

Michael Wei

Full-Stack Systems Researcher.

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about

I'm a full-stack systems researcher. I dive deep into all aspects of complex systems to understand what makes them tick, and what makes them break. My research and open source contributions span multiple disciplines, including computer architecture, distributed systems, operating systems, and programming languages.

Through the course of my work, I have not only developed cost-effective hardware to simplify distributed systems, but also devised innovative approaches to streamline traditionally opaque operating system interfaces. My aim is always to leverage interdisciplinary insights for improved efficiency and resilience, while actively sharing knowledge through accessible, comprehensive documentation and meaningful open-source contributions.

experience

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|-------------|--|-------------------------------------|
| 2023–Now | Senior Research Scientist, AI Labs As a researcher at the VMware Research Group, a part of VMware AI Labs, I lead efforts in sustainable AI systems infrastructure, leveraging low power and edge accelerators on platform such as the AGX Orin. | VMware Research |
| 2020–2023 | Senior Research Scientist I lead the clocks project, which aims to democratize precision time and leverage it as a distributed primitive. I also serve as a technical advisor to the VMware blockchain product, especially in scaling the VMware Ethereum stack. | VMware Research |
| 2017–2020 | Research Scientist I published award-winning papers on a broad range of topics including bridging the semantic gaps between kernel and userspace, interfaces for programmable hardware, RDMA and security. | VMware Research |
| 2015–2017 | Postdoctoral Researcher I led the tech transfer of CorfuDB, a high throughput, strongly consistent research database as open-source software with over 50 contributors into NSX, VMware's market leading multi-billion dollar SDN product. CorfuDB now serves as the distributed control plane of NSX. | VMware Research |
| Winter 2015 | Research Intern I led the rebuild of CORFU, a research project I worked on at Microsoft Research, from scratch in Java as CorfuDB, adding object support, in-memory time-travel and new transaction resolution mechanisms. | VMware Research |
| 2011–2013 | Consultant Researcher I implemented and evaluated ZooKeeper over CORFU, one of the first scale-out applications running on top of the CORFU distributed log. | Microsoft Research |
| Summer 2011 | Research Intern I built a hardware prototype of a CORFU Flash Unit using the BEE3 FPGA Platform. | Microsoft Research |
| 2010–2017 | Graduate Researcher At the Non-Volatile Systems Laboratory (NVSL), I led work on reliably erasing flash memory and reported findings to the military and other government organizations. | University of California, San Diego |
| 2008–2009 | Undergraduate Researcher At the Cognitive Anterior Robotics Laboratory (CARL), I worked on an optimized version of the Izhikevich spiking neuron model on the IBM CELL. | University of California, Irvine |

2006–Now

Independent Contractor

Wei Enterprises

I build hardware and software for startups under tight deadlines. My code runs in consumer products all over the world.

education

2010–2017

Ph.D., Computer Science

University of California, San Diego

Advisor Steven Swanson

Thesis CORFU: A Platform for Scalable Consistency

2010–2015

C. Phil, Computer Science

University of California, San Diego

2010–2012

M.S., Computer Science

University of California, San Diego

2004–2009

B.S., Computer Science

University of California, Irvine

2004–2009

B.S., Biological Sciences

University of California, Irvine

2004–2009

B.A., Philosophy

University of California, Irvine

awards

2022

Best Paper Award

NSDI 2022

Graham: Synchronizing Clocks by Leveraging Local Clock Properties

2020

Best Paper Award

Eurosys 2020

Don't shoot down TLB shutdowns!

2019

Best Paper Award

Systor 2019

Storm: A Fast Transactional Dataplane for Remote Data Structures

2017

Best Paper Award

USENIX ATC 2018

The Design and Implementation of Hyperupcalls

2016

Best Paper Award

USENIX ATC 2016

Replex: A Scalable, Highly Available Multi-Index Store

2014

Best WACI Talk

ASPLOS 2014

Dirty RAM and Rotten Caches: Saving the World From Useless Updates

2012

Google Security Hall of Fame

Google

Google Voice Authentication Flaw

2012

Graduate Research Fellowship Program (GRFP)

NSF

Fellow Award Recipient

2011

Graduate Research Fellowship Program (GRFP)

NSF

Honorable Mention

publications

Refereed Papers

NSDI '22

Graham: Synchronizing Clocks by Leveraging Local Clock Properties

Best Paper

Ali Najafi and **Michael Wei**

19th USENIX Symposium on Networked Systems Design and Implementation (NSDI 22), 2022, Renton, WA

