# 2013 IEEE/ACM 28th International Conference on Automated Software Engineering

# (ASE 2013)

## Palo Alto, California, USA
## 11-15 November 2013

**IEEE Catalog Number:** CFP13075-POD
**ISBN:** 978-1-4799-0216-3

# Contents

## Preface

Message from the Chairs . . . iii

## Invited Papers

BOOM: Experiences in Language and Tool Design for Distributed Systems (Keynote)
Joseph M. Hellerstein — *University of California at Berkeley, USA* . . . 1

The Challenges of Verification and Validation of Automated Planning Systems (Keynote)
Jeremy Frank — *NASA Ames Research Center, USA* . . . 2

Big Problems in Industry (Panel)
John Penix — *Google, USA* . . . 3

## Technical Research Track

### Concurrency

Round-Up: Runtime Checking Quasi Linearizability of Concurrent Data Structures
Lu Zhang, Arijit Chattopadhyay, and Chao Wang — *Virginia Tech, USA* . . . 4

Constraint-Based Automatic Symmetry Detection
Shao Jie Zhang, Jun Sun, Chengnian Sun, Yang Liu, Junwei Ma, and Jin Song Dong — *Singapore University of Technology and Design, Singapore; National University of Singapore, Singapore; Nanyang Technological University, Singapore* . . . 15

Proving MCAPI Executions Are Correct using SMT
Yu Huang, Eric Mercer, and Jay McCarthy — *Brigham Young University, USA* . . . 26

Efficient Data Race Prediction with Incremental Reasoning on Time-Stamped Lock History
Malay K. Ganai — *NEC Labs, USA* . . . 37

### Dynamic Analysis

PIEtrace: Platform Independent Executable Trace
Yonghwi Kwon, Xiangyu Zhang, and Dongyan Xu — *Purdue University, USA* . . . 48

Improving Efficiency of Dynamic Analysis with Dynamic Dependence Summaries
Vijay Krishna Palepu, Guoqing Xu, and James A. Jones — *University of California at Irvine, USA* . . . 59

Efficient Parametric Runtime Verification with Deterministic String Rewriting
Patrick Meredith and Grigore Roşu — *University of Illinois at Urbana-Champaign, USA* . . . 70

Identifying Execution Points for Dynamic Analyses
William N. Sumner and Xiangyu Zhang — *Simon Fraser University, Canada; Purdue University, USA* . . . 81

### Testing

Operator-Based and Random Mutant Selection: Better Together
Lingming Zhang, Milos Gligoric, Darko Marinov, and Sarfraz Khurshid — *University of Texas at Austin, USA; University of Illinois at Urbana-Champaign, USA* . . . 92

Testing Properties of Dataflow Program Operators
Zhihong Xu, Martin Hirzel, Gregg Rothermel, and Kun-Lung Wu — *University of Nebraska-Lincoln, USA; IBM Research, USA* . . . 103

Bita: Coverage-Guided, Automatic Testing of Actor Programs
Samira Tasharofi, Michael Pradel, Yu Lin, and Ralph E. Johnson — *University of Illinois at Urbana-Champaign, USA; ETH Zurich, Switzerland* . . . 114

SABRINE: State-Based Robustness Testing of Operating Systems
Domenico Cotroneo, Domenico Di Leo, Francesco Fucci, and Roberto Natella — *Università degli Studi di Napoli Federico II, Italy; Critiware, Italy* . . . 125

## Verification

Blitz: Compositional Bounded Model Checking for Real-World Programs
Chia Yuan Cho, Vijay D'Silva, and Dawn Song — *University of California at Berkeley, USA* . . . 136

Ranger: Parallel Analysis of Alloy Models by Range Partitioning
Nicolás Rosner, Junaid H. Siddiqui, Nazareno Aguirre, Sarfraz Khurshid, and Marcelo F. Frias — *Universidad de Buenos Aires, Argentina; LUMS School of Science and Engineering, Pakistan; Universidad Nacional de Río Cuarto, Argentina; University of Texas at Austin, USA; Instituto Tecnológico de Buenos Aires, Argentina* . . . 147

Automated Verification of Pattern-Based Interaction Invariants in Ajax Applications
Yuta Maezawa, Hironori Washizaki, Yoshinori Tanabe, and Shinichi Honiden — *University of Tokyo, Japan; Waseda University, Japan; National Institute of Informatics, Japan* . . . 158

