JOHN RUSSELL LANGE
Curriculum Vitae

University of Pittsburgh
Department of Computer Science
Sennott Square, Office 5407
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Research Interests

My research focuses on the design of core systems software capable of fully utilizing next generation hardware environments while at the same time being amenable to dynamic resource managers. My research is based specifically in the context of high performance computing. To increase the applicability of high performance systems, I seek to provide unmodified applications transparent access to high performance resources. My research predominantly uses virtualization mechanisms to achieve these goals. My methods are based on the design, implementation and evaluation of experimental systems.

Education

Northwestern University
Ph.D. in Computer Science, 2010
Thesis: Symbiotic Virtualization
Advisor: Peter A. Dinda
M.S. in Computer Science, 2006
B.S. in Computer Science, 2003
B.S. in Computer Engineering, 2003

Employment

University of Pittsburgh — 9/2016 - present
Associate Professor
Department of Computer Science
Member of Computer Engineering Faculty
Affiliation with Center for Simulation and Modelling
Affiliation with Institute for Cyber Law, Policy, and Security

Sandia National Laboratories — 7/2016 - 7/2017
Visiting Faculty (Sabbatical)
Computer Science Research Institute

University of Pittsburgh — 9/2010 - 9/2016
Assistant Professor
Department of Computer Science

Northwestern University — Winter 2009
Adjunct Lecturer
Department of Electrical Engineering and Computer Science

Neokast LLC — 6/2007 - 9/2008
Software Engineer

Symantec Research Labs — Summer 2007
Research Intern

Symantec Research Labs — Summer 2006
Research Intern

Northwestern University — 9/2004 - 9/2010
Graduate Research Assistant
Department of Electrical Engineering and Computer Science

International Center for Advanced Internet Research 1/2004 - 9/2004
Research Associate

Graduate Students

PhD	Debashis Ganguly	expected 2022
PhD	Judicael-Briand Djoko-Takougue	expected 2020 (Co-advised with Adam Lee)
PhD	Brian Kocoloski	graduated 2017 (Asst. Professor at Washington University in St Louis)
PhD	Jianan Ouyang	graduated 2016 (Engineer at Facebook)
MS	Boyu Sun	graduated 2012 (Engineer at Amazon)

Teaching

University of Pittsburgh

CS 0449: Introduction to Systems Software
(Spring 2011, Spring 2013, Spring 2015, Spring 2016)
CS 1651: Advanced Systems Software
(Fall 2013)
CS 1652: Data Communication and Computer Networks
(Fall 2010, Fall 2011, Fall 2012, Fall 2013, Fall 2014, Fall 2015, Fall 2017)
CS 2510: Graduate Operating Systems
(Fall 2012, Fall 2015, Fall 2017)
CS 3510: Advanced Topics in Operating System Research
(Spring 2012, Spring 2014)

Northwestern University

Taught MSIT short course on Resource Virtualization and the Enterprise
(Winter 2009)
Teaching Assistant for Introduction to Electrical Engineering
(Winter 2007)
Teaching Assistant for Resource Virtualization
(Winter 2006)
Teaching Assistant for Operating Systems
(Fall 2006)
Teaching Assistant for Probabilistic Systems and Random Signals
(Fall 2006)

Honors

Departmental Teaching Award	2014
Departmental Teaching Award	2013
Symantec Graduate Research Fellowship Recipient	2007 - 2008

Organizational Activities

Steering Committee HPDC 2017
The 26th International Symposium on High Performance Distributed Computing

Program Committee Co-Chair HPDC 2016
The 25th International Symposium on High Performance Distributed Computing

BOF Committee Supercomputing 2014
The International Conference for High Performance Computing, Networking, Storage and Analysis

Sponsorship Co-Chair HPDC 2014
The 23rd International Symposium on High Performance Distributed Computing

Sponsorship Chair HPDC 2012
The 21st International Symposium on High Performance Distributed Computing

Publicity Co-Chair HPDC 2011
The 20th International Symposium on High Performance Distributed Computing

Student Activities Co-Chair HPDC 2010
The 19th International Symposium on High Performance Distributed Computing

