

Christian Engelmann, Ph.D.

Senior Computer Scientist & Intelligent Systems and Facilities Group Leader
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Professional Accomplishments

13 Research grants (\$29.45M, 5 as lead):	110 Peer-reviewed articles/papers:	3,715 Publication citations:
8 Current direct reports	11 Journal articles	H-index: 29, i10-index: 66
8 Co-advised M.Sc. theses	55 Conference papers	Erdős number: 3
4 Mentored summer faculty	44 Workshop papers	160 Committees at 44 conferences
56 Invited talks and seminars	12 Peer-reviewed conference posters	54 Article & book reviews

Awards: 2015 US Department of Energy Early Career Award

Education and Training

2008 : Ph.D. in Computer Science, University of Reading, UK

2001 : M.Sc. in Computer Science, University of Reading, UK

2001 : Dipl.-Ing. (FH) in Computer Systems Engineering, University of Applied Sciences Berlin, Germany

Research and Professional Experience

2020–Present : **Intelligent Systems and Facilities Group Leader, ORNL**

2018–Present : **Senior R&D Staff Scientist, ORNL**

- rOpenMP: A resilient parallel programming model for heterogeneous systems
- Design patterns for a structured approach to resilience at extreme scale

2009–2018 : **R&D Staff Scientist, ORNL**

- Taxonomy, catalog and models of faults in extreme-scale systems and applications
- Resilient operating system and runtime software for extreme-scale scientific HPC
- Resilient Monte Carlo solvers with natural fault tolerance for exascale HPC
- HPC hardware/software co-design: performance/resilience/power modeling and simulation
- Soft-error injection for vulnerability analysis of scientific applications
- HPC resiliency system software for monitoring, fault prediction, and fault avoidance
- HPC checkpoint storage virtualization and MPI-level computational redundancy
- Light-weight simulation of extreme scale HPC architectures (~100,000,000 cores)

2004–2009 : **Associate R&D Staff Scientist, ORNL**

- Fault tolerance for MPI: Scalable membership, job pause, and process migration
- 99.9997% high availability for HPC head/service nodes: Torque and PVFS MDS
- Ph.D. thesis: Symmetric active/active high availability for HPC system services
- Virtual system environments for “plug-and-play” HPC using hypervisors
- Enhancing application development via a common view across platforms

2001–2004 : **Post-Master’s Research Associate, ORNL**

- Harness Distributed Virtual Machine: Pluggable, lightweight, and fault tolerant
- Light-weight simulation of HPC architectures at large scale (~1,000,000 cores)

2000–2001 : **Software Developer, ORNL**

- M.Sc. thesis: Distributed peer-to-peer control for Harness (a fault-tolerant runtime)

Most Cited Peer-reviewed Publications

- [1] A. Nagarajan, F. Mueller, C. Engelmann, and S. Scott. **Proactive fault tolerance for HPC with Xen virtualization.** In *Intl. Conf. on Supercomputing (ICS)*, 2007. doi: 10.1145/1274971.1274978. Accept. rate 23.6%. 455 citations.
- [2] M. Snir et al. **Addressing failures in exascale computing.** *Intl. J. of High Performance Comp. Applications (IJHPCA)*, 28(2), 2014. doi: 10.1177/1094342014522573. 342 citations.
- [3] D. Fiala, F. Mueller, C. Engelmann, K. Ferreira, R. Brightwell, and R. Riesen. **Detection and correction of silent**

