James Bornholt

2317 Speedway, Stop D9500, Austin, TX 78712-1757
bornholt@cs.utexas.edu
https://www.cs.utexas.edu/~bornholt/

Employment

University of Texas at Austin — Austin, TX, USA
Assistant Professor, Department of Computer Science — 2021–

Amazon Web Services — Austin, TX, USA
Amazon Scholar, Amazon S3 — 2022–
Amazon Visiting Academic, Amazon S3 — 2021–2022
Senior Applied Scientist, Amazon S3 — 2019–2021

Amazon Web Services — Seattle, WA, USA
Research Intern, Automated Reasoning Group — 2018

Microsoft Research — Canberra, Australia
Software Engineer, Research in Software Engineering (RiSE) group — 2014

Microsoft Research — Seattle, WA, USA
Research Intern, Research in Software Engineering (RiSE) group — 2012–2013
Research Intern, Research in Software Engineering (RiSE) group — 2011–2012

Education

University of Washington — Seattle, WA, USA
Ph.D., Computer Science & Engineering — 2014–2019
- Advisors: Emina Torlak, Dan Grossman, Luis Ceze
- Thesis: Optimizing the Automated Programming Stack

University of Washington — Seattle, WA, USA
M.S., Computer Science & Engineering — 2016

Australian National University — Canberra, Australia
Bachelor of Philosophy (Honours) — 2010–2013
- Advisor: Steve Blackburn
- First Class Honours and the University Medal in Computer Science

Publications

Conference Papers

SquirrelFS: using the Rust compiler to check file-system crash consistency. Hayley LeBlanc, Nathan Taylor, James Bornholt and Vijay Chidambaram. OSDI 2024.

Automatic Generation of Vectorizing Compilers for Customizable Digital Signal Processors. Samuel Thomas and James Bornholt. ASPLOS 2024. **Best Paper Award**.

Synthesis-Aided Crash Consistency for Storage Systems. Jacob Van Geffen, Xi Wang, Emina Torlak, and James Bornholt. ECOOP 2023.

Chipmunk: Investigating Crash-Consistency in Persistent-Memory File Systems. Hayley LeBlanc, Shankara Pailoor, Om Saran, Isil Dillig, James Bornholt, and Vijay Chidambaram. EuroSys 2023. **Best Paper Award**.

Synthesizing Fine-Grained Synchronization Protocols for Implicit Monitors. Kostas Ferles, Benjamin Sepanski, Rahul Krishnan, James Bornholt, and Isil Dillig. OOPSLA 2022.

Using Lightweight Formal Methods to Validate a Key-Value Storage Node in Amazon S3. James Bornholt, Rajeev Joshi, Vytautas Astrauskas, Brendan Cully, Bernhard Kragl, Seth Markle, Kyle Sauri, Drew Schleit, Grant Slatton, Serdar Tasiran, Jacob Van Geffen, and Andrew Warfield. SOSP 2021. **Best Paper Award**.

Vectorization for Digital Signal Processors via Equality Saturation. Alexa VanHattum, Rachit Nigam, Vincent T. Lee, James Bornholt, and Adrian Sampson. ASPLOS 2021.

A Synthesis-Aided Compiler for DSP Architectures. Alexa VanHattum, Rachit Nigam, Vincent T. Lee, James Bornholt, and Adrian Sampson. LCTES 2020.

Automatic Generation of High-Performance Quantized Machine Learning Kernels. Meghan Cowan, Thierry Moreau, Tianqi Chen, James Bornholt, and Luis Ceze. CGO 2020.

Fixing Code That Explodes Under Symbolic Evaluation. Sorawee Porncharoenwase, James Bornholt, and Emina Torlak. VMCAI 2020.

Scaling Symbolic Evaluation for Automated Verification of Systems Code with Serval. Luke Nelson, James Bornholt, Ronghui Gu, Andrew Baumann, Emina Torlak, and Xi Wang. SOSP 2019. **Best Paper Award**. **Distinguished Artifact Award**.

