

Christian Engelmann, Ph.D.

Senior Computer Scientist - Extreme-scale High-Performance Computing
Computer Science and Mathematics Division, Oak Ridge National Laboratory (ORNL)

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Professional Accomplishments

13 Research grants (\$30.5M, 5 as lead)	11 Peer-reviewed journal articles	52 Invited talks and seminars
8 Co-advised M.Sc. theses	52 Peer-reviewed conference papers	146 Committees at 44 conferences
4 Mentored summer faculty	41 Peer-reviewed workshop papers	50 Article & book proposal reviews
10 Direct reports over 10 years	12 Peer-reviewed conference posters	11 Conference booth exhibitions
Erdős number of 3	+3,000 Total publication citations	H-index of 28 / i10-index of 58

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

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)

2012–2015 : **Task Lead of the System Software team, ORNL**

- Co-management of the System Software team (5 R&D Staff Scientists)

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)

Publications

- [1] S. Hukerikar and C. Engelmann. Resilience design patterns: A structured approach to resilience at extreme scale. *J. of Supercomputing Frontiers and Innovations (JSFI)*, 4(3), 2017.
- [2] S. Gupta, T. Patel, C. Engelmann, and D. Tiwari. Failures in large scale systems: Long-term measurement, analysis, and implications. In *Intl. Conf. on High Performance Comp., Networking, Storage and Analysis (SC)*, 2017.
- [3] M. Snir et al. Addressing failures in exascale computing. *Intl. J. of High Performance Comp. Applications (IJHPCA)*,

28(2), 2014.

- [4] C. Engelmann. Scaling to a million cores and beyond: Using light-weight simulation to understand the challenges ahead on the road to exascale. *Future Generation Comp. Systems (FGCS)*, 30(0), 2014.
- [5] 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.
- [6] 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.
- [7] C. Wang, F. Mueller, C. Engelmann, and S. Scott. Proactive process-level live migration and back migration in HPC environments. *J. of Parallel and Distributed Comp. (JPDC)*, 72(2), 2012.
- [8] 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.
- [9] 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.

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 : 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) + SIGHPC/SIGOPS, IEEE + ComSoc/CS/RL, IEEE CS TCFT/TCDP/TCPP/TCSC, SIAM, USENIX

Collaborators and Co-editors (Past 48 Months, Excl. Advisors, Advisees, Junior Pers., and Non-US)

J. Abraham (UT Austin), F. Aderholdt (TN Tech), S. Adve (UIUC), S. Alam (SNSC), D. Arnold (UNM), S. Arunagiri (UTEP), S. Bagchi (Purdue U), C. Baker (ServiceMesh), P. Balaji (ANL), B. Barrett (SNL), J. Belak (LLNL), M. Benzi (Emory U), S. Borkar (Intel), P. Bose (IBM), J. Brandt (SNL), E. Brewer (UC Berkeley), P. Bridges (UNM), R. Brightwell (SNL), A. Butt (VA Tech), K. Cameron (VA Tech), F. Cappello (ANL), B. Carlson (IDA), Z. Chen (UC Riverside), A. Chien (U Chicago), R. Clay (SNL), P. Coteus (IBM), N. Debardeleben (LANL), D. Dillow (Google), P. Dinda (Northwestern U), P. Diniz (USC), J. Dongarra (UTK), G. Eisenhauer (GA Tech), J. Elliott (NCSU), M. Elnozahy (KAUST), M. Erez (UT Austin), S. Fazzari (Booz Allen), K. Ferreira (SNL), D. Fiala (NCSU), A. Gavrilovska (GA Tech), A. Gentile (SNL), S. Ghafoor (TN Tech), X. Gu (NCSU), R. Gupta (ANL), S. Gurumurthi (AMD), P. Hargrove (LBNL), R. Harrison (Stony Brook U), S. Hemmert (SNL), M. A. Heroux (SNL), S. Hofmeyr (LBNL), C. Iancu (LBNL), B. Jacob (UMD), C. Janssen (Google), J. Jia (LinkedIn), F. Johnson (SAIC), I. Jones (Ocado, UK), G. B. Kandiraju (IBM), L. Kaplan (Cray), S. W. Keckler (NVIDIA), K. Kharbas (NCSU), S. Krishnamoorthy (PNNL), J. Kubiatowicz (UC Berkeley), P. Kudva (IBM), M. Lagadapati (NCSU), I. Laguna (LLNL), M. Lang (LANL), J. Lange (U Pitt), J. Laros (SNL), C. Leangsuk-sun (LA Tech), S. Leyffer (ANL), M. Li (IBM), D. Liberty (AMD), J. Lofstead (SNL), D. Lowenthal (UAZ), B. Lucas (USC), A. Lumsdaine (Indiana U), X. Ma (Qatar CRI), P. McCormick (LANL), F. Meng (NCSU), S. Mitra (Stanford U), F. Mueller (NCSU), T. Munson (ANL), L. Nowell (DOE), R. Numrich (UMN), R. Oldfield (SNL), H. Ong (MIMOS Berhad), M. Paun (LA Tech), K. Pedretti (SNL), R. Riesen (Intel), A. Rodrigues (SNL), E. Roman (LBNL), R. Ross (ANL), K. D. Ryu (IBM), R. Schreiber (HP Labs), M. Schulz (LLNL), K. Schwan (GA Tech), S. Scott (TN Tech), G. Smith (UoR, UK), M. Snir (ANL), V. Sridharan (AMD), J. Stearley (SNL), T. Sterling (Indiana U), B. Still (LLNL), M. Taylor (SNL), P. Teller (UTEP), D. Terpstra (UTK), T. Tsai (NVIDIA), E. Van Hensbergen (ARM), A. Vishnu (PNNL), A. Walker (UMES), R. Wisniewski (Intel), M. Wolf (GA Tech), J. Wu (LBNL)

Graduate and Postdoctoral Advisors and Advisees

Advisors: V. Alexandrov, BSC, Spain; A. Geist, ORNL; U. Metzler, HTW Berlin; S. Scott, TN Tech

Advisees: R. Baumann, TI, Germany; S. Böhm, ORNL; I. Jones, Ocado, UK; F. Lauer, UTK; A. Litvinova, Gresham Comp., UK; B. Könnig, TU Berlin; K. Uhlemann, Coca Cola, Germany; M. Weber, TU Dresden