

Brian J. Kocoloski

Curriculum Vitae
November 21, 2017

CONTACT INFORMATION	University of Pittsburgh Department of Computer Science Sennott Square Building Room 5412 210 South Bouquet Street Pittsburgh, Pennsylvania 15260	http://people.cs.pitt.edu/~briankoco briankoco@cs.pitt.edu
EDUCATION	University of Pittsburgh Doctor of Philosophy (Ph.D.) in Computer Science Advisor: Dr. John Lange GPA: 3.96 / 4.00	Aug 2011 – Sep 2017
	University of Dayton Bachelor of Science (B.S.) in Computer Science Minor in Mathematics Advisor: Dr. R. Sriharan GPA: 3.91 / 4.00	Aug 2007 – May 2011
RESEARCH INTERESTS	<p>The theme of my research is to make it easier to efficiently utilize large parallel computers. Most of my prior work has focused on system software for high performance computing (HPC) systems, where I have designed lightweight operating systems (OSes) and virtualization mechanisms to support parallel applications.</p> <p>In general, I am interested in identifying and addressing challenges that are encountered when designing software for large scale distributed systems. I am an experimental systems researcher; my research generally involves identifying a problem, designing and implementing a solution, and evaluating it in a real system.</p>	
EMPLOYMENT	University of Chicago - Computation Institute Resident Associate	Aug 2017 – <i>Current</i>
	University of Pittsburgh Graduate Student Researcher	Aug 2011 – Aug 2017
	Advanced Micro Devices (AMD) Co-op Engineer, AMD Research Project: Achieving Balanced Execution Through Runtime Detection of Performance Variation Reference: Leonardo Piga	Summer 2015
	Sandia National Laboratories Research Intern, Scalable System Software Project: A Virtual Cluster Test Environment for Operating System and Runtime Development Reference: Kevin Pedretti	Summer 2013
	JPMorgan Chase & Co. Application Developer Projects: Designed ASP.NET websites for student loans department	Summer 2010
	NCR Corporation Quality Assurance Analyst Projects: Performed quality assurance testing on ATM banking software	Summer 2008

PUBLICATION OVERVIEW Total Refereed Publications: 13
Citations (as of November 21, 2017): 82
[Google Scholar profile](#)

Journal Publications

- [J1] **Brian Kocoloski** and John Lange, “Lightweight Memory Management for High Performance Applications in Consolidated Environments,” *IEEE Transactions on Parallel and Distributed Systems (TPDS)*, Volume 27, Issue 2, pages 468-480, Feb 2016.
- [J0] **Brian Kocoloski** and John Lange, “Improving Compute Node Performance Using Virtualization,” *International Journal of High Performance Computing Applications (IJHPCA)*, Volume 27, Issue 2, pages 124-135, May 2013.

Refereed Conference Publications

- [C6] Noah Evans, **Brian Kocoloski**, John Lange, Kevin Pedretti, Shyamali Mukherjee, Ron Brightwell, Michael Lang, and Patrick Bridges, “Hobbes Node Virtualization Layer: System Software Infrastructure for Application Composition and Performance Isolation” (Poster), in *Proceedings of the 28th IEEE/ACM International Conference on High Performance Computing, Networking, Storage and Analysis (SC)*, Nov 2016. To Appear.
- [C5] **Brian Kocoloski**, Leonardo Piga, Wei Huang, Indrani Paul, and John Lange, “A Case for Criticality Models in Exascale Systems,” in *Proceedings of the 18th IEEE International Conference on Cluster Computing (CLUSTER)*, Sep 2016
- [C4] **Brian Kocoloski**, Yuyu Zhou, Bruce Childers, and John Lange, “Implications of Memory Interference for Composed HPC Applications,” in *Proceedings of the 1st International Symposium on Memory Systems (MEMSYS)*, Oct 2015.
- [C3] **Brian Kocoloski** and John Lange, “XEMEM: Efficient Shared Memory for Composed Applications on Multi-OS/R Exascale Systems,” in *Proceedings of the 24th International ACM Symposium on High Performance Parallel and Distributed Computing (HPDC)*, Jun 2015.
- [C2] Jiannan Ouyang, **Brian Kocoloski**, John Lange, and Kevin Pedretti, “Achieving Performance Isolation with Lightweight Co-Kernels,” in *Proceedings of the 24th International ACM Symposium on High Performance Parallel and Distributed Computing (HPDC)*, Jun 2015.
- [C1] **Brian Kocoloski** and John Lange, “HPMMAP: Lightweight Memory Management for Commodity Operating Systems,” in *Proceedings of the 28th IEEE International Parallel and Distributed Processing Symposium (IPDPS)*, May 2014.
- [C0] **Brian Kocoloski**, Jiannan Ouyang, and John Lange, “A Case for Dual Stack Virtualization: Consolidating HPC and Commodity Applications in the Cloud,” in *Proceedings of the 3rd ACM Symposium on Cloud Computing (SOCC)*, Oct 2012.

