Marcin **Copik**

Serverless · HPC · PhD Researcher
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Summary

In my PhD research, I have been working on serverless programming models to bridge the gap between high-performance computing systems and cloud data centers. I developed tailored solutions for different levels of the FaaS computing stack: from computing and network devices to high-level optimizations, efficient system designs, and performance modeling.

Education

PhD in Computer Science
April 2018 - March 2024

ETH Zürich — *Zürich, Switzerland*

- Thesis: High-Performance Serverless for HPC and Clouds
- Advisor: Prof. Torsten Hoefler

Master of Science (MSc) in Simulation Sciences
September 2014 - July 2017

RWTH Aachen — *Aachen, Germany*

- Grade: 1.5. Interdisciplinary program. Major subject: High-Performance Computing
- Thesis: Parallel Prefix Algorithms for the Registration of Arbitrarily Long Electron Micrograph Series
- Advisor: Prof. Paolo Bientinesi, Prof. Benjamin Berkels

Summer School in Mathematics
August 2014

University of Perugia — *Perugia, Italy*

- Courses: Stochastic Processes, Functional Analysis

Bachelor of Science (BSc) in Mathematics
September 2012 - June 2014

Silesian University of Technology — *Gliwice, Poland*

- GPA: 4.6/5.0. Finished two of three years program

Bachelor of Science in Engineering (BSc) in Computer Science
September 2010 - March 2014

Silesian University of Technology — *Gliwice, Poland*

- Grade 5(A). Major subject: Software Engineering
- Thesis: GPU-accelerated stochastic simulator engine for PRISM model checker
- Advisor: Prof. Tadeusz Czachorski

Experience

Postdoctoral Researcher
Zürich, Switzerland

ETH Zürich — *May 2024 -*

- Advising for Bachelor and Master thesis projects.
- Conducting interviews for PhD and PostDoc candidates.
- Teaching assistant for Bachelor and Master courses.

Research Assistant
Zürich, Switzerland

ETH Zürich — *April 2018 - April 2024*

- Advising for Bachelor and Master thesis projects.
- Conducting interviews for PhD and PostDoc candidates.
- Teaching assistant for Bachelor and Master courses.

Research Intern
Redmond, WA, USA

Microsoft — *June - October 2019*

- Analyzing microarchitectural implications of serverless workloads.
- Supervisor: Bobbie Manne.

Mentor
Organization: The STE||AR Group.

Google Summer of Code — *2017, 2018*

- Mentoring students working on HPX.
- Students: Ajai V George, Gabriel Laberge (co-mentored).

Student Research Assistant
Aachen, Germany

RWTH Aachen, High-Performance and Automatic Computing
2016 - December 2017

- Benchmarking linear algebra frameworks.
- Supervisor: Prof. Paolo Bientinesi.

Research Assistant
Baton Rouge, LA, USA

Louisiana State University, STE||AR Group
April 2016 - August 2016

- Integrating single-source GPU programming in HPX.
- Supervisor: Prof. Hartmut Kaiser.

Student Research Assistant
Jülich, Germany

Jülich Supercomputing Centre
October 2014 - March 2016

- Developing tools for performance analysis of parallel applications at Scalasca.
- Supervisor: Dr Pavel Saviankou.

Software Engineer
Organization: The STE||AR Group

Google Summer of Code
2015

- Integrating single-source GPU programming in HPX.
- Supervisor: Dr Hartmut Kaiser.

Software Engineer
Organization: PRISM model checker

Google Summer of Code
2014

- Improving statistical model checking.
- Supervisor: Dr Vojtěch Forejt, Dr Dave Parker.

Student Research Assistant
Gliwice, Poland

The Institute of Theoretical and Applied Informatics
2012 - 2013

- Implementing GPU simulator of Markov Chains.
- Supervisors: Dr Mateusz Nowak, Dr Artur Rataj.

Student Research Assistant
Gliwice, Poland

Silesian University of Technology
2012 - 2013

- Implementing algorithms for registration of respiratory motion.
- Supervisor: Dr Dominik Spinczyk.

