

Michael Wei

Full-Stack Systems Researcher.

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about

I'm a full-stack systems researcher that exploits **all** layers of the stack. To me, optimizing and designing systems means building PCBs if we can do it with inexpensive **hardware**, using **programming language** and **computer architecture** techniques to securely cut across **operating system** interfaces, or using a new **distributed systems** protocols once we convince ourselves they are safe and sound. My most recently, I've looked at **blockchains**, which I view as the intersection of computer science and finance, and **clocks**, which still have much untapped potential in computer systems.

In my free time, I solo remodel homes, tinker with home automation (contributions to the home-assistant and Frigate Object Detection projects) and travel hack flights around the world.

experience

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|-------------|--|---------------------------|
| 2020–Now | VMware Research 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. | Senior Research Scientist |
| 2017–2020 | VMware Research I published award-winning papers with my collaborators and found a forte in extracting key insights from complex research ideas. I worked on a broad range of topics including bridging the semantic gaps between kernel and userspace, interfaces for programmable hardware, RDMA and security. | Research Scientist |
| 2015–2017 | VMware Research I lead the tech transfer of CorfuDB 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, providing a high throughput, strongly consistent fabric. | Postdoctoral Researcher |
| Winter 2015 | VMware Research I led the rebuild of CORFU from scratch in Java as CorfuDB, adding object support, in-memory time-travel and new transaction resolution mechanisms. | Research Intern |
| 2011–2013 | Microsoft Research I implemented ZooKeeper over CORFU. | Consultant Researcher |
| Summer 2011 | Microsoft Research I built a hardware prototype of a CORFU Flash Unit using the BEE3 FPGA Platform. | Research Intern |
| 2010–2017 | University of California, San Diego At the Non-Volatile Systems Laboratory (NVSL), I led work on reliably erasing flash memory and reported findings to government organizations and the military. | Graduate Researcher |
| 2008–2009 | University of California, Irvine At the Cognitive Ant eater Robotics Laboratory (CARL), I worked on an optimized version of the Izhikevich spiking neuron model on the IBM CELL. | Undergraduate Researcher |
| 2006–Now | Wei Enterprises I build hardware and software for startups under tight deadlines. My code runs in consumer products all over the world. | Independent Contractor |

education

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|-----------|---|-------------------------------------|
| 2010–2017 | Ph.D., Computer Science Advisor Steven Swanson Thesis CORFU: A Platform for Scalable Consistency | University of California, San Diego |
| 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

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|------|---|-----------------|
| 2020 | Best Paper Award Don't shoot down TLB shutdowns! | Eurosys 2020 |
| 2019 | Best Paper Award Storm: A Fast Transactional Dataplane for Remote Data Structures | Systor 2019 |
| 2017 | Best Paper Award The Design and Implementation of Hyperupcalls | USENIX ATC 2018 |
| 2016 | Best Paper Award Replex: A Scalable, Highly Available Multi-Index Store | USENIX ATC 2016 |
| 2014 | Best WACI Talk Dirty RAM and Rotten Caches: Saving the World From Useless Updates | ASPLOS 2014 |
| 2012 | Google Security Hall of Fame Google Voice Authentication Flaw | Google |
| 2012 | Graduate Research Fellowship Program (GRFP) Fellow Award Recipient | NSF |
| 2011 | Graduate Research Fellowship Program (GRFP) Honorable Mention | NSF |

publications

Refereed Papers

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|----------------|---|
| SYSTOR '21 | Dealing with (Some of) the Fallout from Meltdown Nadav Amit, Michael Wei , and Dan Tsafir <i>Proceedings of the 14th ACM International Conference on Systems and Storage</i> , 2021, Haifa, Israel. DOI: 10.1145/3456727.3463776 |
| HotOS '21 | Systems Research is Running out of Time Ali Najafi, Amy Tai, and Michael Wei <i>Proceedings of the Workshop on Hot Topics in Operating Systems</i> , 2021, Ann Arbor, Michigan. DOI: 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 <i>2021 USENIX Annual Technical Conference (USENIX ATC 21)</i> , 2021 |
| OSDI '21 | Optimizing Storage Performance with Calibrated Interrupts Amy Tai, Igor Smolyar, Michael Wei , and Dan Tsafir <i>15th USENIX Symposium on Operating Systems Design and Implementation (OSDI 21)</i> , 2021 |
| Page 2 of 5 | Michael Wei - Curriculum Vitae Built 2021-10-04 21:42:25Z, latest: http://wei.systems/cv.pdf |

- 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](#)
- 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 Tsafir, and Marcos Aguilera
Proceedings of the 12th ACM International Conference on Systems and Storage, 2019, Haifa, Israel. doi: [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](#)
- 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](#)
- 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 Roszbach, 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)

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

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