

Michael Pradel

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Research Interests

My research focuses on tools and techniques for building reliable, efficient, and secure software. To this end, I work on testing and analysis of complex software systems. As part of my research, I have contributed to techniques that detected thousands of bugs in widely used software. I'm particularly interested in JavaScript-based web applications, concurrency, and performance profiling.

Positions and Experience

- Oct 2014 – now **TU Darmstadt, Germany.**
Independent research group leader. Since April 2017: Assistant Professor (W1)
- Sep 2013 – **University of California, Berkeley, USA.**
Aug 2014 Postdoctoral researcher
- Jan 2013 – **ETH Zurich, Switzerland.**
Jun 2013 Postdoctoral researcher and lecturer in the Laboratory for Software Technology lead by Thomas Gross
- 2008 – 2012 **ETH Zurich, Switzerland.**
Research assistant in the Laboratory for Software Technology lead by Thomas Gross
- Aug 2006 – **Fraunhofer Institute for Secure Information Technology SIT, Darmstadt, Germany.**
Sep 2006 Internship. Survey of static source code analysis tools. Study on Ajax-related security issues
- Jul 2005 – **Computer science research center FZI, Karlsruhe, Germany.**
Aug 2005 Internship. Developed a Java application to visualize large object-oriented software
- 2001 – 2002 **Community service, Jena, Germany.**
Day-care center for disabled children

Education

- 2008 – 2012 **ETH Zurich, Switzerland.**
Ph.D. (Dr. sc.) in computer science. Laboratory for Software Technology lead by Thomas Gross.
Dissertation: *Program Analyses for Automatic and Precise Error Detection.*
Software Engineering Award of the Ernst-Denert-Foundation (best dissertation)
Examinors: Thomas Gross, Jonathan Aldrich, Andreas Zeller
- Jan 2008 – **Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland.**
Jul 2008 Diploma thesis in the Programming Methods Laboratory lead by Martin Odersky.
Best student paper award at ICSoft'08
- 2006 – 2008 **TU Dresden, Germany.**
Diplom (\approx M.S.) in computer science, with distinction. Specialization: software engineering.
Awarded as one of the best engineering graduates of the year
- 2004 – 2006 **Ecole Centrale Paris, France.**
Diplôme d'Ingénieur (\approx M.S.) in engineering
- 2002 – 2004 **TU Dresden, Germany.**
Vordiplom (\approx B.S.) in computer science

Peer-reviewed Conference Publications

- ASE'17 **Automatically Reducing Tree-Structured Test Inputs.**
Satia Herfert, Jibesh Patra, Michael Pradel. *International Conference on Automated Software Engineering*
- ASE'17 **Saying “hi!” Is Not Enough: Mining Inputs for Effective Test Generation.**
Luca Della Toffola, Cristian-Alexandru Staicu, Michael Pradel. *International Conference on Automated Software Engineering*, conditionally accepted

