

Curriculum Vitae: Karthik Pattabiraman

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Research Interests

Error Resilient Systems, Compilers and Programming Languages, Web Applications' Reliability and Security.

Education

PhD in Computer Science	University of Illinois (Urbana Champaign) <i>Advisor: Ravishankar K. Iyer</i>	May 2009
MS in Computer Science	University of Illinois (Urbana Champaign) <i>Advisor: Daniel A. Reed</i>	Dec 2004
B.Tech in Information Technology	Sri Venkateswara College of Engineering, University of Madras (Chennai, India)	Jul 2001

Awards and Honors

- NSERC Discovery Accelerator Grant Supplement (DAS) Award for 2015-2018. "The DAS Program provides substantial and timely resources to researchers who have a superior research program that is highly rated in terms of originality and innovation, and who show strong potential to become international leaders within their field." One of 125 awarded across all fields of science and engineering out of more than 3000 applications submitted in 2015.
- Member of the IFIP WG 10.4 on Dependable Computing and Fault Tolerance (January 2015 onwards). "The working group gathers a small percentage of the researchers active in the area, who are elected by their peers, in a regular and selective process, aiming at recognizing the merit and achievements of leading scientists and engineers in Dependable Computing and Fault Tolerance."
- ACM SIGSOFT Distinguished paper award at the IEEE/ACM International Conference on Software Engineering (ICSE) 2014, one of nine papers that received the award (out of nearly 500 submissions).
- Distinguished paper awards at the European Dependable Computing Conference (EDCC), 2015 and 2016 (twice). One of three papers from more than 50 submissions in each year.
- Best paper award nominee at the IEEE International Conference on Software Testing, Verification and Validation (ICST) 2012, and Best paper award runner up at ICST 2013.
- Winner of the 2008 *William C. Carter* award sponsored by the IEEE Technical Committee on Fault-Tolerant Computing (TC-FTC) and the IFIP Working Group on Dependable Computing and Fault Tolerance (WG 10.4). The William C. Carter Award is presented annually since 1997 "to recognize an individual who has made a significant contribution to the field of dependable computing through his or her graduate dissertation research". The award is given to one student a year at the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN).
- Nominated by the University of Illinois's Computer Science Department for the 2009 *Ross J. Martin* award, given to one student in the college of engineering based on research excellence. Each department is allowed up to one nominee for the award, and one award is given per year.

Work Experience

- Associate Professor, Dept. of Electrical and Computer Engineering, University of British Columbia, 2015-present.
- Assistant Professor, Dept. of Electrical and Computer Engineering, University of British Columbia, 2010-2015.
- Post-Doctoral Researcher, Microsoft Research, Jan-Dec 2009, Software Engineering Group
- Research assistant, University of Illinois, Jan 2004 – Dec 2008, Pablo and DEPEND research groups
- Summer Intern/Consultant, Microsoft Research, May 2006-Aug 2007, Software Design & Implementation group
- Summer Intern, IBM Research T J Watson, May-Aug 2004, Utility Operating Systems Group
- Summer Intern, Los Alamos National Labs, Summer 2003, Radiant Group.
- Undergraduate Intern, ATI Research, India, 2000.

Curriculum Vitae: Karthik Pattabiraman

Current Students (PhD/MASc)

1. Frolin Ocariza, PhD, from 2010 (co-advised with Ali Mesbah): NSERC CGS and FYF awardee. Best paper award nominee at ICST'12. Interned at Microsoft Research, and Fujitsu Labs.
2. Bo Fang, PhD, from 2011 (co-advised with Matei Ripeanu). Interned at Los Alamos National Labs (LANL).
3. Farid Molazem Tabrizi, PhD, from 2011. Interned at Fortinet, Vancouver, and Google, Mountain View. Distinguished paper award at EDCC 2015.
4. Saba Alimadadi, PhD, from 2012 (co-advised with Ali Mesbah), Distinguished paper award at ICSE 2014. Interned at SAP Vancouver.
5. Maryam Raiyat, PhD, from 2013.
6. Guanpeng Li, PhD, from 2014. FYF awardee from UBC. Interned at Nvidia Research.
7. Abraham Chan, MASc, from 2015.

Former Students

1. Layali Rashid, PhD, 2013 (co-advised with Sathish Gopalakrishnan), NSERC CGS(D) and FYF awardee,. Co-authored papers [1][29][40][46][70][75][76][77]. First position: Qualcomm, US
2. Jiesheng Wei, MASc, 2012. Co-authored papers [30][41][69][71][75][63]. First position: Microsoft Canada.
3. Anna Thomas, MASc, 2013: Co-authored papers [30][38][69][63]. First position: IBM Canada.
4. Majid Dadashi, MASc, 2014: Co-authored papers [29][70]. First position: 1-QBit.
5. Xin Chen, MASc, 2014. Co-authored papers [26] [68]. First position: Unknown.
6. Sheldon Sequira, MASc, 2014 (co-advised with Ali Mesbah), Distinguished paper award at ICSE'14. Co-authored papers [32]. First Position: SAP, Vancouver.
7. Kartik Bajaj, MASc, 2014 (co-advised with Ali Mesbah), FYF awardee, MITACS Globalink Fellowship and FYF awardee. Vancouver. Co-authored papers [20][27] [33][37]. First Position: Hootesuite, Vancouver.
8. Qining Lu, MASc, 2015. Co-authored papers [28][23][63]. First position: Google, Canada.
9. Shabnam Mirshokraie, PhD, 2015 (co-advised with Ali Mesbah), Best paper runner up at ICST 2013. Co-authored papers [36][39] [24][6][13]. First Position: Co-founder of a Startup in Stealth mode now
10. Nithya Narayanamurthy, MASc, 2015. Co-authored paper [13]. Distinguished paper award at EDCC 2016. First Position: Oracle Labs, Vancouver.