SYSTOR '21

Dealing with (Some of) the Fallout from Meltdown

Nadav Amit, **Michael Wei**, and Dan Tsafir

Proceedings of the 14th ACM International Conference on Systems and Storage, 2021, Haifa, Israel. doi: [10.1145/3456727.3463776](https://doi.org/10.1145/3456727.3463776)

- HotOS '21 Systems Research is Running out of Time
Ali Najafi, Amy Tai, and **Michael Wei**
Proceedings of the Workshop on Hot Topics in Operating Systems, 2021, Ann Arbor, Michigan. DOI: [10.1145/3458336.3465293](https://doi.org/10.1145/3458336.3465293)
- USENIX ATC '21 RainBlock: Faster Transaction Processing in Public Blockchains
Soujanya Ponnappalli, Aashaka Shah, Souvik Banerjee, Dahlia Malkhi, Amy Tai, Vijay Chidambaram, and **Michael Wei**
2021 USENIX Annual Technical Conference (USENIX ATC 21), 2021
- OSDI '21 Optimizing Storage Performance with Calibrated Interrupts
Amy Tai, Igor Smolyar, **Michael Wei**, and Dan Tsafirir
15th USENIX Symposium on Operating Systems Design and Implementation (OSDI 21), 2021
- EuroSys '20 **Best Paper** Don't Shoot down TLB Shootdowns!
Nadav Amit, Amy Tai, and **Michael Wei**
Proceedings of the Fifteenth European Conference on Computer Systems, 2020, Heraklion, Greece. DOI: [10.1145/3342195.3387518](https://doi.org/10.1145/3342195.3387518)
- USENIX ATC '19 JumpSwitches: Restoring the Performance of Indirect Branches In the Era of Spectre
Nadav Amit, Fred Jacobs, and **Michael Wei**
2019 USENIX Annual Technical Conference (USENIX ATC 19), 2019, Renton, WA
- SYSTOR '19 **Best Paper** Storm: A Fast Transactional Dataplane for Remote Data Structures
Stanko Novakovic, Yizhou Shan, Aasheesh Kolli, Michael Cui, Yiyang Zhang, Haggai Eran, Boris Pismenny, Liran Liss, **Michael Wei**, Dan Tsafirir, and Marcos Aguilera
Proceedings of the 12th ACM International Conference on Systems and Storage, 2019, Haifa, Israel. DOI: [10.1145/3319647.3325827](https://doi.org/10.1145/3319647.3325827)
- ASPLOS '19 Just-In-Time Compilation for Verilog: A New Technique for Improving the FPGA Programming Experience
Eric Schkufza, **Michael Wei**, and Christopher J. Rossbach
Proceedings of the Twenty-Fourth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 19), 2019, Providence, RI, USA. DOI: [10.1145/3297858.3304010](https://doi.org/10.1145/3297858.3304010)
- USENIX ATC '18 Remote regions: a simple abstraction for remote memory
Marcos K. Aguilera, Nadav Amit, Irina Calciu, Xavier Deguillard, Jayneel Gandhi, Stanko Novaković, Arun Ramanathan, Pratap Subrahmanyam, Lalith Suresh, Kiran Tati, Rajesh Venkatasubramanian, and **Michael Wei**
2018 USENIX Annual Technical Conference (USENIX ATC 18), 2018, Boston, MA
- USENIX ATC '18 **Best Paper** The Design and Implementation of Hyperupcalls
Nadav Amit and **Michael Wei**
2018 USENIX Annual Technical Conference (USENIX ATC 18), 2018, Boston, MA
- OSDI '18 Sharing, Protection, and Compatibility for Reconfigurable Fabric with AmorphOS
Ahmed Khawaja, Joshua Landgraf, Rohith Prakash, **Michael Wei**, Eric Schkufza, and Christopher J. Rossbach
13th USENIX Symposium on Operating Systems Design and Implementation (OSDI 18), 2018, Carlsbad, CA
- HotOS '17 Hypercallbacks: Decoupling Policy Decisions and Execution
Nadav Amit, **Michael Wei**, and Cheng-Chun Tu
Proceedings of the 16th Workshop on Hot Topics in Operating Systems, 2017, Whistler, BC, Canada. DOI: [10.1145/3102980.3102987](https://doi.org/10.1145/3102980.3102987)
- SysTeX '17 Hypercallbacks: A New Mechanism for Trusted, Secure Introspection
Michael Wei and Nadav Amit
2nd Workshop on System Software for Trusted Execution (SysTEX 2017), 2017, Shanghai, CN
- NSDI '17 vCorfu: A Cloud-Scale Object Store on a Shared Log
Michael Wei, Amy Tai, Christopher J. Rossbach, Ittai Abraham, Maithem Munshed, Medhavi Dhawan, Jim Stabile, Udi Wieder, Scott Fritch, Steven Swanson, Michael J. Freedman, and Dahlia Malkhi
14th USENIX Symposium on Networked Systems Design and Implementation (NSDI 17), 2017, Boston, MA