Software Model Checking for Distributed Systems with Selector-Based, Non-blocking Communication
Cyrille Artho, Masami Hagiya, Richard Potter, Yoshinori Tanabe, Franz Weitl, and Mitsuharu Yamamoto — *AIST, Japan; University of Tokyo, Japan; National Institute of Informatics, Japan; Chiba University, Japan* . . . 169

## Evolution

A Study of Repetitiveness of Code Changes in Software Evolution
Hoan Anh Nguyen, Anh Tuan Nguyen, Tung Thanh Nguyen, Tien N. Nguyen, and Hridesh Rajan — *Iowa State University, USA* . . . 180

Consistency-Preserving Edit Scripts in Model Versioning
Timo Kehrer, Udo Kelter, and Gabriele Taentzer — *University of Siegen, Germany; Philipps-Universität Marburg, Germany* 191

JFlow: Practical Refactorings for Flow-Based Parallelism
Nicholas Chen and Ralph E. Johnson — *University of Illinois at Urbana-Champaign, USA* . . . 202

Automated Planning for Software Architecture Evolution
Jeffrey M. Barnes, Ashutosh Pandey, and David Garlan — *Carnegie Mellon University, USA* . . . 213

## Generation and Synthesis

Automatically Synthesizing SQL Queries from Input-Output Examples
Sai Zhang and Yuyin Sun — *University of Washington, USA* . . . 224

SEDGE: Symbolic Example Data Generation for Dataflow Programs
Kaituo Li, Christoph Reichenbach, Yannis Smaragdakis, Yanlei Diao, and Christoph Csallner — *University of Massachusetts at Amherst, USA; Goethe University Frankfurt, Germany; University of Athens, Greece; University of Texas at Arlington, USA* . . 235

Characteristic Studies of Loop Problems for Structural Test Generation via Symbolic Execution
Xusheng Xiao, Sihan Li, Tao Xie, and Nikolai Tillmann — *North Carolina State University, USA; University of Illinois at Urbana-Champaign, USA; Microsoft Research, USA* . . . 246

Entropy-Based Test Generation for Improved Fault Localization
José Campos, Rui Abreu, Gordon Fraser, and Marcelo d'Amorim — *University of Porto, Portugal; University of Sheffield, UK; Federal University of Pernambuco, Brazil* . . . 257

## Recommendations

Detecting Bad Smells in Source Code using Change History Information
Fabio Palomba, Gabriele Bavota, Massimiliano Di Penta, Rocco Oliveto, Andrea De Lucia, and Denys Poshyvanyk — *University of Salerno, Italy; University of Sannio, Italy; University of Molise, Italy; College of William and Mary, USA* . . . 268

Personalized Defect Prediction
Tian Jiang, Lin Tan, and Sunghun Kim — *University of Waterloo, Canada; Hong Kong University of Science and Technology, China* . . . 279
Automatic Recommendation of API Methods from Feature Requests
Ferdian Thung, Shaowei Wang, David Lo, and Julia Lawall — *Singapore Management University, Singapore; Inria, France; Lip6, France* . . . 290
Variability-Aware Performance Prediction: A Statistical Learning Approach
Jianmei Guo, Krzysztof Czarnecki, Sven Apel, Norbert Siegmund, and Andrzej Wąsowski — *University of Waterloo, Canada; University of Passau, Germany; IT University of Copenhagen, Denmark* . . . 301

## Security

A Scalable Approach for Malware Detection through Bounded Feature Space Behavior Modeling
Mahinthan Chandramohan, Hee Beng Kuan Tan, Lionel C. Briand, Lwin Khin Shar, and Bindu Madhavi Padmanabhuni — *Nanyang Technological University, Singapore; University of Luxembourg, Luxembourg* . . . 312
Automatically Partition Software into Least Privilege Components using Dynamic Data Dependency Analysis
Yongzheng Wu, Jun Sun, Yang Liu, and Jin Song Dong — *Singapore University of Technology and Design, Singapore; Nanyang Technological University, Singapore; National University of Singapore, Singapore* . . . 323
Finding Architectural Flaws using Constraints
Radu Vanciu and Marwan Abi-Antoun — *Wayne State University, USA* . . . 334

