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Dr. Roger Kowalewski

Personal Summary

I provide 6+ years of experiences in low-level systems programming and high performance computing (HPC) applications on CPU and GPU architectures. Deep knowledge of programming models for distributed and shared memory systems, including MPI, OpenMP, and CUDA. Strong technical skills in C/C++. Intermediate knowledge in Python and system administration tools on Linux (Bash, Perl). Interested in cloud computing technology, machine learning and optimization problems. Strong passion for open source high-quality software. Life-long learning through sharing ideas in a motivated team, publishing papers or writing a personal blog. Experience in giving talks at conferences, workshops. Held several lectures and tutorials for the computer science course at the LMU Munich.

Cyclist (racing, mountain biking) and runner in spare time.

Education

01/2016 – 02/2021 **Doctoral Candidate, Computer Science**, *Ludwig-Maximilians-Universität*, Munich
Research: Programming Models for Exascale Computing.
Advisors: Prof. Dr. Dieter Kranzlmüller (LMU, LRZ), Prof. Dr. Martin Schulz (TUM)
Thesis title: *Partial Aggregation for Collective Communication in Distributed Memory Machines*

10/2013 – 10/2015 **Master of Science Informatics**, *Ludwig-Maximilians-Universität*, Munich
Main focus: Research in High Performance (scientific) Computing, Knowledge Discovery in Databases, Formal Verification of Parallel Programs.
Thesis title: *Nasty-MPI: An Adverse Implementation of MPI-3 RMA for Correctness Debugging*

10/2007 – 10/2010 **Bachelor of Science Business Informatics**, *Cooperative State University*, Ravensburg
Focus: Software engineering, operating systems and project management.
Thesis title: *Konzeption und Implementierung eines Monitoring-Services zur Überwachung verteilter Windows-Prozesse*

01/2009 – 06/2009 Semester abroad, *University of Technology*, Durban, South Africa

Industry Experience

Since 03/2021 **Expert Developer**, *SAP SE*, Munich

Solving logistic optimization problems based on Genetic Algorithms, Reinforcement Learning, and Mixed Integer Linear Programming. Programming Languages: C++, Python

- Efficient and heuristics to solve routing problems with many constraints.
- Performance analysis and optimization of existing codes using `perf`
- Project Lead: Reinforcement Learning to solve the Bin Packing Problem.
- Linear and quadratic programming with Gurobi.
- C++ expert across multiple teams, author of a biweekly series on modern C++.
- Supervision of PhD students at Technical University of Munich (TUM).

06/2017 – 03/2018 **Freelancer**, *Westfalia GmbH*, Munich

Design and implementation of a IPv4 based communication protocol for medical devices.

- Role: System Architect and Programmer.
- Tasks
  - Specification and Implementation of a communication protocol for medical devices.
  - Reverse Engineering of a proprietary IPv4 communication protocol.
  - Coaching in C++ Network Programming.

10/2013 – 08/2014 **Consultant**, *comsysto GmbH*, Munich

Consulting of a startup to build enterprise applications from scratch.

- Role: Software Architect, Requirements Engineering, Project Management
- Tasks and achievements
  - Mentoring a team of 3 developers.
  - Monitoring and improvement of application performance.
  - Languages: Java, Javascript

01/2013 – 08/2013 **Senior JEE Software Developer**, *comsysto GmbH*, Munich

Development and maintenance of an e-commerce online portal (http://o2online.de)

- Role: Performance Engineering, Redesigning an Enterprise Platform Architecture.
- Programming: Java, AMQP.
- Tasks and achievements
  - Identification and specification of business use cases.
  - Improved scalability and performance sensitive core functionalities.
  - Supervising two employees.

11/2010 – 12/2012 **JEE Consultant**, *Accenture GmbH*, Nürnberg

Reengineering of a highly scalable JEE intranet platform.

