

Per Larsen

Immunant, Inc.
5141 California Ave., Suite 250
Irvine, CA 92617 U.S.A.

Phone: 949-293-7927
Email: perl@immunant.com, perl@uci.edu
URL: <http://ics.uci.edu/~perl>
LinkedIn: <https://www.linkedin.com/in/perlarsen/>

Current Position

CEO & Co-founder, Immunant, Inc., California

Areas of Specialization

Systems Security; Software Diversity; Exploit Mitigation.

Professional Experience

2015–present Project Scientist, University of California, Irvine
2011–2015 Postdoctoral Scholar, University of California, Irvine
2010–2010 Summer Intern, IBM Haifa Research Labs
2005–2007 Software Engineer, IHPostal A/S
2002–2005 Software Engineer, Mobilized Workforce A/S
2000–2002 Software Engineer, Aston Business Solutions A/S

Education

2011 PhD in Computer Science, Technical University of Denmark
2005 MSc in Computer Science, Technical University of Denmark

Patents & Honors

- 2018 Andrei Homescu, Stephen Crane, and Per Larsen; “Software Diversification in External Contexts”; United States Application No. 15,871,663; filed January 2018.
- 2016 Michael Franz, Andrei Homescu, Stefan Brunthaler, and Per Larsen; “Code Randomization for Just-In-Time Compilers”; United States Patent No. 9,250,937; filed November 2014, issued February 2016.
- 2015 Recognized as a DARPA Riser[†]
- 2015 Per Larsen, Stefan Brunthaler, and Michael Franz; “Error Report Normalization”; United States Application No. US 15,514,811, filed October 2015.

Service to the Profession

- 2018 Program Committee Member, WOOT
- 2018 Program Committee Member, ASIACCS
- 2017 Program Committee Member, WOOT
- 2017 Program Committee Member, ASIACCS
- 2016 Program Committee Member, USENIX Security Symposium
- 2016 Program Committee Member, ICDCS

Publications

BOOKS

- 2015 Per Larsen, Stefan Brunthaler, Luca Davi, Ahmad-Reza Sadeghi, and Michael Franz; “Automated Software Diversity”; Morgan & Claypool, San Rafael, California; December 2015. ISBN 978-1-6270-5734-9 (paperback), ISBN 978-1-6270-5755-4 (ebook).

EDITED VOLUMES

- 2018 Timothy Vidas, Per Larsen, Hamed Okhravi, Ahmad-Reza Sadeghi (Guest Eds.); “Hacking Without Humans”; *IEEE Security & Privacy Magazine*, Vol. 16, No. 2, March/April 2018.
- 2018 Per Larsen, Ahmad-Reza Sadeghi (Eds.); “The Continuing Arms Race: Code Reuse Attacks and Defenses”; ACM and Morgan & Claypool, New York, NY; 2018. ISBN: 978-1-97000-183-9 (hardcover), ISBN : 978-1-97000-181-5 (ebook).

[†]This early-career honor is conferred to “[up-and-coming standouts in their fields, capable of discovering and leveraging innovative opportunities for technological surprise.](#)”

JOURNAL ARTICLES

- J8 Nathan Burow, Scott A. Carr, Joseph Nash, Per Larsen, Michael Franz, Stefan Brunthaler, and Mathias Payer “Control-Flow Integrity: Protection, Security, and Performance”; in *ACM Computing Surveys (CSUR)*, Vol. 50, No. 1, Article No. 16; April 2017.
- J7 Gregor Wagner, Per Larsen, Stefan Brunthaler, and Michael Franz “Thinking Inside the Box: Compartmentalized Garbage Collection”; in *ACM Transactions on Programming Languages and Systems (TOPLAS)*, Vol. 38, No. 3, Article No. 9, May 2016.
- J6 Andrei Homescu, Todd Jackson, Stephen Crane, Per Larsen, and Michael Franz; “Large-scale Automated Software Diversity—Program Evolution Redux”; in *IEEE Transactions on Dependable and Secure Computing (TDSC)*, Issue 99, 2015.
- J5 Per Larsen, Stefan Brunthaler, Michael Franz; “Automatic Software Diversity”; in *IEEE Security & Privacy Magazine*, Vol. 13, No. 2, March 2015.
- J4 Gülfem Savrun-Yeniçeri, Wei Zhang, Huahan Zhang, Chen Li, Stefan Brunthaler, Per Larsen, and Michael Franz; “Efficient Interpreter Optimizations for the JVM”; in *ACM Transactions on Architecture and Code Optimization (TACO)*, Vol. 11, No. 1, Article No. 9; February 2014.
- J3 Per Larsen, Stefan Brunthaler, and Michael Franz; “Security Through Diversity: Are We There Yet?” in *IEEE Security & Privacy Magazine*, Vol. 12, No. 2, March 2014.
- J2 Christoph Kerschbaumer, Eric Hennigan, Per Larsen, Stefan Brunthaler, and Michael Franz; “Information Flow Tracking meets Just-In-Time Compilation.”; in *ACM Transactions on Architecture and Code Optimization (TACO)*, Vol. 10, No. 4, Article No. 38; December 2013.
- J1 Per Larsen, Sven Karlsson, and Jan Madsen; “Expressing Coarse-grain Dependencies among Tasks in Shared Memory Programs.” in *IEEE Transactions on Industrial Informatics*, Vol. 7, Issue 4. 2011.