- USENIX ATC '16 Best Paper** Replex: A Scalable, Highly Available Multi-Index Data Store
Amy Tai, **Michael Wei**, Michael J. Freedman, Ittai Abraham, and Dahlia Malkhi
2016 USENIX Annual Technical Conference (USENIX ATC 16), 2016, Denver, CO
- HotStorage '16** Silver: A Scalable, Distributed, Multi-versioning, Always Growing (Ag) File System
Michael Wei, Chris Rossbach, Ittai Abraham, Udi Wieder, Steven Swanson, Dahlia Malkhi, and Amy Tai
8th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage 16), 2016, Denver, CO
- NVMW '15** AppNVM: A software-defined, application-driven SSD
Matias Bjørling, **Michael Wei**, Jesper Madsen, Javier González, Steven Swanson, and Philippe Bonnet
6th Annual Non-Volatile Memories Workshop 2015 (NVMW 2015), 2015, San Diego, CA
- USENIX ATC '14** I/O Speculation for the Microsecond Era
Michael Wei, Matias Bjørling, Philippe Bonnet, and Steven Swanson
2014 USENIX Annual Technical Conference (USENIX ATC 14), 2014, Philadelphia, PA
- SOSP '13** Tango: Distributed Data Structures over a Shared Log
Mahesh Balakrishnan, Dahlia Malkhi, Ted Wobber, Ming Wu, Vijayan Prabhakaran, **Michael Wei**, John D. Davis, Sriram Rao, Tao Zou, and Aviad Zuck
Proceedings of the Twenty-Fourth ACM Symposium on Operating Systems Principles, 2013, Farmington, Pennsylvania. doi: [10.1145/2517349.2522732](https://doi.org/10.1145/2517349.2522732)
- IEEE S&P '13** Welcome to the Entropics: Boot-Time Entropy in Embedded Devices
Keaton Mowery, **Michael Wei**, David Kohlbrenner, Hovav Shacham, and Steven Swanson
2013 IEEE Symposium on Security and Privacy, 2013, Oakland, CA. doi: [10.1109/SP.2013.46](https://doi.org/10.1109/SP.2013.46)
- SYSTOR '13** Beyond Block I/O: Implementing a Distributed Shared Log in Hardware
Michael Wei, John D. Davis, Ted Wobber, Mahesh Balakrishnan, and Dahlia Malkhi
Proceedings of the 6th International Systems and Storage Conference, 2013, Haifa, Israel. doi: [10.1145/2485732.2485739](https://doi.org/10.1145/2485732.2485739)
- NSDI '12** CORFU: A Shared Log Design for Flash Clusters
Mahesh Balakrishnan, Dahlia Malkhi, Vijayan Prabhakaran, Ted Wobber, **Michael Wei**, and John D. Davis
9th USENIX Symposium on Networked Systems Design and Implementation (NSDI 12), 2012, San Jose, CA
- FAST'11** Reliably Erasing Data from Flash-Based Solid State Drives
Michael Wei, Laura M. Grupp, Frederick E. Spada, and Steven Swanson
Proceedings of the 9th USENIX Conference on File and Storage Technologies, 2011, San Jose, California
- BuildSys'10** Occupancy-Driven Energy Management for Smart Building Automation
Yuvraj Agarwal, Bharathan Balaji, Rajesh Gupta, Jacob Lyles, **Michael Wei**, and Thomas Weng
Proceedings of the 2nd ACM Workshop on Embedded Sensing Systems for Energy-Efficiency in Building, 2010, Zurich, Switzerland. doi: [10.1145/1878431.1878433](https://doi.org/10.1145/1878431.1878433)

Journal Articles

Leveraging Hyperupcalls To Bridge The Semantic Gap: An Application Perspective

Michael Wei and Nadav Amit

IEEE Data Eng. Bull. 42.1 (2019) pp. 22–35. 2019

Consistent Clustered Applications with Corfu

Michael Wei, Medhavi Dhawan, Gurprit Johal, Jim Stabile, Vjekoslav Brajkovic, James Chang, Kapil Goyal, Kevin James, Zee-shan Lokhandwala, Anny Martinez Manzanilla, Roger Michoud, Maithem Munshed, Srinivas Neginhal, Konstantin Spirov, Scott Fritchie, Chris Rossbach, Ittai Abraham, and Dahlia Malkhi

