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## ALEKSANDAR PROKOPEC

### Personal Information

Birth date: 6. August 1985.  
Slovenian, married  
Swiss Permit B (2014 – 2019)

### Summary

I am a computer science researcher with 7 years of academic and industrial experience. I published 12 peer-reviewed research publications, and led multiple software projects, supervised EPFL-hosted open source projects with external funding from Google, and organized a highly successful Coursera massive open online course on reactive programming. In 2016, I created the Parallel Programming course at Coursera, where I was the main lecturer. The Parallel Programming course was one of the three parts of Coursera's Scala specialization program for the Scala programming language, which in total earned more than one million dollars. I have participated in several international collaborations with top universities and industrial partners. I participated on industrial and research conferences and meetups, held 9 invited talks, and authored a textbook on concurrent programming in Scala. Between 2014 and 2016, I worked at Google on systems for Big Data analytics. Since 2016, I work at Oracle Labs on Graal language infrastructure project.

### Education

École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland 2009 – 2014  
Ph.D. in Computer Science  
Advisor: Martin Odersky  
Committee: Douglas Lea, Erik Meijer, Viktor Kuncak, Ola Svensson

Faculty of Electrical Engineering and Computing, Zagreb, Croatia 2004 – 2009  
M.A. in Computer Science  
Advisor: Marin Golub

### Professional Experience

Principal Researcher, Oracle Labs, Zürich, Switzerland 2016 –

- Working on the Graal language infrastructure project, the next generation runtime for modern programming languages.

Software Engineer, Google Inc., Zürich, Switzerland 2014 – 2016  
Product area: Geo

- Maintaining a distributed logging infrastructure for Google Maps products.
- Working on a massively distributed system used to analyze Geo product usage.
- Led the implementation of a real-time distributed pipeline for spam detection. Awarded a Google Spot Bonus for this effort.
- Designed and implemented a test automation suite for product documentation.

- Main organizer of the team-internal monthly Hackathon events.  
Awarded a Google Peer Bonus for this effort.

Scala Open Source Developer, Scala Team, Lausanne, Switzerland 2009 – 2016

- Designed and implemented Scala Coroutines – language extension for first-class coroutines, used to facilitate asynchronous programming.
- Designed and implemented Parallel Collections – support for data-parallel programming (part of the Scala programming language since 2011).
- Core part of the Futures and Promises working group, aimed to design the support for asynchronous programming (part of Scala programming language since 2012).
- Maintained and improved the Scala compiler and the Scala standard library.
- Engaged in various open-source activities: ScalaDays conference organization, Scala Workshop program committee member, Scala Improvement Proposal process, on-line education (MOOCs) and documentation, etc.

## Collaborations

FORTH Institute of Computer Science (Greece),  
Computer Architecture and VLSI Systems Laboratory  
Research collaboration aimed at developing a novel high-performance  
concurrent data structures for traditional embedded systems. 2015 – now

Typesafe (USA),  
Collaborating on maintenance, development, technology and innovation  
exchange related to the Scala project (~30 Scala developers). 2011 – now

Akka team (Sweden),  
Member of the working group (~10 people) that developed a unifying  
asynchronous programming framework for Scala. 2011 – 2012

Stanford University (USA),  
Pervasive Parallelism Laboratory  
Collaborated on the LMS and Delite compiler frameworks and runtimes  
for parallel embedded domain-specific languages (~10 people). Designed  
high-performance data structures and collections frontends. 2011 – 2013

## Teaching Experience

Lecturer, Organizer, Parallel Programming  
Coursera MOOC on Parallel Programming. 2016

External Lecturer, Co-Organizer, Reactive Programming and Parallelism  
Co-organized, prepared materials and exercises, led teaching staff (~7 people)  
on the undergraduate course on parallel, distributed, and asynchronous  
programming at EPFL, ~90 students. 2015

Lead Organizer, Principles of Reactive Programming  
Coursera MOOC on reactive programming in Scala, with 2 iterations  
and >60,000 participants so far. 2013

- Coordinated a team of three lecturers during recording and  
lecture material production.

- Led graduate student teaching staff (~8 people), directed content production, designed and implemented exercise materials, managed the production of lecture videos, organized community TAs on Coursera.
- Received the EPFL IC Teaching Award for this effort.

Teaching Assistant, Functional Programming in Scala 2010-2013  
Required EPFL undergraduate course on functional programming (~160 students).

## Research Interests

My focus is design and implementation of frameworks, programming languages, and runtime support for concurrent, parallel and distributed software development. I proposed and implemented novel persistent, concurrent and incremental data structures that support these programming paradigms. I use the Scala programming language as both the underlying development platform and research vehicle.

