

# Michael Ferdman

Assistant Professor, Computer Science, Stony Brook University

Co-Director, Computer Architecture at Stony Brook (COMPAS) Laboratory

## Curriculum Vitae - October 2017

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Department of Computer Science

343 New Computer Science

Stony Brook, NY 11794-2424

## Research Interests

Computer architecture, with particular emphasis on the design of efficient server systems. My primary research objective is to understand the fundamental properties and interactions of application software, operating systems, networks, processor microarchitecture, and datacenter dynamics, to enable software and hardware co-design of high-performance, power-efficient, and compact servers.

## Education

**Carnegie Mellon University**

Pittsburgh, PA

*Ph.D. in Electrical and Computer Engineering*

June 2012

*M.S. in Electrical and Computer Engineering*

December 2002

*B.S. in Electrical and Computer Engineering*

December 2002

*B.S. in Computer Science*

May 2002

## Honors and Awards

**David R. Smith Young Scholar in Computer Science Award (2016-2020)**

**NSF CAREER Award (2015)**

**Graduate Teaching Award (2014)**

**Best Paper Award** at the 11th International Conference on Virtual Execution Environment (VEE) for "A Comprehensive Implementation and Evaluation of Direct Interrupt Delivery."

**IEEE Micro Top Picks** from Computer Architecture Conferences of 2013, "A Case for Specialized Processors for Scale-Out Workloads."

**Best Paper Award** at the 17th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS) for "Clearing the Clouds: A Study of Emerging Scale-out Workloads on Modern Hardware."

**Best Paper Finalist** at the 17th International Symposium on High-Performance Computer Architecture (HPCA) for "Cuckoo Directory: A Scalable Directory for Many-Core Systems."

**Paper Award** from the European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC) for "Cuckoo Directory: A Scalable Directory for Many-Core Systems."

**IEEE Micro Top Picks** from Computer Architecture Conferences of 2009, "R-NUCA: Data Placement in Distributed Shared Caches."

**IEEE Micro Top Picks** from Computer Architecture Conferences of 2009, "Practical Off-chip Meta-data for Temporal Memory Streaming."

**2005 DARPA Grand Challenge** driverless desert race, 2nd and 3d place autonomous vehicles for RedTeam.

## Publications

### Peer-reviewed Conference Papers

- [2017] **Maximizing CNN Accelerator Efficiency Through Resource Partitioning**  
Yongming Shen, Michael Ferdman, Peter Milder, *In 44th International Symposium on Computer Architecture (ISCA)*, 2017.
- [2017] **Escher: A CNN Accelerator with Flexible Buffering to Minimize Off-Chip Transfer**  
Yongming Shen, Michael Ferdman, Peter Milder, *In 25th IEEE International Symposium on Field-Programmable Custom Computing Machines (FCCM)*, 2017.
- [2016] **Fused-Layer CNN Accelerators**  
Manoj Alwani, Han Chen, Michael Ferdman, Peter Milder, *In 49th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2016.
- [2016] **Overcoming Resource Underutilization in Spatial CNN Accelerators**  
Yongming Shen, Michael Ferdman, Peter Milder, *In 26th International Conference on Field Programmable Logic and Applications (FPL)*, 2016.
- [2016] **Demystifying Cloud Benchmarking**  
Tapti Palit, Yongming Shen, Michael Ferdman, *In 2016 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2016.
- [2015] **A Comprehensive Implementation and Evaluation of Direct Interrupt Delivery**  
Cheng-Chun Tu, Michael Ferdman, Chao-tung Lee, Tzi-cker Chiueh, *In 11th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environment (VEE)*, 2015. (recognized as Best Paper by the program committee)
- [2015] **Architectural Support for Dynamic Linking**  
Varun Agrawal, Abhiroop Dabral, Tapti Palit, Yongming Shen, Michael Ferdman, *In 20th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2015.
- [2014] **DIMMer: A case for turning off DIMMs in clouds**  
Dongli Zhang, Moussa Ehsan, Michael Ferdman, Radu Sion, *In ACM Symposium on Cloud Computing (SOCC)*, 2014.
- [2014] **Temporal Stream Branch Predictor**  
Yongming Shen, Michael Ferdman, *In JWAC-4: Championship Branch Prediction workshop (in conjunction with ISCA'14)*, 2014.
- [2012] **Scale-Out Processors**  
Pejman Lotfi-Kamran, Boris Grot, Michael Ferdman, Stavros Volos, Onur Kocberber, Javier Picorel, Almutaz Adileh, Djordje Jevdjic, Sachin Idgunji, Emre Ozer, Babak Falsafi, *In 39th International Symposium on Computer Architecture (ISCA)*, 2012.
- [2012] **Clearing the Clouds: A Study of Emerging Scale-out Workloads on Modern Hardware**  
Michael Ferdman, Almutaz Adileh, Onur Kocberber, Stavros Volos, Mohammad Alisafae, Djordje Jevdjic, Cansu Kaynak, Adrian Daniel Popescu, Anastasia Ailamaki, Babak Falsafi, *In 17th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2012. (recognized as Best Paper by the program committee and recognized as Top Pick of 2013 by IEEE Micro)
- [2011] **Proactive Instruction Fetch**  
Michael Ferdman, Cansu Kaynak, Babak Falsafi, *In 44th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2011.

