

Eric Koskinen

Research Scientist, Lecturer, Principal Investigator
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Summary

My career has ranged from the practical to the theoretical. I have over 10 years of experience in academia (Cambridge, NYU, Yale) and 5 years of experience in industry (Amazon.com, Microsoft, IBM). I hold a PhD in Computer Science from the University of Cambridge. I am currently a Research Scientist and Lecturer at Yale University, where I conduct a research program supported by over \$1.2M in funds from the National Science Foundation (NSF) and DARPA. My expertise and interests include software engineering, algorithms, systems, architecture, programming languages, and web/mobile application development.

Education

University of Cambridge, Ph.D. in Computer Science 2008 – 2012

- Thesis: Temporal verification of programs. Advisors: Byron Cook and Michael J.C. Gordon.

Brown University, Sc.M. in Computer Science 2005 – 2008

- Thesis: Transactional Boosting: Highly Concurrent Transactional Objects. Advisor: Maurice Herlihy.

College of William & Mary, B.S. in Computer Science (Highest Honors), B.S. in Physics 1997 – 2001

Awards

- Two NSF Awards and one DARPA Award (totalling >\$1.3M) to work on verification, concurrency, security.
- Computer Aided Verification (CAV) Award paper. October 2011.
- Gates Cambridge Scholarship. February 2007.
- Highest Honors for Undergraduate Thesis. May 2001.

Employment Summary

- Yale University, Lecturer, New Haven, CT 2016 – *present*
- Yale University, Research Scientist, New Haven, CT 2015 – *present*
- IBM TJ Watson Research Center, Research Staff Member, Yorktown Heights, NY 2014 – 2015
- New York University, Visiting Assistant Professor, New York, NY 2013 – 2014
- New York University, Research Scientist and Principal Investigator, New York, NY 2011 – 2013
- Nagoya University, Visiting Professor, Nagoya, Japan Spring 2013
- Microsoft Research, Research Intern, Redmond, WA Summer 2008
- Microsoft Research, Research Intern, Cambridge, UK Summer 2006
- Amazon.com, Software Engineer, Seattle, WA 2003 – 2005

Consultation Experience

- Testifying Expert. *Class-action lawsuit*. Winter 2017
- Testifying Expert. *Software contract dispute*. Fall 2016
- Source Code Expert. *FitBit vs. Jawbone*. Gibson Dunn, atty. ITC No. 337-TA-973. Winter 2016
- Testifying Expert. *Confluence, Intl. vs Minnesota Department of Transportation*. Winter 2016
- Source Code Expert. *Medical software trade secrets case*. 2014 - 2016
- Source Code Expert. *Samsung vs. Ericsson*. District #6:12-cv-00894-LED. Kikland & Ellis. 2013 - 2014
- Source Code Expert. *Samsung vs. Ericsson*. ITC No. 337-TA-866. Kikland & Ellis. 2013
- Source Code Expert. *Guy Carpenter vs. Aon Benfield*. Patent case. Irell & Manella. Winter 2013

Publications

- P Ferrara, O Tripp, E Koskinen, P Liu. Using Abstract Interpretation to Correct Synchronization Faults. *To appear in Proceedings of the 18th International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI 2017)*.

