

Jens Domke, Dr.

Curriculum Vitae

1-1-9 Minatojima,
Chuo-ku, Kobe 650-0045

Education

- Oct. 2014 – **PhD student at Faculty of Computer Science, Technische Universität Dresden,**
Mar. 2017 Dresden, Germany.
- Topic: Routing on the Channel Dependency Graph: A New Approach to Deadlock-Free, Destination-Based, High-Performance Routing for Lossless Interconnection Networks
 - Final Degree: Doctor rerum naturalium (Dr. rer. nat.) awarded in June 2017
- Oct. 2004 – **Diploma Student in Mathematics, Technische Universität Dresden, Dresden,**
Dec. 2010 Germany.
- Topic: Optimized Routing for InfiniBand Networks in the field of HPC systems
 - Final Degree: Diplommathematiker
- Aug. 1995 – **High School, Landau-Gymnasium Weißwasser, Weißwasser, Germany.**
July 2003 ◦ Qualification: High School Diploma (ger. Abitur)
- Aug. 1991 – **Primary School, 1. Grundschule Weißwasser, Weißwasser, Germany.**
June 1995

Employment History

Research

- July 2022 – **Team Leader of the Supercomputing Performance Research Team, RIKEN**
present *Center for Computational Science (R-CCS), Kobe, Japan.*
- Performance modelling, performance studies, HPC co-design, and tool development
 - Supervising researchers, postdoctoral researchers, and students
- Apr. 2021 – **Research Scientist of the High Performance Big Data Research Team,**
June 2022 *RIKEN Center for Computational Science (R-CCS), Kobe, Japan.*
- Benchmarking processor- and network-related aspects of current HPC installation at R-CCS
 - Researching alternative CPU, memory, and network architectures to steer co-design
- Apr. 2019 – **Postdoctoral Researcher of the High Performance Big Data Research Team,**
Apr. 2021 *RIKEN Center for Computational Science (R-CCS), Kobe, Japan.*
- Benchmarking processor- and network-related aspects of current HPC installation at R-CCS
 - Researching alternative CPU, memory, and network architectures to steer co-design
- May 2019 – **Tokyo Tech Research Fellow, Tokyo Institute of Technology, Tokyo, Japan.**
present ◦ Performing interconnect simulations and benchmarking newest HPC hardware
- Feb. 2019 – **RIKEN R-CCS Visiting Researcher, RIKEN Center for Computational Science**
Mar. 2019 *(R-CCS), Kobe, Japan.*
- Assisting and consulting in the early stages of the HPC system procurement
 - Benchmarking network-related aspects of current HPC installation at R-CCS

- Apr. 2017 – **Research Staff at Matsuoka & Endo Laboratory, Global Scientific Information and Computing Center, Tokyo Institute of Technology, Tokyo, Japan.**
 Mar. 2019
- Modifying an existing supercomputer at TokyoTech to evaluate the novel HyperX topology
 - Research in the area of HPC interconnects, topology design, and simulation frameworks
 - Planning and consulting activities for future AI/HPC supercomputers, such as TSUBAME4 and AIST's ABCI system
 - Supervising and mentoring undergraduate and graduate students of the Matsuoka Laboratory
- July 2016 – **Student Internship, Lawrence Livermore National Laboratory, Livermore, United States of America.**
 Sept. 2016
- Applying modern network routing techniques to large-scale production HPC systems and measuring the impact
 - Analyzing the disadvantages of existing routing algorithms and develop solutions to allow a more efficient and workload-specific traffic routing
 - Combining two existing network simulation frameworks to improve simulation accuracy and scalability of statically routed large-scale HPC topologies
- Feb. 2015 – **Tokyo Tech Research Fellow, Tokyo Institute of Technology, Tokyo, Japan.**
 Mar. 2017
- Performing network simulations and benchmarking newest InfiniBand hardware
- Oct. 2014 – **Research Associate at Faculty of Computer Science, Technische Universität Dresden, Dresden, Germany.**
 Mar. 2017
- Research in the area of high performance interconnection networks at the Institute of Computer Engineering
 - Implementation of software tools for monitoring and performance analysis
 - Integration into the teaching activities of the institute and student supervision
- Sept. 2013 – **Research Associate at Matsuoka Laboratory, Global Scientific Information and Computing Center, Tokyo Institute of Technology, Tokyo, Japan.**
 Sept. 2014
- Development of new deadlock-free oblivious routing algorithms
- Oct. 2012 – **Visiting Researcher at Matsuoka Laboratory, Global Scientific Information and Computing Center, Tokyo Institute of Technology, Tokyo, Japan.**
 Sept. 2013
- Enhancing the deadlock-free oblivious routing algorithm and focusing on research related to routing algorithms, network topologies and network faults
 - Providing knowledge and support in the field of performance analysis tools, like Vampir and Scalasca, for an application scalability study
- Aug. 2011 – **Research Associate at Joint Institute for Computational Sciences (JICS) University of Tennessee and Oak Ridge National Laboratory (ORNL), University of Tennessee, Knoxville, United States of America.**
 Aug. 2012
- Enhancing the functionality of the Vampir framework, from the Technische Universität Dresden, to support running in a mixed environment of X86 processors and General-Purpose computation on Graphics Processing Units processors
 - Supporting the analysis process of large scale applications on Jaguar (Jaguar was the third fastest HPC system in the Top500 list, Nov. 2011)
- Feb. 2011 – **Research Associate at Center for Information Services and High Performance Computing (ZIH), Technische Universität Dresden, Dresden, Germany.**
 Aug. 2011
- Extending the Vampir/VampirTrace tool set within an European–Russian project, called HOPSA