Honors & Awards

2024	**Best Research Poster Award**, ACM/IEEE Supercomputing 2024
2024	**SIGHPC Travel Grant**, awarded for travel to ACM/IEEE Supercomputing 2024.
2023	**SIGHPC Travel Grant**, awarded for travel to ACM/IEEE Supercomputing 2023.
2022	**ACM/IEEE George Michael Memorial HPC Fellowship**, awarded for contributions into high-performance serverless.
2022	**Gold Medal at the ACM Student Research Competition**, ACM/IEEE Supercomputing 2022
2022	**AWS Cloud Credit for Research Application**
2022	**Google Cloud Research Credits**
2021	**Microsoft Research PhD Fellowship**, awarded for the 2021/2022 academic year.
2019	**Gold Medal at the ACM Student Research Competition**, ACM/IEEE Supercomputing 2019

Peer-reviewed Publications

A Priori Loop Nest Normalization: Automatic Loop Scheduling in Complex Applications
CGO

Trümper L., Schaad P., Ates B., Calotoiu A., **Copik M.**, Hoefler T.
2025

Protocol Buffer Deserialization DPU Offloading in the RPC Datapath
IXPUG Workshop @ Supercomputing

Frantz R., Garcia J., **Copik M.**, Monroy I., Olmos J., Bloch G., Di Girolamo S.
2024

Process-as-a-Service: Unifying Elastic and Stateful Clouds with Serverless Processes
ACM SoCC

Copik M., Calotoiu A., Gyorgy R., Böhringer R., Bruno R., Hoefler T.
2024

- Acceptance Rate 30.1% (63/209)

FaaSKeeper: Learning from Building Serverless Services with ZooKeeper as an Example
ACM HPDC

Copik M., Calotoiu A., Zhou P., Taranov K., Hoefler T.
2024

- Acceptance Rate 17.3% (26/150)

XaaS: Acceleration as a Service to Enable Productive High-Performance Cloud Computing — *IEEE CiSE*, *2024*

Hoefler T., **Copik M.**, Beckman P., Jones A., Foster I., Parashar M., Reed D., Troyer M., Schulthess T., Ernst D., Dongarra J.

Software Resource Disaggregation for HPC with Serverless Computing — *IEEE IPDPS*, *2024*

Copik M., Chrapek M., Schmid L., Calotoiu A., Hoefler T.

- Acceptance Rate 26.1% (88/337)

User-guided Page Merging for Memory Deduplication in Serverless Systems — *IEEE Big Data*, *2023*

Qiu W., **Copik M.**, Wang Y., Calotoiu A., Hoefler T.

- Acceptance Rate 17.5% (92/526)

FMI: Fast and Cheap Message Passing for Serverless Functions — *ACM ICS*, *2023*

Copik M., Böhringer R., Calotoiu A., Hoefler T.

- Acceptance Rate 29.4% (40/136)

rFaaS: Enabling High Performance Serverless with RDMA and Leases — *IPDPS*, *2023*

Copik M., Taranov K., Calotoiu A., Hoefler T.

- Acceptance Rate 25.7% (95/369)

Performance-Detective: Automatic Deduction of Cheap and Accurate Performance Models — *ACM ICS*, *2022*

Schmid L., **Copik M.**, Calotoiu A., Werle D., Reiter A., Selzer M., Koziolek A., Hoefler T.

- Acceptance Rate 24.2% (39/161)

MOM: Matrix Operations in MLIR — *IMPACT*, *2022*

Chelini L., Barthels H., Bientinesi P., **Copik M.**, Grosser T., Spaminato D.

Work-stealing Prefix Scan: Addressing Load Imbalance in Large-scale Image Registration — *IEEE TPDS*, *2021*

Copik M., Grosser T., Hoefler T., Bientinesi P., Berkels B.

SeBS: A Serverless Benchmark Suite for Function-as-a-Service Computing — *ACM/IFIP Middleware*, *2021*

Copik M., Kwasniewski G., Besta M., Podstawski M., Hoefler T.

- Acceptance Rate 31% (33/107)

Extracting Clean Performance Models from Tainted Programs — *ACM PPoPP*, *2021*

Copik M., Calotoiu A., Grosser T., Wicki N., Wolf F., Hoefler T.

- Acceptance Rate 21% (31/150)

GraphMineSuite: Enabling High-Performance and Programmable Graph Mining Algorithms with Set Algebra — *VLDB*, *2021*

Besta M. [and 18 others, including **Copik M.**]

SISA: Set-Centric Instruction Set Architecture for Graph Mining on Processing-in-Memory Systems — *IEEE MICRO*, *2021*

Besta M. [and 18 others, including **Copik M.**]

The Generalized Matrix Chain Algorithm — *CGO*, *2018*

Barthels H., **Copik M.**, Bientinesi P.