CONFERENCE PAPERS

- C28 Dokyung Song, Julian Lettner, Prabhu Rajasekaran, Yeoul Na, Stijn Volckaert, Per Larsen, and Michael Franz “SoK: Sanitizing for Security”; to appear in 39th *IEEE Symposium on Security & Privacy*, 2019.
- C27 Julian Lettner, Dokyung Song, Taemin Park, Stijn Volckaert, Per Larsen, and Michael Franz “PartiSan: Fast and Flexible Sanitization via Run-time Partitioning”; to appear in 21st *International Symposium on Research in Attacks, Intrusions and Defenses*, 2018.
- C26 Stijn Volckaert, Bart Coppens, Bjorn De Sutter, Koen De Bosschere, Per Larsen, and Michael Franz “Taming Parallelism in a Multi-Variant Execution Environment”; in 2017 *European Conference on Computer Systems (EuroSys)*, 2017.
- C25 Robert Rudd, Richard Skowrya, David Bigelow, Veer Dedhia, Thomas Hobson, Stephen Crane, Christopher Liebchen, Per Larsen, Lucas Davi, Michael Franz, Ahmad-Reza Sadeghi, Hamed Okhravi “Address Oblivious Code Reuse: On the Effectiveness of Leakage Resilient Diversity”; in 2017 *Network and Distributed System Security Symposium (NDSS)*, 2017.
- C24 Stephen Crane, Andrei Homescu, and Per Larsen “Code Randomization: Haven’t We Solved This Problem Yet?”; in *IEEE Cybersecurity Development (SecDev)*, 2016.