Program Committees

2017: HPDC, Supercomputing, ICDCS, IPDPS, ICS, Cluster, ICCCN, BigData, ROSS, VHPC
2016: ROSS, BigData
2015: HPDC, INFOCOM, BigData, ROSS, BigSystem
2014: HPDC, INFOCOM, IPDPS, BigData, Cluster, ROSS, BigSystem
2013: HPDC, INFOCOM, BigData, VTDC, DataCloud
2012: HPDC, INFOCOM, Supercomputing, VTDC, DataCloud
2011: HPDC, INFOCOM, VTDC
2010: HPDC, VTDC, VPACT
2009: HPCVirt, VTDC, MMCS
2007: GOBS

Other Activities

Program reviewer/panelist for NSF and DOE

Journal Reviewer, IEEE Transactions on Parallel and Distributed Systems

Journal Reviewer, ACM Transactions on Computer Systems

Journal Reviewer, Cluster Computing

Journal Reviewer, International Journal on High Performance Computing Applications

Co-Founder, Northwestern Graduate Research Seminar

Grants

CSR: Small: Collaborative Research: Flexible Resource Management and Coordination Schemes for Lightweight, Rapidly Deployable OS/Rs
Jack Lange (PI at Pitt), Kyle Hale (PI at IIT)
National Science Foundation, Proposal No. CNS-1718287
09/2017 - 09/2020; $250,000 to Pitt, $500,000 total

SaTC: CORE: Medium: Collaborative: Scalable Dynamic Access Control for Untrusted Cloud Environments
Adam Lee (PI at Pitt), Jack Lange (Co-PI at Pitt), Steve Myers (PI at IU)
National Science Foundation, Proposal No. CNS-1704139
09/2017 - 09/2021; $800,000 to Pitt, $1,200,000 total

CSR: Small: Collaborative Research: Extending cloud utility through dynamic isolation
Jack Lange (PI at Pitt), Karsten Schwan (PI at GaTech)
National Science Foundation, Proposal No. CNS-1421585
09/2014 - 09/2017; $250,000 to Pitt, $400,000 total

Student Travel Support for ACM HPDC 2014
National Science Foundation Award No. CCF-1441903
$15,000

Hobbes: OS and Runtime Support for Application Composition
Ron Brightwell (Lead-PI), Jack Lange (PI at Pitt)
Department of Energy, ASCR FOA 13-02

07/2013 - 07/2016: $375,000 to Pitt, $10,500,000 total

Exploring the use of virtualization on exascale systems
Jack Lange (PI)
Sandia National Laboratories, LDRD
05/2013 - 09/2013: $50,000

Student Travel Support for ACM HPDC 2012
National Science Foundation Award No. CNS-1233209
$20,000

Enabling Exascale Hardware and Software Design through Scalable System Virtualization
Department of Energy Award No. DE-SC0005343
Patrick Bridges (Lead-PI), Jack Lange
09/2010 - 09/2013: $150,000 to Pitt, $2,500,000 total

Software

My research focuses on the design and implementaion of high performance system software. As part of this work my group and I have developed a large set of software artifacts that are being used by numerous collaborators and other researchers as well as the community at large.

Hobbes Exascale OS/R Prototype

Most recently my group has provided the majority of the system software components currently adopted by one of two Department of Energy (DOE) research programs to deliver the next generation system software environment for next generation (Exascale) supercomputing platforms.

Pisces A co-kernel architecture for natively deploying multiple specialized high performance lightweight operating systems (or enclaves) simultaneously on the same compute node. Pisces has been adopted as the exascale OS prototype architecture by numerous national labs and other universities involed in the DOE exascale design effort.

XEMEM: A shared memory communication system designed for multi-enclave and multi-tenant environments. XEMEM provides application level APIs to allow portable and fast shared memory communication channels between application components. XEMEM has been adopted as the underlying communication channel by numerous national labs and other universities involed in the DOE exascale design effort.

Palacios VMM: An OS Independent Embeddable Virtual Machine Monitor released as open source under BSD license, and designed specifically for HPC and supercomputing platforms. Palacios has been downloaded in excess of 10,000 times, and has been adopted as the virtualization layer for the DOE's exascale OS effort.

Kitten LWK: Kitten is a lightweight kernel operating system designed specifically for supercomputing platforms. The Kitten project is led by Sandia National Laboratories, however my research group is one of the primary contributors to the project.