Finding Code That Explodes Under Symbolic Evaluation. James Bornholt and Emina Torlak. OOPSLA 2018. **Distinguished Artifact Award**.

Nickel: A Framework for Design and Verification of Information Flow Control Systems. Helgi Sigurbjarnarson, Luke Nelson, Bruno Castro-Karney, James Bornholt, Emina Torlak, and Xi Wang. OSDI 2018.

Hyperkernel: Push-Button Verification of an OS Kernel. Luke Nelson, Helgi Sigurbjarnarson, Kaiyuan Zhang, Dylan Johnson, James Bornholt, Emina Torlak, and Xi Wang. SOSP 2017.

Synthesizing Memory Models from Framework Sketches and Litmus Tests. James Bornholt and Emina Torlak. PLDI 2017.

Push-Button Verification of File Systems via Crash Refinement. Helgi Sigurbjarnarson, James Bornholt, Emina Torlak, and Xi Wang. OSDI 2016. **Best Paper Award**.

Disciplined Inconsistency with Consistency Types. Brandon Holt, James Bornholt, Irene Zhang, Dan R. K. Ports, Mark Oskin, and Luis Ceze. SoCC 2016.

Specifying and Checking File System Crash-Consistency Models. James Bornholt, Antoine Kaufmann, Jialin Li, Arvind Krishnamurthy, Emina Torlak, and Xi Wang. ASPLOS 2016.

A DNA-Based Archival Storage System. James Bornholt, Randolph Lopez, Douglas M. Carmean, Luis Ceze, Georg Seelig, and Karin Strauss. ASPLOS 2016. **IEEE Micro Top Picks**.

Optimizing Synthesis with Metasketches. James Bornholt, Emina Torlak, Dan Grossman, and Luis Ceze. POPL 2016.

Hardware–Software Co-Design: Not Just a Cliché. Adrian Sampson, James Bornholt, and Luis Ceze. SNAPL 2015.

Uncertain<T>: A First-Order Type for Uncertain Data. James Bornholt, Todd Mytkowicz, and Kathryn S. McKinley. ASPLOS 2014. **SIGPLAN Research Highlight**. **IEEE Micro Top Picks**.

Journal Papers

Noninterference Specifications for Secure Systems. Luke Nelson, James Bornholt, Arvind Krishnamurthy, Emina Torlak, and Xi Wang. ACM SIGOPS Operating Systems Review, vol. 54, no. 1, pp. 31–39, July 2020.

A Taxonomy of General Purpose Approximate Computing Techniques. Thierry Moreau, Joshua San Miguel, Mark Wyse, James Bornholt, Armin Alaghi, Luis Ceze, Natalie Enright Jerger, and Adrian Sampson. IEEE Embedded Systems Letters, vol. 10, no. 1, pp. 2–5, March 2018.

Toward a DNA-Based Archival Storage System. James Bornholt, Randolph Lopez, Douglas M. Carmean, Luis Ceze, Georg Seelig, and Karin Strauss. IEEE Micro, vol. 37, no. 3, pp. 98–104, May–June 2017.

Uncertain<T>: Abstractions for Uncertain Hardware and Software. James Bornholt, Todd Mytkowicz, and Kathryn S. McKinley. IEEE Micro, vol. 35, no. 3, pp. 132–143, May–June 2015.

Workshop Papers

Scaling Program Synthesis by Exploiting Existing Code. James Bornholt and Emina Torlak. ML4PL 2015 (colocated with ECOOP 2015).

Approximate Program Synthesis. James Bornholt, Emina Torlak, Luis Ceze, and Dan Grossman. WAX 2015 (colocated with PLDI 2015).

REACT: A Framework for Rapid Exploration of Approximate Computing Techniques. Mark Wyse, Andre Baixo, Thierry Moreau, Bill Zorn, James Bornholt, Adrian Sampson, Luis Ceze, and Mark Oskin. WAX 2015 (colocated with PLDI 2015).

Programming the Internet of Uncertain <T>hings. James Bornholt, Na Meng, Todd Mytkowicz, and Kathryn S. McKinley. SCAW 2015 (colocated with HPCA 2015).