Undergraduate students: I have mentored a total of 20 undergraduate students as summer interns or undergraduate project advisers at UBCs. Three of these students were NSERC USRA interns (equivalent of NSF REUs in Canada).

Selected Activities

- Steering Committee Member for the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2015-2020. One of ten members of the Steering Committee.
- Guest co-editor of a special issue of the IEEE Transactions on Dependable and Secure Computing (TDSC), 2016 on dependability and security data analysis (one of three co-editors).
- Conference Organization
 - Program co-chair for the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2017.
 - Industry track co-chair for the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2017.
 - Program co-coordinator for the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2016.
 - Workshops co-chair of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2016.
 - Finance chair of the 14th ACM/IFIP/Usenix International Conference on Middleware, 2015.
 - Local Chair of 1st IEEE International Conference on Software Quality, Reliability and Security (QRS), 2015.

Curriculum Vitae: Karthik Pattabiraman

- Publicity co-chair of the 11th European Dependable Computing Conference (EDCC), 2015.
- Publications chair of the 8th IEEE/ACM International Symposium of Network On Chips (NOCS), 2015
- Fast abstracts chair, IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014.
- Student Track chair, IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014.
- General chair of the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2013.
- Program co-chair of the first and second workshops on *Compiler and Architectural Techniques for Application Reliability and Security* (CATARS), held in conjunction with the IEEE International Conference on Dependable Systems and Networks (DSN), 2008 and 2009.
- Delivered tutorial on “Modern Web Applications’ Reliability Engineering” at the 25th IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014. Attended by about 30 people at the conference. Also, delivered at the IEEE International Conference on Quality, Reliability and Security (QRS), 2015.
- Selected Technical Program Committee member
 - IEEE International Conference on Dependable Systems and Networks (DSN), 2010-2012, 2015-2016.
 - IEEE International Symposium on Software Reliability Engineering (ISSRE), 2012, 2016.
 - International Conference on Computer Safety, Reliability and Security (SafeComp), 2016.
 - IEEE International Symposium on Applied Computing (SAC), 2015.
 - IEEE International Conference on Cloud Computing (Cloud), 2015, 2016.
 - IEEE International Online Testing Symposium (IOLTS), 2014, 2015.
 - IEEE International High Assurance Systems Symposium (HASE), 2010-2016.
 - IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE), 2011-2014.
- Reviewer for the following journals:
 - IEEE Transactions on Dependable and Secure Computing (TDSC),
 - IEEE Embedded Systems Letters,
 - ACM Journal on Emerging Technologies in Computing (JETC),
 - IEEE Transactions on Computers,
 - Elsevier Journal of Systems Architecture,
 - IEEE Transactions on CAD (TCAD)
- ECE Department, UBC – Space Committee (2011), Scholarship Committee (2012, 2013, 2014 - chair), Graduate Experience Committee (2013), Merit/PSA Committee (2013), Curriculum Committee (2016).
- Senior Member of the IEEE (since 2015), and Member of the ACM and the Usenix Association (since 2010).

Teaching Experience: I have taught 8 courses at UBC. Teaching evaluation scores from the last time I taught each course are provided out of 5.0, based on the answer to the question “Overall, the instructor was an effective teacher”. The ECE department average for undergraduate courses is around 3.7, while for graduate courses it is around 3.9.

1. Undergraduate courses (total of 10 courses)

- a. Software Engineering (EECE 310) – Taught three times (Score: 4.0)
- b. Software Design (EECE 309/210) – Taught twice (Score: 4.0)
- c. Software Architecture (EECE 417) – Taught twice (Score: 3.8)
- d. Operating Systems (EECE 315) – Taught once (Score 4.4)
- e. Building Modern Web Applications (CPEN 400A) – Created, and Taught once (Score: 4.4)

2. Graduate Courses (total of 5 courses)

- a. Design of Fault-tolerant Systems (EECE 513) – Taught three times (Score: 4.2)
- b. Program Analysis and Optimization (EECE 571P) – Created and Taught three times (Score: 4.4)
- c. Error Resilient Computing Systems (EECE 513) – Created and Taught once (Score: 4.0)

