Matthias Springer

シュプリンガー　マティアス

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📄 Profile

I am currently a software engineer at Google Japan in the ChromeOS team. My research at university was concerned with code generation, design-specific languages (DSLs), programming models and memory access optimizations for SIMD/GPU architectures.

🖥 Work Experience

Since Oct. 2019 **Google Japan G.K.** 【グーグル合同会社】, *Shibuya-ku, Tokyo, Japan*, Software Engineer.
Part of the ChromeOS platform team, working on ARCVM (Android Runtime for Chrome), a virtual machine that runs Android on ChromeOS. Working mainly on the ChromeOS/Android camera stacks and overall performance optimizations. Gained experience in virtualization, kernel/OS development and large-scale software development (mainly C++, some Java and Golang).

2017, 2018 **Google LLC**, *United States*, Software Engineering Intern (Summer Internship).
2016, 2014
(4 × 3 months)
- [2018; Mountain View, CA; Host: DeLesley Hutchins, Ph.D.] Worked in Research and Machine Intelligence on an auto-batching system for tree-structured RNNs. Implemented linear algebra operations and TPU-specific optimizations with TensorFlow XLA. Identified and eliminated performance bottlenecks on TPUs.
- [2017; Mountain View, CA; Host: DeLesley Hutchins, Ph.D.] Worked in Research and Machine Intelligence on LLGTM* (Low-level Library for Gradients, Tensors, and Matrices), a deep learning C++ framework for dynamic computation graphs. Implemented Eigen/CUDA kernels and TensorFlow kernel adapters.
- [2016; Seattle, WA; Host: Vijay Menon, Ph.D.] Part of the Dart programming language team. Worked on a Dart-to-Java compiler, focusing on performance optimizations and language interoperability.
- [2014; Boulder, CO; Host: Craig Wright] Worked on a business event process engine for an internal Google payments system, using Megastore, F1/Spanner, Java and Guice.

April 2012 **Tokyo Institute of Technology / Hasso Plattner Institute**, Teaching Assistant.
- June 2017 TA for exchange students and courses: Information Literacy (Prof. Morozov, Ph.D.), Mathematics II (Dr. habil. Börner), Software Architecture (Prof. Dr. Hirschfeld), Software Engineering I (Prof. Dr. Hirschfeld)

Aug. 2012 **Senacor Technologies AG**, *Munich, Germany*, Software Engineering Intern.
- Oct. 2012 Developed software components and tests for a service-oriented environment in the financial sector, using Java EE, the Spring Framework and Oracle database servers.

Aug. 2011 **TNG Technology Consulting GmbH**, *Munich, Germany*, Software Engineering Intern.
- Oct. 2011 Developed plugins for Atlassian JIRA/Confluence (Subversion commit monitor) and Hudson/Jenkins (job status monitor). Set up an LDAP server for user authentification for SSH and Atlassian JIRA/Confluence.

July 2005 **Max Planck Computing & Data Facility (Rechenzentrum Garching)**, *Garching, Germany*, Intern.

* An older version of LLGTM is available on GitHub.

🎓 Education

Oct. 2015 **Tokyo Institute of Technology** 【東京工業大学】, *Meguro-ku, Tokyo, Japan*,
- Sept. 2019 Programming Research Group, Dept. of Mathematical and Computing Sciences
Doctor of Philosophy (Ph.D.). Academic advisor: Prof. Dr. Hidehiko Masuhara.
- *Doctoral thesis:* Memory-Efficient Object-Oriented Programming on GPUs
- *Research areas:* Compilers, Program Optimization, GPGPU, Modularity, Context-oriented Programming
- *Relevant coursework:* Programming Language Design, Practical Parallel Computing, Distr. Computing

Sept. 2014 **Hasso Plattner Institute, University of Potsdam**, *Potsdam, Brandenburg, Germany*,
- Sept. 2015 Master of Science, IT Systems Engineering, overall grade: 1.0 (A+).
- *Master's project:* Spur to go faster: Low-level Functionality in a High-level Language
- *Master's thesis:* Nested Class Modularity in Squeak/Smalltalk
  Project and thesis supervised by Prof. Dr. Robert Hirschfeld, Tim Felgentreff, Tobias Pape
- *Relevant coursework:* VMs and Execution Environments, Context-oriented Programming

Sept. 2013 - June 2014	**University of California San Diego**, *La Jolla, CA, United States*, Visiting student, Department of Computer Science and Engineering, GPA: 4.0.

