

# Nathan Beckmann

School of Computer Science  
Carnegie Mellon University  
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## RESEARCH INTERESTS

Computer systems, computer architecture, operating systems, parallelism, and performance modeling & analysis.

## EDUCATION

**Massachusetts Institute of Technology** ..... Sep 2015

*Ph.D.*, Electrical Engineering and Computer Science.

*Thesis:* Design and Analysis of Spatially-Partitioned Shared Caches.

*Supervisor:* Daniel Sanchez.

**Massachusetts Institute of Technology** ..... Sep 2010

*S.M.*, Electrical Engineering and Computer Science.

*Thesis:* Distributed Naming in a Factored Operating System.

*Supervisor:* Anant Agarwal.

**University of California, Los Angeles** ..... Mar 2008

*B.S.* Computer Science. *Summa cum Laude.*

*B.S.* Mathematics of Computation. *Summa cum Laude.*

## AWARDS

George M. Sprowls Doctoral Thesis Prize ..... 2015

*Best doctoral thesis in computer science at MIT.*

William A. Martin Memorial Thesis Award ..... 2010

*Best master's thesis in computer science at MIT.*

UCLA Bachelor of the Year in Computer Science ..... 2008

UCLA Rose Hills Foundation Science and Engineering Scholarship (2×) ..... 2007 & 2008

## PROFESSIONAL EXPERIENCE

**Carnegie Mellon University** ..... Jan 2017 - Present

ASSISTANT PROFESSOR in the Computer Science Department of the School of Computer Science. My research focuses on hardware-software co-design to improve the performance and energy-efficiency of future systems. By working across many layers of the system stack, from theory to hardware, I design systems that dynamically and transparently optimize themselves to active applications. In particular, one major problem facing computer systems today is that applications are increasingly bottlenecked on accessing data. My recent work focuses on two ways to make data accesses inexpensive: *scheduling data* in caches near the cores that access it; and using *analytical performance models* to manage cache space more efficiently.

**Massachusetts Institute of Technology** ..... Sep 2015 - Jan 2017

POSTDOC with Prof. Daniel Sanchez; worked on well-behaved, high-performance memory systems for parallel processors.

**Massachusetts Institute of Technology** ..... Sep 2012 - Sep 2015

RESEARCH ASSISTANT to Prof. Daniel Sanchez; worked on scheduling data across caches in parallel processors.

**Massachusetts Institute of Technology** ..... Sep 2008 - Sep 2012

RESEARCH ASSISTANT to Profs. Anant Agarwal, Frans Kaashoek, and Nickolai Zeldovich; worked on distributed operating systems (fos project).

**NVidia** ..... Summer 2007

SOFTWARE INTERN in the embedded division; worked on OpenGL ES 2.0 and optimizing customer applications.

**Symantec Research Labs** ..... Summers 2005 & 2006

RESEARCH INTERN at Symantec Research Labs; prototyped an early design of an extrusion detection system.

**University of California, Los Angeles** ..... Sep 2003 - Mar 2008

UNDERGRADUATE RESEARCHER with Profs. Glenn Reinman and Miodrag Potkonjak; worked on cache organization for physics simulation and statistical analysis of sensor networks.