Curriculum Vitae: Karthik Pattabiraman

Selected Recent Talks

- *Failure Analysis of Jobs in Compute Clouds: A Google Cluster Case Study*, IFIP WG 10.4 Meeting, Soreze, France, 2016.
- *Does Error Resilience matter in the age of Approximate Computing?* Invited Panelist at Workshop on Silicon Errors in Logic, Systems Effects (SELSE), 2016 on “Resilience and Probabilistic Computing”.
- *A Flexible Intrusion Detection System for Memory-Constrained Embedded Devices*, IFIP Working Group on Dependability (10.4), Research Reports, 2016.
- *Error Resilient Systems and Approximate Computing: Conjoined Twins Separated at Birth?* Dagstuhl workshop on Approximate and Probabilistic Computing, November 2015 (invited).
- *Good Enough Dependability: A new paradigm for Dependable Systems Design*,
 - Rutgers, State University of New Jersey, October 2016. ECE Colloquium.
 - Microsoft Research, August 2015.
 - TU Darmstadt, November 2014.
 - University of Maryland (College Park), February 2015.
- *Application-level Error Resilience: Tolerating Hardware Faults through Software Techniques*, Nvidia Research, May 2015.
- *Good Enough Dependability: Providing Security and Reliability at Low Cost for Embedded Devices*, Qualcomm Research Silicon Valley, May 2015.
- *Helping Developers Understand, Analyze and Synthesize JavaScript Code in Web Applications*, Intel, May 2015.
- *Tolerating Silent Data Corruption (SDC) causing Hardware Faults through Software Techniques*,
 - Electrical and Computer Engineering, Georgia Tech, Computer Engineering Seminar, June 2014.
 - IBM T.J. Watson Research, New York, August 2014.
 - AMD Research, Boston, August 2014.
- *LLFI: A High-Level Fault Injection Framework for Evaluating Software Resilience Techniques*, Workshop on Compilers Assisted SoC Assembly (CASA), 2014, Oct. 2014. Co-held with Embedded Systems Week, 2014.
- *Model-based Intrusion Detection for Smart Meters*, Workshop on Smart Electric Grids’ Dependability, Meeting of the IFIP Working Group on Dependability (WG 10.4), Atlanta, Georgia June 2014.
- *Invited Panelist: “Towards 21st Century High assurance Engineering”*, 15th IEEE High Assurance System Engineering (HASE), Miami, Florida. (one of four panelists)
- *Evaluating the Robustness of GPGPU Applications*, Embedded Tutorial Session, Symposium on Design Automation and Test in Europe (DATE), March 2014.
- *How I learned to Stop Worrying and Love the DOM*,
 - IFIP WG 2.4 Meeting, Victoria (April 2016)
 - Microsoft Research, Redmond (August, 2014)
 - Intel, Santa Clara (May 2013)
 - Microsoft Research, India (August 2013)
 - IBM Research, India (August 2013)
- *Why do Web Applications Fail and What can we do about it?*,
 - Workshop on Future Directions in Dependability and Security, Meeting of the IFIP Working Group on Dependability (10.4), June 2013, Visegard, Hungary.
 - Workshop on Rich Internet and Mobile Applications, CASCON, November 2012, ON, Canada.
 - Intel, Santa Clara, September 2012.
 - CS department Colloquium, Queens University, August 2012.
 - Coordinated Science Laboratory, University of Illinois at Urbana-Champaign (UIUC), May 2012.
 - Microsoft Research, Redmond, June, 2011.

Curriculum Vitae: Karthik Pattabiraman

- *Good Enough Software Systems: Tolerating (most) Hardware Errors in Software*,
 - CS department Colloquium, University of Pittsburgh, Feb 2012.
 - CS department Colloquium, McGill University, Montreal, Quebec, March 2011.

Research Funding (Includes grants currently held and held in the past)

1. Building Error-Resilient Applications on Many-Core Platforms, NSERC Discovery Grant¹, 2010-2015, \$120,000
2. Microsoft Research, Unrestricted Gift, 2010, \$17,000.
3. Teaching and Learning Enhancement Fund, University of British Columbia, 2011 (co-PI with 2 others), \$39,000.
4. WATERS: A computational Infrastructure for Web Application Testing, Energy-Efficiency, Reliability and Security, Leaders Opportunity Funds (LOF), Canada Foundation for Innovation (CFI), 2011 (PI, 1 co-PI), \$280,000
5. Shared-memory Multiprocessor for Parallel Algorithms and Architectures, NSERC Research Tools and Infrastructure Grant (RTI), 2011. (Co-PI with six others). \$80,000.
6. Leveraging Dynamic Co-Processor Platforms for High-Performance Computing Applications, NSERC Engage Grant, 2011 (Sole PI). \$22,750. (Industry partner: Secodix, Vancouver).
7. Assessing the Error Reporting Capabilities of the Freescale QoRIQ Platform, NSERC Engage Grant, 2011 (Sole PI), 24,675. (Industry partner: Freescale).
8. Nokia Research, Unrestricted Gift, 2012. \$15,000.
9. Teaching and Learning Enhancement Fund, University of British Columbia, 2012 (co-PI, 1 PI) \$31,000.
10. Automatic Code Partitioning for XPU Acceleration, MITACS Accelerate Grant, 2012 (Sole PI), \$30,000.
11. Hardening Software to Detect Hardware Faults, NSERC Engage Grant, 2012 (Sole PI). \$25,000. (Industry partner: Cisco).
12. Systematic Software Analysis and Maintenance Techniques for Web 2.0 Applications, NSERC Strategic Project Grant, 2012-2015 (Co-PI with three others), \$480,000.
13. Unifying Static and Dynamic Analysis Techniques for Checking Non-Functional Properties, Lockheed Martin Research Grant, 2012-2013 (Co-PI with four others), \$180,000.
14. Intel, Unrestricted Gift, 2012-2013 (Sole PI), \$65,000.
15. Secure and Trusted Network Terminals for Smart vehicular Networks, DIVA Strategic Network Grant, 2010-2015 (Multiple PIs, my portion is \$20,000 a year).
16. Software Robustness Assessment through Fault Injection, Research Grant, Cisco Systems, 2013-2015 (Sole PI). \$120,000.
17. Hardware Fault Injection for GPGPU Applications, NSERC Engage Grant, 2013 (Sole PI). \$25,000. (Industry partner: AMD).
18. Nvidia Equipment Donation, 2013. \$3000 market value.
19. Programming Techniques for QUBO compatible processors II, MITACS Accelerate Grant (Sole PI), 2013. \$30,000. (Industry partner: 1-Qbit, Vancouver).
20. Intel, Unrestricted Gift, 2013-2016 (PI, one co-PI), \$205,000. This is a continuation of the grant 14 above. NOTE: The funding was awarded each year on a competitive basis for four years in a row.
21. AMD, Unrestricted gift, 2014. \$8000.
22. Building Error-Resilient Applications on Next Generation Computing Platforms, NSERC Discovery Grant, 2015-2020, \$250,000 (Awarded an additional Discovery Accelerator (DAS) Supplement of \$120,000 for 2015-2018).
23. Low-cost Security for Internet of Things (IoT) Security, NSERC Engage Grant, 2015 (Sole PI), \$25,000. (Industry partner: Sierra Wireless).
24. Error Propagation Analysis for GPGPU Applications, NSERC Engage Grant, 2015 (Sole PI), \$23,000. (Industry partner: Nvidia).

