

# Marcel Böhme

Postdoctoral Fellow at National University of Singapore (NUS)

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## Summary

Marcel Böhme is Senior Research Fellow at NUS since 2015. Before that he spent one year abroad with Prof. Andreas Zeller as postdoctoral advisor at Saarland University, Germany. Marcel completed his PhD at the School of Computing, NUS advised by Prof. Abhik Roychoudhury in 2014 after joining Abhik's team in 2011. He received his MSc. degree (Dipl.-Inf.) in 2009 from TU Dresden, Germany. While at NUS, Marcel represented the graduate students of the School of Computing on several occasions: organizing talks from / for students, discussing concerns with the School's administration, and engaging in conversations with Singapore's Ministry of Education. As undergrad he spent more than 4 years working for companies in the domain of embedded systems and software engineering.

Marcel's research is focussed on automated vulnerability detection, analysis, testing, debugging, and repair of large software systems, where he investigates practical topics such as efficiency, scalability, and reliability of automated techniques via theoretical and empirical analysis. His tools discovered 100+ bugs in widely-used software systems, more than 40 of which are security-critical vulnerabilities registered as CVEs at the US National Vulnerability Database.

Research Profile: <http://www.comp.nus.edu.sg/~mboehme/>

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## Education

### National University of Singapore

PhD, Computer Science

PhD Thesis: Automated Regression Testing and Verification of Complex Code Changes

Advisor: Abhik Roychoudhury

Grade Point Average: 4.9/5.0

### Technische Universität Dresden

Dipl.-Inf. (M.Sc.), Computer Science

Specializing in Software Technology

Minoring in Robotics and Process Automation

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## Published Security Advisories (42)

[CVE-2016-2226](#), [CVE-2016-4487](#), [CVE-2016-4488](#), [CVE-2016-4489](#), [CVE-2016-4490](#),  
[CVE-2016-4491](#), [CVE-2016-4492](#), [CVE-2016-4493](#), [CVE-2016-6131](#), [CVE-2017-6965](#),  
[CVE-2017-6966](#), [CVE-2017-6969](#), [CVE-2017-7209](#), [CVE-2017-7210](#), [CVE-2017-7223](#),  
[CVE-2017-7224](#), [CVE-2017-7225](#), [CVE-2017-7226](#), [CVE-2017-7227](#), [CVE-2017-7299](#),  
[CVE-2017-7300](#), [CVE-2017-7301](#), [CVE-2017-7302](#), [CVE-2017-7303](#), [CVE-2017-7304](#),  
[CVE-2017-7578](#), [CVE-2017-8392](#), [CVE-2017-8393](#), [CVE-2017-8394](#), [CVE-2017-8395](#),  
[CVE-2017-8396](#), [CVE-2017-8397](#), [CVE-2017-8398](#), [CVE-2017-9047](#), [CVE-2017-9048](#),  
[CVE-2017-9049](#), [CVE-2017-9050](#), [CVE-2017-9051](#), [CVE-2017-9052](#), [CVE-2017-9053](#),  
[CVE-2017-9054](#), [CVE-2017-9055](#)

## Publications

### **[ESEC/FSE'17] Where is the Bug and How is it Fixed? An Experiment with Practitioners.**

Marcel Böhme, E. O. Soremekun, S. Chattophadyay, E. Ugherughe, Andreas Zeller  
*11th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE) 2017, pp. 1-11*

### **[ICSE'17] How Developers Debug Software -- The DBGBENCH Dataset**

Marcel Böhme, E. O. Soremekun, S. Chattophadyay, E. Ugherughe, Andreas Zeller  
*39th ACM SIGSOFT International Conference on Software Engineering (ICSE) 2017 (Poster)*

### **[CCS'16] Coverage-based Greybox Fuzzing as Markov Chain**

Marcel Böhme, Van-Thuan Pham, and Abhik Roychoudhury  
*23rd ACM Conference on Computer and Communications Security (CCS) 2016, pp. 1032-1043*  
\* Our tool [AFLFast](#) has been **evaluated by the community** finding bugs in [Perl](#) and [Erlang VM](#).

### **[ASE'16] Model-based Whitebox Fuzzing for Program Binaries**

Van-Thuan Pham, Marcel Böhme, and Abhik Roychoudhury  
*31st International Conference on Automated Software Engineering (ASE) 2016, pp. 543-553*

### **[TSE'16] Probabilistic Analysis of the Efficiency of Automated Software Testing**

Marcel Böhme and Soumya Paul  
*IEEE Transaction on Software Engineering, Volume:42, Issue: 4, pp. 345-360*

### **[SE'15] Über die Effizienz des Automatischen Testens**

Marcel Böhme and Soumya Paul  
*Software Engineering 2015, Fachtagung des GI-Fachbereichs Softwaretechnik*  
*Short version of [FSE'14], in German.*

### **[DISS] Regression Testing and Verification of Complex Code Changes**

Marcel Böhme  
*Thesis submitted for the degree of Doctor of Philosophy (PhD), Department of Computer Science, National University of Singapore, PhD Defense July'14*

### **[FSE'14] On the Efficiency of Automated Testing**

Marcel Böhme and Soumya Paul  
*22nd ACM International Symposium on Foundations of Software Engineering 2014, pp. 632-642*  
\* Invited to **give a talk** at [UCL](#), [SUTD](#), [NTU](#), [TU Darmstadt](#), and [Saarland University](#).

