

# James Bornholt

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## Employment

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

**Amazon Web Services**  
Amazon Scholar, Amazon S3 2021–

**Amazon Web Services** Seattle, WA, USA  
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

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

## Education

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**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

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### Conference Papers

*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<sup><T></sup>: 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<sup><T></sup>: 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

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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

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<b>CS 345H/386L: Programming Languages</b>	University of Texas at Austin
Instructor	Fall 2022
<b>CS 395T: Systems Verification and Synthesis</b>	University of Texas at Austin

Instructor

Spring 2022

**CS 395T: Systems Verification and Synthesis**

University of Texas at Austin

Instructor

Spring 2021

**CSE 507, Computer Aided Reasoning for Software**

University of Washington

Teaching Assistant

Winter 2017

**CSE 507, Computer Aided Reasoning for Software**

University of Washington

Teaching Assistant

Spring 2016

## Students

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Nathan Taylor (PhD)	2021–
Sammy Thomas (PhD)	2021–
Dani Wang (PhD)	2021–
Stefan deBruyn (BS Honors)	2021–2022
Owen Graves (BS Honors)	2021

## Service

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### Program Committees

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

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

PhD Admissions Committee, University of Texas at Austin	2021, 2022
Graduate Admissions Committee, University of Washington	2017–2019
Prospective Student Committee Co-Chair, University of Washington	2016
Prospective Student Committee, University of Washington	2015–2019

## Student Committees

Mihir Mehta, PhD Dissertation Committee	2021
Kostas Ferlas, PhD Dissertation Committee	2020

## Presentations and Seminars

### *Program Synthesis in the Small*

Purdue University, Invited Talk	Oct 2020
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### *Synthesizing System Specifications*

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