¹ Note that grant amounts from Canadian funding agencies such as the NSERC do not typically include overheads (i.e., indirect costs of research). Further, summer salaries are typically not paid from research grants, and hence grant amounts do not include summer salaries.

Curriculum Vitae: Karthik Pattabiraman

Publications (by type, in chronological order): Names of students I have advised or co-advised are bolded.

(a) *Journals: In my area, conference papers are often more prestigious and rigorous than journal papers.*

- [1] *A Study of Causes and Consequences of Client-Side JavaScript Bugs*, **Frolin Ocariza, Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, To appear in the IEEE Transactions on Software Engineering (TSE). Accept Date: June 2016. (Expanded version of [37])
- [2] *A Systematic Methodology for Evaluating the Error Resilience of GPGPU Applications*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu, and Sudhanva Gurumurthi, To appear in the IEEE Transactions on Parallel and Distributed Systems (TPDS). Accept date: December 2015. (Expanded version of [34]).
- [3] *Understanding JavaScript Event-Based Interactions with Clematis*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, To appear in the ACM Transactions on Software Engineering and Methodology (TOSEM), Accept date: October 2015. (Expanded version of [32]).
- [4] *Error Detector Placement for Soft-Computing Applications*, **Anna Thomas** and Karthik Pattabiraman, To appear in the ACM Transactions on Embedded Computing Systems (TECS), 2015. Accept date: July 2015 (expanded version of [38]).
- [5] *Automatic Fault Localization for Client-Side JavaScript*, **Frolin Ocariza, Guanpeng Li**, Karthik Pattabiraman and Ali Mesbah, To appear in the Journal of Software Testing, Verification and Reliability (STVR), 2015. Accept Date: March 2015. (expanded version of [42]).
- [6] *Guided Mutation Testing for JavaScript Web Applications*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, IEEE Transactions on Software Engineering (TSE), 41(5), 429-444 (2015) (expanded version of [39]).
- [7] *Characterizing the Impact of Intermittent Hardware Faults on Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, IEEE Transactions on Reliability (TR), [64\(1\)](#): 297-310, 2015 (expanded version of [46]).
- [8] *Modular Protections against Non-control Data Attacks*, Cole Schlesinger, Karthik Pattabiraman, Nikhil Swamy, David Walker, and Benjamin Zorn, Journal of Computer Security (JCS), [22\(5\)](#): 699-742, 2014 (expanded version of [44]). **Invited as one of the best papers from CSF'11.**
- [9] *SymPLFIED: Symbolic Program Level Fault Injection and Error Detection*, Karthik Pattabiraman, Nitin Nakka, Zbigniew Kalbarczyk and Ravishankar K Iyer, IEEE Transactions on Computers (TC). 62(11), 2013. (expanded version of [9]).
- [10] *Efficient Runtime Detection and Toleration of Asymmetric Races*, Paruj Ratanaworabhan, Martin Burtscher, Darko Kirovski, Benjamin Zorn, Rahul Nagpal, Karthik Pattabiraman, IEEE Transactions on Computers (TC), 61(4), 2012. (expanded version of [50]).
- [11] *Automated Derivation of Application-specific Error Detectors using Dynamic Analysis*, Karthik Pattabiraman, Giacinto Paolo Saggese, Daniel Chen, Zbigniew Kalbarczyk and Ravishankar Iyer, IEEE Transactions on Dependable and Secure Computing (TDSC), 8(5), 2011, (expanded version of [55]).
- [12] *Automated Derivation of Application-aware Error Detectors using Static Analysis*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, IEEE Transactions on Dependable and Secure Computing (TDSC), 8(1), 2011. (expanded version of [53]).

