

Jayaram Kallapalayam Radhakrishnan (K. R. Jayaram)

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RESEARCH Area: Distributed systems, programming languages, software engineering.
Focus: Distributed software systems and distributed programming.

EMPLOYMENT **Current: (as of 15th Nov 2013)**
– HP Labs, Palo Alto, USA. **Postdoctoral Researcher.** June 2012 – Present.

Previous:

- Purdue University, West Lafayette, USA. Graduate Assistant. June 2005 – May 2012.
- IBM Research, Thomas J Watson Research Center, Hawthorne, USA. Intern. Summer 2011.
- Amazon.com, Seattle, USA. Intern. Summer 2010.
- Microsoft Corp, Redmond, USA. Intern. Summer 2007.
- Alcatel-Lucent, Bangalore, India. Software Engineer. Aug 2004 – May 2005.

EDUCATION **Purdue University, W Lafayette, USA**
Ph.D. Computer Science, December 15, 2012. *Defense date: June 28, 2012.*
Advisor: Prof. Patrick Eugster
Thesis: Engineering Efficient Event-based Distributed Systems.

Purdue University, W Lafayette, USA
Master of Science, Computer Science, December 20, 2008. GPA: 3.57/4.0

Birla Institute of Technology and Science (BITS), Pilani, India
Bachelor of Engineering in Computer Science (with Honors), May 27, 2004. GPA: 8.88/10.0

AWARDS Best paper award, MIDDLEWARE 2013.
Best paper award, MIDDLEWARE 2010.
Maurice H. Halstead award, recognizing outstanding research in software engineering. April 2011.

PUBLICATIONS All papers can be obtained from www.jayaramkr.com

Journals

- (1) **K. R. Jayaram**, Patrick Eugster and Chamikara Jayalath.
Parametric Content-based Publish/Subscribe.
ACM Transactions on Computer Systems, ACM TOCS. May 2013.
- (2) Adrian Holzer, Lukasz Ziarek, **K. R. Jayaram**, Patrick Eugster.
Abstracting Context in Event-based Software.
Transactions on Aspect Oriented Software Development, TAOSD, December 2012.

Conferences

- (1) **K. R. Jayaram.** *Elastic Remote Methods.*
ACM/IFIP/USENIX 14th International Middleware Conference (MIDDLEWARE 2013).
- (2) Michael Lee, Indrajit Roy, Alvin AuYoung, Vanish Talwar, **K. R. Jayaram** and Yuanyuan Zhou.
Views and Transactional Storage for Large Graphs.
(Awarded Best Paper).
ACM/IFIP/USENIX 14th International Middleware Conference (MIDDLEWARE 2013).
- (3) William Culhane, **K. R. Jayaram** and Patrick Eugster
Weighted Partial Message Matching for Implicit Multicast Systems.
International Symposium on Distributed Computing (DISC 2012). *Brief Announcement*
- (4) **K. R. Jayaram**, Chunyi Peng, Zhe Zhang, Minkyong Kim, Han Chen and Hui Lei.
An Empirical Analysis of Similarity between Virtual Machine Images.
ACM/IFIP/USENIX 12th International Middleware Conference (MIDDLEWARE 2011 Industry Track).

- (5) Gregory A. Wilkin, **K. R. Jayaram**, Patrick Eugster and Ankur Khetrpal. *FAIDECS: Fair Decentralized Event Correlation* ACM/IFIP/USENIX 12th International Middleware Conference (MIDDLEWARE 2011).
- (6) **K. R. Jayaram** and Patrick Eugster. *Program Analysis for Event-based Distributed Systems* 5th ACM International Conference on Distributed Event-Based Systems, (DEBS 2011)
- (7) **K. R. Jayaram** and Patrick Eugster. *Split and Subsume: Subscription Normalization for Effective Content-based Messaging* International Conference on Distributed Computing Systems (ICDCS 2011)
- (8) Adrian Holzer, Lukasz Ziarek, **K. R. Jayaram** and Patrick Eugster. *Putting Events in Context – Aspects for Event-based Distributed Programming.* International Conference on Aspect Oriented Software Development (AOSD 2011)
- (9) **K. R. Jayaram**, Chamikara Jayalath and Patrick Eugster *Parametric Subscriptions for Content-based Publish/Subscribe Networks (Awarded Best Paper).* ACM/IFIP/USENIX International Middleware Conference (MIDDLEWARE 2010)
- (10) **K. R. Jayaram** and Patrick Eugster. *Scalable Efficient Composite Event Detection* International Conference on Coordination Models and Languages (COORDINATION) 2010.
- (11) Patrick Eugster and **K. R. Jayaram**. *EventJava – An Extension of Java for Event Correlation.* European Conference on Object-Oriented Programming (ECOOP) 2009.
- (12) Christopher Line, **K. R. Jayaram** and Patrick Eugster. *Lazy Argument Passing in Java RMI* ACM International Conference on Principles and Practice of Programming In Java (PPPJ) 2008.

Papers under submission (This is *unpublished* work. Please treat confidentially.)

