Per Larsen

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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[1]

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 ISBN: 978-1-97000-183-9 (hardcover), ISBN : 978-1-97000-181-5 (ebook).

[1] 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 Skowyra, 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, Mohanned 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 Codruţ 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 Codruţ 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.