- Acceptance Rate 28.6% (30/105)

Using SYCL as an Implementation Framework for HPX.Compute — *DHPCC++ Workshop, IWOCL*, *2017*

Copik M., Kaiser H.

A GPGPU-based Simulator for Prism: Statistical Verification of Results of PMC — *CS&P*, *2016*

Copik M., Rataj A., Woźna-Szczęśniak B.

Methods for abdominal respiratory motion tracking — *Computer Aided Surgery*, *2014*

Spinczyk D., Karwan A., **Copik M.**

Presentations and Talks

XaaS: Acceleration as a Service to Enable Productive High-Performance Cloud Computing — *November 2024*

Panel Moderator at CANOPIE-HPC Workshop @ ACM/IEEE Supercomputing 2024

Serverless HPC: Challenges, Opportunities, and Future Prospects for Accelerated Cloud Computing — *November 2024*

Panel Moderator at ACM/IEEE Supercomputing 2024

MIGnificient: Fast, Isolated, and GPU-Enabled Serverless Functions *November 2024*

ACM/IEEE Supercomputing 2024 Poster

Benchmarking Serverless with SeBS: Past, Present, and Future *June 2024*

Third International Workshop on Serverless Computing Experience 2024

High Performance Serverless for HPC and Cloud *June 2024*

Invited talk, Intelligent Serverless and Cloud Applications Symposium, Zurich University of Applied Sciences.

Evaluating FaaS Systems with the Serverless Benchmark Suite SeBS *June 2024*

SEATED Workshop on Serverless at the Edge, HPDC 2024

Cppless: Productive and Performant Serverless Programming in C++ *November 2023*

Lightning Talk, LLVM-HPC at ACM/IEEE Supercomputing 2023.

High Performance Serverless for HPC and Clouds *November 2023*

Poster presentation at Doctoral Showcase, SC 2023.

Serverless As a Bridge Between HPC and Clouds *May 2023*

Invited talk, AWS Cloud for Research at ETH.

Serverless As a Bridge Between HPC and Clouds *May 2023*

Invited talk, 5th Workshop on Parallel AI and Systems for the Edge (PAISE), IPDPS 2023.

Serverless As a Bridge Between HPC and Clouds *May 2023*

Poster presentation at PhD Forum, IPDPS 2023.

Software Resource Disaggregation for HPC with Serverless Computing *November 2022*

ACM/IEEE Supercomputing 2022 Poster, **Gold Medal at the ACM Student Research Competition**.

Software Resource Disaggregation for HPC with Serverless Computing *November 2022*

SuperCompCloud at ACM/IEEE Supercomputing 2022.

Interactive Computing with Serverless Functions in rFaaS *November 2022*

Lightning Talk, UrgentHPC at ACM/IEEE Supercomputing 2022.

Extracting Clean Performance Models from Tainted Programs" *February 2022*

SIAM Conference on Parallel Processing for Scientific Computing (PP22) minisymposium

perf-taint: Taint Analysis for Automatic Many-Parameter Performance Modeling *November 2019*

ACM/IEEE Supercomputing 2019 Poster, **Gold Medal at the ACM Student Research Competition**.

Parallel Prefix Algorithms for the Registration of Arbitrarily Long Electron Micrograph Series *November 2017*

ACM/IEEE Supercomputing 2017 Poster, ACM Student Research Competition.

HPX and GPU-parallelized STL *May 2016*

C++Now 2016 conference.

Skills

Programming	**Experienced:** C++, Python, Java **Familiar:** Matlab, Julia, Mathematica, R, Pascal, x86 ASM
Technologies	MPI, OpenMP, LLVM, OpenCL, SYCL, C++AMP, Docker, Kubernetes
Tools	Git, SVN, Mercurial, CMake, autotools, SLURM
Experience	serverless computing, parallel programming, cloud computing, performance modeling, GPU programming, model checking
Languages	English, German, Polish

Service

2025	Workshop on Parallel AI and Systems for the Edge (PAISE)	*Organizing committee*
2025	EuroSys	*Shadow PC*
2025	Accelerated HPC in the Cloud-Edge Continuum (AHPC3) @ PDP	*Program Committee*
2025	IEEE IPDPS	*Program Committee*
2024	Journal of Systems Architecture	*Reviewer*
2024	Workshop on Parallel AI and Systems for the Edge (PAISE)	*Organizing committee*
2023	ACM/IEEE Supercomputing	*Student Volunteer*
2022	ACM/IEEE Supercomputing	*Student Volunteer*
2022	International Journal of High Performance Computing Applications	*Reviewer*
2020	LLVM-HPC Workshop	*Reviewer*
2019	ISC High Performance	*Reviewer*