There's Something About Bayes: Effective Probabilistic Programming for the Rest of Us. James Bornholt, Todd Mytkowicz, and Kathryn S. McKinley. APPROX 2014 (colocated with PLDI 2014).

Posters & Talks

Uncertain<T>: A First-Order Type for Uncertain Data. James Bornholt. PLDI 2013 Student Research Competition. **First Place, PLDI Student Research Competition**. **Second Place, ACM Student Research Competition Grand Final**.

The Model Is Not Enough: Understanding Energy Consumption in Mobile Devices. James Bornholt, Todd Mytkowicz, and Kathryn S. McKinley. Hot Chips 24, 2012.

Theses

Optimizing the Automated Programming Stack. James Bornholt. PhD thesis, University of Washington, 2019.

Abstractions and Techniques for Programming with Uncertain Data. James Bornholt. Honours thesis, Bachelor of Philosophy (Honours), Australian National University, 2013.

Awards

ASPLOS Best Paper Award	2024
EuroSys Best Paper Award	2023
SOSP Best Paper Award	2021
SOSP Best Paper Award	2019
OOPSLA Distinguished Artifact Award	2018
Facebook Ph.D. Fellowship	2018–2020
IEEE Micro Top Picks from the Computer Architecture Conferences, for DNA storage	2017
OSDI Jay Lepreau Best Paper Award	2016
IEEE Micro Top Picks from the Computer Architecture Conferences, for Uncertain<T>	2015
ACM SIGPLAN Research Highlight, for Uncertain<T>	2014

David Notkin Endowed Graduate Fellowship, University of Washington 2014–2015

Second Place, ACM Student Research Competition Grand Finals (undergraduate) 2014

First Place, ACM PLDI Student Research Competition (undergraduate) 2013

ANU University Medal for Computer Science 2013

Teaching

CS 395T: Systems Verification and Synthesis University of Texas at Austin

Instructor Spring 2023

Instructor Spring 2022

Instructor Spring 2021

CS 345H/386L: Programming Languages University of Texas at Austin

Instructor Spring 2024

Instructor Fall 2022

CSE 507, Computer Aided Reasoning for Software University of Washington

Teaching Assistant Winter 2017

Teaching Assistant Spring 2016

Students

Nathan Taylor (PhD) 2021–

Sammy Thomas (PhD) 2021–

Dani Wang (PhD) 2021–

Julia Benginow (BS Honors) 2023–

Finn Frankis (BS Honors) 2022–2023

Stefan Debruyn (BS Honors) 2021–2022

Owen Graves (BS Honors) 2020–2021

Service

Program Committees

Programming Languages Design and Implementation (PLDI) — Program Committee 2024

European Conference on Computer Systems (EuroSys) — Program Committee 2024

Architectural Support for Programming Languages and Operating Systems (ASPLOS) — External Review Committee 2024

Architectural Support for Programming Languages and Operating Systems (ASPLOS) — Program Committee 2023

Programming Languages Design and Implementation (PLDI) — Program Committee 2022

Architectural Support for Programming Languages and Operating Systems (ASPLOS) — External Review Committee 2022

Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA) — External Review Committee 2021

Operating Systems Design and Implementation (OSDI) — Program Committee 2021

Architectural Support for Programming Languages and Operating Systems (ASPLOS) — Program Committee 2021

Programming Languages Design and Implementation (PLDI) — Program Committee 2020

Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA) — Review Committee 2020

Architectural Support for Programming Languages and Operating Systems (ASPLOS) — External Review Committee 2020

Principles and Practice of Parallel Programming (PPoPP) — Brief Announcements Program Committee	2020
Formal Techniques for Java-Like Programs (FTfJP) — Program Committee	2019
Programming Languages Design and Implementation (PLDI) — External Review Committee	2017
Computer-Aided Verification (CAV) — Artifact Evaluation Committee	2017
Principles of Programming Languages (POPL) — Artifact Evaluation Committee	2016
Programming Languages Design and Implementation (PLDI) — Artifact Evaluation Committee	2015