- E Koskinen, J Yang. Reducing Crash Recoverability to Reachability. In *Proceedings of the 43rd ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages (POPL 2016)*.
- E Koskinen, M Parkinson. The Push/Pull Model of Transactions. In *Proceedings of the ACM SIGPLAN Conference on Programming Language Design & Implementation (PLDI 2015)*.
- E Koskinen, T Terauchi. Local Temporal Reasoning. In *Proceedings of the Joint Meeting of the 29th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS 2014)*.
- D Dimitrov, V Raychev, M Vechev, E Koskinen. Commutativity Race Detection. In *Proceedings of the ACM SIGPLAN Conference on Programming Language Design & Implementation (PLDI 2014)*.
- M Herlihy, E Koskinen. Composable Transactional Objects: A Position Paper. In *Proceedings of the 23rd European Symposium on Programming (ESOP 2014)*.
- O Tripp, E Koskinen, M Sagiv. Turning Nondeterminism into Parallelism. In *Proceedings of the 27th Annual ACM SIGPLAN Conference on Object-Oriented Prog., Sys., Lang., and App. (OOPSLA 2013)*.
- B Cook, E Koskinen. Reasoning about Nondeterminism in Programs. In *Proceedings of the ACM SIGPLAN Conference on Programming Language Design & Implementation (PLDI 2013)*.
- K Bansal, E Koskinen, T Wies, D Zufferey. Structural counter abstraction. In *Proceedings of the 19th Int'l Conf. on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2013)*.
- B Cook, E Koskinen, M Vardi. Temporal property verification as a program analysis task. In *Proceedings of the 23rd International Conference on Computer Aided Verification (CAV 2011)*. **Award paper.**
- B Cook, E Koskinen. Making Prophecies with Decision Predicates. In *Proceedings of the 38th ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages (POPL 2011)*.
- E Koskinen, M Parkinson, M Herlihy. Coarse-Grained Transactions. In *Proceedings of the 37th ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages (POPL 2010)*.
- S Gulwani, S Jain, E Koskinen. Control-flow Refinement and Progress Invariants for Bound Analysis. In *Proceedings of the ACM SIGPLAN 2009 Conf. on Programming Language Design & Impl. (PLDI 2009)*.
- E Koskinen, M Herlihy. Brief Announcement: Concurrent Non-commutative Boosted Transactions. In *Proceedings of the 28th Annual ACM SIGACT-SIGOPS Symposium on Principles of Distributed Computing (PODC 2009)*.
- E Koskinen, M Herlihy. Checkpoints and Continuations Instead of Nested Transactions. In *Proceedings of the 20th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2008)*.
- E Koskinen, M Herlihy. Deadlocks: Efficient Deadlock Detection. In *Proceedings of the 20th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2008)*.
- M Herlihy, E Koskinen. Transactional Boosting: A Methodology for Highly Concurrent Transactional Objects. In *Proceedings of the 13th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP 2008)*.
- E Koskinen, J Jannotti. BorderPatrol: Isolating Events for Precise Black-box Tracing. In *Proceedings of the ACM SIGOPS European Conference on Computer Systems (EuroSys 2008)*.

Drafts

- T Antonopolous, P Gazzillo, E Koskinen, T Terauchi, M Hicks, S Wei. Decomposition Instead of Self-Composition for k -Safety. *Under submission*. November 2016.
- T Antonopolous, P Gazzillo, E Koskinen, Z Shao. A Theory of Vertically Composable Reversible Atomic Objects. *Under submission*. October 2016.
- E Koskinen, M Vardi, H Unno. Games Programs Play: Analyzing Two-Player Games over Infinite State Space. *Under submission*. July 2016.

Journals

- T Dickerson, P Gazzillo, M Herlihy, E Koskinen. Transactional Boosting. *Under preparation*.
- B Cook, E Koskinen, M Vardi. Temporal property verification as a program analysis task [Extended Version]. In *Formal Methods of System Design (FMSD 2012)*. 2012.

Workshops

- K Bansal, E Koskinen, O Tripp. Synthesizing Commutativity Conditions. In *Proceedings of the 8th International Workshop on Exploiting Concurrency Efficiently and Correctly ((EC)2 2015)*. July 2015.
- E Koskinen. Local Temporal Reasoning. In *Proceedings of the 2014 conference on High Confidence Software and Systems (HCSS 2014)*. May 2014.
- E Koskinen. Reasoning about nondeterminism. In *Proceedings of the 2012 conference on High Confidence Software and Systems (HCSS 2012)*. May 2012.
- M Herlihy, E Koskinen. Simplified Synchronization through Optimistic Linearizability. In *Proceedings of the 2nd Workshop on the Theory of Transactional Memory (WTTM 2010)*. September 2010.

- E Koskinen, M Herlihy. Concurrent Non-commutative Boosted Transactions. In *Proceedings of the 4th ACM SIGPLAN Workshop on Transactional Computing (TRANSACT 2009)*. February 2009.
- M Herlihy, E Koskinen. Dreadlocks: Efficient Deadlock Detection. In *Proceedings of the 3rd ACM SIGPLAN Workshop on Transactional Computing (TRANSACT 2008)*. March 2008.
- M Herlihy, E Koskinen. Checkpoints and Continuations instead of Nested Transactions. In *Proceedings of the 3rd ACM SIGPLAN Workshop on Transactional Computing (TRANSACT 2008)*. 2008.

Teaching Experience

Courses

- *Lecturer*. “Cloud-Scale Software Engineering,” undergrad./mast., Yale University, CT, Spring 2017. (exp.)
- *Professor*. “Object-Oriented Programming,” undergraduate, New York University, NY, Fall 2014.
- *Professor*. “Data-structures,” undergraduate, enrollment of 110, New York University, NY, Spring 2014.
- *Professor*. “Data-structures,” undergraduate, enrollment of 80, New York University, NY, Fall 2013.
- *Professor*. “Software Project Planning,” undergraduate, Newbury College, MA. Spring 2007.
- *Guest Lecturer*. “Databases,” undergraduate, University of Cambridge. 2010.
- *Guest Lecturer*. “Verification of infinite-state programs,” MPhil course, University of Cambridge. 2009.
- *Supervisor*. “Specification and Verification Part I & Part II,” undergraduate, taught students in small groups, University of Cambridge. 2008 – 2010.
- *Guest Lecturer, Teaching Assistant*. “Algorithmic Foundations of Computational Biology,” undergraduate, Brown University. Spring 2006.