- ○ Full tuition and living expenses covered by *UC Education Abroad Program* and *DAAD Scholarship*
- ○ *Relevant coursework:* Advanced Compilers (CSE 131/231), Programming Languages (CSE 130/230), Adv. Algorithms (CSE 190/202/203A), Parallel Computation (CSE 260), Database Analytics (CSE 190)

Aug. 2010 - July 2013	**Hasso Plattner Institute, University of Potsdam**, *Potsdam, Brandenburg, Germany*, Bachlor of Science, IT Systems Engineering, overall grade: 1.0 (A+), rank 1/74.

- ○ *Bachelor's project:* Evolving Applications: Object-migration with Ruby and GemStone
- ○ *Bachelor's thesis:* Inter-language Collaboration in an Object-oriented Virtual Machine
  Project and thesis supervised by Prof. Dr. Robert Hirschfeld, Tim Felgentreff, Tobias Pape
- ○ *Relevant coursework:* Software Architecture, Software Engineering I, Advanced Modularity, Database Systems I/II, Internet and WWW Technologies, Designing Interactive Systems (HCI)

⚗ Research Experience

Oct. 2014 - Sept. 2019	**Programming Languages**, *Tokyo Institute of Technology / Hasso Plattner Institute*, Research with Prof. Hidehiko Masuhara and Prof. Robert Hirschfeld.

- ○ DYNASOAR: A lock-free CUDA memory allocator with SOA layout, based on hierarchical bitmaps.
- ○ COMPACTGPU: Fully parallel GPU memory defragmentation.
- ○ IKRA-CPP: A C++/CUDA DSL for object-oriented programming with Structure-of-Arrays (SOA) data layout.
- ○ IKRA-RUBY: A GPGPU library for Ruby with parallel array operations.
- ○ MATRIONA: A module system for Squeak/Smalltalk based on class nesting/parameterization.
- ○ CONTEXTAMBER: A COP (Context-oriented Programming) library for Amber Smalltalk.
- ○ *Other Projects*: Minor contributions to the RSQUEAK VM and to the Truffle-based JRUBY implementation.

March 2014 - Nov. 2014	**Relationship Queries**, *University of California San Diego*, Database research with Prof. Yannis Papakonstantinou and Chunbin Lin.

Evaluated algorithms and data structures for relationship queries in relational/graph database systems, and compared them with latest column store techniques. Implemented the first GQ-FAST DB prototype.

May 2011 - Apr. 2013	**Internet Technologies**, *Hasso Plattner Institute, Internet Technologies and Systems Group*.

- ○ SOA SECURITY LAB: A browser-based simulation system for modelling and executing web service scenarios. Worked on the Oryx Modelling Editor, developed a database backend with Grails and PostgreSQL, and integrated the system into an existing OpenNebula VM network.
- ○ TELE-LAB: A hands-on system for teaching and simulating network security scenarios on a cluster of virtual machines. Worked on the user interface using Grails, HTML and JavaScript.

🏆 Achievements and Prizes

July 2019, Nov. 2018, Feb. 2018	**ACM Student Research Competition**, *Association for Computing Machinery*.

- ○ [PLDI 2019] 1st place, graduate category for COMPACTGPU
- ○ [SPLASH 2018] 1st place, graduate category for SOAALLOC (now called DYNASOAR)
- ○ [CGO 2018] 3rd place, graduate category for IKRA-CPP

April 2018 - Sept. 2019	**Research Fellowship for Young Scientists (JSPS DC2)** 【日本学術振興会特別研究員DC2】. Fellowship from the Japan Society for the Promotion of Science (JSPS), covering living expenses. Research expenses covered by KAKENHI (科研費) Grant-in-Aid for JSPS Fellows (18J14726).

Oct. 2015 - Mar. 2018	**Monbukagakusho (MEXT) Scholarship** 【文部科学省奨学金】. Japanese government scholarship for doctoral students, covering tuition and living expenses.

