Irene Y. Zhang

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Education

University of Washington — Seattle, WA
Ph.D. in Computer Science and Engineering
Advisors: Hank Levy and Arvind Krishnamurthy

University of Washington — Seattle, WA
M.S. in Computer Science and Engineering — December 2013
Advisors: Hank Levy, Arvind Krishnamurthy, and Steve Gribble
Thesis: *Simplifying Mobile/Cloud Applications with Sapphire*

Massachusetts Institute of Technology — Cambridge, MA
M.Eng. in Electrical Engineering and Computer Science — June 2009
Advisor: M. Frans Kaashoek
Thesis: *Efficient File Distribution in a Flexible, Wide-area File System*

Massachusetts Institute of Technology — Cambridge, MA
S.B. in Computer Science and Engineering — June 2008

Interests

Operating systems, distributed systems, virtualization, and networking

Recent Research

Automating Data Management for Reactive Applications — OSDI '16
Diamond is a new data management system for wide-area, reactive applications. Reactive applications automatically propagate updates across across mobile devices and the cloud server. Diamond simplifies this task by providing applications with persistent cloud storage, reliable synchronization between storage and mobile devices, and automated execution of application code in response to shared data updates.

Building Consistent Transactions with Inconsistent Replication — SOSP '15
TAPIR – the Transactional Application Protocol for Inconsistent Replication – provides externally consistent transactions using a replication protocol with *no consistency guarantees*. TAPIR eliminates the need for a Paxos leader and commits transactions *in a single round-trip*. Compared to a conventional protocol, TAPIR halves the commit latency and triples the throughput.

Simplifying Deployment for Mobile/Cloud Applications — OSDI '14
Sapphire is a new distributed programming platform providing customizable and extensible deployment of mobile/cloud applications. The key concept is an architecture that supports *deployment managers* (DMs), which solve complex distributed systems tasks, such as code-offloading and caching. Rather than writing distributed systems code, programmers compose a custom deployment using DMs to meet their application's needs.

Enforcing User Privacy Policies for Mobile/Cloud Applications
Agate is a new trusted distributed runtime system that enforces user sharing policies on untrusted applications. Agate uses information flow control to give users both *access control* (i.e., which applications have access to their data) and *flow control* (i.e., whom applications can share that data with). Agate leverages the mobile OS to automatically tag user data without trusting the application or the application programmer.

Arrakis: The Operating System is the Control Plane — OSDI '14
Arrakis is a new operating system that provides high performance I/O using hardware virtualization technology, which is designed to eliminate the hypervisor from fast-path I/O operations. Arrakis takes this technology a step further by using it to eliminate the operating system as well, allowing applications to directly access the hardware during normal execution and providing significantly better performance, reliability and customizability.

Conference Publications

I. Zhang, N. Lebeck, P. Fonseca, B. Holt, R. Cheng, A. Norberg, A. Krishnamurthy, H. M. Levy. *Automating Data Management for Wide-area, Reactive Applications.* In Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI). Savannah, GA. November 2016.

B. Holt, J. Bornholt, **I. Zhang**, D. R. K. Ports, M. Oskin, L. Ceze. *Disciplined Inconsistency.* In Proceedings of the ACM Symposium on Cloud Computing (SoCC). Santa Clara, CA. October 2016.

I. Zhang, N. K. Sharma, A. Szekeres, D. R. K. Ports, A. Krishnamurthy. *Building Consistent Transactions with Inconsistent Replication..* In Proceedings of the ACM Symposium on Operating Systems Principles (SOSP). Monterey, CA. October 2015.

I. Zhang, A. Szekeres, D. Van Aken, I. Ackerman, S. D. Gribble, A. Krishnamurthy, H. M. Levy. *Customizable and Extensible Deployment for Mobile/Cloud Applications.* In Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI). Broomfield, CO. October 2014.

S. Peter, J. Li, **I. Zhang**, D. R. K. Ports, D. Woos, A. Krishnamurthy, T. Anderson, T. Roscoe. *Arrakis: The Operating System is the Control Plane.* In Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI). Broomfield, CO. October 2014. **Best Paper Award**.

I. Zhang, T. Denniston, Y. Baskakov, A. Garthwaite. *Optimizing VM Checkpointing for Restore Performance in VMware ESXi.* In Proceedings of the USENIX Annual Technical Conference (USENIX ATC). San Jose, CA. June 2013.

I. Zhang, A. Garthwaite, Y. Baskakov, K. C. Barr. *Fast Restore of Checkpointed Memory Using Working Set Estimation.* In Proceedings of the ACM Conference on Virtual Execution Environments (VEE). Newport Beach, CA. March 2011.