### **[ISSTA'14] CoREBench: Studying Complexity of Regression Errors**

Marcel Böhme and Abhik Roychoudhury  
*23rd ACM/SIGSOFT International Symposium on Software Testing and Analysis 2014, pp. 398-408*  
\* **Making the Top10 of most downloaded articles** for three months ([ACM SEN Nov'14](#)).

### **[ESEC/FSE'13] Regression Tests to Expose Change Interaction Errors**

Marcel Böhme, Bruno C.d.S. Oliveira, and Abhik Roychoudhury  
*9th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE) 2013, pp. 339-349*

### **[ICSE'13] Partition-based Regression Verification**

Marcel Böhme, Bruno C.d.S. Oliveira, and Abhik Roychoudhury  
*ACM/IEEE International Conference on Software Engineering (ICSE) 2013, pp.300-309*

### **[ADCOM'13] Regression Testing of Evolving Programs**

Marcel Böhme, Abhik Roychoudhury, and Bruno C.d.S. Oliveira  
*Advances in Computers, Elsevier, 2013, Volume 89, Chapter 2, pp.53-88*

### **[ICSE'12] Software Regression as Change of Input Partitioning**

Marcel Böhme  
*ACM/IEEE International Conference on Software Engineering (ICSE) 2012, pp.1523-1526*

### **[NUS'11] Comprehensive Test Suite Augmentation**

Marcel Böhme and Abhik Roychoudhury  
*Technical Report, National University of Singapore, pp. 1-11*

### **[GPCE'09] Generating Safe Template Languages**

F. Heidenreich, J. Johannes, M. Seifert, C. Wende, and M. Böhme  
*ACM International Conference on Generative Programming and Component Engineering (GPCE) 2009, pp.99-108*

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## Work Experience

### **Senior Research Fellow at National University of Singapore**

Since July 2015

- Research on Software Fuzzing and Vulnerability Detection within the TSUNAMi project

### **Co-lecturer and Lab Coordinator at National University of Singapore**

January 2016 - May 2016 (5 months)

- CS4218 Software Testing: prepared slides and taught in the second half of the semester
- CS4218 Software Testing Lab: coordinated two teaching assistants and prepared material

### **Research Fellow at Saarland University**

July 2014 - June 2015 (1 year)

- (Co-)advisor of PhD and BSc candidates
- Co-organizer of lecture "Programming for Engineers"
- Research on Software Testing Efficiency

### **Lecturer at Saarland University**

November 2014 - February 2015 (4 months)

- Seminar on Automated Debugging (organized as reading group)
- Voted **Best Seminar**
- Voted **Top-3 among \*all\* courses** in Computer Science at Saarland University

### **Research Assistant at National University of Singapore**

June 2013 - June 2014 (1 year 1 month)

- Research on Testing of Evolving Programs

## Teaching Assistant at National University of Singapore

November 2013 - April 2014 (6 months)

- CS4218 Software Testing and Debugging (Weekly exercises, labs, tutorials, and grading)
- Involved in designing the schedule and details for exercises, labs, and tutorials
- First time the course was provided

## Teaching Assistant at National University of Singapore

August 2010 - November 2010 (4 months)

- CS3215 Software Engineering Project (Weekly consultations, lab, and grading)

## Research Assistant at TU Dresden

January 2009 - July 2009 (7 months)

- Graph-based Model Transformation Tool (Tornado)
- Component-based Software Composition System (TraCo)
- Conference paper based on my Master Thesis (GPCE'09)

*Full-time (40h/week)*

## Software Engineer at NXP Semiconductors Dresden

November 2006 - November 2008 (2 years 1 month)

- Debugger - Eclipse Debugging Framework interfacing a DUT in real time
- Code Generator (+Editor) from IpXact to VHDL, C,...

*Part-time (20h/week)*

## Software Engineer at NXP Semiconductors Singapore

April 2007 - October 2007 (7 months)

- Service-oriented Test Automation in a distributed environment with Unit Tests
- Several research presentations

*Full-time (43h/week)*

## Teaching Assistant at TU Dresden

April 2006 - October 2006 (7 months)

- Software Technology Practical Course

## Software Engineer at Gesellschaft für Softwaremanagement

April 2005 - October 2006 (1 year 7 months)

- Involved in several projects on requirements elicitation, business process management specification, and 3D visualization

*Part-time (20h/week)*

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## Certifications

**IBM Certified Database Administrator**

**--- DB2 Universal Database V8.1**

**IBM Certified Database Associate**

**--- DB2 Universal Database V8.1 Family**

**Gamification**

**--- Statement of Accomplishment**

Coursea.org (Prof. Werbach - Wharton School, University of Pennsylvania)