(b) *Conference Proceedings (Acceptance rates provided where known: see note above): Publications in tier-1 conferences are indicated with a '*'. These are highly competitive venues with low acceptance rates.*

- [13] **Understanding Error Propagation in GPGPU Applications*, **Guanpeng Li**, Karthik Pattabiraman, Chen-Yong Cher and Pradip Bose, To appear in the Proceedings of the International Conference for High-Performance Computing, Storage and Networking (SC), 2016. (Acceptance Rate: 18%).
- [14] *Finding Resilience-Friendly Compiler Optimizations Using Meta-Heuristic Search Techniques*, **Nithya Narayanamurthy**, Karthik Pattabiraman and Matei Ripeanu, To appear in the Proceedings of the European Dependable Computing Conference (EDCC), 2016. (Acceptance Rate: 41%). **Best Paper Award Nominee.**

Curriculum Vitae: Karthik Pattabiraman

- [15] *FIDL: A Fault Injection Description Language for Compiler-Based Tools*, **Maryam Raiyat Ailabadi** and Karthik Pattabiraman, To appear in the Proceedings of the 35th International Conference on Computer Safety, Reliability and Security (SafeComp), 2016. (Acceptance Rate: 35%)
- [16] **ePVF: An Enhanced Program Vulnerability Factor Methodology for Cross-Layer Resilience Analysis*, **Bo Fang, Qining Lu**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurumurthi, To appear in the Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2016. (Acceptance Rate: 21%)
- [17] *Atrina: Inferring Unit Oracles from GUI Test Cases*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2016. (Acceptance Rate: 27%)
- [18] **Understanding Asynchronous Interactions in Full-Stack JavaScript*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2016. (Acceptance Rate: 19%)
- [19] *An Application-Specific Checkpointing Technique for Minimizing Checkpoint Corruption*, **Guanpeng Li**, Karthik Pattabiraman, Chen-Yong Cher and Pradip Bose, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2015. (Acceptance Rate: 32%)
- [20] **Synthesizing Web Element Locators*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Automated Software Engineering (ASE), 2015. (Acceptance Rate: 20.6%)
- [21] *Flexible Intrusion Detection Systems for Memory-Constrained Embedded Systems*, **Farid Tabrizi** and Karthik Pattabiraman, Proceedings of the 11th European Conference on Dependable Computing (EDCC), March 2015. (Acceptance Rate: 46%). **Distinguished paper award – one of three from 54 submissions.**
- [22] **Hybrid Change-Impact Analysis for JavaScript Applications*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the European Conference on Object Oriented Programming (ECOOP), 2015. (Acceptance rate: 22.8%)
- [23] **Fine Grained Characterization of Faults Causing Long Latency Crashes in Programs*, **Guanpeng Li, Qining Lu**, and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems (DSN), 2015. (Acceptance Rate: 22.5%)
- [24] *JSEFT: Automated JavaScript Unit Test Generation*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2015. (Acceptance Rate: 25%). **Invited as one of the best papers in the conference to the Journal on Software Testing and Verification (STVR).**
- [25] **Finding Inconsistencies in JavaScript MVC Applications*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2015. (Acceptance Rate: 18.5%)
- [26] *Failure Analysis of Jobs in Compute Clouds: A Google Cluster Case Study*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, Proceedings of the 25th IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014. (Acceptance rate: 25%)
- [27] **DOMpletion: DOM-Aware JavaScript Code Completion*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the ACM International Conference on Automated Software Engineering (ASE), 2014. (Acceptance Rate: 20%)
- [28] **SDCTune: A Model for Predicting the SDC Proneness of an Application for Configurable Protection*, **Qining Lu**, Karthik Pattabiraman, Meeta S. Gupta and Jude A. Rivers, International Conference on Compilers, Architecture and Synthesis for Embedded Systems (CASES), 2014. (Acceptance Rate: 30%)
- [29] **Integrated Hardware-Software Diagnosis for Intermittent Hardware Faults*, **Majid Dadashi, Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014. (Acceptance Rate: 30%)
- [30] **Quantifying the Accuracy of High-Level Fault Injection Techniques for Hardware Faults*, **Jiesheng Wei, Anna Thomas, Guanpeng Li**, and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014. (Acceptance Rate: 30%)