- Nov. 2007 – **Student Research Assistant at Center for Information Services and High Performance Computing (ZIH)**, *Technische Universität Dresden*, Dresden, Germany.
 Dec. 2010
- Implementation/parallelization of different sparse linear algebra algorithms for Cell BE
 - BenchIT Project: Designing and testing of measurement kernels
 - Performed measurements on a variety of HPC installations: SGI Altix 4700, Linux Networx Evolocity II PC-Farm, IBM BladeCenter QS21, NEC SX6 (ZIH, Dresden), NEC SX8 (HLRS, Stuttgart)
 - Winner (Team) of the Cluster Challenge at Supercomputing 08 (Austin, Texas)

Vocational Internship

- Aug. 2007 – **Usability investigation of Cell BE based console for efficient calculation of sparse matrices**, *Center for Information Services and High Performance Computing at Technische Universität Dresden*, Dresden, Germany.
 Sept. 2007
- Build and tuned a cluster of Playstation 3 consoles and implemented different sparse linear algebra algorithms

German armed forces

- Oct. 2003 – **Officer Candidate**, *German Air Force*, Bayreuth, Fürstenfeldbruck, Germany.
 June 2004
- In early 2004, resigned as officer candidate and moved to basic military service

Computer skills

Languages:	C, Python, FORTRAN, Bourne Shell, MATLAB, C++, Java	Programming:	InfiniBand, MPI, OpenMP, x86, Cell BE
Platforms:	GNU/Linux, Mac OS X	Math	MATLAB, Maple, SPSS
		Packages:	
Performance Analysis:	Vampir/VampirTrace, Score-P, BenchIT, GNU gprof, TAU, PAPI	Publishing:	L ^A T _E X

Languages

German:	Fluent	
English:	Upper-Intermediate	<i>native language</i> <i>ten years at school,</i> <i>two semester at university,</i> <i>living in the US for 1 year</i>

Publications

J. Mueller, T. Schneider, J. Domke, R. Geyer, M. Haesing, T. Hoefler, S. Hoehlig, G. Juckeland, A. Lumsdaine, M. Mueller, and W. Nagel, “Cluster Challenge 2008: Optimizing Cluster Configuration and Applications to Maximize Power Efficiency,” in *Proceedings of the 10th LCI International Conference on High-Performance Clustered Computing*, Mar. 2009. LCI’09 2nd Best Paper Award.

J. Domke, T. Hoefler, and W. E. Nagel, “Deadlock-Free Oblivious Routing for Arbitrary Topologies,” in *Proceedings of the 25th IEEE International Parallel & Distributed Processing Symposium (IPDPS)*, (Washington, DC, USA), pp. 613–624, IEEE Computer Society, May 2011.

