Irene Y. Zhang

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Seattle, WA 98195

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http://irenezhang.net

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

Research

Building Consistent Transactions with Inconsistent Replication
TAPIR – the Transactional Application Protocol for Inconsistent Replication – provides externally consistent transactions using a replication protocol with *no consistency guarantees*. Unlike conventional protocols that use Paxos, TAPIR does not require a Paxos leader or coordination between replicas in a shard. Thus, TAPIR can commit a transaction *in a single round-trip* and eliminate the bottleneck at the Paxos leader.

Customizable and Extensible Deployment for Mobile/Cloud Applications
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*, which solve complex distributed systems tasks, such as code-offloading and caching. Rather than writing distributed systems code, programmers compose a custom deployment to meet their application's needs.

User-controlled Privacy for Mobile/Cloud Applications
Agate is a new trusted distributed runtime system that gives users control over how mobile/cloud applications share sensitive user data collected on mobile devices (e.g., photos, GPS location). Agate combines aspects of access control and information flow control to allow applications to share user data in application-specific ways, while enforcing user policies without trusting the application or the application programmer.

Arrakis: The Operating System is the Control Plane
Arrakis is a new operating system that provides high performance I/O by taking advantage of hardware virtualization technology. Hardware virtualization technologies are 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.

Improving VM Checkpoint Restore Performance
With collaborators at VMware, I developed two techniques for improving the performance of restoring checkpointed virtual machines. The first estimates and prefetches the working set of the checkpointed VM on restore, improving the responsiveness of the VM during restore. The second groups memory pages together on disk that are likely to be accessed together, improving disk efficiency during restore.

Conference Publications

Irene Zhang, Adriana Szekeres, Dana Van Aken, Isaac Ackerman, Steven D. Gribble, Arvind Krishnamurthy, Henry 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.

Simon Peter, Jialin Li, **Irene Zhang**, Dan R. K. Ports, Doug Woos, Arvind Krishnamurthy, Thomas Anderson, Timothy 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**.

Irene Zhang, Tyler Denniston, Yury Baskakov, Alex 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.

Irene Zhang, Alex Garthwaite, Yury Baskakov, Kenneth 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.

Dan R. K. Ports, Austin Clements, **Irene Zhang**, Samuel Madden, Barbara 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.

Jeremy Stribling, Yair Sovran, **Irene Zhang**, Xavid Pretzer, Jinyang Li, M. Frans Kaashoek, Robert 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.

In Submission

Irene Zhang, Naveen Kr. Sharma, Adriana Szekeres, Dan R. K. Ports, Arvind Krishnamurthy. *Building Consistent Transactions with Inconsistent Replication.*

Adriana Szekeres, **Irene Zhang**, Isaac Ackerman, Franziska Roesner, Dan R. K. Ports, Arvind Krishnamurthy, Henry M. Levy. *User-controlled Privacy: Enforcing Privacy Policies on Mobile/Cloud Applications.*

Workshop Publications

Simon Peter, Jialin Li, Doug Woos, **Irene Zhang**, Dan R. K. Ports, Thomas Anderson, Arvind Krishnamurthy, Mark 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

Irene Zhang, Naveen Kr. Sharma, Adriana Szekeres, Dan R. K. Ports, Arvind Krishnamurthy. *Optimistic, Replicated Two-Phase Commit.* ACM Asia-Pacific Workshop on Systems (APSys). Beijing, China. June 2014.

Irene Zhang, Alex Garthwaite, Yury Baskakov, Kenneth C. Barr, Jesse Pool, Kevin Christopher. *Fast Restore of Checkpointed Memory Using Working Set Estimation.* ACM Symposium on Operating Systems Principles (SOSP). Big Sky, MT. October 2009.

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

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.

Honors & Awards

Industrial Affiliates Madrona Prize 2014

OSDI Best Paper Award 2014

National Science Board Annual Meeting Student Panel 2013

National Science Foundation Fellowship 2013

ARCS Foundation Fellowship 2012

Jeff Dean and Heidi Hopper Endowed Regental Fellowship 2012

VMware Academic Program Top Intern Project 2008

CRA Outstanding Undergraduate Award, Honorable Mention 2008

Northern Telecom/BNR Award for Best Undergrad. Lab Project 2006

Talks

Operating Systems for Modern Applications
CSE Symposium — Jan 2015

Building Consistent Transactions with Inconsistent Replication
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 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

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

UW Conference on Potentially Computer Science (PoCSci)
Program Co-chair — 2015

UW Graduate Student Committee
Graduate Women's Event Coordinator — 2014-2015
Graduate Visit Days Committee Co-chair — 2013-2014

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 (CSE 452)
Teaching Assistant, UW Department of CSE — Winter 2015

Introduction to Operating Systems (CSE 451)
Tutor, UW Department of CSE — Fall 2014
Tutor, UW Department of CSE — Spring 2014
Guest Lecturer, UW Department of CSE — Fall 2013
Tutor, UW Department of CSE — Spring 2013

The Hardware/Software Interface (CSE 351)
Tutor, UW Department of CSE — Winter 2014
Tutor, UW Department of CSE — Winter 2013

Operating Systems Engineering (6.828)
Teaching Assistant, MIT Department of EECS — Fall 2008

Intro. to Digital Systems Lab (6.111)
Teaching Assistant, MIT Department of EECS — Spring 2008

Computation Structures (6.004)
Lab Assistant, MIT Department of EECS — Spring 2007

Intro. to Computer Science and Programming (6.00)
Lab Assistant, MIT Department of EECS — Fall 2006

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