- OOPSLA'17 **Detecting Argument Selection Defects.**
Andrew Rice, Edward Aftandilian, Ciera Jaspan, Emily Johnston, Michael Pradel, Yulissa Arroyo-Paredes. *Conference on Object-Oriented Programming, Systems, Languages, and Applications*, conditionally accepted
- PLDI'17 **Systematic Black-Box Analysis of Collaborative Web Applications.**
Marina Billes, Anders Møller, Michael Pradel. *Conference on Programming Language Design and Implementation*, pages 171–184
- ISSTA'17 **An Actionable Performance Profiler for Optimizing the Order of Evaluations.**
Marija Selakovic, Thomas Glaser, Michael Pradel. *International Symposium on Software Testing and Analysis*, pages 170–180
- ICSE'17 **Making Malory Behave Maliciously: Targeted Fuzzing of Android Execution Environments.**
Siegfried Rasthofer, Steven Arzt, Stefan Triller, Michael Pradel. *International Conference on Software Engineering*, pages 300-311
- ICSE'17 **Efficient Detection of Thread Safety Violations via Coverage-Guided Generation of Concurrent Tests.**
Ankit Choudhary, Shan Lu, Michael Pradel. *International Conference on Software Engineering*, pages 266-277
- ICSE'16 **Performance Issues and Optimizations in JavaScript: An Empirical Study.**
Marija Selakovic, Michael Pradel. *International Conference on Software Engineering*, pages 61–72
- ICSE'16 **Nomen Est Omen: Exploring and Exploiting Similarities between Argument and Parameter Names.**
Hui Liu, Qiurong Liu, Cristian-Alexandru Staicu, Michael Pradel, Yue Luo. *International Conference on Software Engineering*, pages 1063–1073
- ISSTA'16 **Monkey See, Monkey Do: Effective Generation of GUI Tests with Inferred Macro Events.**
Markus Ermuth, Michael Pradel. *International Symposium on Software Testing and Analysis*, pages 82–93
- ISSTA'16 **SyncProf: Detecting, Localizing, and Optimizing Synchronization Bottlenecks.**
Tingting Yu, Michael Pradel. *International Symposium on Software Testing and Analysis*, pages 389–400
- OOPSLA'15 **Performance Problems You Can Fix: A Dynamic Analysis of Memoization Opportunities.**
Luca Della Toffola, Michael Pradel, Thomas R. Gross. *Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pages 607–622
- FSE'15 **JITProf: Pinpointing JIT-Unfriendly JavaScript Code.**
Liang Gong, Michael Pradel, Koushik Sen. *European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, pages 357–368
- ISSTA'15 **DLint: Dynamically Checking Bad Coding Practices in JavaScript.**
Liang Gong, Michael Pradel, Manu Sridharan, Koushik Sen. *International Symposium on Software Testing and Analysis*, pages 94–105
- ECOOP'15 **The Good, the Bad, and the Ugly: An Empirical Study of Implicit Type Conversions in JavaScript.**
Michael Pradel, Koushik Sen. *European Conference on Object-Oriented Programming*, pages 519–541
- ICSE'15 **TypeDevil: Dynamic Type Inconsistency Analysis for JavaScript.**
Michael Pradel, Parker Schuh, Koushik Sen. *International Conference on Software Engineering*, pages 314–324
- OOPSLA'14 **EventBreak: Analyzing the Responsiveness of User Interfaces through Performance-Guided Test Generation.**
Michael Pradel, Parker Schuh, George Necula, Koushik Sen. *Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pages 33-47
- ISSTA'14 **Performance Regression Testing of Concurrent Classes.**
Michael Pradel, Markus Huggler, Thomas R. Gross. *International Symposium on Software Testing and Analysis*, pages 13–25
- ASE'13 **Bitas: Coverage-guided, Automatic Testing of Actor Programs.**
Samira Tasharofi, Michael Pradel, Yu Lin, Ralph Johnson. *International Conference on Automated Software Engineering*, pages 114-224

- ICSE'13 **Automatic Testing of Sequential and Concurrent Substitutability.**
Michael Pradel, Thomas R. Gross. *International Conference on Software Engineering*, pages 282–291
- PLDI'12 **Fully Automatic and Precise Detection of Thread Safety Violations.**
Michael Pradel, Thomas R. Gross. *Conference on Programming Language Design and Implementation*, pages 521–530
- ISSTA'12 **Static Detection of Brittle Parameter Typing.**
Michael Pradel, Severin Heiniger, Thomas R. Gross. *International Symposium on Software Testing and Analysis*, pages 265–275
- ICSE'12 **Leveraging Test Generation and Specification Mining for Automated Bug Detection without False Positives.**
Michael Pradel, Thomas R. Gross. *International Conference on Software Engineering*, pages 288–298
- ICSE'12 **Statically Checking API Protocol Conformance with Mined Multi-Object Specifications.**
Michael Pradel, Ciera Jaspan, Jonathan Aldrich, Thomas R. Gross. *International Conference on Software Engineering*, pages 925–935
- ICSE'12 **Ballerina: Automatic Generation and Clustering of Efficient Random Unit Tests for Multithreaded Code.**
Adrian Nistor, Qingzhou Luo, Michael Pradel, Thomas R. Gross, Darko Marinov. *International Conference on Software Engineering*, pages 727–737
- ISSTA'11 **Detecting Anomalies in the Order of Equally-typed Method Arguments.**
Michael Pradel, Thomas R. Gross. *International Symposium on Software Testing and Analysis*, pages 232–242
- ICSM'10 **A Framework for the Evaluation of Specification Miners Based on Finite State Machines.**
Michael Pradel, Philipp Bichsel, Thomas R. Gross. *International Conference on Software Maintenance*, pages 1–10
- ASE'09 **Automatic Generation of Object Usage Specifications from Large Method Traces.**
Michael Pradel, Thomas R. Gross. *International Conference on Automated Software Engineering*, pages 371–382
- ICSOFT'08 **Scala Roles - A Lightweight Approach towards Reusable Collaborations.**
Michael Pradel, Martin Odersky. *International Conference on Software and Data Technologies*, pages 13–20. *Best student paper award*
- RR'08 **Ontology Design and Reuse with Conceptual Roles.**
Jakob Henriksson, Michael Pradel, Steffen Zschaler, Jeff Z. Pan. *International Conference on Web Reasoning and Rule Systems*, pages 104–118