## PEER-REVIEWED PUBLICATIONS

**Cache Calculus: Modeling Caches through Differential Equations** ..... CAL 2016

*Nathan Beckmann, Daniel Sanchez*

**Whirlpool: Improving Cache Management with Application-Level Data Classification** ..... ASPLOS 2016

*Anurag Mukkara, Nathan Beckmann, Daniel Sanchez*

*Acceptance rate: 22%*

<b>Modeling Cache Performance Beyond LRU</b> .....	HPCA 2016
<i>Nathan Beckmann, Daniel Sanchez</i>	<i>Acceptance rate: 22%</i>
Extended technical report: MIT CSAIL, April 2015.	
<b>Rubik: Fast Analytical Power Management for Latency-Critical Systems</b> .....	MICRO 2015
Harshad Kasture, Davide Bartolini, <i>Nathan Beckmann, Daniel Sanchez</i>	<i>Acceptance rate: 22%</i>
<b>Talus: A Simple Way to Remove Cliffs in Cache Performance</b> .....	HPCA 2015
<i>Nathan Beckmann, Daniel Sanchez</i>	<i>Acceptance rate: 22%</i>
<b>CDCS: Scaling Non-Uniform Cache Architectures with Computation and Data Co-Scheduling</b> .....	HPCA 2015
<i>Nathan Beckmann, Po-An Tsai, Daniel Sanchez</i>	<i>Acceptance rate: 22%</i>
<b>Jigsaw: Scalable Software-Defined Caches</b> .....	PACT 2013
<i>Nathan Beckmann, Daniel Sanchez</i>	<i>Acceptance rate: 17%</i>
<b>The Case for Elastic Operating System Services in fos</b> .....	DAC 2012
Lamia Youseff, <i>Nathan Beckmann, Harshad Kasture, Charles Gruenwald III, David Wentzloff, Anant Agarwal</i>	<i>Acceptance rate: 23%</i>
<b>An Operating System for Multicore and Clouds: Mechanisms and Implementation</b> .....	SOCC 2010
David Wentzloff, Charles Gruenwald III, <i>Nathan Beckmann, Kevin Modzelewski, Adam Belay, Lamia Youseff, Jason Miller, Anant Agarwal</i>	<i>Acceptance rate: 19%</i>
Extended technical report: MIT CSAIL, Feb 2010.	
<b>ATAC: Improving Performance and Programmability with On-Chip Optical Networks</b> .....	ISCAS 2010
James Psota, Jason Miller, George Kurian, Henry Hoffmann, <i>Nathan Beckmann, Jonathan Eastep, Anant Agarwal</i>	<i>Acceptance rate: 45%</i>
<b>A Unified Operating System for Clouds and Manycore: fos</b> .....	CAOS at HiPEAC 2010
David Wentzloff, Charles Gruenwald III, <i>Nathan Beckmann, Kevin Modzelewski, Adam Belay, Lamia Youseff, Jason Miller, Anant Agarwal</i>	
Extended technical report: MIT CSAIL, November 2009.	
<b>Graphite: A Distributed Parallel Simulator for Multicores</b> .....	HPCA 2010
Jason Miller, Harshad Kasture, George Kurian, Charles Gruenwald III, <i>Nathan Beckmann, Christopher Celio, Jonathan Eastep, Anant Agarwal</i>	<i>Acceptance rate: 18%</i>
Extended technical report: MIT CSAIL, November 2009.	
<b>Hardware-based Public-key Cryptography with Public Physically Unclonable Functions</b> .....	IH 2009
<i>Nathan Beckmann, Miodrag Potkonjak</i>	
<b>ADDITIONAL TECHNICAL REPORTS</b>	
<b>PIKA: A Network Service for Multikernel Operating Systems.</b> .....	MIT CSAIL, Jan 2014
<i>Nathan Beckmann, Charles Gruenwald III, Charles Johnson, Harshad Kasture, Fillipo Sironi, Anant Agarwal, Frans Kaashoek, Nickolai Zeldovich</i>	
<b>Efficient Cache Coherence on Manycore Optical Networks</b> .....	MIT CSAIL, Feb 2010
George Kurian, <i>Nathan Beckmann, Jason Miller, James Psota, Anant Agarwal</i>	
<b>Core Count vs Cache Size for Manycore Architectures in the Cloud</b> .....	MIT CSAIL, Feb 2010
David Wentzloff, <i>Nathan Beckmann, Jason Miller, Anant Agarwal</i>	
<b>ATAC: A Manycore Processor with On-Chip Optical Network</b> .....	MIT CSAIL, May 2009
Jason Miller, James Psota, George Kurian, <i>Nathan Beckmann, Jonathan Eastep, Jifeng Liu, Mark Beals, Jurgen Michel, Lionel Kimerling, Anant Agarwal</i>	
<b>POSTERS</b>	
<b>CDCS: Computation and Data Co-Scheduling</b> .....	Cloud Workshop, MIT, 2014
Po-An Tsai, <i>Nathan Beckmann, Daniel Sanchez</i>	
<i>Best student poster.</i>	
<b>Jigsaw: Software-defined Caches</b> .....	MIT CSAIL Industry Affiliate Program, 2013
<i>Nathan Beckmann, Daniel Sanchez</i>	
<b>Scalable Applications on a Factored Operating System</b> .....	ASPLOS 2012
Chris Johnson, Charles Gruenwald III, <i>Nathan Beckmann, Harshad Kasture, David Wentzloff, Larry Stewart, Adam Belay, James Ward, Lamia Youseff, Anant Agarwal</i>	
<b>Applications on a Factored Operating System</b> .....	EuroSys 2012
Charles Gruenwald III, <i>Nathan Beckmann, Harshad Kasture, Chris Johnson, Barry Kasindorf, Larry Stewart, Anant Agarwal</i>	
<b>Distributed Parallel Network Stack for Multicore</b> .....	NSDI 2011
Charles Gruenwald III, <i>Nathan Beckmann, David Wentzloff, Harshad Kasture, James Ward, Anant Agarwal</i>	

**TEACHING**

**6.823: Computer System Architecture** ..... Spring 2014  
TEACHING ASSISTANT ..... Massachusetts Institute of Technology

**PATENTS**

**Authentication of financial transactions via wireless link** ..... US Patent 9177311, Nov 2015  
Miodrag Potkonjak, *Nathan Beckmann*

**Autonomous, non-interactive, context-based services for cellular phone** ..... US Patent 8744429, June 2014  
Miodrag Potkonjak, *Nathan Beckmann*

**Differential uncloneable variability-based cryptography** ..... US Patent 9020150, Jun 2013  
*Nathan Beckmann*, Miodrag Potkonjak

**Method and apparatus for efficient token matching using complex rules** ..... US Patent 8160989, April 2012  
Scott Schneider, *Nathan Beckmann* (at Symantec Research Labs)

**Semantic compression** ..... US Patent pending (filed Apr 2010)  
*Nathan Beckmann*, Miodrag Potkonjak

**PERSONAL**

*Background:* Born 1986 in Boulder, CO. Raised in Los Angeles, CA. *Citizenship:* United States of America.