## Debugging

Improving Bug Localization using Structured Information Retrieval
Ripon K. Saha, Matthew Lease, Sarfraz Khurshid, and Dewayne E. Perry — *University of Texas at Austin, USA* . . . 345
Leveraging Program Equivalence for Adaptive Program Repair: Models and First Results
Westley Weimer, Zachary P. Fry, and Stephanie Forrest — *University of Virginia, USA; University of New Mexico, USA* . . . 356
Detecting and Characterizing Semantic Inconsistencies in Ported Code
Baishakhi Ray, Miryung Kim, Suzette Person, and Neha Rungta — *University of Texas at Austin, USA; NASA Langley Research Center, USA; NASA Ames Research Center, USA* . . . 367
Lightweight Control-Flow Instrumentation and Postmortem Analysis in Support of Debugging
Peter Ohmann and Ben Liblit — *University of Wisconsin-Madison, USA* . . . 378

## Resources

Characterizing and Detecting Resource Leaks in Android Applications
Chaorong Guo, Jian Zhang, Jun Yan, Zhiqiang Zhang, and Yanli Zhang — *Institute of Software at Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China* . . . 389
Dangling References in Multi-configuration and Dynamic PHP-Based Web Applications
Hung Viet Nguyen, Hoan Anh Nguyen, Tung Thanh Nguyen, Anh Tuan Nguyen, and Tien N. Nguyen — *Iowa State University, USA* . . . 399
Dynamically Transforming Data Structures
Erik Österlund and Welf Löwe — *Linnaeus University, Sweden* . . . 410
Towards Precise Metrics for Predicting Graph Query Performance
Benedek Izsó, Zoltán Szatmári, Gábor Bergmann, Ákos Horváth, and István Ráth — *Budapest University of Technology and Economics, Hungary* . . . 421

## Specification Mining

TzuYu: Learning Stateful Typestates
Hao Xiao, Jun Sun, Yang Liu, Shang-Wei Lin, and Chengnian Sun — *Nanyang Technological University, Singapore; Singapore University of Technology and Design, Singapore; National University of Singapore, Singapore* . . . 432
Mining Branching-Time Scenarios
Dirk Fahland, David Lo, and Shahar Maoz — *Eindhoven University of Technology, Netherlands; Singapore Management University, Singapore; Tel Aviv University, Israel* . . . 443

### Models and Complexity

Measuring the Structural Complexity of Feature Models
Richard Pohl, Vanessa Stricker, and Klaus Pohl — *University of Duisburg-Essen, Germany* . . . . . 454

Scalable Product Line Configuration: A Straw to Break the Camel's Back
Abdel Salam Sayyad, Joseph Ingram, Tim Menzies, and Hany Ammar — *West Virginia University, USA* . . . . . 465

# Experience Track

### Experience: Software Analysis

Software Analytics for Incident Management of Online Services: An Experience Report
Jian-Guang Lou, Qingwei Lin, Rui Ding, Qiang Fu, Dongmei Zhang, and Tao Xie — *Microsoft Research, China; University of Illinois at Urbana-Champaign, USA* . . . . . 475

A Comparative Analysis of Software Architecture Recovery Techniques
Joshua Garcia, Igor Ivkovic, and Nenad Medvidovic — *University of Southern California, USA; Wilfrid Laurier University, Canada* . . . . . 486

Towards Contextual and On-Demand Code Clone Management by Continuous Monitoring
Gang Zhang, Xin Peng, Zhenchang Xing, Shihai Jiang, Hai Wang, and Wenyun Zhao — *Fudan University, China; Nanyang Technological University, Singapore* . . . . . 497

The Potential of Polyhedral Optimization: An Empirical Study
Andreas Simbürger, Sven Apel, Armin Größlinger, and Christian Lengauer — *University of Passau, Germany* . . . . . 508

### Experience: Testing and Verification

Automated Unit Testing of Large Industrial Embedded Software using Concolic Testing
Yunho Kim, Youil Kim, Taeksu Kim, Gunwoo Lee, Yoonkyu Jang, and Moonzoo Kim — *KAIST, South Korea; Samsung Electronics, South Korea* . . . . . 519

Minimizing CPU Time Shortage Risks in Integrated Embedded Software
Shiva Nejati, Morayo Adedjouma, Lionel C. Briand, Jonathan Hellebaut, Julien Begey, and Yves Clement — *University of Luxembourg, Luxembourg; Delphi, Luxembourg* . . . . . 529

Model Based Test Validation and Oracles for Data Acquisition Systems
Daniel Di Nardo, Nadia Alshahwan, Lionel C. Briand, Elizabeta Fourneret, Tomislav Nakić-Alfirević, and Vincent Masquelier — *University of Luxembourg, Luxembourg; SES, Luxembourg* . . . . . 540