Peer-reviewed Journal Publications and Book Chapters

- 2017 **A Survey of Dynamic Analysis and Test Generation for JavaScript.**
Esben Andreasen, Liang Gong, Anders Møller, Michael Pradel, Marija Selakovic, Koushik Sen, Cristian-Alexandru Staicu. *ACM Computing Surveys (CSUR)*, to appear
- 2013 **Name-based Analysis of Equally Typed Method Arguments.**
Michael Pradel, Thomas R. Gross. *IEEE Transactions on Software Engineering (TSE)*, 39(8), pages 1127–1143
- 2011 **Mining API Usage Protocols from Large Method Traces.**
Michael Pradel, Thomas R. Gross. *Mining Software Specifications: Methodologies and Applications*, pages 85–112. Edited by David Lo, Khoo Siau Cheng, Jiawei Han, and Chao Liu. CRC Press
- 2010 **A Good Role Model for Ontologies: Collaborations.**
Michael Pradel, Jakob Henriksson, Uwe Aßmann. *International Journal of Enterprise Information Systems*, 6(1), pages 1–11

Technical Reports, Workshops, and Other Writings

- 2017 **Automated Program Repair (Dagstuhl Seminar 17022).**
Sunghun Kim, Claire Le Goues, Michael Pradel, Abhik Roychoudhury
- Front Matter - ECOOP 2017, Artifact Evaluation.**
Philipp Haller, Michael Pradel, Tijs van der Storm

- 2016 **Understanding and Automatically Preventing Injection Attacks on Node.js.**
Cristian-Alexandru Staicu, Michael Pradel, Ben Livshits. Technical Report No. TUD-CS-2016-14663. TU Darmstadt.
- Learning to Fuzz: Application-Independent Fuzz Testing with Probabilistic, Generative Models of Input Data.**
Jibesh Patra, Michael Pradel. Technical Report No. TUD-CS-2016-14664. TU Darmstadt.
- Language-Independent Fuzz Testing with Probabilistic, Generative Models.**
Jibesh Patra, Michael Pradel. *European Conference on Object-Oriented Programming (ECOOP) Distinguished Poster Award*
- 2015 **Performance Issues and Optimizations in JavaScript: An Empirical Study.**
Marija Selakovic, Michael Pradel. Technical Report No. TUD-CS-2015-1249. TU Darmstadt. Superseded by ICSE'16 paper.
- Automatically Fixing Real-World JavaScript Performance Bugs.**
Marija Selakovic, Michael Pradel. *International Conference on Software Engineering (ICSE)*, poster track.
- DLint: Dynamically Checking Bad Coding Practices in JavaScript.**
Liang Gong, Michael Pradel, Manu Sridharan, Koushik Sen. Technical Report No. UCB/EECS-2015-5. University of California, Berkeley. Superseded by ISSTA'15 paper.
- 2014 **TypeDevil: Dynamic Type Inconsistency Analysis for JavaScript.**
Michael Pradel, Parker Schuh, Koushik Sen. Technical Report No. UCB/EECS-2014-171. University of California, Berkeley. Superseded by ICSE'15 paper.
- JITProf: Pinpointing JIT-unfriendly JavaScript Code.**
Liang Gong, Michael Pradel, Koushik Sen. Technical Report No. UCB/EECS-2014-144. University of California, Berkeley
- 2008 **Explicit Relations with Roles - A Library Approach.**
Michael Pradel. *Workshop on Relationships and Associations in Object-Oriented Languages (RAOOL) at OOPSLA'08*
- 2007 **A Good Role Model for Ontologies: Collaborations.**
Michael Pradel, Jakob Henriksson, Uwe Aßmann. *International Workshop on Semantic-Based Software Development at OOPSLA'07*