## Thesis

[Data Structures and Algorithms for Data-Parallel Computing in a Managed Runtime](#) EPFL 2014  
Aleksandar Prokopec

## Books

[Learning Concurrent Programming in Scala](#) Packt Publishing 2014  
Aleksandar Prokopec

## Publications

Authored 13 international research publications and several technical reports.

[Pluggable Scheduling for the Reactor Programming Model](#) AGERE 2016  
Aleksandar Prokopec  
AGERE 2016, co-located with SPLASH

[Isolates, Channels and Event Streams for Composable Distributed Programming](#) Onward! 2015  
Aleksandar Prokopec, Martin Odersky  
Onward! 2015

[Conc-Trees for Functional and Parallel Programming](#) LCPC 2015  
Aleksandar Prokopec, Martin Odersky  
Languages and Compilers for Parallel Computing 2015

[SnapQueue: Lock-Free Queue with Constant Time Snapshots](#) SCALA 2015  
Aleksandar Prokopec  
Scala Symposium 2015, co-located with PLDI

[Efficient Lock-Free Work-stealing Iterators for Data-Parallel Collections](#) PDP 2015  
Aleksandar Prokopec, Dmitry Petrashko, Martin Odersky  
Parallel, Distributed and Network-Based Processing 2015

<a href="#">Containers and Aggregates, Mutators and Isolates for Reactive Programming</a>	SCALA 2014
Aleksandar Prokopec, Philipp Haller, Martin Odersky Annual Scala Workshop 2014, co-located with ECOOP	
<a href="#">Near Optimal Work-Stealing Tree Scheduler for Highly Irregular Data-Parallel Workloads</a>	LCPC 2013
Aleksandar Prokopec, Martin Odersky Languages and Compilers for Parallel Computing 2013	
<a href="#">Composition and Reuse with Compiled Domain-Specific Languages</a>	ECOOP 2013
Arvind K. Sujeeth, Tiark Rompf, Kevin J. Brown, HyoukJoong Lee, Hassan Chafi, Victoria Popic, Michael Wu, Aleksandar Prokopec, Vojin Jovanovic, Martin Odersky, Kunle Olukotun European Conference on Object-Oriented Programming 2013	
<a href="#">FlowPools: A Lock-Free Deterministic Concurrent Dataflow Abstraction</a>	LCPC 2012
Aleksandar Prokopec, Heather Miller, Tobias Schlatter Philipp Haller, Martin Odersky Languages and Compilers for Parallel Computing 2012	
<a href="#">Concurrent Tries with Efficient Non-blocking Snapshots</a>	PPOPP 2012
Aleksandar Prokopec, Nathan Bronson, Phil Bagwell, Martin Odersky Symposium on Principles and Practice of Parallel Programming 2012	
<a href="#">Lock-Free Resizeable Concurrent Tries</a>	LCPC 2011
Aleksandar Prokopec, Phil Bagwell, Martin Odersky Languages and Compilers for Parallel Computing 2011	
<a href="#">A Generic Parallel Collection Framework</a>	Euro-Par 2011
Aleksandar Prokopec, Phil Bagwell, Tiark Rompf, Martin Odersky Euro-Par 2011	
<a href="#">Adaptive Mutation Operator Cycling</a>	ICADIWT 2009
Aleksandar Prokopec, Marin Golub International Conference on the Applications of Digital Information and Web Technologies 2009	

**Selected  
Tech Reports**

<a href="#">Achieving Efficient Work-Stealing for Data-Parallel Collections</a>	April 2013
Aleksandar Prokopec, Martin Odersky	
<a href="#">Multi-Lane FlowPools: A Detailed Look</a>	September 2012
Tobias Schlatter, Aleksandar Prokopec, Heather Miller, Philipp Haller, Martin Odersky	
<a href="#">FlowPools: A Lock-Free Deterministic Concurrent Dataflow Abstraction – Proofs</a>	June 2012
Aleksandar Prokopec, Heather Miller, Philipp Haller	