- [2011] **Cuckoo Directory: A Scalable Directory for Many-Core Systems**  
Michael Ferdman, Pejman Lotfi-Kamran, Ken Balet, Babak Falsafi, *In 17th IEEE International Symposium on High Performance Computer Architecture (HPCA)*, 2011. (selected by the program committee for Best Student Papers session)
- [2010] **TurboTag: lookup filtering to reduce coherence directory power**  
Pejman Lotfi-Kamran, Michael Ferdman, Daniel Crisan, Babak Falsafi, *In International Symposium on Low Power Electronics and Design (ISLPED)*, 2010.
- [2009] **Reactive NUCA: near-optimal block placement and replication in distributed caches**  
Nikos Hardavellas, Michael Ferdman, Babak Falsafi, Anastasia Ailamaki, *In 36th International Symposium on Computer Architecture (ISCA)*, 2009. (recognized as Top Pick of 2009 by IEEE Micro)
- [2009] **Practical Off-Chip Meta-Data for Temporal Memory Streaming**  
Thomas F. Wenisch, Michael Ferdman, Anastasia Ailamaki, Babak Falsafi, Andreas Moshovos, *In 15th International Symposium on High Performance Computer Architecture (HPCA)*, 2009. (recognized as Top Pick of 2009 by IEEE Micro)
- [2008] **Temporal Instruction Fetch Streaming**  
Michael Ferdman, Thomas F. Wenisch, Anastasia Ailamaki, Babak Falsafi, Andreas Moshovos, *In 41st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2008.
- [2008] **Cache bursts: A new approach for eliminating dead blocks and increasing cache efficiency**  
Haiming Liu, Michael Ferdman, Jaehyuk Huh, Doug Burger, *In 41st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2008.
- [2008] **Temporal Streams in Commercial Server Applications**  
Thomas F. Wenisch, Michael Ferdman, Anastasia Ailamaki, Babak Falsafi, Andreas Moshovos, *In 2008 IEEE International Symposium on Workload Characterization (IISWC)*, 2008.
- [2007] **Mitigating multi-bit soft errors in L1 caches using last-store prediction**  
Brian T Gold, Michael Ferdman, Babak Falsafi, Ken Mai, *In Proceedings of the Workshop on Architectural Support for Gigascale Integration (ASGI)*, 2007.
- [2007] **Last-Touch Correlated Data Streaming**  
Michael Ferdman, Babak Falsafi, *In 2007 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2007.
- [2003] **Analysis of IC Manufacturing Process Deformations: An automated approach using SRAM bit fail maps**  
Thomas Zanon, Michael Ferdman, Kambiz Komeyli, Wojciech P. Maly, *In 29th International Symposium for Testing and Failure Analysis*, 2003.

#### Journal Articles

- [2014] **A Case for Specialized Processors for Scale-Out Workloads**  
Michael Ferdman, Almutaz Adileh, Onur Kocberber, Stavros Volos, Mohammad Alisafae, Djordje Jevdjic, Cansu Kaynak, Adrian Daniel Popescu, Anastasia Ailamaki, Babak Falsafi, *In IEEE Micro's Top Picks*, 2014. (original at ASPLOS'12)
- [2012] **Quantifying the Mismatch between Emerging Scale-Out Applications and Modern Processors**  
Michael Ferdman, Almutaz Adileh, Onur Kocberber, Stavros Volos, Mohammad Alisafae, Djordje Jevdjic, Cansu Kaynak, Adrian Daniel Popescu, Anastasia Ailamaki, Babak Falsafi, *In ACM Trans. Comput. Syst.*, ACM, volume 30, 2012.
- [2011] **Toward Dark Silicon in Servers**

Nikos Hardavellas, Michael Ferdman, Babak Falsafi, Anastasia Ailamaki, *In IEEE Micro*, volume 31, 2011.