Curriculum Vitae: Karthik Pattabiraman

- [31] **Vejovis: Suggesting Fixes for JavaScript Faults*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2014, Hyderabad, India (Acceptance Rate: 20%).
- [32] **Understanding JavaScript Event-Based Interactions*, **Saba Alimadi, Sheldon Sequira**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2014, Hyderabad, India (Acceptance Rate: 20%). **ACM SIGSOFT Distinguished Paper Award (9 of nearly 500 submissions)**.
- [33] *Mining Questions Asked by Web Developers*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the 11th Working Conference on Mining Software Repositories (MSR), 2014. (Acceptance Rate: 34%)
- [34] *GPU-Qin: A Methodology for Evaluating the Error Resilience of GPGPU Applications*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurumurthi, Proceedings of the IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), 2014, Monterrey, CA (Acceptance Rate: 30%).
- [35] *Model-based Intrusion Detection for Smart Meters*, **Farid M. Tabrizi** and *Karthik Pattabiraman*, Proceedings of the IEEE International Symposium on High Assurance Systems Engineering (HASE), 2014. Miami, USA (Acceptance rate: 30%).
- [36] **Pythia: Generating Test Cases with Oracles for JavaScript Applications*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the ACM/IEEE International Conference on Automated Software Engineering (ASE), New Ideas Track, 2013. October 2013 (Acceptance rate: 23%).
- [37] *An Empirical Study of Client-Side JavaScript Bugs*, **Frolin Ocariza, Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), 2013, March, 2013 (Acceptance rate: 28 %).
- [38] **Error Detector Placement for Soft Computation*, **Anna Thomas** and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2013, Budapest, Hungary (Acceptance Rate: 20%).
- [39] *Efficient JavaScript Mutation Testing*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2013, Luxembourg. (Acceptance Rate: 25 %). **Ranked as the second best paper (i.e., first runner up) at the conference of over 200 submissions.**
- [40] *Intermittent Hardware Errors Recovery: Modeling and Evaluation*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the International Conference on Quantitative Evaluation of Systems (QEST), 2012, London UK (Acceptance rate: Unknown).
- [41] **BlockWatch: Leveraging Similarity in Parallel Programs for Error Detection*, **Jiesheng Wei** and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2012, Boston, USA (Acceptance rate: 17%).
- [42] *AutoFlox: An Automatic Fault Localizer For JavaScript*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, IEEE International Conference on Software Testing, Verification and Validation (ICST), 2012, Montreal, Canada. (Acceptance rate: 27%). **Nominated for best paper award (one of six)**.
- [43] *JavaScript Errors in the Wild: An Empirical Study*, **Frolin Ocariza**, Karthik Pattabiraman and Benjamin Zorn, Proceedings of the International Symposium on Software Reliability Engineering (ISSRE), 2011, Hiroshima, Japan (Acceptance Rate: 25%).
- [44] *Modular Protections against Non-control Data Attacks*, **Cole Schlesinger**, Karthik Pattabiraman, Nikhil Swamy, David Walker and Benjamin Zorn, Proceedings of the IEEE Computer Security Foundations (CSF) Symposium, France, 2011 (Acceptance Rate: 26%). **Invited for a special issue by Journal of Computer Security (JCS) as one of the best papers at the conference.**
- [45] **Flicker: Saving DRAM Refresh-power through Critical Data Partitioning*, **Song Liu**, Karthik Pattabiraman, Thomas Moscibroda and Benjamin Zorn, Proceedings of the ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), California, 2011. (Acceptance Rate: 20%).
- [46] *Modeling the Propagation of Intermittent Hardware Faults in Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), Tokyo, Japan, 2010. (Acceptance rate: 41.5%).

Curriculum Vitae: Karthik Pattabiraman

- [47] *DoDOM: Leveraging DOM Invariants for Robustness Testing of Web 2.0 Applications*, Karthik Pattabiraman and Benjamin Zorn, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), California. 2010. (Acceptance rate: 32 %).
- [48] **An End-to-end Approach for the Automatic Derivation of Application-aware Error Detectors*, Galen Lyle, Shelley Chen, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), Estoril, Portugal, 2009. (Acceptance rate: 25%).
- [49] *Discovering Application-level Insider attacks using Symbolic Execution*, Karthik Pattabiraman, Nithin Nakka, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IFIP International Information Security Conference (SEC), 2009, Cyprus. (Acceptance Rate: 22%).
- [50] *ToleRace: Detecting and Tolerating Asymmetric Races*, Paruj Ratanaworabhan, Martin Burtscher, Darko Kirovski, Benjamin Zorn, Karthik Pattabiraman and Rahul Nagpal, Proceedings of the ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP), 2009, Salt Lake City, Utah. (Acceptance Rate: 24%).
- [51] **SymPLFIED: Symbolic Program Level Fault-Injection and Error Detection Framework*, Karthik Pattabiraman, Nithin Nakka, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2008, Anchorage, AK. (Acceptance Rate: 25%).
- [52] **Samurai: Protecting Critical Heap Data in Unsafe Languages*, Karthik Pattabiraman, Vinod Grover and Benjamin Zorn, Proceedings of the ACM European Systems Conference (EuroSys), 2008, Glasgow, Scotland. (Acceptance Rate: 18%).
- [53] *Automated Derivation of Application-Aware Error Detectors using Static Analysis*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE International Online Test Symposium (IOLTS), 2007, Herkalion, Greece.
- [54] **Processor-level Selective Replication*, Nithin Nakka, Karthik Pattabiraman and Ravishankar Iyer, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2007, Edinburgh, UK. (Acceptance Rate: 25%).
- [55] *Dynamic Derivation of Application-Specific Error Detectors and their Hardware Implementation*, Karthik Pattabiraman, Giacinto Paulo Saggese, Daniel Chen, Zbigniew Kalbarczyk, and Ravishankar Iyer, Proceedings of the European Dependable Computing Conference (EDCC), 2006, Coimbra, Portugal. (Acceptance Rate: 27%).
- [56] *Application-Based Metrics for Strategic Placement of Detectors*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE Symposium on Pacific Rim Dependable Computing (PRDC), 2005, Changsha city, China. (Acceptance Rate: 36.5%).
- [57] **Modeling Coordinated Checkpointing for Large-Scale Supercomputers*, Long Wang, Karthik Pattabiraman, Larry Votta, Chris Vick, Alan Wood, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2005, Yokohoma, Japan. (Acceptance Rate: 25%).
- [58] *Formal Reasoning of Various Categories of Widely Exploited Security Vulnerabilities by Pointer Taintedness Semantics*, Shuo Chen, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IFIP International Information Security Conference (SEC), Toulouse, France, 2004. (Acceptance Rate: 22%).

