
University Education

- since 2018 **Ph.D. studies**, *University of Münster*, Münster, Germany.
Supervisor: Prof. Sergei Gorlatch, Dr. Michel Steuwer (University of Glasgow)
Main research interests: High-level functional performance-portable programming abstractions for high-performance computing. I am especially interested in developing a functional pattern-based intermediate array language and formalizing its translation process to imperative code. My goal is to have a pattern-based intermediate array language where legal expressions are translated to provably valid GPU programs which achieve high-performance.
- 2014 – 2018 **Master of Science in computer science**, *University of Münster*, Münster, Germany.
Thesis title: *Implementing and Optimizing Fast Fourier Transforms in Lift*,
In this thesis, I methodically derive expressions for FFTs based on high-level functional primitives and extend the Lift compiler framework to generate high-performance GPU code from the derived expressions.
- 2011 – 2014 **Bachelor of Science in computer science**, *University of Münster*, Münster, Germany.
Thesis title: *Implementing SDN-based Multicast in RTF*,
In this thesis, I extend the communication layer of the Real-Time Framework, developed at the University of Münster, to support multicast in software defined networks.

Publications

- 2019 [1] **B. Köpcke**, M. Steuwer, and S. Gorlatch. “Generating Efficient FFT GPU Code with Lift”. In: *Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2019, Berlin, Germany, August 18, 2019*. 2019, pp. 1–13.
- [2] **B. Köpcke**, M. Steuwer, and S. Gorlatch. “Generating Efficient FFT Code for GPU from High-Level, Pattern-Based Abstractions”. In: *Informal Proceedings of HLPP '19*. 2019.
- 2015 [3] F. Stahl, A. Godde, B. Hagedorn, **B. Köpcke**, M. Rehberger, and G. Vossen. “High Quality Information Delivery: Demonstrating the Web in Your Pocket for Cineast Tourists”. In: *Proceedings of the BTW 2015*. 2015, pp. 667–670.
- 2014 [4] F. Stahl, A. Godde, B. Hagedorn, **B. Köpcke**, M. Rehberger, and G. Vossen. “Implementing the WiPo architecture”. In: *E-Commerce and Web Technologies*. Springer, 2014, pp. 1–12.

Research Visits

- 08/2019 **Visiting Researcher (5 weeks)**, *University of Glasgow*, Glasgow, UK.
– 10/2019 Funded by HiPEAC
During this visit, I investigated the translation of a functional pattern-based intermediate representation for the Lift language into an intermediate imperative language from which OpenCL code is generated. My main focus was on higher control over memory allocations (e.g. OpenCL address spaces) in the functional language to generate high-performance OpenCL kernels for GEMM.
- 01/2019 **Visiting Researcher (2 months)**, *University of Glasgow*, Glasgow, UK.
– 03/2019 Funded by HPC-Europa3
During this visit, I started extending a newly designed compiler and intermediate representation for the Lift language towards a working OpenCL code generation. My main focus was on making previously hidden compiler decisions, such as parallelism and copies between memory regions, explicit on the functional language level.

Presentations

- 04/2019 Talk: *Generating Efficient FFT GPU Code with Lift*.
International Workshop on Functional High-Performance and Numerical Computing (FHPNC), Berlin, Germany
- 07/2019 Talk: *Generating Efficient FFT Code for GPU from High-Level, Pattern-Based Abstractions*.
International Symposium on High-Level Parallel Programming and Applications (HLPP), Linköping, Sweden
- 02/2019 Invited Talk: *Programming Specialized Hardware Using Lift*.
Edinburgh Parallel Computing Centre (EPCC), Edinburgh, UK

Research Projects

- since **LIFT**, *A Novel Approach to Achieving Performance Portability on Accelerators*.
03/2018 Ongoing research, www.lift-project.org
The Lift project is a novel approach to generate high-performance OpenCL kernels from high-level functional programs. As one of the main developers of the project, I have been mostly working on extending Lift in order to express complex high-performance applications with a particular focus on Fast Fourier Transforms.
- 2014 – 2017 **KETTI**, *Competence Development of Student Teaching Assistants in Computer Science*.
Project webpage, www.uni-muenster.de/Ketti/en/index.html
As a student and later research assistant, I assisted in qualitative and quantitative research towards the implementation of a competence model for teaching assistants. The aim of KETTI is to formalize the preparation of teaching assistants to activate students and support their learning.

Attended Academic Events And Scientific Committees

- 2019 Artifact Evaluation Committee – CGO 2020
FHPNC – *International Workshop on Functional High-Performance and Numerical Computing*, Berlin, Germany
ICFP – *International Conference on Functional Programming*, Berlin, Germany
SPLV – *Scottish Summer School on Programming Languages and Verification*, Glasgow, UK

ACACES Summer School (organized by HiPEAC) – *Fifteenth International Summer School on Advanced Computer Architecture and Compilation for High-Performance and Embedded Systems*, Fiuggi, Italy

HLPP – *International Symposium on High-Level Parallel Programming and Applications*, Linköping, Sweden

CSW (organized by HiPEAC) – *Computing Systems Week*, Edinburgh, UK

SPLS – *Scottish Programming Languages Seminar*, St. Andrews, UK

2015 PRACE course – *Advanced Parallel Programming with MPI and OpenMP*, Jülich Supercomputing Centre, Germany

BTW – *16th Conference on Database Systems for Business, Technology, and Web*, Hamburg, Germany

Teaching

Winter '20 Supervised a student project: *Developing a CUDA Backend for Lift Targeting Tensor-Cores*

Winter '20 Teaching assistant for the course: *Introduction to Programming with Java*

Summer '19 Teaching assistant for the course: *Distributed Systems*

Summer '19 Teaching assistant for the course: *Introduction to Programming with C and C++*

Winter '19 Teaching assistant for the course: *Introduction to Programming with Java and Haskell*

Winter '15 Student assistant for the course: *Introduction to Programming*

Summer '14 Student assistant for the course: *Data Structures and Algorithms*