**Data Analysis & Statistical Inference**

**--- Statement of Accomplishment w/Distinction**

Coursea.org (Dr. Çetinkaya-Rundel - Department of Statistical Science, Duke University)

## Invited Talks, Honors, and Awards

### Research Achievement Award

Outstanding Research Performance, SoC, NUS

### Best Seminar for Seminar on Automated Debugging

Winter Semester 2014/15 at Computer Science, Saarland University, Germany

### Certificate of Appreciation

Contributions as Graduate Student Representative, SoC, NUS (2010 & 2011)

### ACM SIGSOFT CAPS Award

Merit-based Travel Grant to ICSE'13, San Francisco

### Invited Talks

“Testing versus Verification for Vulnerability Detection” at *Simon Fraser University, Canada*, 02.2017  
“On the Efficiency of Automated Testing” at *SOLA, University of Darmstadt, Germany*, 06.2015  
“On the Efficiency of Automated Testing” at *CREST, University College London, UK*, 04.2015  
“On the Efficiency of Automated Testing” at *SE, Nanyang Technical University, Singapore*, 04.2015  
“On the Efficiency of Automated Testing” at *ISTD, Singapore Univ. of Technology and Design*, 04.2015  
“Automated Regression Testing and Verification of Complex Code Changes” at *CSI, A\*STAR*, 06.2014  
“Regression Testing via Symbolic Execution” at *Prof. Zeller’s Chair, Saarland Uni., Germany*, 08.2013

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## Service

- **Committee Member**
  - ICSE NIER Papers: 2015 ([session chair](#))
  - FSE Demo Papers: 2016
  - ISSTA Artifact Evaluation: 2015, 2016
  - ICSE Student Research Competition (SRC): 2018
- **Reviewer**
  - Transactions on Software Engineering (TSE): 2014, 2015, 2016, 2017
  - Journal on Information and Software Technology (IST): 2015
  - Journal of Software: Evolution and Process (JSME): 2017
  - International Conference on Software Engineering (ICSE): 2017
  - International Symposium on the Foundations of Software Engineering (FSE): 2017
  - International Symposium on Software Testing & Analysis (ISSTA): 2013, 2015, 2016
  - International Conference on Automated Software Engineering (ASE): 2013
  - International Conference on Software Testing (ICST): 2013, 2014
  - International Conference on Fundamental Approaches to Software Engineering (FASE): 2013
- **Other Service**
  - Organizer of CSTalks, a seminar-style talk series (2011 and 2012)
  - Graduate Student Representative @ Graduate Liason Committee (2010 and 2011)
  - Outreach NUS to Technische Universität Dresden, Germany
  - University Ambassador @ Technische Universität Dresden, Germany
  - Focus Group Discussions with MoE. Nominated and selected to participate in discussions with the Ministry of Education about the future of graduate studies in Singapore (1 rep. per faculty/school)
  - GYSS'14. Nominated and selected to participate in Global Young Scientist Summit -- a meeting of bright young scientists with Nobel Laureates and Fields Medal Winners (1 rep. per faculty/school).

## Practical Security Impact

My tools have found several security-critical vulnerabilities in widely used open-source projects and libraries, such as [php](#) (4), [valgrind](#), [gdb](#), [coreutils](#) (13), [binutils](#) (56), [libiberty](#) (8), [libdwarf](#) (7), [libxml2](#) (4), [libming](#), and [libav](#). My tools have been discussed on [Hackernews](#) and by the coreutils package maintainer [Pádraig Brady](#).

### Security Advisories:

CVE-2016-2226, CVE-2016-4487, CVE-2016-4488, CVE-2016-4489, CVE-2016-4490, CVE-2016-4491, CVE-2016-4492, CVE-2016-4493, CVE-2016-6131, CVE-2017-6965, CVE-2017-6966, CVE-2017-6969, CVE-2017-7209, CVE-2017-7210, CVE-2017-7223, CVE-2017-7224, CVE-2017-7225, CVE-2017-7226, CVE-2017-7227, CVE-2017-7299, CVE-2017-7300, CVE-2017-7301, CVE-2017-7302, CVE-2017-7303, CVE-2017-7304, CVE-2017-7578, CVE-2017-8392, CVE-2017-8393, CVE-2017-8394, CVE-2017-8395, CVE-2017-8396, CVE-2017-8397, CVE-2017-8398, CVE-2017-9047, CVE-2017-9048, CVE-2017-9049, CVE-2017-9050, CVE-2017-9051, CVE-2017-9052, CVE-2017-9053, CVE-2017-9054, CVE-2017-9055

Community Appraisal: “*The paper on AFLFast is, IMO, a great example of where academia shines: carefully looking at how and why something works, developing some theory and a working model, and then using that to get a substantial improvement on the state of the art (and doing a nice evaluation to show that it really works)*” via [Hacker News](#).

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## Professional References

### **Abhik Roychoudhury**

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National University of Singapore  
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Website: <https://www.comp.nus.edu.sg/~abhik/>  
Doctoral Research Advisor

### **Andreas Zeller**

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PhD Thesis Committee Member

### **Matthew B. Dwyer**

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