D. R. K. Ports, A. Clements, **I. Zhang**, S. Madden, B. Liskov. *Transactional Consistency and Automatic Management in an Application Data Cache.* In Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI). Vancouver, Canada. October 2010.

J. Stribling, Y. Sovran, **I. Zhang**, X. Pretzer, J. Li, M. F. Kaashoek, R. Morris. *Flexible, Wide-Area Storage for Distributed Systems with WheelFS.* In Proceedings of the USENIX Symposium on Networked Systems Design and Implementation (NSDI). Boston, MA. April 2009.

Journal Publications

I. Zhang, F. Adib, P. Bailis. *Research for Practice: Distributed Transactions and Networks as Physical Sensors.* ACM Queue. October 2016.

I. Zhang, N. K. Sharma, A. Szekeres, D. R. K. Ports, A. Krishnamurthy. *When Is Operation Ordering Required in Replicated Transactional Storage?.* IEEE Data Engineering Bulletin. March 2016.

S. Peter, J. Li, **I. Zhang**, D. R. K. Ports, D. Woos, A. Krishnamurthy, T. Anderson, T. Roscoe. *Arrakis: The Operating System is the Control Plane.* ACM Transactions on Computer Systems (TOCS). November 2015.

Workshop Publications

B. Holt, **I. Zhang**, D. R. K. Ports, M. Oskin and L. Ceze. *Claret: Using Data Types for Highly Concurrent Distributed Transactions.* In Proceedings of the Workshop on Principles and Practice of Consistency for Distributed Data (PaPoC). Bordeaux, France. April 2015.

S. Peter, J. Li, D. Woos, **I. Zhang**, D. R. K. Ports, T. Anderson, A. Krishnamurthy, M. Zbikowski. *Towards High-Performance Application-Level Storage Management.* In Proceedings of the USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage). Philadelphia, PA. June 2014.

Posters & Extended Abstracts

I. Zhang, N. K. Sharma, A. Szekeres, D. R. K. Ports, A. Krishnamurthy. *Optimistic, Replicated Two-Phase Commit.* ACM Asia-Pacific Workshop on Systems (APSys). Beijing, China. June 2014.

I. Zhang, A. Garthwaite, Y. Baskakov, K. C. Barr, J. Pool, K. Christopher. *Fast Restore of Checkpointed Memory Using Working Set Estimation.* ACM Symposium on Operating Systems Principles (SOSP). Big Sky, MT. October 2009.

I. Zhang, K. C. Barr. *Improving VMware Workstation Restore using Working Set Estimation.* VMworld Conference. Las Vegas, NV. September 2008.

Fellowships & Awards

Microsoft Research PhD Fellowship	2015
Google Anita Borg Memorial Fellowship	2015
National Science Foundation Fellowship	2013
ARCS Foundation Fellowship	2012
Jeff Dean and Heidi Hopper Endowed Regental Fellowship	2012
OSDI Best Paper Award	2014
CRA Outstanding Undergraduate Award, Honorable Mention	2008
Rising Stars Workshop	2016
NCWIT Collegiate Award Runner-up	2016
UW CSE Industrial Affiliates Madrona Prize Runner-Up	2015
Bob Bandes Teaching Award Honorable Mention	2015
UW CSE Industrial Affiliates Madrona Prize	2014
National Science Board Annual Meeting Student Panel	2013
VMware Academic Program Top Intern Project	2008
Northern Telecom/BNR Award for Best Undergrad. Lab Project	2006

Invited Talks

Automating Data Management for Wide-area, Reactive Applications

CloudPhysics Tech Talk, Host: Irfan Ahmad	Dec 2016
Symposium on Operating Systems Design and Implementation (OSDI)	Nov 2016
UW CSE Industrial Affiliates Meeting	Oct 2016

Building Consistent Transactions with Inconsistent Replication

UW Cloud Day	Jun 2016
MSR Tech Talk, Host: Myeongjae Jeon	Mar 2016
Google Tech Talk, Host: Daniel Myers	Dec 2015
UW CSE Industrial Affiliates Annual Meeting	Oct 2015
Symposium on Operating Systems Principles (SOSP)	Oct 2015
Amazon Tech Talk, Host: Andrew Certain	Nov 2014

Customizable and Extensible Deployment for Mobile/Cloud Applications

MSR Tech Talk, Host: Phil Bernstein	Nov 2014
UW CSE Industrial Affiliates Annual Meeting	Oct 2014
Symposium on Operating Systems Design and Implementation (OSDI)	Oct 2014
UW Systems Seminar	Oct 2014
Symposium on Operating Systems Principles (SOSP) Work-in-Progress	Nov 2013
UW/MSR Research Day	Apr 2013