Leviathan: Leviathan is a node level information service designed for multi-enclave and multi-tenant environments. Leviathan provides unified namespaces for system and application resources as well as provides coordination and control services for large scale application compositions.

Other Systems

HPMMAP A High Performance memory management layer for unmodified Linux environments

EmNet Empathic home network traffic optimization system

Speculative VNC Extended VNC client with embedded Markov predictor

Virtuoso	Distributed management service for a virtual machine marketplace Server management service and web based frontend interface
VTL	Framework for implementing transparent network services
VNET	Layer 2 overlay network for networking of wide area distributed virtual machines
PERSONA	Network path component resource scheduler for circuit switched optical networks

References

Peter Dinda
Professor, Northwestern University

Arthur Barney Maccabe
Division Director, Computer Science and Math at Oak Ridge National Laboratory

Ada Gavrilovska
Associate Professor, Georgia Tech

David Lowenthal
Professor and Associate Head of Computer Science, University of Arizona

Patrick Bridges
Associate Professor, University of New Mexico

Publications

Journals

B. Kocoloski and J. Lange, **Lightweight Memory Management for Consolidated Environments**, *IEEE Transactions on Parallel and Distributed Systems, Volume 27, Issue 2, pages 468-480*, February 2016 — TPDS

L. Xia, Z. Cui, J. Lange, Y. Tang, P. Dinda, P. Bridges, **Fast VMM-based Overlay Networking For Bridging the Cloud and High Performance Computing**, *Cluster Computing*, Volume 17, Issue 1, pages 39-59, March 2014 — CLUSTER

B. Kocoloski, J. Lange, **Improving Compute Node Performance Using Virtualization**, *International Journal of High Performance Computing Applications*, Volume 27, Number 2, pages 124-135, May, 2013 — IJHPCA

Y. Tang, L. Xia, Z. Cui, J. Lange, P. Dinda, P. Bridges, and J. Li, **High Performance Virtual Network Embedding Virtual Machine Monitor**, *Chinese Journal of Scientific Instrument*, Volume 33, Number 5, pages 1195-1199, May, 2012

P. Bridges, D. Arnold, K. Pedretti, M. Suresh, F. Lu, P. Dinda, R. Joseph, and J. Lange, **Virtual Machine-based Emulation of Future Generation High-performance Computing Systems**, *International Journal of High Performance Computing Applications*, Volume 26, Number 2, pages 125-135, May, 2012 — IJHPCA

G. Hoang, C. Bae, J. Lange, L. Zhang, P. Dinda, R. Joseph, **A Case for Alternative Nested Paging Models for Virtualized Systems**, *Computer Architecture Letters*, Volume 9, Number 1, January-June, 2010 — CAL

L. Xia, J. Lange, P. Dinda, C. Bae, **Investigating Virtual Passthrough I/O on Commodity Devices**, *Operating Systems Review*, Volume 43, Number 3, July 2009 — OSR

J. Mambretti, D. Lillethun, J. Lange, J. Weinberger, **Optical Dynamic Intelligent Network Services (ODIN): An Experimental Control-Plane Architecture for High-Performance Distributed Environments Based on Dynamic Lightpath Provisioning**, *IEEE Communications Magazine*, Volume 44, Number 3, March 2006 — IEEE Communications

A. Sundararaj, M. Sanghi, J. Lange, P. Dinda, **An Optimization Problem in Adaptive Virtual Environments**, *Performance Evaluation Review*, Volume 33, Number 2, September 2005 — PER

Conferences

D. Ganguly, M. Mofrad, T. Znati, R. Melhem, J. Lange, **Harvesting Underutilized Resources to Improve Responsiveness and Tolerance to Crash and Silent Faults for Data-intensive Applications**, *Proceedings of the International Conference on Cloud Computing (Applications Track)* — IEEE CLOUD 2017

A. Zheng, A. Labrinidis, P. Chrysanthis, and J. Lange, **Argo: Architecture-Aware Graph Partitioning**, *Proceedings of the IEEE International Conference on Big Data* — BigData 2016