- C23 Jason Gionta, William Enck, and Per Larsen “Preventing Kernel Code-Reuse Attacks Through Disclosure Resistant Code Diversification”; in *IEEE Conference on Communications and Network Security (CNS)*, 2016.
- C22 Dean Sullivan, Orlando Arias, Lucas Davi, Per Larsen, Ahmad-Reza Sadeghi, and Yier Jin “Strategy Without Tactics: Policy-Agnostic Hardware-Enhanced Control-Flow Integrity”; in *IEEE/ACM Design Automation Conference (DAC)*, 2016.
- C21 Mauro Conti, Stephen Crane, Tommaso Frassetto, Andrei Homescu, Georg Koppen, Per Larsen, Christopher Liebchen, Mike Perry, and Ahmad-Reza Sadeghi “Selfrando: Securing the Tor Browser against De-anonymization Exploits”; in *16th Privacy Enhancing Technologies Symposium (PETS)*, 2016.
- C20 Stijn Volckaert, Bart Coppens, Alexios Voulimenas, Andrei Homescu, Per Larsen, B. De Sutter, and Michael Franz; “Secure and Efficient Application Monitoring and Replication”; in *2016 USENIX Annual Technical Conference (ATC)*, 2016.
- C19 Julian Lettner, Benjamin Kollenda, Andrei Homescu, Per Larsen, Felix Schuster, Luca Davi, Ahmad-Reza Sadeghi, Thorsten Holz, and Michael Franz. “Subversive-C: Abusing and Protecting Dynamic Message Dispatch”; in *2016 USENIX Annual Technical Conference (ATC)*, 2016.
- C18 Kjell Braden, Stephen Crane, Luca Davi, Michael Franz, Per Larsen, Christopher Liebchen and Ahmad-Reza Sadeghi; “Leakage-Resilient Layout Randomization for Mobile Devices”; in *2016 Network and Distributed System Security Symposium (NDSS)*, 2016.
- C17 Stephen Crane, Stijn Volckaert, Felix Schuster, Christopher Liebchen, Per Larsen, Luca Davi, Ahmad-Reza Sadeghi, Thorsten Holz, Bjorn De Sutter, and Michael Franz; “It’s a TRAP: Table Randomization and Protection against Function Reuse Attacks”; in *22nd ACM Conference on Computer and Communications Security (CCS)*, 2015.
- C16 Mauro Conti, Stephen Crane, Luca Davi, Michael Franz, Per Larsen, Christopher Liebchen, Marco Negro, Mohammed Qunaibit, and Ahmad-Reza Sadeghi; “Losing Control: On the Effectiveness of Control-Flow Integrity under Stack Attacks”; in *22nd ACM Conference on Computer and Communications Security (CCS)*, 2015.
- C15 Gülfem Savrun-Yeniçeri, Michael L. Van de Vanter, Per Larsen, Stefan Brunthaler, and Michael Franz; “Efficient and Generic Event-based Profiler Framework for Dynamic Languages”; in *2015 International Conference on Principles and Practice of Programming on the Java Platform (PPPj)*, 2015.
- C14 Codruț Stancu, Christian Wimmer, Stefan Brunthaler, Per Larsen, and Michael Franz; “Safe and Efficient Hybrid Memory Management for Java”; in *International Symposium on Memory Management (ISMM)*, 2015.
- C13 Stephen Crane, Christopher Liebchen, Andrei Homescu, Luca Davi, Per Larsen, Ahmad-Reza Sadeghi, Stefan Brunthaler, and Michael Franz; “Readactor: Practical Code Randomization Resilient to Memory Disclosure”; in *36th IEEE Symposium on Security & Privacy*, 2015.
- C12 Vishwath Mohan, Per Larsen, Stefan Brunthaler, Kevin Hamlen, and Michael Franz; “Opaque Control-Flow Integrity”; in *2015 Network and Distributed System Security Symposium (NDSS)*, 2015.
- C11 Stephen Crane, Andrei Homescu, Stefan Brunthaler, Per Larsen, and Michael Franz; “Thwarting Cache-Based Side-Channel Attacks Through Dynamic Software Diversity”; in *2015 Network and Distributed System Security Symposium (NDSS)*, 2015.

- C10 Wei Zhang, Per Larsen, Stefan Brunthaler, Michael Franz; “Accelerating Iterators in Optimizing AST Interpreters”; in *ACM Research Conference on Object-Oriented Programming (OOPSLA)*, 2014.
- C9 Per Larsen, Andrei Homescu, Stefan Brunthaler, and Michael Franz; “SoK: Automated Software Diversity”; in *35th IEEE Symposium on Security and Privacy*, 2014.
- C8 Codruț Stancu, Christian Wimmer, Stefan Brunthaler, Per Larsen, and Michael Franz; “Comparing Points-to Static Analysis with Runtime Recorded Profiling”; in *International Conference on the Principles and Practice of Programming in Java (PPPJ)*, 2014.
- C7 Christoph Kerschbaumer, Eric Hennigan, Per Larsen, Stefan Brunthaler, and Michael Franz; “CrowdFlow: Efficient Information Flow Security”; in *16th Information Security Conference (ISC)*, 2013.
- C6 Andrei Homescu, Stefan Brunthaler, Per Larsen, and Michael Franz; “librando: Transparent Code Randomization for Just-in-Time Compilers”; in *20th ACM Conference on Computer and Communications Security (CCS)*, 2013.
- C5 Gülfem Savrun-Yeniçeri, Wei Zhang, Huahan Zhang, Chen Li, Stefan Brunthaler, Per Larsen, and Michael Franz; “Efficient Interpreter Optimizations for the JVM”; in *2013 International Conference on Principles and Practices of Programming on the Java Platform (PPPJ)*, 2013.
- C4 Christoph Kerschbaumer, Eric Hennigan, Per Larsen, Stefan Brunthaler, and Michael Franz; “Towards Precise and Efficient Information Flow Control in Web Browsers”; in *6th International Conference on Trust & Trustworthy Computing (TRUST)*, 2013.
- C3 Eric Hennigan, Christoph Kerschbaumer, Stefan Brunthaler, Per Larsen, and Michael Franz; “First-Class Labels: Using Information Flow to Debug Security Holes”, in *6th International Conference on Trust & Trustworthy Computing (TRUST)*, 2013.
- C2 Andrei Homescu, Steven Neisius, Per Larsen, Stefan Brunthaler, and Michael Franz; “Profile-guided Automated Software Diversity”; in *2013 International Symposium on Code Generation and Optimization (CGO)*, 2013.
- C1 Per Larsen, Razya Ladelsky, Jacob Lidman, Sally A. McKee, Sven Karlsson, and Ayal Zaks; “Parallelizing More Loops with Compiler Guided Refactoring”; in *41st International Conference on Parallel Processing (ICPP)*, 2012.