- J. Domke and D. Wang, “Runtime Tracing of the Community Earth System Model: Feasibility Study and Benefits,” *Procedia Computer Science*, vol. 9, no. 0, pp. 1950–1958, 2012. Proceedings of the International Conference on Computational Science, ICCS 2012.
- J. Domke, T. Hoefler, and S. Matsuoka, “Fail-in-Place Network Design: Interaction between Topology, Routing Algorithm and Failures,” in *Proceedings of the IEEE/ACM International Conference for High Performance Computing, Networking, Storage and Analysis (SC14)*, SC ’14, (New Orleans, LA, USA), pp. 597–608, IEEE Press, Nov. 2014.
- K. Brown, J. Domke, and S. Matsuoka, “Hardware-Centric Analysis of Network Performance for MPI Applications,” in *2015 21th IEEE International Conference on Parallel and Distributed Systems (ICPADS)*, (Melbourne, Australia), p. 8, IEEE Press, Dec. 2015.
- J. Domke, T. Hoefler, and S. Matsuoka, “Routing on the Dependency Graph: A New Approach to Deadlock-Free High-Performance Routing,” in *Proceedings of the 25th ACM International Symposium on High-Performance Parallel and Distributed Computing*, HPDC ’16, (New York, NY, USA), pp. 3–14, ACM, 2016.
- J. Domke and T. Hoefler, “Scheduling-Aware Routing for Supercomputers,” in *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, SC ’16, (Piscataway, NJ, USA), pp. 13:1–13:12, IEEE Press, 2016.
- D. Wang, J. Domke, J. Mao, X. Shi, and D. M. Ricciuto, “A Scalable Framework for the Global Offline Community Land Model Ensemble Simulation,” *Int. J. Comput. Sci. Eng.*, vol. 12, pp. 73–85, Feb. 2016.
- N. Wolfe, M. Mubarak, N. Jain, J. Domke, A. Bhatele, C. D. Carothers, and R. B. Ross, “Preliminary Performance Analysis of Multi-rail Fat-tree Networks,” in *17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing*, CCGrid ’17, (Madrid, Spain), pp. 258–261, IEEE Press, May 2017. Short paper.
- J. Domke, *Routing on the Channel Dependency Graph: A New Approach to Deadlock-Free, Destination-Based, High-Performance Routing for Lossless Interconnection Networks*. Dissertation, Technische Universität Dresden, Fakultät Informatik, Professur für Rechnerarchitektur, 2017.
- M. Mubarak, N. Jain, J. Domke, N. Wolfe, C. Ross, K. Li, A. Bhatele, C. D. Carothers, K.-L. Ma, and R. B. Ross, “Toward Reliable Validation of HPC Interconnect Simulations,” in *Proceedings of the 2017 Winter Simulation Conference*, WSC ’17, (Las Vegas, NV, USA), pp. 659–674, IEEE Press, Dec. 2017.
- H. Bhatia, N. Jain, A. Bhatele, Y. Livnat, J. Domke, V. Pascucci, and P.-T. Bremer, “Interactive Investigation of Traffic Congestion on Fat-Tree Networks Using TREESCOPE,” *Computer Graphics Forum*, vol. 37, no. 3, pp. 561–572, 2018.
- S. A. Smith, C. E. Cromeey, D. K. Lowenthal, J. Domke, N. Jain, J. J. Thiagarajan, and A. Bhatele, “Mitigating Inter-Job Interference Using Adaptive Flow-Aware Routing,” in *Proceedings of the International Conference for High Performance Computing*,

Networking, Storage and Analysis, SC '18, (Piscataway, NJ, USA), pp. 27:1–27:15, IEEE Press, Nov. 2018. Note: Best student paper finalist.

J. Domke, K. Matsumura, M. Wahib, H. Zhang, K. Yashima, T. Tsuchikawa, Y. Tsuji, A. Podobas, and S. Matsuoka, “Double-precision FPUs in High-Performance Computing: an Embarrassment of Riches?,” in *2019 IEEE International Parallel and Distributed Processing Symposium, IPDPS 2019, Rio de Janeiro, Brazil, May 20-24, 2019*, (Rio de Janeiro, Brazil), May 2019.