Refereed Workshop Publications

- [W3] Noah Evans, Kevin Pedretti, Shyamali Mukherjee, Ron Brightwell, **Brian Kocoloski**, John Lange, and Patrick Bridges, “Remora: A MPI runtime for Composed Applications at Extreme Scale,” in *Proceedings of the Workshop on Exascale MPI (ExaMPI)*, Nov 2016. To Appear.
- [W2] Noah Evans, Kevin Pedretti, **Brian Kocoloski**, John Lange, Michael Lang, and Patrick Bridges, “A Cross-Enclave Composition Mechanism for Exascale System Software,” in *Proceedings of the 6th International Workshop on Runtime and Operating Systems for Supercomputers (ROSS)*, Jun 2016.
- [W1] **Brian Kocoloski**, John Lange, Hasan Abbasi, David Bernholdt, Terry Jones, Jai Dayal, Noah Evans, Michael Lang, Jay Lofstead, Kevin Pedretti, and Patrick Bridges, “System-Level Support for Composition of Applications,” in *Proceedings of the 5th International Workshop on Runtime and Operating Systems for Supercomputers (ROSS)*, Jun 2015.
- [W0] **Brian Kocoloski** and John Lange, “Better than Native: Using Virtualization to Improve Compute Node Performance,” in *Proceedings of the 2nd International Workshop on Runtime and Operating Systems for Supercomputers (ROSS)*, Jun 2012.

PRESENTATIONS **Conference & Workshop Presentations**

“A Case for Criticality Models in Exascale Systems,” *18th IEEE International Conference on Cluster Computing (CLUSTER)*, Sep 2016.

“XEMEM: Efficient Shared Memory for Composed Applications on Multi-OS/R Exascale Systems,” *24th International ACM Symposium for High Performance Parallel and Distributed Computing (HPDC)*, Jun 2015.

“System-Level Support for Composition of Applications,” *5th International Workshop on Runtime and Operating Systems for Supercomputers (ROSS)* Jun 2015.

“HPMMAP: Lightweight Memory Management for Commodity Operating Systems,” *28th IEEE International Parallel and Distributed Processing Symposium (IPDPS)*, May 2014.

“Better than Native: Using Virtualization to Improve Compute Node Performance,” *2nd International Workshop on Runtime and Operating Systems for Supercomputers (ROSS)*, Jun 2012.

Other Presentations

“Scalability in the Presence of Variability,” *University of Pittsburgh PhD Dissertation Defense*, Sep 2017.

“Mitigating Variation in High Performance Computing Systems,” *University of Pittsburgh PhD Proposal Defense*, Jun 2016.

“Providing System Services in a Co-Kernel HPC System,” in *Program Committee Meeting: 25th International ACM Symposium for High Performance Parallel and Distributed Computing (HPDC)*, Mar 2016.

“Next Generation HPC Operating and Runtime Systems,” *University of Pittsburgh Comprehensive Evaluation*, Sep 2014.

PATENTS

Brian Kocoloski, Leonardo Piga, Wei Huang, and Indrani Paul. “Achieving Balanced Execution through Runtime Detection of Performance Variation,” filed June 2016.

Leonardo Piga, **Brian Kocoloski**, Wei Huang, Abhinandan Majumdar, and Indrani Paul. “Real-Time Performance Tracking Using Dynamic Compilation,” filed June 2016.

Abhinandan Majumdar, **Brian Kocoloski**, Leonardo Piga, Wei Huang, and Yasuko Eckert. “Temperature-Aware Task Scheduling and Proactive Power Management,” filed June 2016.

**ACADEMIC
HONORS
& AWARDS**

National Science Foundation

Student Travel Awardee for IEEE CLUSTER 2016 2016

Student Travel Awardee for ACM HPDC 2015 2015

Graduate Research Fellowship Program (NSF GRFP) Honorable Mention Awardee 2013

University of Pittsburgh

Orrin E. & Margaret M. Taulbee Award Runner-Up (two time) 2013 – 2014
2014 – 2015

Awarded by the Department of Computer Science for achieving the honor of graduate student excellence and promise as a teacher

Graduate Student Fellowship Fall 2011

University of Dayton

Lawrence A. Jehn Alumni Award for Excellence in the Senior Class 2011

4 Year President’s Scholarship 2007 – 2011

SOFTWARE

As part of the Prognostic Lab at the University of Pittsburgh, I have contributed to the design and implementation of a number of software projects in the area of high performance system software.