Reviewing

Symposium on Operating Systems Principles (SOSP)	2023
National Science Foundation (NSF) panel member	2022
National Science Foundation (NSF) panel member	2021
Architectural Support for Programming Languages and Operating Systems (ASPLOS)	2018
IEEE Transactions on Emerging Topics in Computing	2017
Computer-Aided Verification (CAV)	2015
ACM Transactions on Embedded Computing	2015
Architectural Support for Programming Languages and Operating Systems (ASPLOS)	2015

Department Service

Undergrduate Curriculum Committee, Computer Science, University of Texas at Austin	2022
PhD Admissions Committee, Computer Science, University of Texas at Austin	2021, 2022
Graduate Admissions Committee, Computer Science & Engineering, University of Washington	2017, 2018, 2019
Prospective Student Committee Co-Chair, Computer Science & Engineering, University of Washington	2016
Prospective Student Committee, Computer Science & Engineering, University of Washington	2015–2019

Student Committees

Sekwon Lee, PhD Dissertation Committee	2023
Soujanya Ponnapalli, PhD Dissertation Committee	2023
Aashaka Shah, PhD Dissertation Committee	2023
Rohan Kadekodi, PhD Dissertation Committee	2023
Henrique Fingler, PhD Dissertation Committee	2023
Mihir Mehta, PhD Dissertation Committee	2021
Kostas Ferlas, PhD Dissertation Committee	2020

Presentations and Seminars

Using Lightweight Formal Methods to Validate a Key-Value Storage Node in Amazon S3

High Confidence Software and Systems conference, Invited Talk	May 2022
Facebook, Invited Talk	Apr 2022
SOSP, Conference Talk	Oct 2021
New England Systems Verification Day, Invited Talk	Oct 2021

Program Synthesis in the Small

Purdue University, Invited Talk	Oct 2020

Synthesizing System Specifications

State of the Art in Program Synthesis, Invited Talk	Sep 2019

Optimizing the Automated Programming Stack

Australian National University, Invited Talk	Jul 2019
University of Toronto, Invited Seminar	Apr 2019
Princeton University, Invited Seminar	Apr 2019
University of British Columbia, Invited Seminar	Apr 2019
École Polytechnique Fédérale de Lausanne, Invited Seminar	Apr 2019
University of Massachusetts Amherst, Invited Seminar	Apr 2019
Northeastern University, Invited Seminar	Mar 2019
Microsoft Research, Invited Seminar	Mar 2019
Georgia Institute of Technology, Invited Seminar	Mar 2019
University of California, Berkeley, Invited Seminar	Feb 2019
Brown University, Invited Seminar	Feb 2019
Carnegie Mellon University, Invited Seminar	Feb 2019
University of Maryland, College Park, Invited Seminar	Feb 2019
University of Texas at Austin, Invited Seminar	Feb 2019
Cornell University, Invited Seminar	Jan 2019

Finding Code That Explodes Under Symbolic Evaluation

University of California, Santa Cruz, Guest Lecture	Nov 2019
OOPSLA, Conference Talk	Nov 2018
Galois, Invited Talk	Jun 2018

Ocelot: Relational Logic in a Solver-Aided Language

Future of Alloy Workshop, Invited Talk	Apr 2018

Synthesizing Memory Models from Framework Sketches and Litmus Tests

PLDI, Conference Talk	Jun 2017

Programming with Estimates

Programming Languages Mentoring Workshop, Invited Talk	Jun 2016

Specifying and Checking File-System Crash Consistency Models

DARPA BRASS PI Meeting, Invited Talk	Jul 2016
ASPLOS, Conference Talk	Apr 2016

A DNA-Based Archival Storage System

ASPLOS, Conference Talk	Apr 2016

Optimizing Synthesis with Metasketches

POPL, Conference Talk	Jan 2016
Dagstuhl Seminar 15491 (Approximate and Probabilistic Computing), Invited Talk	Dec 2015