N. Evans, B. Kocoloski, J. Lange, K. Pedretti, S. Mukherjee, R. Brightwell, M. Lang, and P. Bridges, **Hobbes Node Virtualization Layer: System Software Infrastructure for Application Composition and Performance Isolation (Poster)**, *Proceedings of the 28th Annual IEEE/ACM International Conference for High Performance Computing, Networking, Storage and Analysis* — SC 2016

B. Kocoloski, L. Piga, W. Huang, I. Paul, and J. Lange, **A Case for Criticality Models in Exascale Systems**, *Proceedings of the 18th International Conference on Cluster Computing* — CLUSTER 2016

J. Ouyang, J. Lange, and H. Zheng, **Shoot4U: Using VMM Assists to Optimize TLB Operations on Preempted vCPUs**, *Proceedings of the 12th International Conference on Virtual Execution Environments* — VEE 2016

Y. Zhou, B. Subramaniam, K. Keahey, and J. Lange, **Comparison of Virtualization and Containerization Techniques for High-Performance Computing (Poster)**, *Proceedings of the 27th Annual IEEE/ACM International Conference for High Performance Computing, Networking, Storage and Analysis* — SC 2015

B. Kocoloski, Y. Zhou, B. Childers, and J. Lange, **Implications of Memory Interference for Composed HPC Applications (Extended abstract)** *Proceedings of the 1st International Symposium on Memory Systems* — MEMSYS 2015

J. Ouyang, B. Kocoloski, J. Lange and K. Pedretti, **Achieving Performance Isolation with Lightweight Co-Kernels**, *Proceedings of the 24th International ACM Symposium on High Performance Parallel and Distributed Computing* — HPDC 2015
Acceptance Rate: 16%

B. Kocoloski and J. Lange, **XEMEM: Efficient Shared Memory for Composed Applications on Multi-OS/R Exascale Systems**, *Proceedings of the 24th International ACM Symposium on High Performance Parallel and Distributed Computing* — HPDC 2015
Acceptance Rate: 16%

B. Kocoloski and J. Lange, **HPMMAP: Lightweight Memory Management for Commodity Operating Systems**, *Proceedings of the 28th IEEE International Parallel and Distributed Processing Symposium* IPDPS 2014
Acceptance Rate: 21%

Z. Cui, P. Bridges, J. Lange, and P. Dinda, **Virtual TCP Offload: Optimizing Ethernet Overlay Performance on Advanced Interconnects**, *Proceedings of the 22nd International ACM Symposium on High Performance Parallel and Distributed Computing* HPDC 2013
Acceptance Rate: 15%

J. Ouyang, J. Lange, **Preemptable Ticket Spinlocks: Improving Consolidated Performance in the Cloud**, *Proceedings of the 9th International Conference on Virtual Execution Environments* VEE 2013
Acceptance Rate: 40%

Z. Cui, L. Xia, P. Bridges, P. Dinda, J. Lange, **Optimizing Overlay-based Virtual Networking Through Optimistic Interrupts and Cut-through Forwarding**, *Proceedings of the ACM/IEEE International Conference on High Performance Computing, Networking, Storage and Analysis* Supercomputing 2012
Acceptance Rate: 21%

B. Kocoloski, J. Ouyang, J. Lange, **A Case for Dual Stack Virtualization: Consolidating HPC and Commodity Applications in the Cloud**, *Proceedings of the ACM Symposium on Cloud Computing* SOCC 2012
Acceptance Rate: 15%

L. Xia, Z. Cui, J. Lange, Y. Tang, P. Dinda, P. Bridges, **VNET/P: Bridging the Cloud and High Performance Computing Through Fast Overlay Networking**, *Proceedings of the 21st ACM Symposium on High-performance Parallel and Distributed Computing* HPDC 2012
Acceptance Rate: 16% (Best Paper Nominee)

C. Bae, L. Xia, P. Dinda, J. Lange, **Dynamic Adaptive Virtual Core Mapping to Improve Power, Energy, and Performance in Multi-socket Multicores**, *Proceedings of the 21st ACM Symposium on High-performance Parallel and Distributed Computing* HPDC 2012
Acceptance Rate: 16%

C. Bae, J. Lange, P. Dinda, **Enhancing Virtualized Application Performance through Dynamic Adaptive Paging Mode Selection**, *Proceedings of the 8th International Conference on Autonomic Computing* ICAC 2011
Acceptance Rate: 24%