(c) *Selected Workshop Papers (Number of pages given)*

- [59] *SDC is in the Eye of the Beholder: A Survey and Preliminary Study*, **Bo Fang**, Panruo Wu, Qiang Guan, Nathan Debardeleben, Laura Monroe, Sean Blanchard, Zhizong Chen, Karthik Pattabiraman, and Matei Ripeanu, International Workshop on Reliability and Security Data Analysis (RSDA), September 2016 (4 pages). Held in conjunction with the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2016.
- [60] *Intrusion Detection Systems for Embedded Systems*, **Farid Molazem Tabrizi** and Karthik Pattabiraman, Doctoral student Symposium Track of the ACM Middleware Conference (Middleware), 2015. (6 pages).

Curriculum Vitae: Karthik Pattabiraman

- [61] *A Fault Injection Description Language (FIDL) for Compiler-based Tools*, **Maryam Raiyat**, Karthik Pattabiraman and Nematollah Bidokhti, Industry Track of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2015. (1 page – refereed based on abstract)
- [62] *LED: Tool for Synthesizing Web Element Locators*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Tools Track of the IEEE/ACM International Conference on Automated Software Engineering (ASE), 2015. (3 pages)
- [63] *LLFI: An Intermediate Code Level Fault Injector for Hardware Faults*, **Qining Lu, Mostafa Farahani, Jiesheng Wei, Anna Thomas** and **Karthik Pattabiraman**, Proceedings of IEEE International Conference on Quality, Reliability and Security (QRS), August 2015. Short paper. (6 pages)
- [64] *Failure Prediction of Jobs in Compute Clouds: A Google Cluster Case Study*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, International Workshop on Reliability and Security Data Analysis (RSDA), September 2014 (6 pages). Held in conjunction with the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014. (6 pages)
- [65] *Soft-LLFI: A Comprehensive Framework for Software Fault Injection*, **Maryam Raiyat**, Karthik Pattabiraman and Nematollah Bidokhti, Industry Track of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014.
- [66] *Evaluating the Error Resilience of Parallel Programs*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurusurthi, Workshop on Fault Tolerance for High-Performance at Extreme Scale (FTXS), 2014 (6 pages). In conjunction with DSN 2014.
- [67] *Effect of Compiler Optimizations on the Error Resilience of Soft Computing Applications*, **Anna Thomas** and **Karthik Pattabiraman**, First Workshop on Algorithm and Application Error Resilience (AER), 2013, Eugene, OR, in conjunction with ICS 2013 (8 pages).
- [68] *Predicting Job Completion Times Using System Logs in Supercomputers*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, IEEE Workshop on Reliable and Security Data Analysis (RSDA), 2013, in conjunction with DSN 2013, Budapest, Hungary (6 pages).
- [69] *LLFI: An Intermediate Code Level Injector for Soft Computing Applications*, **Anna Thomas** and Karthik Pattabiraman, IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE), 2013. Palo Alto, CA (6 pages).
- [70] *SCRIBE: A Hardware Infrastructure Enabling Fine-Grained Software Error Diagnosis*, **Majid Dadashi, Layali Rashid** and **Karthik Pattabiraman**, IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE), 2013. Palo Alto, CA (6 pages).
- [71] *Towards Building Error Resilient GPGPU Applications*, **Bo Fang, Jiesheng Wei**, Karthik Pattabiraman, Matei Ripeanu, 3rd IEEE Workshop on Resilient Architecture (WRA) in conjunction with MICRO 2012, Vancouver Canada (6 pages).
- [72] *A Model for Security Analysis of Smart Meters*, **Farid M. Tabrizi** and Karthik Pattabiraman, 6th Workshop on Recent Advances in Intrusion Tolerance and Resilience (WRAITS), 2012, in conjunction with DSN 2012. Boston, MA (6 pages).
- [73] *DIEBA: Diagnosing Intermittent Errors by Backtracing Application Failures*, **Layali Rashid**, **Karthik Pattabiraman** and Sathish Gopalakrishnan, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2012. (6 pages).
- [74] *BlockWatch: Leveraging Similarity in Parallel Programs for Error Detection*, **Jiesheng Wei** and **Karthik Pattabiraman**, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2012, Urbana, IL (6 pages).
- [75] *Comparing the Effects of Intermittent and Transient Hardware Faults on Programs*, **Jiesheng Wei, Layali Rashid**, Karthik Pattabiraman, Sathish Gopalakrishnan, Workshop on Dependable and Secure Nano-computing (WDSN), 2011, Hong Kong, China, In conjunction with DSN 2011 (6 pages).
- [76] *Towards Understanding the Effects of Intermittent Hardware Faults on Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Workshop on Dependable and Secure Nanocomputing (WDSN), 2010, Chicago, IL, In conjunction with DSN 2010 (6 pages).
- [77] *Formal Diagnosis of Hardware Transient Errors in Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2010, Palo Alto, CA (6 pages).
- [78] *Hardware Implementation of Information Flow Signatures Derived via Program Analysis*, Paul Dabrowski, William Healey, **Karthik Pattabiraman**, Shelley Chen, Zbigniew Kalbarczyk, Ravishankar Iyer, Workshop on Dependable and Secure Nano-computing (WDSN), 2008, AK, In conjunction with DSN 2008 (6 pages).