Postdoctoral Supervision

- Timos Antonopoulos, PhD Cambridge. Fall 2015 – *present*.
- Paul Gazzillo, PhD NYU. Fall 2015 – *present*.

Mentoring PhD Students

- Abinhav Tamaskar (NYU). Research Assistant, Spring 2015.
- Kshitij Bansal (NYU). Research Assistant, Summer 2015. Collaborations lead to a paper at EC2 2015 and TACAS 2013.
- Mario Alvarez (UCSD). Research Assistant, Summer 2014.
- Ruben Zaccaroni (NYU undergraduate), Fall 2014.
- Patrick Yuen (NYU undergraduate), Fall 2014.
- *Collaborations with other PhD students*: Dimitar Dimitrov, ETH Zurich (PLDI’14), Veselin Raychev, ETH Zurich (PLDI’14), Omer Tripp, Tel-Aviv University (OOPSLA’13), Damien Zufferey, IST Austria (TACAS’13).

Professional Activities

Funding

- Awarded a grant from NSF: *SHF: Small: Collaborative Research: Concurrent Software Verification with Rely/Guarantee Abstraction*. \$ 250,000. June 2016.
- Awarded a grant from DARPA: *SOUCIS: Sound Over- & Under-Approximations of Complexity & Information Security*. \$ 800,000. December 2014.
- Awarded a grant from NSF: *SHF: Small: Collaborative Research: Concurrent Programming with Composable Transactional Objects*. \$ 250,000. June 2014.
- Awarded a grant from the Office of the Provost, New York University. *Verification Tools for Modern Programming Languages*. \$ 17,000. June 2014.
- Awarded a grant from the Japan Society for Promotion of Science (JSPS). ¥1,000,000. September 2012.

Funding Advising

- Member of Formal Methods / Programming Languages review panel, NSF Software and Hardware Foundations (SHF) Program, CCF Core. 2015, 2017.
- Member of an invitation-only NSF panel on programming and concurrency. July 2013.

Dissertation Examination

- Kshitij Bansal, New York University. December 2015.
- Paul Gazzillo, New York University. October 2015.
- Jingyue Wu, Columbia University. May 2014.

Organizer

- *Conference Chair*, IEEE/ACM Conference on Logic in Computer Science (LICS). July 2016.
- *Organizer*, CMACS grant PI Meeting. October 2012.
- *Organizer*, Workshop on concurrency and verification, co-located with POPL. January 2012.

Program committee member

- 42nd International Colloquium on Automata, Languages, and Programming (ICALP 2015).

- 39th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2013).
- 16th International Conference On Principles Of DIstributed Systems (OPODIS 2012).
- 24th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2012).

External Review committee member

- 42nd ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2016).
- 21st ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP 2016).
- 26th European Conference on Object-Oriented Programming (ECOOP 2016).
- 14th Conference on Formal Methods in Computer-Aided Design (FMCAD 2014).

Referee for

- *Book chapter*: Handbook of Model Checking.
- *Journals*: Journal of Parallel and Distributed Computing (JPDC), Logical Methods in Computer Science (LMCS), Formal Methods in System Design (FMSD), Journal of the ACM (JACM), ACM Transactions on Programming Languages and Systems (TOPLAS).
- *Conferences*: ACM SIGPLAN conference on Programming Language Design and Implementation (PLDI), ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL), Conference on Computer aided Verification (CAV), ACM/IEEE Symposium on Logic in Computer Science (LICS), International Symposium on Memory Management (ISMM), Symposium on Parallelism in Algorithms and Architectures (SPAA), International Static Analysis Symposium (SAS), International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA), European Symposium on Programming (ESOP), International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS).
- *Funding*: NSF Software and Hardware Foundations (NSF SHF). May 2015.

Patents

- Static Program Reduction for Complexity Analysis. US # 20100318980 A1. June 2009.
- Optimizing Across Interfaces. US # 8214813 B2. December 2006.

Membership

- Member of the ACM.
- Member of Cambridge in America.
- Microsoft Alumnus.