[2011] **Spatial Memory Streaming**

Stephen Somogyi, Thomas F. Wenisch, Michael Ferdman, Babak Falsafi, *In Journal of Instruction-Level Parallelism (JILP)*, volume 13, 2011.

[2010] **Near-Optimal Cache Block Placement with Reactive Nonuniform Cache Architectures**

Nikos Hardavellas, Michael Ferdman, Babak Falsafi, Anastasia Ailamaki, *In IEEE Micro's Top Picks*, volume 30, 2010. (original at ISCA'09)

[2010] **Making Address-Related Prefetching Practical**

Thomas F. Wenisch, Michael Ferdman, Anastasia Ailamaki, Babak Falsafi, Andreas Moshovos, *In IEEE Micro's Top Picks*, volume 30, 2010. (original at HPCA'09)

[2006] **SimFlex: Statistical Sampling of Computer System Simulation**

Thomas F. Wenisch, Roland E. Wunderlich, Michael Ferdman, Anastasia Ailamaki, Babak Falsafi, James C. Hoe, *In IEEE Micro*, volume 26, 2006.

#### Technical Reports

[2017] **A VM-HDL Co-Simulation Framework for Systems with PCIe-Connected FPGAs**

Shengsun Cho, Mrunal Patel, Basavaraj Kaladagi, Han Chen, Tapti Palit, Michael Ferdman, Peter Milder, Technical report #839, Stony Brook CEAS, 2017.

## Teaching

### **Stony Brook University**

	Stony Brook, NY
<i>CSE 506 - Graduate Operating Systems</i>	Fall 2017
<i>CSE 502 - Graduate Computer Architecture</i>	Spring 2017
<i>CSE 356 - Cloud Computing</i>	Spring 2017
<i>CSE 506 - Graduate Operating Systems</i>	Fall 2015
<i>CSE 356(391) - Cloud Computing</i>	Fall 2015
<i>CSE 506 - Graduate Operating Systems</i>	Spring 2015
<i>CSE 602 - Graduate Advanced Computer Architecture</i>	Fall 2014
<i>CSE 502 - Graduate Computer Architecture</i>	Spring 2014
<i>CSE 506 - Graduate Operating Systems</i>	Fall 2013
<i>CSE 502 - Graduate Computer Architecture</i>	Spring 2013
<i>CSE 602 - Graduate Advanced Computer Architecture</i>	Fall 2012

### **Ecole Polytechnique Fédérale de Lausanne**

	Lausanne, Switzerland
<i>TA - Advanced Topics on Memory Systems (graduate)</i>	Spring 2009 (Babak Falsafi)
<i>TA - Multiprocessor Architecture (graduate)</i>	Fall 2008 (Babak Falsafi)

### **Carnegie Mellon University**

	Pittsburgh, PA
<i>TA - Multiprocessor Architecture (graduate)</i>	Spring 2006 (Babak Falsafi)
<i>TA - Advanced Techniques in Microprocessors (PhD)</i>	Fall 2005 (Babak Falsafi)
<i>TA - Operating Systems (undergraduate)</i>	Fall 2001 (Gregory Kesden)
<i>TA - Embedded Systems (undergraduate)</i>	Fall 2001 (Raj Rajkumar)

## Industry Experience

### **Telinta, Inc.**

Chief Technology Officer

Springfield, NJ

2002-

<b>Cadence Design Systems</b> <i>Software Engineer</i>	Pittsburgh, PA April 2004-August 2007
<b>Neoliner, Inc. (startup acquired by Cadence)</b> <i>Software Engineer</i>	Pittsburgh, PA March 2003-April 2004
<b>Automatika, Inc.</b> <i>Independent Contractor</i>	Pittsburgh, PA September 2002-January 2003
<b>National Robotics Engineering Consortium</b> <i>Circuit Designer and Software Engineer</i>	Pittsburgh, PA February 2001-May 2002

## Professional Service

Organizing committees: ISCA'17 (*finance chair*), IISWC'17 (*travel grant chair*), HPCA'17 (*workshops & tutorials chair*), ISPASS'17 (*workshops & tutorials chair*), ISPASS'16 (*publication chair*), ACM SRC at CGO'15 (*local organizer*), ISPASS'15 (*publication chair*), MICRO'14 (*publication chair*), ISPASS'14 (*web chair*)