- (1) William Culhane, **K. R. Jayaram**, Patrick Eugster and Kirill Kogan. *Fast, Expressive Top-k Matching.* Under submission. Available from <http://bit.ly/1aMWrQ9> .
- (2) Gregory Wilkin, Alessandro Margara, **K. R. Jayaram** and Patrick Eugster. *Efficient Dispatching of Typed Events.* Under submission. Available from <http://bit.ly/11Kud9o>.
- (3) **K. R. Jayaram**, Weihang Wang and Patrick Eugster. *Subscription Normalization for Content-based Publish/Subscribe Systems.* Under submission to IEEE Transactions on Parallel and Distributed Systems (TPDS). Available from <http://bit.ly/145cF4G>

Workshops and Technical Reports

- (1) **K. R. Jayaram** and Patrick Eugster, Context-Oriented Programming with EventJava, Workshop on Context-Oriented Programming (COP) 2009.
- (2) **K. R. Jayaram** and Aditya Mathur, On the Adequacy of Statecharts as a Source of Tests for Cryptographic Protocols. International Workshop on Security in Software Engineering (IWSSE) 2008. Also available as a technical report SERC-TR-288, May 2007.
- (3) **K. R. Jayaram**, Identifying and testing for insecure paths in cryptographic protocol implementations, COMPSAC 2006. (Extended abstract)
- (4) **K. R. Jayaram** and Aditya Mathur, Software Engineering for Secure Software - State of the Art: A Survey. August 2005. Technical Report CERIAS-TR-2005-67, SERC-TR-279

PATENTS

Han Chen, Alexei Karve, Minkyong Kim, Andrzej Kochut, Jayaram K. R., Hui Lei, Zhiming Shen and Zhe Zhang. *Virtual Machine Image Access Deduplication.* Filed in 2012. Pending. This was the result of my work at IBM Research.

PHD THESIS OVERVIEW

My PhD dissertation focusses on increasing the efficiency of event-based distributed applications like algorithmic trading applications by aligning middleware systems (e.g., complex event detection and stream processing systems) with specialized programming language abstractions (e.g. for specifying and reacting to patterns of events). Further details are available in my research statement, which can be obtained from my website.

PROFESSIONAL EXPERIENCE (TOTAL 3 YEARS)

HP Labs. Intelligent Infrastructure Lab.

Palo Alto, CA, USA. Postdoctoral Researcher. June 18, 2012 – Dec 2013.

– **Programming NVRAM-based Datacenters**

- Shared persistent regions (SPR) – Novel distributed programming abstractions for data centers that use Non-Volatile Random Access Memory (NVRAM).

- Memory accesses to to SPRs use transactions. Our SPR implementation contains novel distributed algorithms for scalable, efficient and fault tolerant data storage and access in SPRs, while providing strong ACID guarantees.
- **Event Correlation for Intrusion Detection**
 - Worked on the design and implementation of a large-scale rule-based datacenter intrusion detection system where rules and correlation patterns are dynamic, i.e., stateful.
- **ElasticRMI**
 - An extension to Java RMI to dynamically increase the number of server objects available to handle remote method calls. Instead of instantiating a single remote object, ElasticRMI creates an object pool and load balances method calls among objects in the pool.
 - Implemented on Apache Mesos, and dynamically instantiates additional server objects in the pool on new Mesos slices.
- **Concerto Graph Store**
 - Working on the design and implementation of a large scale in-memory graph storage system.
 - Supports interactive low-latency graph processing, transactional updates to graphs, graph views, and event-driven processing.

IBM Research, Thomas J. Watson Research Center. Cloud Management Group.

Hawthorne, NY, USA. Research Intern. May 9, 2011 – Aug 22, 2011.

- Analyzed the similarity between virtual machine (VM) images in a production data center using black-box similarity detection techniques like fixed size chunking and Rabin fingerprinting.
- Designed and implement a content-aware hypervisor level cache for VM images to improve the runtime performance of VM instances in clouds that stream VM images on demand to the hypervisor.

Amazon.com Inc., Amazon Web Services (AWS), Messaging Technologies Group.

Seattle, USA. Intern. May 24, 2010 – Sep 10, 2010.

- Worked on the *horizontal scalability* of the AWS Simple Workflow (SWF) web service that uses event-based messaging to orchestrate distributed computations in the AWS ecosystem.
- Implemented a scalable, persistent (3 way replication of events for fault tolerance), topic-based event matcher using distributed hash tables.
- Proposed novel load balancing techniques using redundant consistent hashing.
- Other details under NDA. SWF was released to the public in Feb 2012.

Microsoft Inc. Redmond, USA. Intern. May 22, 2007 – August 10, 2007.

- Extended Static Driver Verifier (SDV) to check Interrupt Request Level (IRQL) properties of Windows Kernel Mode Driver Framework (KMDF) drivers.
- Compared the fault-detection effectiveness of SDV vs. Prefast (with annotations) for checking IRQL properties of KMDF drivers.

Alcatel-Lucent Inc. Bangalore, India. Software Engineer. August 16, 2004 – May 28, 2005.