Invited Talks

- NYU, New York, *Using Abstract Interpretation to Correct Synchronization Faults* Dec 2016
- Columbia University, New York, *Robust Concurrent Software from Commutativity & Atomicity* Nov 2016
- Boston University, Boston, *Temporal Verification of Programs* Nov 2016
- NJPLS, *Reversible Atomic Objects* Sep 2016
- NFSC-JSPS Joint Research Workshop, *Proving Crash Recoverability* July 2015
- MIT, Cambridge, MA, *Commutativity Race Detection* Nov 2014
- IBM PL Day, Yorktown Heights, NY, *Commutativity Race Detection* Nov 2014
- Microsoft Research, Cambridge, UK, *Local Temporal Reasoning* June 2014
- University College, London, UK, *Local Temporal Reasoning* June 2014
- Yale University, *Local Temporal Reasoning* Mar 2014
- Brown University, *The Push/Pull Model of Transactions* Mar 2014
- Rice University, *Local Temporal Reasoning* Mar 2014
- Cornell University, *Local Temporal Reasoning* Feb 2014
- IBM Research, New York, *Local Temporal Reasoning* Feb 2014
- NYU, New York, *Local Temporal Reasoning* Jan 2014
- Tokyo University, Japan, *Temporal verification of programs* May 2013
- Nagoya University, Japan, *Temporal verification of programs* Apr 2013
- ETH Zurich, Switzerland, *Commutativity Race Detection* Feb 2013
- Queen Mary University, London, *Specialization for Synchronization* Feb 2013
- NEC Research, *Reasoning about Nondeterminism in Programs* Mar 2013
- Microsoft Research, *A Theory of Serializable Transactions* Nov 2012
- CMACS NSF PI Meeting, *Reasoning about Nondeterminism in Programs* Oct 2012
- IBM PL Day, *Reasoning about Nondeterminism in Programs* Jun 2012
- High Confidence Software and Systems, *Reasoning about Nondeterminism in Programs* May 2012

- Vienna Sci. Tech. Fund, Austria, *Data-structure Commutativity for Multicore Processing* Dec 2011
- NJPLS, *Reasoning about Nondeterminism in Programs* Oct 2011
- IBM TJ Watson Research Lab, *Systems Code Verification: A Moving Target* Apr 2011
- RiSE Seminar, IST Austria, *Systems Code Verification: A Moving Target* Apr 2011
- Microsoft Research Cambridge, *Systems Code Verification: A Moving Target* Mar 2011
- Oxford University, *Branching-time reasoning for general-purpose programs* May 2010
- University of Maryland, *Making prophecies with decision predicates* May 2010
- IBM TJ Watson Research Lab, *Making prophecies with decision predicates* Feb 2010
- Queen Mary University of London, *Symbolic bound analysis* Dec 2008

Industrial Experience

IBM, Inc., Research Staff Member

Yorktown Heights, NY • 2014 – 2015

- Initiated and lead several significant research projects and cross-institution collaborations. (See Publications)
- Filed several patents on testing and concurrency techniques for software.

Amazon.com, Software Engineer

Seattle, WA • 2003 – 2005

- Developed an e-commerce application, used by 300 customers/week and full-time editors.
- Worked with a product manager to design IMDb Resume Services (resume.imdb.com).
- Implemented a high-performance, custom web server capable of serving over 15,000 pages per minute, increasing performance by a factor of ten.
- Developed an engine to export data to customers such as Target, Comcast, Cablevision, and Warner.
- Developed numerous web-based tools, used by editors to manipulate live content on imdb.com.
- Built an interface to expose IMDb data on Amazon.com product detail pages.

Daphnia, Partner, Director of Technology

New York, NY • 2001 – 2003

- Developed e-commerce web sites and custom web applications. Managed project teams consisting of employees, client personnel, partner companies, and freelancers.
- Hosted the majority of customers. Grew company to support one full-time Sales Representative. Clients included Wall Street Systems and Outsource Consultants Inc. www.daphnianyc.com

Software

- *Co-author* of SOUCIS, a tool for proving non-interference properties (such as the absence of side-channel attacks) on Java ByteCode. 2015 – *present*.
- *Co-author* of LTR, a tool for proving temporal properties of higher-order programs via local reasoning (LICS 2014). 2013 – *present*
- *Author* of BORDERPATROL, a suite of tools that enables developers to precisely trace requests through a distributed system without the need for instrumenting application components (EuroSys 2008). BORDERPATROL inspired the start-up company Tracelytics, which was acquired by AppNeta.
<http://cs.brown.edu/research/borderpatrol/>
- *Co-author* of SPEED, a program analysis tool built on the Phoenix C/C++/C# compiler platform. SPEED was applied it to a significant Microsoft product (>670,000 lines of code) and discovered complexity bounds for 90% of the loops (PLDI 2009).
<http://research.microsoft.com/en-us/um/people/sumitg/pubs/speed.html>
- *Collaborator* on the T2 Termination prover. <http://research.microsoft.com/en-us/projects/t2/>. 2008 – 2012.
- *Designer* of IMDb Resume Services. <http://resume.imdb.com>. 2014 – 2015.