Program committees: ISCA'18, HPCA'18, MICRO'17, ISCA'17, HPCA'17, CRC'17, ISCA'16, IISWC'16, ISPASS'16, MICRO'15, IISWC'15, ISCA'15, CGO'15, MICRO'14, ICS'14, ICPP'14, HiPEAC'14, ICCD'13, WIVOSCA'13, DATE'13, CCGrid'13, ISPASS'13, IPDPS'13

NSF invited workshops: *Workshop on Sustainable Data Centers '15*, *XPS Workshop on Exploiting Parallelism and Scalability '15*

External reviewer: ACM TACO'17, CAL'17, ACM TOS'16, MICRO'16, ACM TACO'16, HPCA'16, ACM TACO'15, CAL'15, HPCA'15, ASPLOS'15, CF'14, ISCA'14, TC'14, HPCA'14, PPoPP'14, CAL'13, DAC'13, HPCA'13, JCST'13, MICRO'12, IISWC'12, CAL'12, HPCA'12, IISWC'11, MICPRO/DSD'11, ICS'11, ISCA'11, HPCA'11, HiPEAC'10, ISCA'10, HPCA'10, JPDC'09

NSF service: 2016 (*panelist, reviewer*), 2014 (*panelist*)

Invited Lectures and Talks: *Cloud Computing course at HiPEAC ACACES'17*, *Keynote at RAPIDO'13*

PhD committees: *Tan Li (Harness Multicore Parallelism for High Performance Data Replication)*, *Fatima Zarinni (Understanding and Improving Performance in Next-Generation WiFi and Cellular Networks)*, *Mingwei Zhang (Static Binary Instrumentation with Applications to COTS Software Security)*, *Niranjan Hasabnis (Infrastructure for Architecture-independent Binary Analysis and Transformation)*, *Vasily Tarasov (Multi-dimensional Analysis of I/O Workloads for Modern Storage Systems)*, *Zhichao Li (GreenDM: A Versatile Tiering Hybrid Drive for the Trade-Off Evaluation of Performance, Energy, and Endurance)*, *Cheng-Chun (William) Tu (Memory-based Rack-area Network)*

MS committees: *Bharath Kumar Reddy Vangoor (To FUSE or not to FUSE?)*, *Kavita Agarwal (A Study of Virtualization Overheads)*, *Arun Olappamanna Vasudevan (Finding the right balance - Security vs Performance with Network Storage Systems)*

Department Service: *CS Operations Committee (S'17, F'16, S'16)*, *Graduate Committee (S'17, F'16, S'16)*, *Undergraduate Committee (S'16)*, *Open House Chair (S'17, S'16, S'15)*, *Graduate Admission Committee (S'17, F'16, S'16, F'15, S'15, S'14, F'14, F'13, S'13, F'12)*, *Faculty Recruitment Committee (S'17, S'14, F'14)*, *Department Orientation Organizer (F'16)*

Co-developer of *CloudSuite*, a benchmark suite for scale-out workloads.

Co-developer of *FLEXUS*, a scalable, full-system, cycle-accurate multi-processor and multi-core simulation framework between 2005 and 2012.

*SIMFLEX and ProtoFlex: Fast, Accurate, and Flexible Simulation of Computer Systems* Tutorial at

- 2010 IEEE International Symposium on Workload Characterization (IISWC). Atlanta, GA, December 2010 with Eric Chung, Pejman Lotfi-Kamran, and Michael Papamichael.
- 42st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO). New York, NY, December 2009 with Eric Chung and Michael Papamichael.
- 17th International Conference on Parallel Architectures and Compilation Techniques (PACT), Toronto, Canada, October 2008 with Eric Chung and Nikos Hardavellas.

Organizer of the Fall 2009 weekly seminar of the Systems Labs at Ecole Polytechnique Fédérale de Lausanne.

Organizer of the Fall 2007 weekly seminar of the Computer Architecture Lab at Carnegie Mellon (CALCM).

Member, IEEE Computer Society, ACM SIGARCH, ACM SIGMICRO, ACM SIGOPS, HiPEAC Associate.