Awards and Distinctions

- July 2016 Distinguished Poster Award at ECOOP'16 for *Language-Independent Fuzz Testing with Probabilistic, Generative Models*
- January 2014 Software Engineering Award of the Ernst-Denert-Foundation for the best dissertation (€5,000)
- November 2009 Enno Heidebroek award (best engineering graduates at TU Dresden)
- October 2009 Second winner in the Student Research Competition at OOPSLA'09 for paper *Dynamically Inferring, Refining, and Checking API Usage Protocols*
- July 2008 Best student paper award at the International Conference on Software and Data Technology for paper *Scala Roles - A Lightweight Approach towards Reusable Collaborations*

External Funding

- July 2017 Collaborative research project funded by the State of Hesse. *Software-Factory 4.0*. Principal investigator.
- May 2017 Collaborative research project funded by the German Federal Ministry of Education and Research (BMBF) and by the State of Hesse. *Center for Research in Security and Privacy (CRISP)*. Principal investigator.
- October 2015 Collaborative research project funded by the German Federal Ministry of Education and Research (BMBF) and by the State of Hesse. *Center for Research in Security and Privacy (CRISP)*. Principal investigator.
- October 2014 Collaborative research project funded by the German Federal Ministry of Education and Research (BMBF). *European Center for Security and Privacy by Design (EC-SPRIDE)*. Principal investigator.
- September 2014 Emmy Noether research group funded by DFG. *ConcSys: Reliable and Efficient Complex, Concurrent Software Systems*. Sole principal investigator. €1,300,000

Spring 2008 Scholarship of the German Academic Exchange Service DAAD. €4,250

2004 – 2006 Scholarship of the French-German University UFA/DFH. €6,000

Note: In addition to the above, I have obtained various smaller grants (<€1,000) for myself and my students, e.g., travel grants from ACM SIGPLAN and ACM SIGSOFT.

Talks

Note: The following does not include regular paper presentations at conferences and workshops.

- 2017 University of Lugano (USI). Host: Mauro Pezze
Karlsruhe Institute of Technology. Host: Ralf Reussner
Stanford University. Host: Alex Aiken
Google, Mountain View. Host: Omer Tripp
Dagstuhl seminar on *Automated Program Repair*
University of Passau. Host: Christian Lengauer
SE 2017
- 2016 Meeting of the IFIP working group 2.4 (Software Implementation Technology)
IMDEA Software Institute, Madrid. Host: Alessandra Gorla
Massachusetts Institute of Technology (MIT). Host: Martin Rinard
Harvard University. Host: Stephen Chong
Workshop at the ECOOP program committee meeting.
University of Stuttgart. Host: Daniel Weiskopf
TU Dresden. Host: Ivo F. Sbalzarini
- 2015 ETH Zurich. Host: Thomas R. Gross
Purdue University. Host: Mathias Payer
Aarhus University. Host: Anders Møller
Workshop on Programming Language Evolution. Invited speaker
Advisory Council of University Professors for the German Informatics Society (GIBU), Invited speaker
SE 2015. Two talks
Max Planck Institute for Software Systems, Host: Viktor Vafeiadis
- 2014 Workshop on Software Engineering for Parallel Systems. Invited speaker
Mozilla Research, San Francisco. Host: Michael Bebenita
University of California, Davis. Host: Zhendong Su
Google, Mountain View. Host: Ciera Jaspan
Samsung Research, San Jose. Host: Satish Chandra
TU Darmstadt. Hosts: Mira Mezini and Eric Bodden
SE 2014, Kiel. Award talk on the occasion of receiving the Software Engineering award of the Ernst-Denert-Foundation for the best dissertation
Meeting of the IFIP working group 2.4 (Software Implementation Technology)
- 2013 University of Lugano (USI). Host: Matthias Hauswirth
TU München. Host: Alexander Pretschner
TU Kaiserslautern. Host: Arnd Poetzsch-Heffter
TU Berlin. Host: Jean-Pierre Seifert
TU Dresden. Host: Uwe Assmann
Saarland University. Host: Andreas Zeller
University of Bern. Host: Oscar Nierstrasz
University of Zurich. Host: Harald Gall
Karlsruhe Institute of Technology. Host: Walter Tichy
TU Darmstadt. Hosts: Mira Mezini and Eric Bodden