J. Lange, P. Dinda, **SymCall: Symbiotic Virtualization Through VMM-to-Guest Upcalls**, *Proceedings of the 2011 ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments* VEE 2011
Acceptance Rate: 30%

J. Lange, K. Pedretti, P. Dinda, P. Bridges, C. Bae, P. Soltero, A. Merritt, **Minimal Overhead Virtualization of a Large Scale Supercomputer**, *Proceedings of the 2011 ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments* VEE 2011
Acceptance Rate: 30%

J. Lange, K. Pedretti, T. Hudson, P. Dinda, Z. Cui, L. Xia, P. Bridges, M. Levenhagen, R. Brightwell, A. Gocke, S. Jaconette, **Palacios and Kitten: New High Performance Operating Systems for Scalable Virtualized and Native Supercomputing**, *Proceedings of the 24th IEEE International Parallel & Distributed Processing Symposium* IPDPS 2010

Acceptance Rate: 24%

J. S. Miller, J. Lange, P. Dinda, **EmNet: Satisfying the Individual User Through Empathic Home Networks**, *Proceedings of IEEE INFOCOM 2010* — INFOCOM 2010
Acceptance Rate: 17.5%

J. Lange, J. S. Miller, P. Dinda, **EmNet: Satisfying the Individual User Through Empathic Home Networks: Summary (poster)**, *Proceedings of ACM Sigmetrics 2009* — SIGMETRICS 2009

J. Lange, P. Dinda, S. Rossoff, **Experiences with Speculative Remote Display**, *Proceedings of the USENIX Annual Technical Conference* — USENIX 2008
Acceptance Rate: 19%

J. Lange, P. Dinda, F. Bustamante, **Vortex: Enabling Cooperative Selective Wormholing for Network Security Systems**, *Proceedings of the 16th IEEE International Symposium on Recent Advances in Intrusion Detection* — RAID 2007
Acceptance Rate: 16%

J. Lange, P. Dinda, **Transparent Network Services via a Virtual Traffic Layer for Virtual Machines**, *Proceedings of the 16th IEEE International Symposium on High Performance Distributed Computing* — HPDC 2007
Acceptance Rate: 20%

A. Sundararaj, M. Sanghi, J. Lange, P. Dinda, **Hardness of Approximation and Greedy Algorithms for the Adaptation Problem in Virtual Environments (Poster)**, *Proceedings of the 3rd IEEE International Conference on Autonomic Computing* — ICAC 2006

J. Lange, A. Sundararaj, P. Dinda, **Automatic Dynamic Run-time Optical Network Reservations**, *Proceedings of the 14th IEEE International Symposium on High Performance Distributed Computing* — HPDC 2005
Acceptance Rate: 17%

Workshops

D. Ganguly, J. Lange, **The Effect of Asymmetric Performance on Asynchronous Task Based Runtimes**, *Proceedings of the 7th International Workshop on Runtime and Operating Systems for Supercomputers* — ROSS 2017

N. Evans, K. Pedretti, S. Mukherjee, R. Brightwell, B. Kocoloski, J. Lange, P. Bridges, **Remora: A MPI runtime for Composed Applications at Extreme Scale**, *Proceedings of the Workshop on Exascale MPI* — ExaMPI 2016

N. Evans, K. Pedretti, B. Kocoloski, J. Lange, M. Lang, P. Bridges, **A Cross-Enclave Composition Mechanism for Exascale System Software**, *Proceedings of the 6th International Workshop on Runtime and Operating Systems for Supercomputers* — ROSS 2016

R. Riesen, A. B. Maccabe, B. Gerofi, D. N. Lombard, J. Lange, K. Iskra, K. Pedretti, K. Ferreira, M. Lang, P. Keppel, R. W. Wisniewski, R. Brightwell, R. Inglett, Y. Park and Y. Ishikawa **What is a Lightweight Kernel?**, *Proceedings of the 5th International Workshop on Runtime and Operating Systems for Supercomputers* — ROSS 2015