Oct. 2014 - Sept. 2015	**Hasso Plattner Scholarship**. One-year scholarship awarded to the best Bachelor graduates of each year, covering living expenses.

March 2015	**Media Hack Day Berlin**, *Second Prize, Allryder API Prize, Fab Lab Berlin Prize*. Developed GREENTIRE, an iOS app which consolidates useful information from different sensors of the car and from partner APIs to evaluate the driving behavior.

Sept. 2013 - May 2014	**German Academic Exchange Service Scholarship (DAAD Jahresstipendium)**. Government scholarship from DAAD (Deutscher Akademischer Austausch Dienst) to study at a North American university for one academic year, covering tuition and living expenses.

2007 - 2010	**German Federal Competition in Computer Science (Bundeswettbewerb Informatik)**. Participated three years in a row. 30/around 1100 participants are invited to the final round. ○ [2009/2010] 1st prize in first two rounds, invited to final round *(University of Freiburg)* ○ [2008/2009] 2nd prize in first two rounds ○ [2007/2008] 1st prize in first two rounds, invited to final round *(Max Planck Institute for CS)*
2010/2011	**informatiCup 2011**, *organized by the Gesellschaft für Informatik, Bonn, Germany*. Participated in first round and in final round (6/38 teams invited). Wrote optimization algorithms for placing ATMs on a map, using Simulated Annealing, Tabu Search and greedy algorithms.
(various)	**Academic Honors**, Graduation with distinction (Bachelor's, Master's), 2x Provost's Honors at UCSD.
(various)	**Travel Grants**, ECOOP Summer School 2016, SIGPLAN-PLMW (POPL 2017), SIGPLAN-PAC (PLDI 2017), Google MUC Compiler and PL Summit (2017, 2018), ACM SRC (CGO 2018, SPLASH 2018, PLDI 2019).

Peer-reviewed Publications

ISMM 2019	**Massively Parallel GPU Memory Compaction**. M. Springer, H. Masuhara. International Symposium on Memory Management. 🏆 First prize in ACM Student Research Competition at PLDI 2019 (Graduate category). 🏆 Best Student Presentation Award.
ECOOP 2019	**DynaSOAr: A Parallel Memory Allocator for Object-oriented Programming on GPUs with Efficient Memory Access**. M. Springer, H. Masuhara. European Conference on Object-oriented Programming. 🏆 First prize in ACM Student Research Competition at SPLASH 2018 (Graduate category).
ARRAY 2018	**Inner Array Inlining for Structure of Arrays Layout**. M. Springer, Y. Sun, H. Masuhara. Workshop on Libraries, Languages, and Compilers for Array Programming.
WPMVP 2018	**Ikra-Cpp: A C++/CUDA DSL for Object-oriented Programming with Structure-of-Arrays Data Layout**. M. Springer, H. Masuhara. Workshop on Programming Models for SIMD/Vector Processing. 🏆 Third prize in ACM Student Research Competition (Graduate category).
ARRAY 2017	**Modular Array-based GPU Computing in a Dynamically-typed Language**. M. Springer, P. Wauligmann, H. Masuhara. Workshop on Libraries, Languages, and Compilers for Array Programming.
ICOOOLPS 2017	**dart2java: Running Dart in Java-based Environments**. M. Springer, A. Krieger, S. Manilov, H. Masuhara. Workshop on Implementation, Compilation, Optimization of Object-Oriented Languages, Programs and Systems.
JIP 2017	**A Layer-based Approach to Hierarchical Dynamically-scoped Open Classes**. M. Springer, H. Masuhara, R. Hirschfeld. IPSJ Transactions on Programming, Vol. 10, No. 2
VLDB 2016	**Fast In-Memory SQL Analytics on Typed Graphs**. C. Lin, B. Mandel, Y. Papakonstantinou, M. Springer. Proceedings of the VLDB Endowment, Vol. 10, Iss. 3.
COP 2016	**Classes as Layers: Rewriting Design Patterns with COP**. M. Springer, H. Masuhara, R. Hirschfeld. Workshop on Context-oriented Programming.
ARRAY 2016	**Object Support in an Array-based GPGPU Extension for Ruby**. M. Springer, H. Masuhara. Workshop on Libraries, Languages, and Compilers for Array Programming.
MODULARITY 2016	**Matriona: Class Nesting with Parameterization in Squeak/Smalltalk**. M. Springer, F. Niephaus, R. Hirschfeld, H. Masuhara. Conference on Modularity.
LASSY 2016	**Hierarchical Layer-based Class Extensions in Squeak/Smalltalk**. M. Springer, H. Masuhara, R. Hirschfeld. Workshop on Live Adaptation of Software Systems.
COP 2015	**Efficient Layered Method Execution in ContextAmber**. M. Springer, J. Lincke, R. Hirschfeld. International Workshop on Context-oriented Programming.
ICOOOLPS 2015	**Call-target-specific Method Arguments**. F. Niephaus, M. Springer, T. Felgentreff, T. Pape, R. Hirschfeld. Workshop on Implementation, Compilation, Optimization of Object-Oriented Languages, Programs and Systems.