- Designed and developed modules for the Optical Network Management (ONM) Team

Research Intern, INRIA Sophia-Antipolis, France. Jan 5, 2004 – May 25, 2004

- Worked on Formal Verification of Cryptographic protocols towards my Bachelor’s thesis
- Proved that the verification of cryptographic protocols is decidable in the absence of name generation, even in the presence of an unbounded number of interacting processes.
- Developed a symbolic reduction technique for the efficient formal verification of cryptographic protocols.

TALKS

1. *Abstractions and Algorithms for Low Latency Distributed Transactions.* IBM Research. Sep 2013.
2. *Distributed Persistent Regions.* HP Labs. Jan 2013.
3. *An Empirical Analysis of Similarity between Virtual Machine Images.* MIDDLEWARE 2011.
4. *Effective Abstractions and Algorithms for Dynamic Event-based Distributed Systems.* IBM Research. November 2011.

5. *Effective Abstractions and Algorithms for Dynamic Event-based Distributed Systems*. HP Labs. November 2011.
6. *Content Aware Caching of Virtual Machine Images*. IBM Research. August 2011.
7. *Program Analysis for Event-based Distributed Systems*. DEBS 2011.
8. *Split and Subsume: Subscription Normalization for Effective Content-based Messaging*. ICDCS 2011.
9. *Parametric Subscriptions for Content-based Publish/Subscribe Networks*. MIDDLEWARE 2010.
10. *Scalable Efficient Composite Event Detection*. COORDINATION 2010.
11. *EventJava – An Extension to Java for Event Correlation*. ECOOP 2009.
12. *Lazy Argument Passing in Java RMI*. PPPJ 2008.
13. *EventJava – An Extension to Java for Event Correlation*. IBM Research. June 2008.

TEACHING
EXPERIENCE

Teaching Assistant, Purdue University, West Lafayette, USA.

- CS 505 Distributed Systems (graduate), Jan 2009 - May 2009, Jan 2011 - May 2011.
 - Assisted Prof. Patrick Eugster (2009) and Prof. Ananth Grama (2011)
 - Designed and evaluated programming assignments and lab sessions
 - Assisted in preparing and grading midterms and final exams.
- CS 390DS Distributed Systems (undergraduate), August 2011 - Dec 2011.
 - Assisted Prof. Patrick Eugster.
 - Designed and evaluated programming assignments and lab sessions
 - Assisted in preparing and grading midterms and final exams.
- CS 422 Computer Networks (undergraduate) Jan 2009 - May 2009.
 - Assisted Prof. Gustavo Rodriguez Rivera.
 - Designed and evaluated programming assignments and lab sessions
 - Assisted in preparing and grading midterms and final exams.
- CS 307 Software Engineering (undergraduate), August 2007 - Dec 2007.
 - Assisted Prof. Patrick Eugster.
 - Course involved a live project for Hewlett-Packard (HP)
 - Supervised four student teams through all phases of the project (requirements engineering, design, implementation and testing) resulting in four high quality prototypes to HP.
- CS 456 Programming Languages (undergraduate). Jan 2007 – May 2007.
 - Assisted Prof. Patrick Eugster.
 - Assisted in preparing and teaching compiler design exercises for domain specific languages using Polyglot.

Teaching Assistant, Birla Institute of Technology and Science (BITS), Pilani, India.

- TA C252 Computer Programming II. Jan 2003 - May 2003.
 - Second course in computer programming taken by all undergraduate students of BITS.
 - Advanced concepts in C and introduction to data structures
 - I designed and conducted programming lab sessions
- CS 363 Data Structures and Algorithms. Jan 2003 - May 2003.
 - Undergraduate algorithms course taken by computer science majors.
 - I designed and graded programming assignments.
- TA C162 Computer Programming I, August 2002 - December 2002.
 - First course in computer programming (C) taken by all undergraduate students of BITS.
 - I designed and conducted programming lab sessions.

SERVICE

- Program Committee Member, DAIS 2014.
- Program Committee Member, IC2E 2014.
- Poster Session Co-chair. SPLASH 2013.
- Program Committee Member, ICDCS 2013. P2P, Distributed OS and MIDDLEWARE Track.
- Program Committee Member, COORDINATION 2013.

- External reviewer for ICDCS 2012, PLDI 2011, VEE 2011, APLAS 2009, ECOOP 2009, COORDINATION 2010, OOPSLA 2010, POPL 2011 and the Journal of Logic and Algebraic Programming Special Issue on Processes and Security.

PROGRAMMING
SKILLS

C and Java

Previous Programming Experience: C++, ML, SQL, PL/SQL, x86 Assembly, UML Modeling.

RELEVANT
COURSEWORK

Graduate: Distributed Programming, Software Reliability, Software Engineering, Advanced Topics in Distributed Systems, Information Security, Model-based Software Testing, Algorithm Analysis and Design, Programming Languages, Computer Networks, Operating Systems

Undergraduate: Software Engineering, Data Structures and Algorithms, Operating Systems, Data Communications and Networks, Digital Design, Computer Architecture, Compilers, Database Systems, Discrete Mathematics, Fuzzy Logic

REFERENCES

Available on request.