- 2012 Coverity, San Francisco. Host: Murali Krishna Ramanathan
University of California, Berkeley. Host: Koushik Sen
University of Washington. Host: Michael Ernst
Google, Zurich. Host: Andreas Leitner
- 2011 Google, Zurich. Hosts: Jürgen Allgayer and Andreas Leitner
University of Waterloo. Hosts: Ondrej Lhotak and Patrick Lam
Carnegie Mellon University. Host: Jonathan Aldrich
- 2010 Dagstuhl seminar on *Relationships, Objects, Roles, and Queries in Modern Programming Languages*
Saarland University. Hosts: Sebastian Hack and Andreas Zeller
- 2009 Victoria University of Wellington. Host: David J. Pearce

Teaching Experience

Lecturer

- Summer 2017 **Analyzing Software with Deep Learning.**
Integrated course at TU Darmstadt. Newly designed course.
- Winter 2016/17 **Program Testing and Analysis.**
Integrated course at TU Darmstadt. About 80 students. Weekly lectures of 90 minutes. In addition to a final exam, students work on a larger coding project and write a term paper.
- Winter 2015/16 **Program Testing and Analysis.**
Integrated course at TU Darmstadt. About 60 students. Newly designed course (13 lectures of 90 minutes). In addition to a final exam, students work on a larger coding project and write a term paper.
- Winter 2014/15 **Program Analysis.**
Seminar at TU Darmstadt. 10-20 students. Newly designed course.
- Spring 2013 **Software Architecture and Engineering.**
Core undergraduate course at ETH Zurich. About 100 students. Co-taught with Martin Vechev. Re-designed and extended existing course. Full responsibility for 13 lectures of 90 minutes, exercise sessions, a larger coding project, and for managing a group of teaching assistants.
- Fall 2012 **Compiler Design.**
Replacement lecturer for one lecture of 90 minutes, at ETH Zurich.

Teaching Assistant

Teaching assistantships involve preparing and presenting exercises, preparing and grading exams, organizing office hours, and organizing larger coding projects.

- Fall 2012 **Compiler Design.**
- Fall 2011 **Compiler Design.**
- Fall 2009 **System Programming and Computer Architecture.**
- Fall 2008 **Computer Architecture.**
- Fall 2008 **System Programming.**

Mentor

- Spring 2011 **Software Engineering seminar.**
- Fall 2008 **Software Engineering seminar.**

Advising and Mentoring

- PhD students Andrew Habib. Since October 2015
Martin Billes. Since April 2015
Jibesh Patra. Since March 2015
Marija Selakovic. Since October 2014
Cristian-Alexandru Staicu. Since October 2014
- Master theses Daniel Lehmann. *Automatic Testing of Interactive JavaScript Debuggers.* 2017
Sebastian Ruhleder. *Automatic Generation of Performance Benchmarks for JavaScript Libraries.* 2017