Publications on Google Scholar: https://scholar.google.com/citations?user=EvHvYtMAAAAJ

🏛 Academic Service

Program Committee, CROW 2016, COP 2017, COP 2018.

Reviewer, APLAS 2016, ARRAY 2017, ECOOP 2020, LASSY 2017, MPLR 2019, SIMPAT.

Student Volunteer, ECOOP (2015, 2016, 2017, 2019), PLDI (2016, 2017, 2018), SPLASH 2018.

Organizing Committee, Student volunteer co-chair at PLDI 2019.

⚙ Other Projects

Sept. 2014 - July 2015	**ME310 Global Team-based Product Innovation & Engineering**, *Collaboration between Hasso Plattner Institute and Stanford University, including several exchange visits.* Worked on a design challenge by Audi USA with Stanford mechanical engineering students. Prototyped concepts for communication between pedestrians, passengers and autonomous cars, using design thinking.
June 2013 - Sept. 2013	**Athens for Amber Smalltalk**, *Google Summer of Code 2013 Project, European Smalltalk User Group (ESUG), Mentors: Nicolas Petton, Igor Stasenko.* Implemented the Athens vector graphics library in Amber Smalltalk, a Smalltalk system running in the web browser, using HTML5 Canvas. Developed a Morphic-like framework for building GUIs with Athens.
Dec. 2012 - June 2013	**MagLev Database Explorer**, *Part of Bachelor's project at HPI, Software Architecture Group.* Developed an IDE running in a web browser for exploring Ruby/Smalltalk objects persisted in a GemStone/S 64 image, writing Ruby/Smalltalk code and debugging Rails/Sinatra applications interactively.

</> Skills

Programming	Android (A), C (C), C++ (B), C# .NET (A), CUDA (C), Dart (B), Go (B), Haskell (A), Java SE (C), LLVM (A), NumPy (A), Python (B), Ruby (MRI, MagLev) (B), Smalltalk (Amber, GemStone, Pharo, Squeak) (C), SQL (B), Visual Basic (VB 6, VBA) (A).
Software Engineering	Design Patterns (B), Extreme Programming (A), Git (B), Jenkins (A), Scrum (A), Subversion (A), TDD (A), UML (B).
Server OS	Debian/Linux Server (A), Windows Server (A).
Web	CSS (A), Grails (B), Groovy (A), HTML (A), JavaScript (A), jQuery (A), Ruby on Rails (A).
Certifications	Database Administration Fundamentals (MTA 98-364) Windows Server Administration Fundamentals (MTA 98-365) Windows Applications Development with Microsoft .NET Framework 4 (MCTS 72-511) .

A: level 1/basic, B: level 2/experienced, C: level 3/expert

👤 Personal Information

Languages	German (native speaker), English (CEFR C2, TOEFL iBT score 118/120), Japanese (少し話せます).
Memberships	ACM, ACM-SIGPLAN, Bundeswettbewerb Informatik Alumni und Freunde e.V.).
Hobbies	Running, weightlifting, Dance Dance Revolution, playing trumpet and flugelhorn.

Date: December 28, 2020