Automated Verification of Interactive Rule-Based Configuration Systems
Deepak Dhungana, Ching Hoo Tang, Christoph Weidenbach, and Patrick Wischnewski — *Siemens, Austria; Max-Planck-Institute for Informatics, Germany; Logic4Business, Germany* . . . . . 551

# New Ideas Track

### New Ideas: Adaptation and Transformation

AutoComment: Mining Question and Answer Sites for Automatic Comment Generation
Edmund Wong, Jinqiu Yang, and Lin Tan — *University of Waterloo, Canada* . . . . . 562

Detecting System Use Cases and Validations from Documents
Smita Ghaisas, Manish Motwani, and Preethu Rose Anish — *Tata Consultancy Services, India* . . . . . 568

Multi-user Variability Configuration: A Game Theoretic Approach
Jesús García-Galán, Pablo Trinidad, and Antonio Ruiz-Cortés — *University of Seville, Spain* . . . . . 574

From Comparison Matrix to Variability Model: The Wikipedia Case Study
Nicolas Sannier, Mathieu Acher, and Benoit Baudry — *University of Rennes 1, France; Inria, France; Irisa, France* . . . . 580

Learning Effective Query Transformations for Enhanced Requirements Trace Retrieval
Timothy Dietrich, Jane Cleland-Huang, and Yonghee Shin — *DePaul University, USA* . . . . . 586

Environment Rematching: Toward Dependability Improvement for Self-Adaptive Applications
Chang Xu, Wenhua Yang, Xiaoxing Ma, Chun Cao, and Jian Lü — *Nanjing University, China* . . . . . 592

Cloud Twin: Native Execution of Android Applications on the Windows Phone
Ethan Holder, Eeshan Shah, Mohammed Davoodi, and Eli Tilevich — *Virginia Tech, USA* . . . . . 598

SBFR: A Search Based Approach for Reproducing Failures of Programs with Grammar Based Input
Fitsum Meshesha Kifetew, Wei Jin, Roberto Tiella, Alessandro Orso, and Paolo Tonella — *Fondazione Bruno Kessler, Italy; Georgia Institute of Technology, USA* . . . . . 604

### New Ideas: Testing and Debugging

Pythia: Generating Test Cases with Oracles for JavaScript Applications
Shabnam Mirshokraie, Ali Mesbah, and Karthik Pattabiraman — *University of British Columbia, Canada* . . . . . 610

Randomizing Regression Tests using Game Theory
Nupul Kukreja, William G. J. Halfond, and Milind Tambe — *University of Southern California, USA* . . . . . 616

Automated Inference of Classifications and Dependencies for Combinatorial Testing
Cu Duy Nguyen and Paolo Tonella — *Fondazione Bruno Kessler, Italy* . . . . . 622

Adding Context to Fault Localization with Integration Coverage
Higor Amario de Souza and Marcos Lordello Chaim — *University of Sao Paulo, Brazil* . . . . . 628

Using Automatically Generated Invariants for Regression Testing and Bug Localization
Parth Sagdeo, Nicholas Ewalt, Debjit Pal, and Shobha Vasudevan — *University of Illinois at Urbana-Champaign, USA* . . 634

Class Level Fault Prediction using Software Clustering
Giuseppe Scanniello, Carmine Gravino, Andrian Marcus, and Tim Menzies — *University of Basilicata, Italy; University of Salerno, Italy; Wayne State University, USA; West Virginia University, USA* . . . . . 640

ExPort: Detecting and Visualizing API Usages in Large Source Code Repositories
Evan Moritz, Mario Linares-Vásquez, Denys Poshyvanyk, Mark Grechanik, Collin McMillan, and Malcom Gethers — *College of William and Mary, USA; University of Illinois at Chicago, USA; University of Notre Dame, USA; University of Maryland in Baltimore County, USA* . . . . . 646

Flow Permissions for Android
Shashank Holavanalli, Don Manuel, Vishwas Nanjundaswamy, Brian Rosenberg, Feng Shen, Steven Y. Ko, and Lukasz Ziarek — *SUNY Buffalo, USA* . . . . . 652

### New Ideas: Models and Requirements

A Pattern-Based Approach to Parametric Specification Mining
Giles Reger, Howard Barringer, and David Rydeheard — *University of Manchester, UK* . . . . . 658

Semi-automatic Generation of Metamodels from Model Sketches
Dustin Wüest, Norbert Seyff, and Martin Glinz — *University of Zurich, Switzerland* . . . . . 664