B. Kocoloski, J. Lange, H. Abbasi, D. Bernholdt, T. Jones, J. Dayal, N. Evans, M. Lang, J. Lofstead, K. Pedretti, P. Bridges, **System-Level Support for Composition of Applications**, *Proceedings of the 5th International Workshop on Runtime and Operating Systems for Supercomputers* — ROSS 2015

J. Lange, A. Labrinidis, P. Chrystanthis, **Towards Automated Personalized Data Storage**, *Proceedings of the 9th International Workshop on Self-Managing Database Systems* SMDB 2014

R. Brightwell, R. Oldfield, D. Bernholdt, A. Maccabe, E. Brewer, P. Bridges, P. Dinda, J. Dongarra, C. Iancu, M. Lang, J. Lange, D. Lowenthal, F. Mueller, K. Schwan, T. Sterling and P. Teller, **Hobbes: Composition and Virtualization as the Foundations of an Extreme-scale OS/R**, *Proceedings of the 3rd International Workshop on Runtime and Operating Systems for Supercomputers* ROSS 2013

B. Kocoloski, J. Lange, **Better than Native: Using Virtualization to Improve Compute Node Performance**, *Proceedings of the 2nd International Workshop on Runtime and Operating Systems for Supercomputers* ROSS 2012

L. Xia, J. Lange, P. Dinda, **Towards Virtual Passthrough I/O on Commodity Devices**, *Proceedings of the 1st Workshop on I/O Virtualization* WIOV 2008

A. Sundararaj, M. Sanghi, J. Lange, P. Dinda, **An Optimization Problem in Adaptive Virtual Environments**, *Proceedings of the 7th Workshop on Mathematical Performance Modeling and Analysis* MAMA 2005

Book Chapters

B. Kocoloski, J. Lange, K. Pedretti, R. Brightwell, *Operating Systems for High Performance Computing*, (To Appear)

Technical Reports

C. Bae, J. Lange, P. Dinda, **Comparing Approaches to Virtualized Page Translation in Modern VMMs**, *Department of Electrical Engineering and Computer Science, Northwestern University*, April 2010 NWU-EECS-10-07

J. Lange, K. Pedretti, T. Hudson, P. Dinda, Z. Cui, P. Bridges, S. Jaconette, M. Levenhagen, R. Brightwell, P. Widener, **Palacios and Kitten: High Performance Operating Systems For Scalable Virtualized and Native Supercomputing**, *Department of Electrical Engineering and Computer Science, Northwestern University*, July 2009 NWU-EECS-09-14

J. S. Miller, J. Lange, P. Dinda, **EmNet: Satisfying the Individual User through Empathic Home Networks**, *Department of Electrical Engineering and Computer Science, Northwestern University*, April 2009 NWU-EECS-09-05

J. Lange, P. Dinda, **An Introduction to the Palacios Virtual Machine Monitor – Release 1.0**, *Department of Electrical Engineering and Computer Science, Northwestern University*, November 2008 NWU-EECS-08-11

D. Choffnes, J. Lange, A. Kuzmanovic, **Rethinking the Use of Parallel TCP in Web Browsers**, *Department of Electrical Engineering and Computer Science, Northwestern University*, October 2006 NWU-EECS-06-15

A. Sundararaj, M. Sanghi, J. Lange, P. Dinda, **Hardness of Approximation and Greedy Algorithms for the Adaptation Problem in Virtual Environments**, *Department of Electrical Engineering and Computer Science, Northwestern University*, July 2006 NWU-EECS-06-06

A. Shoykhet, J. Lange, P. Dinda, **Virtuoso: A System for Virtual Machine Marketplaces**, NWU-CS-04-39
Department of Computer Science, Northwestern University, July 2004
B. Cornell, J. Lange, P. Dinda, **An Implementation of Diffusion in the Linux Kernel**, NWU-CS-02-12
Department of Computer Science, Northwestern University, September 2002

Thesis

J. Lange, **Symbiotic Virtualization**, Ph.D. Dissertation, Northwestern University Department of Electrical Engineering and Computer Science Technical Report No. NWU-EECS-10-08, Auguest 2010

Patents

P. Dinda, A. Sundararaj, J. Lange, A. Gupta, B. Lin, **Methods and Systems for Automatic Inference and Adaptation of Virtualized Computing Environments** Patent # 20080155537