- Methodologies: Scrum, Model Driven Development.
- Programming: C99, Java.
- Role: Technical Lead of a scrum team with 4 developers.
- Tasks and achievements
  - Initiator of a framework to support model-driven JUnit testing.
  - Responsibility for regular release builds and optimization of build process.
  - Part of a task force to monitor and improve application performance.
  - Supervision and mentoring of one employee.
- Requirements engineering and contact person for customer

Research Experience

01/2016 – 02/2021 **Researcher**, *Ludwig-Maximilians-Universität*, Munich

Researching under the supervision of Prof. Dr. Dieter Kranzlmüller, funded by the German Research Foundation (DFG).

- Core Developer of DASH: Distributed Data Structures in the Partitioned Global Address Space Model (PGAS), http://dash-project.org.
- Studying and contributing to state of the art academics for programming with heterogeneous memory systems.
- Designing data structures and algorithms for shared and distributed memory machines.
- Automatic load-balancing in heterogenous CPU-GPU memory systems.
- Programming: C/C++11, MPI, OpenMP, CUDA, Xeon Phi (KNC, KNL).

03/2014 – 11/2015 **Student Research Assistant**, *Ludwig-Maximilians-Universität*, Munich

Researching under the supervision of Dr. Karl Fürlinger.

- Programming: C/C++11, MPI, OpenMP, CUDA.
- Description: Developed Nasty-MPI which enables to validate semantic synchronization errors in MPI-3 one-sided applications. The project is publicly accessible on Github: https://github.com/dash-project/nasty-MPI

Teaching Experience

01/2016 – 02/2021 **Teaching Assistant**, *Ludwig-Maximilians-Universität*, Munich

Involved in lecturing, grading, holding office hours and problem solving for the following:

- Lectures
  - Introduction to Grid Computing (Summer 2016).
  - Parallel and High Performance Computing (Winter 2016).
  - Computer Networks (summer terms 2017–2019).
  - Computer Networks Engineering (winter terms 2017–2019).
- Supervised Student Theses
  - Implementing a MESI Cache Simulator for Teaching Purposes (Bachelor Thesis, 2016)
  - Evaluating One-Sided Communication Strategies for Regular Stencils (Bachelor Thesis, 2017)
  - Implementing a Load-Balanced Key-Value Store in the PGAS Model (Master Thesis, 2018)
  - Evaluating HPC Programming Models for Large-Scale SAR Data Processing (Master Thesis, 2019)

Talks

10/2019 Communication-Efficient Sorting in Distributed Memory, SPPEXA Annual Plenary Meeting, Dresden, Germany

09/2019 Engineering a Distributed Histogram Sort, Cluster Conference, Albuquerque, NM, USA

03/2018 Utilizing Heterogeneous Memory Hierarchies in the PGAS model, PDP Conference, Cambridge, UK

03/2017 Debugging Latent Synchronization Errors in MPI-3 One-Sided Applications, Workshop on Tools in HPC, Stuttgart, Germany

09/2016 Nasty-MPI: Debugging Synchronization Errors in MPI-3 One-Sided Applications, Euro-Par Conference, Grenoble, France

Posters

08/2018 Locality-Preserving Sort on Many-Core Architectures with PGAS, Workshop on Data Locality (co-organized with the Euro-Par conference), Turin, Italy

08/2018 Locality-Aware MPI All-to-All with PGAS, Workshop on Data Locality (co-organized with the Euro-Par conference), Göttingen, Germany

Technical Skills

Languages	C/C++14/17, Embedded C, Java/JEE, JavaScript, Perl, Python, Scala, Shell Scripts
Parallel Programming	POSIX, openMP (Shared Memory), CUDA, Message Passing Interface (Distributed Memory)
Frameworks	Spring Framework, Hibernate, AngularJS, NodeJS, xUnit, Google Test
Version Control	SVN, Git
Operating Systems	Linux, Windows, Mac OS, OpenBSD
Methodologies	Kanban, Scrum
Development Tools	Vim, IntelliJ IDEA, Eclipse

