and Pramod Bhatotia
[Arxiv pre-print];

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

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*
[Under submission];

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

Publications

Conference publications:

Scaling Quantum Computations via Gate Virtualization
Nathaniel Tornow, Emmanouil Giortamis, and Pramod Bhatotia
ACM Programming Language Design and Implementation (PLDI) '25;
Acceptance Rate: $\sim$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: $\sim$32%

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:

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

Quantum Operating System (QOS)
https://github.com/TUM-DSE/QOS

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
— 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, Intel Quantum SDK, NVIDIA cuQuantum, LLVM (knowledgeable);

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`