Hobbes

A US Department of Energy (DOE) research program to deliver the system software environment for next generation exascale supercomputing systems. The XEMEM shared memory architecture, Pisces lightweight co-kernel system, Palacios virtual machine monitor, and Kitten lightweight kernel have all been adopted as part of the Hobbes node virtualization layer (NVL).

XEMEM

A communication system designed to allow shared memory communication between processes executing in multi-OS environments. XEMEM provides an API which is portable and consistent across OS instances, facilitating the construction of shared memory mappings in multi-OS environments. Currently, XEMEM is used to support the deployment of various system services across multiple OS instances, as well as a high performance IPC framework for HPC application communication.

I am the lead developer of XEMEM. XEMEM has been adopted as the main communication mechanism in the Hobbes exascale project.

Related publications: [C2], [C3], [W1], [W2]

Online: <http://www.prognosticlab.org/xemem/>

Pisces

A co-kernel architecture for deploying multiple specialized native operating system instances (enclaves) on a single compute node. Pisces has been adopted as one of the main components of the Hobbes project to facilitate the construction of multi-enclave (multi-OS) environments targeting exascale applications.

Related Publications: [C2], [C3], [W1], [W2]

Online: <http://www.prognosticlab.org/pisces/>

Palacios

A lightweight OS-independent, embeddable virtual machine monitor designed specifically for HPC supercomputing platforms. I have built several systems in Palacios, including a virtual device which facilitates the construction of XEMEM shared memory mappings in processes running in Palacios virtual machines.

Related Publications: [J0], [C0], [C3], [W0], [W1]

Online: <http://www.prognosticlab.org/palacios/> (Version run by the Prognostic Lab)

Online: <http://v3vee.org/palacios/> (Original version lead by the V3VEE project)

Kitten

A lightweight kernel operating system designed for HPC supercomputing platforms. The Kitten project is lead by Sandia National Laboratories, but I have contributed significantly to its facilitation in multi-enclave environments in the context of the Hobbes project.

Related Publications: [J0], [C2], [C3], [W0], [W1], [W2]

Online: <http://www.github.com/HobbesOSR/kitten/>

HPMMAP

A lightweight memory management layer designed to support HPC applications running in commodity OS environments based on the Linux operating system. HPMMAP provides unmodified HPC applications access to high performance memory management mechanisms, such as guaranteed large page mappings and the removal of demand page fault overheads.

I am the lead developer of HPMMAP.

Related Publications: [J1], [C1]

Online: <http://www.prognosticlab.org/hpmmmap.html>

TEACHING EXPERIENCE

University of Pittsburgh

CS 1550 - Introduction to Operating Systems

2014

Teaching Assistant

Orrin E. & Margaret M. Taulbee Award Runner-Up in relation to this course

CS 1550 - Introduction to Operating Systems	2013
Teaching Assistant	
Orrin E. & Margaret M. Taulbee Award Runner-Up in relation to this course	
CS 1652 - Data Communication and Computer Networks	2013
Teaching Assistant	
CS 2510 - Computer Operating Systems (Graduate course)	2012
Teaching Assistant	
CS 445 - Data Structures	2012
Teaching Assistant	

University of Dayton

Various computer science courses	2009 – 2011
Teaching Assistant	

PROFESSIONAL SERVICE

Technical Program Committee Memberships

8th IEEE International Conference on Cloud Computing Technology and Science (CloudCom), 2016
 11th Workshop on Virtualization in High-Performance Cloud Computing (VHPC), 2016
 4th International Conference on Future Internet of Things and Cloud (FiCloud), 2016

Journal Reviewing

IEEE Transactions on Parallel and Distributed Systems, 2016
 IEEE Transactions on Mobile Computing, 2015

External Reviewing

IEEE International Conference on Big Data, 2015
 24th International Symposium on High Performance Parallel and Distributed Computing (HPDC), 2015
 23rd International Symposium on High Performance Parallel and Distributed Computing (HPDC), 2014

Other Service

Publication Chair - 25th International Symposium on High Performance Parallel and Distributed Computing (HPDC), 2016

PROFESSIONAL AFFILIATIONS

Association for Computing Machinery

Member	2011 – <i>Present</i>
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Institute of Electrical and Electronics Engineers

Member	2016 – <i>Present</i>
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