Assessing the Maturity of Requirements through Argumentation: A Good Enough Approach
Varsha Veerappa and Rachel Harrison — *Oxford Brookes University, UK* . . . . . 670

Natural Language Requirements Quality Analysis Based on Business Domain Models
Annervaz K.M., Vikrant Kaulgud, Shubhashis Sengupta, and Milind Savagaonkar — *Accenture Technology Labs, India* . 676

Model/Code Co-Refactoring: An MDE Approach
Jens von Pilgrim, Bastian Ulke, Andreas Thies, and Friedrich Steimann — *Fernuniversität in Hagen, Germany* . . . . . 682

Recovering Model Transformation Traces using Multi-Objective Optimization
Hajer Saada, Marianne Huchard, Clémentine Nebut, and Houari Sahraoui — *Université Montpellier 2, France; CNRS, France; Université de Montréal, Canada* . . . . . 688

## Tool Demonstrations

Model Repair and Transformation with Echo
Nuno Macedo, Tiago Guimarães, and Alcino Cunha — *HASLab at INESC TEC, Portugal; Universidade do Minho, Portugal* 694

Smart Cloud Broker: Finding Your Home in the Clouds
Mohan Baruwal Chhetri, Sergei Chichin, Quoc Bao Vo, and Ryszard Kowalczyk — *Swinburne University of Technology, Australia* . . . . . 698

OCRA: A Tool for Checking the Refinement of Temporal Contracts
Alessandro Cimatti, Michele Dorigatti, and Stefano Tonetta — *Fondazione Bruno Kessler, Italy* . . . . . 702

The Bounded Model Checker LLBMC
Stephan Falke, Florian Merz, and Carsten Sinz — *KIT, Germany* . . . . . 706
CSeq: A Concurrency Pre-processor for Sequential C Verification Tools
Bernd Fischer, Omar Inverso, and Gennaro Parlato — *Stellenbosch University, South Africa; University of Southampton, UK* 710
Automated Testing of Cloud-Based Elastic Systems with AUToCLES
Alessio Gambi, Waldemar Hummer, and Schahram Dustdar — *University of Lugano, Switzerland; Vienna University of Technology, Austria* . . . . . 714
Tool Support for Automatic Model Transformation Specification using Concrete Visualisations
Iman Avazpour, John Grundy, and Lars Grunske — *Swinburne University of Technology, Australia; University of Stuttgart, Germany* . . . . . 718
CCmutator: A Mutation Generator for Concurrency Constructs in Multithreaded C/C++ Applications
Markus Kusano and Chao Wang — *Virginia Tech, USA* . . . . . 722
Crushinator: A Framework towards Game-Independent Testing
Christopher Schaefer, Hyunsook Do, and Brian M. Slator — *North Dakota State University, USA* . . . . . 726
Pex4Fun: A Web-Based Environment for Educational Gaming via Automated Test Generation
Nikolai Tillmann, Jonathan de Halleux, Tao Xie, and Judith Bishop — *Microsoft Research, USA; University of Illinois at Urbana-Champaign, USA* . . . . . 730
Developing Self-Verifying Service-Based Systems
Radu Calinescu, Kenneth Johnson, and Yasmin Rafiq — *University of York, UK* . . . . . 734
TRAM: A Tool for Transforming Textual Requirements into Analysis Models
Keletso J. Letsholo, Liping Zhao, and Erol-Valeriu Chioasca — *University of Manchester, UK* . . . . . 738
iProbe: A Lightweight User-Level Dynamic Instrumentation Tool
Nipun Arora, Hui Zhang, Junghwan Rhee, Kenji Yoshihira, and Guofei Jiang — *NEC Labs, USA* . . . . . 742

# Doctoral Symposium

Detecting and Fixing Emergent Behaviors in Distributed Software Systems using a Message Content Independent Method
Fatemeh Hendijani Fard — *University of Calgary, Canada* . . . . . 746
Synthesizing Fault-Tolerant Programs from Deontic Logic Specifications
Ramiro Demasi — *McMaster University, Canada* . . . . . 750
Supporting Bug Investigation using History Analysis
Francisco Servant — *University of California at Irvine, USA* . . . . . 754
Context-Aware Task Allocation for Distributed Agile Team
Jun Lin — *Nanyang Technological University, Singapore* . . . . . 758
Preventing Erosion of Architectural Tactics through Their Strategic Implementation, Preservation, and Visualization
Mehdi Mirakhorli — *DePaul University, USA* . . . . . 762