	Cache-Aware Lock-Free Concurrent Hash Tries Aleksandar Prokopec, Phil Bagwell, Martin Odersky	June 2011
Open Source	Scala Programming Language, Scala team member <ul style="list-style-type: none"> <li>• <a href="#">Scala Coroutines</a>, lead Scala language extension for first-class coroutines, used for easier asynchronous programming.</li> <li>• <a href="#">Reactors Framework for Distributed Programming</a>, lead Programming framework aimed at building asynchronous, composable, distributed systems.</li> <li>• <a href="#">Scala-Blitz – High-Performance Data-Parallelism Framework</a>, lead Scala module for highly efficient data-parallel programming.</li> <li>• <a href="#">ScalaMeter Benchmarking Framework</a>, lead Microbenchmarking and performance regression testing framework for Scala and JVM, adopted in various open source projects.</li> <li>• <a href="#">Scala Futures &amp; Promises (Scala Improvement Proposal 14)</a>, team member Asynchronous programming framework for Scala, used as a basic building block for other concurrency frameworks within the Scala ecosystem (part of standard Scala distribution since 2012).</li> <li>• <a href="#">Parallel Collections Framework</a>, lead Scala standard library module for data-parallel programming (part of the standard Scala distribution in 2011).</li> </ul>	2009 – now
	Java Group at Faculty of Electrical Engineering and Computing, Zagreb, <ul style="list-style-type: none"> <li>• <a href="#">VHDDLlab</a>, team member Award-winning online educational VHDL editor for modeling and simulation of digital circuits (used as part of the computer science curriculum at the Faculty of Electrical Engineering and Computing in Zagreb since 2007).</li> </ul>	2006 – 2008
Honors and Awards	Google Spot Bonus for the Distributed Real-Time Spam Detection Project Google Peer Bonus for the Team Hackathon Initiative Nominated for the Patrick Denantes Doctoral Thesis Award EPFL Outstanding Teaching Assistant Award LCPC Best Paper Presentation Award EPFL Computer Science Fellowship University of Zagreb Rector Award for Best Project (VHDDLlab) Faculty of Electrical Engineering and Computing Josip Loncar Award Faculty of Electrical Engineering and Computing Josip Loncar Award Participation in the International Physics Olympiad (IPhO) 1st Place in the Croatian National Physics Competition (Finals) Participation in the Croatian National Physics Competition (Finals) Participation in the Croatian National Physics Competition (Finals)	2015 2015 2014 2013 2011 2009 – 2010 2008 2007 2006 2004 2004 2002 2001

## Selected Talks

Gave over 20 academic and industrial talks, 8 as an invited speaker.

[Pluggable Scheduling for the Reactor Programming Model](#) AGERE 2016  
Academic Conference Talk  
Amsterdam, Netherlands, October 30, 2016

[First-Class Coroutines for the Scala Programming Language](#) Scala World 2016  
Developer Conference Talk  
Lake District, UK, September 12, 2016

[Reactors - Road to Composable Distributed Computing](#) ScalaDays 2016  
Developer Conference Talk  
Berlin, Germany, June, 2016

[Reactor Model for Composable Distributed Computing](#) Voxxed Days Zurich 2016  
Developer Conference Talk  
Zurich, Switzerland, March 3, 2016

[Isolates, Channels and Event Streams for Composable Distributed Programming](#) Onward! 2015  
Academic Conference Talk  
Pittsburgh, Pennsylvania, USA, October 29, 2015

[Scala – The Learning Curve](#) Jazoon 2015  
Developer Conference Talk  
Zurich, Switzerland, October 23, 2015

[Conc-Tree Data Structure for Functional and Parallel Programming](#) LCPC 2015  
Academic Conference Talk  
Raleigh, North Carolina, USA, September 10, 2015

[SnapQueue: Lock-Free Queue with Constant Time Snapshots](#) SCALA 2015  
Academic Conference Talk  
Portland, Oregon, USA, June 13, 2015

[ScalaMeter – Performance Regression Testing Framework](#) Oracle VM Meetup 2014  
Academic Meetup Talk  
ETH, Zürich, Switzerland, September 11, 2014

Containers and Aggregates, Mutators and Isolates  
for Reactive Programming SCALA 2014  
Academic Conference Talk  
Uppsala, Sweden, July 28, 2014

[Reactive Collections and 3D Engine Design](#) ScalaDays 2014  
Industrial Conference Talk (800 attendees)  
Berlin, Germany, June 24, 2014

[Macro-based Scala Parallel Collections](#) Scala eXchange 2013  
Industrial Conference Talk (350 attendees, invited talk)  
London, UK, December 2, 2013