Teaching

Fall 2024	Information Systems for Engineers	*ETH Zürich*
Spring 2024	Parallel Programming	*ETH Zürich*
Fall 2023	Big Data	*ETH Zürich*
Spring 2023	Parallel Programming	*ETH Zürich*
Spring 2022	Parallel Programming	*ETH Zürich*
Fall 2021	Information Systems for Engineers	*ETH Zürich*
Spring 2021	Parallel Programming	*ETH Zürich*
Fall 2020	Compiler Design	*ETH Zürich*
Spring 2020	Parallel Programming	*ETH Zürich*
Fall 2019	Design of Parallel and High-Performance Computing	*ETH Zürich*
Spring 2019	Parallel Programming	*ETH Zürich*
Fall 2018	Numerical Methods for Computational Science and Engineering	*ETH Zürich*

Students

Andrea Jiang	Co-supervised Master Thesis: Serverless and Cloud Runtimes for Graph-of-Thoughts	*2024, ETH Zürich*
Entiol Liko	Co-supervised Semester Project: Serverless Co-location with ML	*2024, ETH Zürich*
Oana Rosca	Semester Project: Long-Term Serverless Performance Variability	*2024, ETH Zürich*
Constantin Dragancea	Master Thesis: Adoption and Evolution of C++	*2024, ETH Zürich*
Prajin Khadka	Co-supervised Google Summer of Code Student: Expanded serverless benchmarks	*2024, GSoC*
Syed Mujtaba	Google Summer of Code Student: Using serverless ZooKeeper in Apache projects	*2024, GSoC*
Abhishek Kumar	Co-supervised Google Summer of Code Student: New serverless benchmarks	*2024, GSoC*
Matt Nappo	Co-supervised Google Summer of Code Student: Libfabric Implementation of rFaaS	*2023, GSoC*
Boyan Zhou	Master Thesis: Adoption and evolution of C++ in HPC Applications	*2023, ETH Zürich*
Gyorgy Rethy	Master Thesis: Process-as-a-Service computing on modern serverless platforms	*2022, ETH Zürich*
Laurin Brandner	Master Thesis: Serverless workflows benchmarking	*2022, ETH Zürich*
Lukas Möller	Bachelor Thesis: Serverless C++ Executor	*2022, ETH Zürich*
Malte Wächter	Bachelor Thesis: Profiling and optimizations of serverless functions	*2022, ETH Zürich*
Qiu Wei	Master Thesis: Serverless memory deduplication	*2022, ETH Zürich*
Lukas Tobler	Master Thesis: Serverless GPU functions	*2022, ETH Zürich*
Arnet Colin	Bachelor Thesis: Verification of representativeness of benchmarking suite	*2021, ETH Zürich*
Roman Böhringer	Master Thesis: Serverless collectives.	*2021, ETH Zürich*
Emir İşman	Bachelor Thesis: FaaStest collectives: reliable communication in serverless world	*2021, ETH Zürich*
Konrad Handrick	Co-supervised Bachelor Thesis: Offloading serverless with sPIN	*2021, ETH Zürich*
Tobias Lüscher	Bachelor Thesis: TaintImpact: Taint-Based Change Impact Analysis	*2021, ETH Zürich*
Siegfried Hartogs	Bachelor Thesis: Code-driven Language Development: Framework for Analysis of C/C++ Open-Source Projects	*2021, ETH Zürich*
Lukas Gygi	Bachelor Thesis: CppBuild: Large-Scale, Automatic Build System for Open Source C++ Repositories	*2021, ETH Zürich*
Nicolas Wicki	Bachelor Thesis: Control Flow Taint Analysis for Performance Modeling in LLVM	*2020, ETH Zürich*

Philipp Bomatter	Co-supervised Bachelor Thesis: Towards Extreme-Scale Cache Coherence Protocols and Simulations	*2019, ETH Zürich*
Gabriel Laberge	Co-supervised Google Summer of Code Student: Alternative smart executors	*2018, GSoC*
Ajai V George	Google Summer of Code Student: Work on Parallel Algorithms	*2017, GSoC*