WORKSHOP PAPERS

- W9 Benjamin Davis, Per Larsen, Stijn Volckaert, Simon Winwood, David Melski, Michael Franz, and Stephen Magill; “Composition Challenges for Automated Software Diversity”; in *10th ACM Layered Assurance Workshop (LAW)*, 2016.
- W8 Mark Murphy, Per Larsen, Stefan Brunthaler, Michael Franz; “Software Profiling Options and Their Effects on Security Based Code Diversification”; in *First ACM Workshop on Moving Target Defense (MTD)*, 2014.
- W7 Stephen Crane, Per Larsen, Stefan Brunthaler, and Michael Franz; “Booby Trapping Software.”; in *2013 New Security Paradigms Workshop (NSPW)*, 2013.
- W6 Andrei Homescu, Michael Stewart, Per Larsen, Stefan Brunthaler, and Michael Franz; “Microgadgets: Size Does Matter in Turing-Complete Return Oriented Programming”; in *6th USENIX Workshop on Offensive Technologies (WOOT)*, 2012.
- W5

Nicklas Bo Jensen, Per Larsen, Razya Ladelsky, Ayal Zaks, and Sven Karlsson; “Guiding Programmers to Higher Memory Performance.”; in 5th *Workshop on Programmability Issues for Multi-Core Computers (MULTIPROG)*, 2012.

- W₄ Per Larsen, Razya Ladelsky, Sven Karlsson, and Ayal Zaks; “Compiler Driven Code Comments and Refactoring”; in *4th Workshop on Programmability Issues for Multi-Core Computers (MULTIPROG)*, 2011. **Best Paper Award.**
- W₃ Per Larsen, Razya Ladelsky, Sven Karlsson, and Ayal Zaks. “Compiler Driven Code Comments and Refactorin”; in *Third Swedish Workshop on Multi-Core Computing (MCC)*, 2010.
- W₂ Per Larsen, Sven Karlsson, and Jan Madsen. “Expressing Inter-task Dependencies between Parallel Stencil Operations.” in *3rd Workshop on Programmability Issues for Multi-Core Computers (MULTIPROG)*, 2010.
- W₁ Per Larsen, Sven Karlsson and Jan Madsen; “Identifying Inter-task Communication in Shared Memory Programming Models”; in *5th International Workshop on OpenMP (IWOMP)* 2009.

PRESENTATIONS & BOOK CHAPTERS

- 2018 Stephen Crane, Andrei Homescu, Per Larsen, Hamed Okhravi, Michael Franz; “Diversity and Information Leaks”; in P. Larsen, AR Sadeghi (Eds.), *The Continuing Arms Race*, ACM and Morgan & Claypool, ISBN: 978-1-97000-183-9, 2018.
- 2015 Stephen Crane, Christopher Liebchen, Andrei Homescu, Lucas Davi, Per Larsen, Ahmad-Reza Sadeghi, Stefan Brunthaler, Michael Franz; “Return to Where? You Can’t Exploit What You Can’t Find”; Presentation at *Black Hat USA*, August 2015.
- 2015 AR Sadeghi, L Davi, and P. Larsen; “Securing Legacy Software against Real-World Code-Reuse Exploits: Utopia, Alchemy, or Possible Future?”; Keynote at *10th ACM Symposium on Information, Computer and Communications Security (AsiaCCS)*, 2015.
- 2012 Todd Jackson, Andrei Homescu, Stephen Crane, Per Larsen, Stefan Brunthaler, and Michael Franz. “Diversifying the Software Stack using Randomized NOP Insertion”; in S. Jajodia, A. K. Gosh, V. S. Subrahmanian, V. Swarup, C. Wang, X. S. Wang (Eds.), *Moving Target Defense II: Application of Game Theory and Adversarial Modeling*, Springer, ISBN 978-1-4614-5415-1, 2012.