<a href="#">Work-Stealing Tree Scheduling</a> Academic Conference Talk San Jose, CA, USA, September 26, 2013	LCPC 2013
Scala as a Research Tool ECOOP Tutorial (w/ Heather Miller and Philipp Haller) Montpellier, France, July 1, 2013	ECOOP 2013
<a href="#">Scala Performance Regression Testing</a> Industrial Conference Talk (invited talk) London, UK, November 19, 2012	Scala eXchange 2012
<a href="#">Parallel Concurrent Hash Tries</a> Industrial Conference Talk (400 attendees) London, UK, April 18, 2012	ScalaDays 2012
Concurrent Hash Tries in Scala Academic Meetup Talk (invited talk) Zagreb, Croatia, April 11, 2012	Croatian IEEE Chapter Meetup
<a href="#">Concurrent Tries with Efficient Non-Blocking Snapshots</a> Academic Conference Talk New Orleans, Louisiana, USA, February 29, 2012	PPOPP 2012
<a href="#">Lock-Free Resizeable Concurrent Tries</a> Academic Conference Talk Fort Collins, CO, USA, September 9, 2011	LCPC 2011
<a href="#">Generic Parallel Collection Framework</a> Academic Conference Talk Bordeaux, France, September 2, 2011	Euro-Par 2011
<a href="#">Parallel Collections</a> Industrial Conference Talk (280 attendees, invited talk) London, UK, June 15, 2011	Scala eXchange 2011
<a href="#">Scala Parallel Collections</a> Industrial Conference Talk Palo Alto, CA, USA, June 3, 2011	ScalaDays 2011
<a href="#">Introduction to Scala</a> Industrial Talk, Java User Group Grenoble (invited talk) Grenoble, France, March, 2011	JUG Meetup 2011
<a href="#">Parallel Collections</a> Industrial Conference Talk (150 attendees, invited talk) Lausanne, Switzerland, April 15, 2010	ScalaDays 2010

External  
Service

Reviewer or program committee member on various scientific conferences and journals.

Parallel Processing Letters 2016, external reviewing	2016
AGERE! 2016, program committee	2016
ICPADS 2016, program committee	2016
HLPP 2016, program committee	2016
On Principles of Distributed Systems (OPODIS 2015), external reviewer	2015
Transactions on Computers 2015, journal submission reviewer	2015
Scala Workshop 2014, program committee	7/2014
High-Level Parallel Programming and Applications 2014, external reviewer	4/2014
ECOOP 2013, external reviewer	7/2013
Scala Workshop 2013, program committee (co-chair)	7/2013
ScalaDays 2010, external reviewer	6/2010
ICADIWT 2009, external reviewer	8/2009

### Supervised Projects<sup>1</sup>

Supervised 14 bachelor and master student projects.

Joël Rossier, MacroGL Scala.JS Backend B.Sc. level	2/2014 – 6/2014
Sven Reber, MacroGL API Extensions B.Sc. level	2/2014 – 6/2014
Gwangbae Choi, ScalaMeter Inline Benchmarking B.Sc. level	2/2014 – 6/2014
Kristof Szabo, ScalaMeter Java API B.Sc. level	2/2014 – 6/2014
Nicolas Stucki, Scala Multiset Collection M.Sc. level	9/2013 – 1/2014
Timo Babst, Data-Parallel Raytracer B.Sc. level	9/2013 – 1/2014
Clément Moutet, Data-Parallel Flocking Algorithm B.Sc. level	9/2013 – 1/2014
Roman Zoller, ScalaMeter D3js Frontend M.Sc. level	2/2013 – 6/2013
Tobias Schlatter, FlowSeqs: Barrier-Free ParSeqs M.Sc. level, co-supervision w/ Philipp Haller & Heather Miller	9/2012 – 1/2013
Roger Vion, Improvements to ScalaMeter B.Sc. level	9/2012 – 1/2013
Tobias Schlatter, Multi-Lane FlowPools M.Sc. level, co-supervision w/ Philipp Haller & Heather Miller	2/2012 – 6/2012
Bruno Studer, A Non-Blocking Concurrent Queue Algorithm B.Sc. level	2/2012 – 6/2012

<sup>1</sup>EPFL research labs prepare projects for B.Sc./M.Sc. students to complete for credits. These projects are designed and supervised by EPFL doctoral assistants.



GSoC  
Projects<sup>2</sup>

Ngoc Duy Pham, Scala Benchmarking Suite – Performance Regression Pinpointing M.Sc. level	8/2011 – 1/2012
Pamela Delgado, Scala Invariant Verifier M.Sc. level	8/2011 – 1/2012
Supervised 4 Google Summer of Code projects.	
Krzysztof Janosz, ScalaMeter -- Binary Compatible Serialization Format and Invocation Measurers	5/2015 – 9/2015
Dmitry Petrashko, Specializing Parallel Collections with Scala Macros	5/2013 – 9/2013
Ivan Oreskovic, Porting Scala Parallel Collections to the Android Platform	5/2012 – 9/2012
Heather Miller, Parallel Collections Extensions	5/2011 – 9/2011

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<sup>2</sup>The Scala Team is a regular host of Google Summer of Code Projects. These are 3-month paid projects offered to students all over the world, sponsored by Google and supervised by members of various open-source organizations.

## References

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