J. Domke, S. Matsuoka, I. R. Ivanov, Y. Tsushima, T. Yuki, A. Nomura, S. Miura, N. McDonald, D. L. Floyd, and N. Dubé, “The First Supercomputer with HyperX Topology: A Viable Alternative to Fat-Trees?,” HOTI26, (Piscataway, NJ, USA), p. 4, IEEE Press, Aug. 2019. Note: peer-reviewed short paper.

J. Domke, S. Matsuoka, I. R. Ivanov, Y. Tsushima, T. Yuki, A. Nomura, S. Miura, N. McDonald, D. L. Floyd, and N. Dubé, “HyperX Topology: First At-Scale Implementation and Comparison to the Fat-Tree,” in *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '19, (New York, NY, USA), pp. 40:1–40:23, ACM, Nov. 2019.

T. Dey, K. Sato, B. Nicolae, J. Guo, J. Domke, W. Yu, F. Cappello, and K. Mohror, “Optimizing Asynchronous Multi-Level Checkpoint/Restart Configurations with Machine Learning,” in *IEEE International Workshop on High-Performance Storage*, HPS '20, (New Orleans, LA, USA), May 2020.

M. Wahib, H. Zhang, T. T. Nguyen, A. Drozd, J. Domke, L. Zhang, R. Takano, and S. Matsuoka, “Scaling distributed deep learning workloads beyond the memory capacity with karma,” in *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '20, IEEE Press, 2020.

M. Besta, J. Domke, M. Schneider, M. Konieczny, S. D. Girolamo, T. Schneider, A. Singla, and T. Hoefler, “High-performance routing with multipathing and path diversity in ethernet and hpc networks,” *IEEE Transactions on Parallel and Distributed Systems*, vol. 32, no. 4, pp. 943–959, 2021.

J. Domke, E. Vatai, A. Drozd, C. Peng, Y. Oyama, L. Zhang, S. Salaria, D. Mukunoki, A. Podobas, M. Wahib, and S. Matsuoka, “Matrix Engines for High Performance Computing: A Paragon of Performance or Grasping at Straws?,” in *2021 IEEE International Parallel and Distributed Processing Symposium, IPDPS 2021, Portland, Oregon, USA, May 17-21, 2021*, (Portland, Oregon, USA), p. 10, May 2021.

J. Domke, “A64FX – Your Compiler You Must Decide!,” in *2021 IEEE International Conference on Cluster Computing (CLUSTER), EAHPC Workshop*, (Portland, Oregon, USA), IEEE Computer Society, 2021.

S. Farrell, M. Emani, J. Balma, L. Drescher, A. Drozd, A. Fink, G. Fox, D. Kanter, T. Kurth, P. Mattson, D. Mu, A. Ruhela, K. Sato, K. Shirahata, T. Tabaru, A. Tsaris, J. Balewski, B. Cumming, T. Danjo, J. Domke, T. Fukai, N. Fukumoto, T. Fukushi, B. Gerofi, T. Honda, T. Imamura, A. Kasagi, K. Kawakami, S. Kudo, A. Kuroda, M. Martinasso, S. Matsuoka, H. Mendonça, K. Minami, P. Ram, T. Sawada, M. Shankar, T. S. John, A. Tabuchi, V. Vishwanath, M. Wahib, M. Yamazaki, and J. Yin, “MLPerf HPC: A Holistic Benchmark Suite for Scientific Machine Learning on

HPC Systems,” in *7th IEEE/ACM Workshop on Machine Learning in High Performance Computing Environments (MLHPC@SC’21)*, St. Louis, MO, USA, November 15, 2021, IEEE, Nov. 2021.

Satoshi Matsuoka, Jens Domke, Mohamed Wahib, Aleksandr Drozd, Raymond Bair, Andrew A. Chien, Jeffrey S. Vetter, and John Shalf, “Preparing for the Future—Rethinking Proxy Applications,” *Computing in Science & Engineering*, vol. 24, pp. 85–90, Mar. 2022.

T. T. Nguyen, F. Trahay, J. Domke, A. Drozd, E. Vatai, J. Liao, M. Wahib, and B. Gerofi, “Why Globally Re-shuffle? Revisiting Data Shuffling in Large Scale Deep Learning,” in *2022 IEEE International Parallel and Distributed Processing Symposium, IPDPS 2022, Lyon, France, May, 2022*, (Lyon, France), May 2022.