SIGOPS Oper. Syst. Rev. 51.1 (Sept. 2017) pp. 78–82. *Association for Computing Machinery*, 2017, doi: [10.1145/3139645.3139658](https://doi.org/10.1145/3139645.3139658)

CORFU: A Distributed Shared Log

Mahesh Balakrishnan, Dahlia Malkhi, John D. Davis, Vijayan Prabhakaran, **Michael Wei**, and Ted Wobber

ACM Trans. Comput. Syst. 31.4 (Dec. 2013). *Association for Computing Machinery*, 2013, doi: [10.1145/2535930](https://doi.org/10.1145/2535930)

Technical Reports

Dynamically scalable, fault-tolerant coordination on a shared logging service

Michael Wei, Mahesh Balakrishnan, John D Davis, Dahlia Malkhi, Vijayan Prabhakaran, and Ted Wobber

Technical Report MSR-TR-2013-40, 2013

SAFE: Fast, Verifiable Sanitization for SSDs

Steven Swanson and **Michael Wei**

Technical Report UCSD TR-cs2011-0963, 2011

Patents

| | |
|-----------------|---|
| US10545742B2 | Annotation-driven framework for generating state machine updates |
| US20210026785A1 | Enforcing code integrity using a trusted computing base |
| US11055184B2 | In-place garbage collection of a sharded, replicated distributed state machine |
| US11003471B2 | Just-in-time hardware for field programmable gate arrays |
| US11003472B2 | Just-in-time hardware for field programmable gate arrays |
| US10997338B2 | Just-in-time hardware for field programmable gate arrays |
| US10990730B2 | Just-in-time hardware for field programmable gate arrays |
| US10990730B2 | Just-in-time hardware for field programmable gate arrays |
| US11068422B1 | Software-controlled interrupts for I/O devices |
| US10908912B1 | Target injection safe method for dynamically inlining branch predictions |
| US10649981B2 | Direct access to object state in a shared log |
| US10642792B2 | Distributed transaction conflict resolution |
| US10819611B2 | Dynamic timeout-based fault detection |
| US10706005B2 | File system interface for remote direct memory access |
| US10635541B2 | Fine-grained conflict resolution in a shared log |
| US10877881B2 | In-place garbage collection of a sharded, replicated distributed state machine |
| US10574571B2 | Method for transparently logging and replicating distributed services |
| US10599835B2 | 32-bit address space containment to secure processes from speculative rogue cache loads |
| US10878085B2 | Compilation-time checks to secure processes from speculative rogue cache loads |
| US20190243966A1 | Dynamic binary translation to secure processes from speculative rogue cache loads |
| US10824717B2 | Dynamic binary translation to secure processes from speculative rogue cache loads |
| US11016767B2 | Target injection safe method for inlining instance-dependent calls |
| US10834255B1 | Target injection safe method for inlining large call tables |
| US10871974B1 | Target injection safe method for inlining registration calls |
| US20190065327A1 | Efficient versioned object management |
| US20190129982A1 | Just-in-time multi-indexed tables in a shared log |
| US20190243776A1 | 32-bit address space containment to secure processes from speculative rogue cache loads |
| US20190243965A1 | Compilation-time checks to secure processes from speculative rogue cache loads |
| US20190243990A1 | Separate cores to secure processes from speculative rogue cache loads |
| US20190236229A1 | Just-in-time hardware for field programmable gate arrays |

US20190235892A1 Just-in-time hardware for field programmable gate arrays
US20190236231A1 Just-in-time hardware for field programmable gate arrays
US20190235893A1 Just-in-time hardware for field programmable gate arrays
US20190236230A1 Just-in-time hardware for field programmable gate arrays
US20180276234A1 Distributed transaction conflict resolution
US20180321963A1 Safe execution of virtual machine callbacks in a hypervisor

service

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|-----------|------------------|----------------|
| 2024 | PC Member | ASPLOS |
| 2023 | PC Member | OSDI |
| 2022–2023 | PC Member | NSDI |
| 2020 | PC Member | HotCloud |
| 2018–2019 | PC Member | USENIX ATC |
| 2018 | PC Member | ACM SoCC |
| 2017 | PC Member | ACM Middleware |
| 2017–2023 | PC Member | HotStorage |
| 2011–2015 | Web Chair | NVMW |