Curriculum Vitae: Karthik Pattabiraman

- [79] *Critical Variable Recomputation for Transient Error Detection*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar K. Iyer, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2007, Austin, TX (6 pages).
- [80] *FPGA Hardware Implementation of Statically Derived Application-aware Error Detectors*, Peter Klemperer, Shelley Chen, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Workshop on Dependable and Secure Nano-computing (WDSN), 2007, Edinburgh, UK, In conjunction with DSN 2007. (6 pages).
- [81] *Tolerance: Tolerating and Detecting Asymmetric Races (Position Paper)*, Rahul Nagpal, Karthik Pattabiraman, Darko Kirovski, Benjamin Zorn, Workshop on Software Tools for Multi-core Systems (STMCS), 2007 (4 pages), in conjunction with PPOPP 2007.
- [82] *Processor-level Selective Replication*, Nithin Nakka, Karthik Pattabiraman, Zbigniew Kalbarczyk, Ravishankar Iyer, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2006, Urbana, IL (6 pages).
- [83] *Automated Derivation and Hardware Implementation of Application-Specific Error Detectors*, Karthik Pattabiraman, Giacinto Paulo Saggese, Daniel Chen, Zbigniew Kalbarczyk and Ravishankar Iyer, Workshop on Reliability Issues in High-Performance Computing (HPCRI), 2005, in conjunction with HPCA'05 (6 pages).

(d) Invited contributions (non-refereed or lightly refereed)

- [84] *GPUS: Combining high-performance with high-reliability*, L. Bautista Gomez, F. Cappello, L. Carro, N. DeBardeleben, **B. Fang**, S. Gurusurthi, K. Pattabiraman, P. Rech, M. Sonza Reorda, Embedded tutorial paper (invited), Proceedings of the International Symposium on Design Automation and Test in Europe (DATE), 2014.
- [85] *Towards Application-aware Security and Reliability*, Ravishankar Iyer, Zbigniew Kalbarczyk, Karthik Pattabiraman, Wen-Mei Hwu, William Healey, Peter Klemperer and Reza Farivar, IEEE Security and Privacy (S&P) Magazine, Jan 2007 (invited). pages: 57- 62.

(f) Patents Filed and Granted

- [86] *Critical Memory*, with Benjamin Zorn and Vinod Grover, Microsoft Corporation, December 2006, USA.
- [87] *Critical Memory using Replication*, with Benjamin Zorn, Vinod Grover, Microsoft Corporation, December 2006.
- [88] *Providing Hardware Resources having Different Reliabilities for Use by an Application*, with Benjamin Zorn, Thomas Moscibroda and Song Liu, Sep 2011, USA.
- [89] *Leveraging On-Chip Variability*, Benjamin Zorn, Darko Kirovski, Ray Bittner, and Karthik Pattabiraman, Dec 2011, USA.

(f) Software Artifacts Released

- [90] *LLFI*: A fault injector based on the LLVM compiler: Available:
<https://github.com/DependableSystemsLab/LLFI>
- [91] *GPU-Qin*: A fault injector for injecting faults into GPGPUs. Available:
<https://github.com/DependableSystemsLab/GPU-Injector>
- [92] *PINFI*: A fault-injector based on Intel's PIN tool for injecting faults into program binaries. Available:
<https://github.com/DependableSystemsLab/PINFI>
- [93] *BugAnalyzer*: Analyze bug reports in JavaScript web applications. Available:
http://ece.ubc.ca/~frolino/projects/js-bugs-study/bugReports/bug_report_analyzer.html
- [94] *AutoFlox*: Localize faults in JavaScript-based Web Applications. Available:
<http://ece.ubc.ca/~frolino/projects/autoflox/>
- [95] *Vejovis*: Suggest fixes for faults in JavaScript-based Web Applications. Available:
<http://ece.ubc.ca/~frolino/projects/vejovis/>
- [96] *Clematis*: Enable understanding of JavaScript-based Web Applications. Available:
<http://salt.ece.ubc.ca/software/clematis/>
- [97] *Mutandis*: Perform mutation testing in JavaScript Web Applications. Available:
<https://github.com/saltlab/mutandis>
- [98] *Pythia*: Generate Oracles for test cases in JavaScript Web Applications. Available:

- [99] *DOMpletion*: Enable automatic code completion in JavaScript Web Applications. Available: <https://github.com/saltlab/Pythia>
<https://github.com/saltlab/dompletion>
- [100] *CrashFinder*: Find long-latency causing crash locations in Programs through Static Analysis. Available: <https://github.com/DependableSystemsLab/CrashFinder>
- [101] *Aurebesh*: Find inconsistencies in MVC frameworks used in web applications. Available: <http://ece.ubc.ca/~frolino/projects/aurebesh/polyglot/index.html>
- [102] *LED*: Synthesize JavaScript code for DOM interactions in web applications. Available: <https://github.com/saltlab/led>
- [103] *ToChal*: Change Impact Analysis for JavaScript-based Web Applications. Available: <https://github.com/saltlab/tochal>
- [104] *JSEFT*: Automated Test and Oracle Generation for JavaScript-based Web applications. Available: <https://github.com/saltlab/JSeft>
- [105] *ReCov*: Fine-grained checkpointing without checkpoint corruption, Available: <https://github.com/DependableSystemsLab/ReCov>