Optimizing VM Checkpointing for Restore Performance in VMware ESXi

USENIX Annual Technical Conference (USENIX ATC)	Jun 2013

Fast Restore of Checkpointed Memory using Working Set Estimation

University of Washington Tech Talk	Oct 2011
Cornell SWE Tech Talk	Sep 2011
Conference on Virtual Execution Environments (VEE)	Mar 2011

Press

Geek of the Week: UW Ph.D. student Irene Zhang has big ideas to make life easier for programmers. GeekWire. December 16, 2016.

Bringing women back to computer science: UW in national spotlight over efforts. Crosscuts. March 28, 2016.

Cutting-edge server operating system wins UW computer science prize. GeekWire. October 23, 2014.

Faster websites, more reliable data. MIT News. October 14, 2010.

Service

ASPLOS, External Reviewer	2017
OSDI, External Reviewer	2016
HotCloud, Program Committee	2016
UW HotPoCSci, Founder	2015
UW PoCSci, PC Chair	2015-2016
UW CSE Annual Women's Research Day	
Committee	2017
Chair	2016
Founder	2015
UW Graduate Student Committee	
Graduate Admissions Committee	2014-2016
Graduate Women's Event Coordinator	2014-2015
Graduate Visit Days Committee Co-chair	2013-2014
UW Undergrad Women Mentor	2015-2016
UW Graduate Student Mentor	2013-2014
VMware Women's Outreach and Recruiting	2009-2012
Eta Kappa Nu EECS Honor Society Officer	2008-2009

Teaching

Distributed Systems (UW CSE 452)	Seattle, WA
Teaching Assistant	Winter 2016
Teaching Assistant	Winter 2015
Introduction to Operating Systems (UW CSE 451)	Seattle, WA
Tutor	Spring 2016
Tutor	Fall 2014
Tutor	Spring 2014
Guest Lecturer	Fall 2013
Tutor	Spring 2013
The Hardware/Software Interface (UW CSE 351)	Seattle, WA
Tutor, UW Department of CSE	Winter 2014
Tutor, UW Department of CSE	Winter 2013
Operating Systems Engineering (MIT 6.828)	Cambridge, MA
Teaching Assistant	Fall 2008
Intro. to Digital Systems Lab (MIT 6.111)	Cambridge, MA
Teaching Assistant	Spring 2008
Computation Structures (MIT 6.004)	Cambridge, MA
Lab Assistant	Spring 2007
Intro. to Computer Science and Programming (MIT 6.00)	Cambridge, MA
Lab Assistant	Fall 2006

Patents

US Patent App. 12/559,484. *Saving and Restoring State Information for Virtualized Computer Systems.* **I. Zhang**, K. C. Barr, G. Venkitachalam, I. Ahmad, A. Garthwaite, J. Pool.

US Patent App. 13/710,185. *Method for Saving Virtual Machine State from a Checkpoint File.* A. Garthwaite, Y. Baskakov, **I. Zhang**, K. Christopher, J. Pool.

US Patent App. 13/710,215. *Method for Restoring Virtual Machine State from a Checkpoint File.* A. Garthwaite, Y. Baskakov, **I. Zhang**, K. Christopher, J. Pool.

US Patent App. 13/935,382. *Identification of Page Sharing Opportunities within Large Pages.* Y. Baskakov, A. Garthwaite, R. Venkatasubramanian, **I. Zhang**, S. Kim, N. Bhatia, K. Tati

Work Experience

VMware, Inc. — Cambridge, MA
MTS, Virtual Machine Monitor Group — Jan 2010 - Feb 2013

VMware, Inc. — Cambridge, MA
R&D Intern, Virtual Machine Monitor Group — Jul - Dec 2009

VMware, Inc. — Cambridge, MA
R&D Intern, Core Performance Group — Jun - Aug 2008

Quickware Engineering and Design — Waltham, MA
Engineering Intern — Jun - Aug 2007

Cummins, Inc. — Columbus, IN
Engineering Intern, Analysis Led Design — Jun - Aug 2005

Cummins, Inc. — Beijing, China
International Business Intern — Jun - Jul 2004

ArvinMeritor, Inc. — Columbus, IN
Web Development Intern — Aug 2003 - May 2004

References

Henry M. Levy
Chairman & Wissner-Slivka Chair
Department of Computer Science & Engineering, University of Washington
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Department of Computer Science & Engineering, University of Washington
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Charles Piper Professor
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