References

Dieter Kranzlmüller	Professor, Institute of Informatics, LMU, Munich
Karl Fürlinger	Senior Researcher, Institute of Informatics, LMU, Munich

Publications

2020 Fuerlinger, K., Gracia, J., Knüpfer, A., Hünich, D., Fuchs, T., Jungblut, P., **Kowalewski**, **R.**, & Schuchart, J. (2020). DASH - Distributed Data Structures and Parallel Algorithms in a Global Address Space. In H.-J. Bungartz, S. Reiz, B. Uekermann, P. Neumann, & W. E. Nagel (Eds.), *Software for Exascale Computing - SPPEXA 2016-2019*. Springer International Publishing. https://doi.org/10.1007/978-3-030-47956-5

2019 **Kowalewski**, **R.**, Jungblut, P., & Fürlinger, K. (2019). Engineering a Distributed Histogram Sort. *2019 IEEE International Conference on Cluster Computing (CLUSTER)*, 1–11. https://doi.org/10.1109/CLUSTER.2019.8891005

2018 Fürlinger, K., **Kowalewski**, **R.**, Fuchs, T., & Lehmann, B. (2018). Investigating the performance and productivity of DASH using the Cowichan problems. *Proceedings of Workshops of HPC Asia on - HPC Asia '18*, 11–20. https://doi.org/10.1145/3176364.3176366

Jungblut, P., **Kowalewski**, **R.**, & Fürlinger, K. (2018). Source-to-Source Instrumentation for Profiling Runtime Behavior of C++ Containers. *2018 IEEE 20th International Conference on High Performance Computing and Communications; IEEE 16th International Conference on Smart City; IEEE 4th International*

Conference on Data Science and Systems (HPCC/SmartCity/DSS), 948–953. https://doi.org/10.1109/HPCC/SmartCity/DSS.2018.00157

Kowalewski, **R.**, Fuchs, T., Fürlinger, K., & Guggemos, T. (2018). Utilizing Heterogeneous Memory Hierarchies in the PGAS Model. *2018 26th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP)*, 353–357. https://doi.org/10.1109/PDP2018.2018.00063

Mößbauer, F., **Kowalewski**, **R.**, Fuchs, T., & Fürlinger, K. (2018). A Portable Multidimensional Coarray for C++. *2018 26th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP)*, 18–25. https://doi.org/10.1109/PDP2018.2018.00012

Schuchart, J., **Kowalewski**, **R.**, & Fürlinger, K. (2018). Recent experiences in using MPI-3 RMA in the DASH PGAS runtime. *Proceedings of Workshops of HPC Asia*, 21–30. https://doi.org/10.1145/3176364.3176367

2017 **Kowalewski**, **R.**, & Fürlinger, K. (2017). Debugging Latent Synchronization Errors in MPI-3 One-Sided Communication. In C. Niethammer, J. Gracia, T. Hilbrich, A. Knüpfer, M. M. Resch, & W. E. Nagel (Eds.), *Tools for High Performance Computing 2016* (pp. 83–96). Springer International Publishing. https://doi.org/10.1007/978-3-319-56702-0_5

2016 Fürlinger, K., Fuchs, T., & **Kowalewski**, **R.** (2016). DASH: A C++ PGAS Library for Distributed Data Structures and Parallel Algorithms. *2016 IEEE 18th International Conference on High Performance Computing and Communications; IEEE 14th International Conference on Smart City; IEEE 2nd International Conference on Data Science and Systems (HPCC/SmartCity/DSS)*, 983–990. https://doi.org/10.1109/HPCC-SmartCity-DSS.2016.0140

Kowalewski, **R.**, & Fürlinger, K. (2016). Nasty-MPI: Debugging Synchronization Errors in MPI-3 One-Sided Applications. In P.-F. Dutot & D. Trystram (Eds.), *Euro-Par 2016: Parallel Processing* (pp. 51–62). Springer International Publishing. https://doi.org/10.1007/978-3-319-43659-3_4