- data corruption for large-scale high-performance computing.** In *Intl. Conf. on High Performance Comp., Networking, Storage and Analysis (SC)*, 2012. doi: 10.1109/SC.2012.49. Accept. rate 21.2%. 293 citations.
- [4] C. Wang, F. Mueller, C. Engelmann, and S. Scott. **Proactive process-level live migration in HPC environments.** In *Intl. Conf. on High Performance Comp., Networking, Storage and Analysis (SC)*, 2008. doi: 10.1145/1413370.1413414. Accept. rate 21.3%. 204 citations.
- [5] J. Elliott, K. Kharbas, D. Fiala, F. Mueller, K. Ferreira, and C. Engelmann. **Combining partial redundancy and checkpointing for HPC.** In *Intl. Conf. on Distributed Comp. Systems (ICDCS)*, 2012. doi: 10.1109/ICDCS.2012.56. Accept. rate 13.8%. 159 citations.
- [6] C. Engelmann, G. Vallée, T. Naughton, and S. Scott. **Proactive fault tolerance using preemptive migration.** In *Euromicro Intl. Conf. on Parallel, Distributed, and network-based Processing (PDP)*, 2009. doi: 10.1109/PDP.2009.31. Accept. rate 42.0%. 112 citations.
- [7] C. Wang, F. Mueller, C. Engelmann, and S. Scott. **A job pause service under LAM/MPI+BLCR for transparent fault tolerance.** In *Intl. Parallel and Distributed Processing Symp. (IPDPS)*, 2007. doi: 10.1109/IPDPS.2007.370307. Accept. rate 26%. 101 citations.
- [8] M. Li, S. Vazhkudai, A. Butt, F. Meng, X. Ma, Y. Kim, C. Engelmann, and G. Shipman. **Functional partitioning to optimize end-to-end performance on many-core architectures.** In *Intl. Conf. on High Performance Comp., Networking, Storage and Analysis (SC)*, 2010. doi: 10.1109/SC.2010.28. Accept. rate 19.8%. 97 citations.
- [9] C. Engelmann, H. Ong, and S. Scott. **The case for modular redundancy in large-scale high performance computing systems.** In *IASTED Intl. Conf. on Parallel and Distributed Comp. and Networks (PDCN)*, 2009. 96 citations.
- [10] C. Wang, S. Vazhkudai, X. Ma, F. Meng, Y. Kim, and C. Engelmann. **NVMalloc: Exposing an aggregate SSD store as a memory partition in extreme-scale machines.** In *Intl. Parallel and Distributed Processing Symp. (IPDPS)*, 2012. doi: 10.1109/IPDPS.2012.90. Accept. rate 20.7%. 80 citations.

Synergistic Activities

- 2010–Present : PC chair: Workshop on Latest Advances in Scalable Algorithms for Large-Scale Systems (ScalA) at the Intl. Conf. on High Perf. Comp., Networking, Storage and Analysis (SC)
- 2009–Present : Chair/PC chair: Workshop on Resiliency in High-Perf. Comp. at Euro-Par/HPDC/CCGrid
- 2017 : Program co-chair: IEEE Intl. Conf. on Networking, Architecture, and Storage (NAS)
- 2016 : System software PC chair: Intl. Conf. on High Perf. Comp., Networking, Storage and Analysis (SC)
- 2013–2015 : Member of the U.S. Department of Energy’s Technical Council on HPC Resilience

Professional Memberships

ACM (Senior), IEEE (Senior), SIAM, USENIX

Collaborators and Co-editors (Past 48 Months; Excluding Advisors, Advisees and ORNL personnel)

A. Armejach (BSC), R. Ashraf (UT Knoxville), E. Ayguade (BSC), F. Bodin (EXDCI), V. Cadambe (PSU), R. Canal (BSC), F. Cappello (ANL), S. Di Carlo (Politecnico di Torino), P. Carpenter (BSC), F. Chaix (FORTH Hellas), S. Derradji (Bull/ATOS), S. Eswar (Georgia Tech), D. Gizopoulos (Univ. of Athens), O. Green (Georgia Tech), P. Grover (CMU), R. Gupta (ANL), V. Gupta (UC Berkeley), Y. Hui (St. Jude), S. Hukerikar (NVIDIA), H. Jeong (Harvard Univ.), R. Jeyapaul (Arm), I. Laguna (LLNL), T. Low (CMU), M. Marazakis (FORTH Hellas), M. Moreto (BSC), O. Mutlu (ETH Zurich), L. Papadopoulos (Athens Polytechnic), O. Perks (Arm), M. Ploumidis (FORTH Hellas), P. Radojkovic (BSC), K. Ramchandran (UC Berkeley), B. Salami (BSC), Y. Sazeides (Univ. of Cyprus), M. Schulz (Technical Univ. of Munich), M. Snir (ANL), D. Soudris (Athens Polytechnic), Y. Sourdis (Chalmers Univ.), P. Stenstrom (Chalmers Univ.), S. Thibault (Univ. of Bordeaux), D. Tiwari (Northeastern Univ.), W. Toms (Univ. of Manchester), O. Unsal (BSC), G. Vallée (Mellanox), R. Vuduc (Georgia Tech), Y. Yang (UC Berkeley), G. de Verdiere (CEA)

Graduate and Postdoctoral Advisors and Advisees

Advisors: V. Alexandrov (Hartree Centre, Science and Technology Facilities Council, UK), A. Geist (Oak Ridge National Laboratory), U. Metzler (University of Applied Sciences Berlin, Germany), S. Scott (Tennessee Tech University)

Advisees: R. Baumann (EADS, Germany), S. Böhm (Oak Ridge National Laboratory), I. Jones (Ocado, UK), F. Lauer (University of Tennessee, Knoxville), H. Jeong (Carnegie Mellon University), A. Litvinova (Gresham Computing, UK), B. Könnig (TU Berlin), K. Uhlemann (Coca Cola, Germany), M. Weber (TU Dresden)