## Funding

National Science Foundation - SPX: Harnessing the Power of High-Bandwidth Memory via Provably Efficient Parallel Algorithms

PI, \$750,000 (\$500,000 SBU, \$250,000 WUSTL), 9/15/2017 - 8/14/2021

Xilinx Corporation - FPGA Hardware for research

Donation, equipment (\$7,000), 7/28/2017

Samsung - SSD Hardware for research

Donation, equipment (\$2,000), 7/6/2017

National Science Foundation - Domestic student travel grant funding for IISWC

PI, \$15,000, 6/01/2017 - 12/31/2017

National Science Foundation - EAGER: Measuring the Stability of Web Links

Co-PI, \$89,200, 4/15/2017 - 10/15/2017

National Science Foundation - Research Experiences for Undergraduates: Secure and Efficient Cloud Infrastructure and Accessibility Services

PI, \$21,900, 8/10/2016 - 8/9/2017

National Science Foundation - EAGER: Preliminary Study to Demonstrate Feasibility and Advantages of Massively Parallel Server Processors

Co-PI, \$146,000, 10/1/2016 - 9/30/2017

Oracle Labs - Exploring Custom Graph Algorithms with PGX and Green-Marl

Gift, \$55,000, 8/17/2016

Google - Taming the Killer Microsecond

Gift, \$58,500, 9/2/2016

National Science Foundation - XPS: FPGA Cloud Platform for Deep Learning, Applications in Computer Vision

PI, \$875,000 (\$574,000 SBU, \$301,000 UNC), 9/1/2015 - 8/31/2019

Intel Corporation - Hardware for research

Donation, equipment (\$21,600), 8/6/2015

National Science Foundation - CAREER: Leveraging temporal streams for micro-architectural innovation in data center servers

PI, \$500,000, 2/15/2015 - 1/31/2020

National Science Foundation - EAGER: Preliminary Study to Demonstrate the Performance and Power Advantages of FPGAs for Deep Learning in Computer Vision

PI, \$95,000, 8/1/2014 - 7/31/2016

Altera Corporation - FPGA Hardware for research

Donation, equipment (\$16,000), 10/22/2014

Cavium - Support of research activities

Gift, \$34,400 + equipment, 7/17/2014

National Science Foundation - CRI: Secure and Efficient Cloud Infrastructure and Accessibility Services

PI, \$200,000, 9/1/2014 - 8/31/2017

Semiconductor Research Corporation - Flexible Hardware Acceleration of the Network Stack for Performance and Energy Efficiency

PI, \$300,000, 1/1/2014 - 1/31/2017

## **Advisees**

### ***PhD (7 students)***

Varun Agrawal, 2013-present

Shenghsun Cho, 2014-present

Yongming Shen, 2014-present

Yuxuan Shui, 2014-2015 (MS Advanced Project), 2016-present

Mina Abbasi Dinani, 2016-present

Sergey Madaminov, 2016-present

Umit Akgun, 2017-present

### ***MS Thesis (2 students)***

Tapti Palit, 2014-2015, Benchmarking Network-Intensive Applications

Manoj Alwani, 2015-2016, Fused Convolutional Neural Network Accelerators

### ***MS Advanced Project (47 students)***

Agarwal Bhavya, Amogh Aakshintala, Balakrishnan Gangabarani, Battula Yagna Srinath Reddy, Bhandary S Sunad, Bhattacharjee Parikshit, Binnamangala Prabhu Shreyas, Chakka Krishna Chaitanya, Chandramohan Rohit, Chandrasekaran Shyam Sundar, Chauhan Abhishek, Dabral Abhiroop, Devineni Dhruva Kumar, Dixit Neeraj, Dsouza Romeyo, Gadi Rahul, Gupta Parag, Harvey Scott, Kaladagi Basavaraj, Kale Akshay, Kalita Arnabjyoti, Krishnamurthy Vinay, Kyathanahalli Sumeeth, Manoharan Tamilmani, Mathew Paul, Mathew Subin, Naik Mandar, Nayak Vishal, Palit Tapti, Panda Biswaranjan, Pandey Ravi Prakash, Parmar Sahil, Patil Ravikiran, Potdar Shantanu, Pugla Karan, Raghupatruni Rajendra Kumar, Rajesh Aavuty, Ramanathan Chidambaram, Sen Saptarshi, Shaji George Jerrin, Shetty Vinay, Singh Aditi, Srinivasan Balaji, Thakur Devashish, Venkatesh Varsha, Wang Yigong, Yang Jihyun

### ***BS Honors Project (1 student)***

Mehrab Hoque

### ***BS Research (4 students)***

Edgar Samudio, Eniola Abdul Mrunal Patel, Roman Scher