

Denys Shabalin

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M.S. (Ph.D. expected) Computer Science
Lausanne, Switzerland
Ukrainian Citizen

My mission is to advance the state of the art of compiler construction and managed runtimes. In particular, I'm interested in optimizing compilers for modern high-level garbage-collected languages.

The majority of my work has been on the Scala programming language. I designed and implemented Scala Native, an ahead-of-time compiler and managed runtime for Scala based on LLVM, and co-founded Scalameta, infrastructure that enables next-generation developer tools for Scala.

Expertise

- Optimizing compilers
- Managed runtimes

Work History

- École polytechnique fédérale de Lausanne (EPFL)
Research Assistant
September 2014 — Present

My research at EPFL has been centered around Scala Native, an ahead-of-time compiler and managed runtime for the Scala programming language built on top of the LLVM compiler infrastructure. I designed and implemented the project from the ground up, starting from the NIR, Scala Native's intermediate representation.

My main focus has been on the development of the compiler infrastructure such as the design of the compilation pipeline from Scala to LLVM IR. In particular, I've developed a whole-program flow-sensitive optimizer called Interflow that in combination with LLVM optimizer is 10% faster than the HotSpot JVM on the benchmark suite from our paper. When used to optimize idiomatic Scala code, Interflow produces up to 3x faster results than bare LLVM through a combination of type-driven flow-sensitive devirtualization, partial escape analysis, and inlining.

I coordinated and supervised the design and development of a custom parallel garbage collector that fits into Scala Native runtime based on the Immix garbage collector design. It obtains comparable allocation rates to the parallel collector of the reference JDK implementation while consuming significantly less memory due to its non-copying nature.

I coordinated the open-source development of the project at large. Scala Native has attracted over 80 contributors who have made a major impact on the work towards library compatibility between JVM and Native implementations.

Additionally, as part of my research, I developed Scala Offheap, a library for high-performance off-heap memory management for Scala. It's based upon an efficient implementation of memory pools and completely eliminates the garbage collection cost for applications that are sensitive to the GC pause times.

- Lightbend Inc. (formerly Typesafe Inc.)
Software Engineer Intern
August 2013 — August 2014

As an intern at Typesafe Inc, I participated in the development of the official Scala compiler. I designed and implemented quasiquotes — a user-friendly notation for creating and matching abstract syntax trees that made a major impact on how users implement macros in Scala. Quasiquotes are implemented as a compile-time transformation that maps textual snippets of Scala code into lower-level code that constructs or deconstructs its corresponding AST.

Moreover, I also co-founded Scalameta together with Eugene Burmako. The project has grown to be the foundation for next-generation tools for Scala such as Scalafmt source code formatter, Scalafix migration tool, and Metals language server, as championed by Ólafur Páll Geirsson. I co-authored the initial design of the syntactic APIs (AST and token level introspection and rewriting) and implemented a Scala parser that works on top of those APIs.

- Fotobooka.com
Software Engineer Contractor
May 2011 — August 2012

Fotobooka.com is a photo album printing service that lets users compose their custom albums using WYSIWYG software. During my work at the company, I implemented a desktop client software for using a combination of Python and Qt technologies.

I also participated in the design and implementation of the backend software that

integrated the user-provided album designs into the publishers printing workflow. This includes the devops infrastructure for the deployment of the underlying web service.

Education

- École polytechnique fédérale de Lausanne (EPFL)
Ph.D. Computer Science: September 2014 — October 2019 (expected)
M.S. Computer Science: September 2012 — June 2014
- National University of Kyiv-Mohyla Academy
B.S. Applied Mathematics: September 2008 — June 2012

Written Work and Publications

- [“Interflow: interprocedural flow-sensitive type inference and method duplication”](#)
Denys Shabalin, Martin Odersky. Scala Symposium 2018, St. Louis, MO, 2018.
- [“Region-based off-heap memory for Scala”](#)
Denys Shabalin, Martin Odersky, Technical Report, 2015.
- [“Hygiene for Scala”](#)
Denys Shabalin, Jason Zaugg, Martin Odersky. Master Thesis, 2014.
- [“Quasiquotes for Scala”](#)
Denys Shabalin, Eugene Burmako, Martin Odersky. Technical Report, 2013.

Tech Talks

- “Interflow”
Scala Symposium 2018, St Louis, MO, September 2018.
- “Scala Native”
SF Scala meetup talk, San Francisco, CA, July 2017.
- “Fast startup & low latency: pick two”
Tech talk at Scala Days 2017, Copenhagen, Denmark, June 2017.
- “Coding up your first game in Scala Native”
Live coding tech demo at Scala Matsuri 2017, Tokyo, Japan, March 2017.

- "Managing Your Resources"
Tech talk at Scala World 2016, Lake District, UK, 2016.
- "Scala goes Native"
Tech talk at Scala Days 2016, New York City, NY, May 2016.
- "Type-safe off-heap memory for Scala"
Tech talk at Scala Days 2015, Amsterdam, Netherlands, June 2015.
- "Quote or be quoted"
Tech talk at Scala Days 2014, Berlin, Germany, June 2014.