- Dileep R. K. Murthy. *Change-aware Dynamic Program Analysis*. 2016
- Pooja Dixit. *Detecting Unexpected Interferences between Scripts in JavaScript Applications*. 2016
- Markus Ermuth. *Effective UI-Level Test Generation for Web Applications through Inferred Macro Events*. 2015. See paper at ISSTA'16
- Ankit Choudhary. *Coverage-driven Generation of Concurrent Tests*. 2015. See paper at ICSE'17
- Michael Fäs. *Automatic and Precise Detection of Deadlocks in Libraries*. 2013
- Markus Huggler. *Performance Regression Testing for Thread-safe Classes*. 2013. See paper at ISSTA'14
- Jérémie Bresson. *Finding API Usage Bugs with Runtime Monitoring*. 2010
- Philipp Bichsel. *Inference of API Usage Documentation*. 2010. See paper at ICSM'10
- Sebastian Grössl. *Finding Implicit Programming Rules and their Violations in Java Programs*. 2009
- Bachelor theses Patrick Mell. *Detecting Parallelization Opportunities in JavaScript Programs*. 2016
- Thomas Glaser. *A Dynamic Analysis to Help Refactoring Complex Conditions for Improved Performance*. 2015. See paper at ISSTA'17
- Pascal Zimmermann. *Name-based Type Inference*. 2012
- Christine Zeller. *Software Anomaly Detection in a Real-world Setting*. Collaboration with Google, Zurich. 2012
- Severin Heiniger. *API Usage Anomaly Detection Based on Points-to Analysis*. 2011. See paper at ISSTA'12
- Claudio Corrodi. *Detecting Library Usage Anomalies*. 2011
- Undergraduate supervision Satia Herfert. 2016–2017. See paper at ASE'17
- Abhijit Singh. 2015–2016.
- Hosam Nima. 2015.
- Parker Schuh. 2013–2014. See papers at OOPSLA'14 and ICSE'15

Reviewing and Service

- Organizer Chair of Artifact Evaluation at European Conference on Object-Oriented Programming (ECOOP), 2017
- Dagstuhl seminar on Automated Program Repair, 2017
- Workshop on Dynamic Analysis (WODA), 2016
- Workshop on Tools for JavaScript Analysis (JSTools) at ECOOP, 2016
- Workshop on Tools for JavaScript Analysis (JSTools) at ECOOP, 2015
- Committee member European Conference on Object-Oriented Programming (ECOOP), 2018
- IEEE Transactions on Software Engineering, Review board, 2017/2018
- Conference on Programming Language Design and Implementation (PLDI), 2017
- International Conference on Software Engineering (ICSE), 2017
- International Symposium on Software Testing and Analysis (ISSTA), 2017
- Workshops at SPLASH, Program Committee, 2017
- ACM Student Research Competition at ESEC/FSE, 2017
- ProWeb workshop on programming methodology for the future web, Program Committee, 2017
- Conference on Programming Language Design and Implementation (PLDI), External review committee, 2016
- European Conference on Object-Oriented Programming (ECOOP), 2016
- International Symposium on Software Testing and Analysis (ISSTA), 2016
- International Symposium on the Foundations of Software Engineering (FSE), Demonstrations Track, 2016
- Student Contest on Software Engineering (SCORE) at ICSE, 2016

- Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2015
- ACM SIGPLAN Student Research Competition at SPLASH, 2015
- Conference on Automated Software Engineering (ASE), Tool Demonstration Track, 2015
- Workshop on Software Engineering for Parallel Systems at OOPSLA, 2015
- Software Engineering (SE), 2015
- Workshop on Software Engineering for Parallel Systems at OOPSLA, 2014
- ACM Student Research Competition at International Conference on Software Engineering (ICSE), 2014
- International Conference on Software Engineering (ICSE), poster track, 2014
- Reviewer IEEE Transactions on Software Engineering, 2014, 2015, 2016, 2017
- Journal on Empirical Software Engineering, 2016
- ACM Transactions on Software Engineering and Methodology (TOSEM), 2015
- IEEE Transactions on Parallel and Distributed Systems, 2014
- Science of Computer Programming, 2013, 2014
- Information and Software Technology, 2013
- IEEE Transactions on Information Forensics and Security, 2012
- Journal of Computer Science and Technology (JCST), 2011
- External Symposium on the Foundations of Software Engineering (FSE), 2016
- reviewer Symposium on Principles of Programming Languages (POPL), 2016
- European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE), 2015
- Conference on Computer Aided Verification (CAV), 2014
- Conference on Programming Language Design and Implementation (PLDI), 2014
- Principles and Practice of Parallel Programming (PPoPP), 2014
- European Conference on Object-Oriented Programming (ECOOP), 2013
- USENIX Workshop on Hot Topics in Parallelism (HotPar), 2012
- Conference on Programming Language Design and Implementation (PLDI), 2011
- Workshop on Relationships and Associations in Object-Oriented Languages (RAOOL) at ECOOP 2009

References

Available on request

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