

## Contact information

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## Research interests

- Applied logic for program verification (especially for concurrency and distributed systems);
- Design and implementation of programming languages;
- Static program analysis (especially in application to higher-order and concurrent programs).

## 1 Education and Qualifications

- Ph.D. in Computer Science, **KU Leuven**, Leuven, Belgium. November 2008–November 2012.  
Thesis: *Operational Aspects of Type Systems*, Advisor: Dave Clarke
- M.Sc. in Mathematics and Computer Science, GPA 5.0/5.0, **Saint Petersburg State University**, Saint Petersburg, Russia. 2003–2008.  
Thesis: *Extraction of musical notation from a musical signal*, Advisor: Andrey E. Barabanov

## 2 Employment History

- **University College London**, Department of Computer Science. London, UK  
*Lecturer (Assistant Professor)*. Started November 2015.
- **Facebook, Inc.**, Static Analysis Tools. London, UK  
*Research Scientist (Part-Time Contingent Worker)*. Started November 2017.
- **IMDEA Software Institute**, Madrid, Spain  
*Post-doctoral Researcher*. February 2013–October 2015.
- **Microsoft Research**, Cambridge, UK  
*Research Intern*. Programming Principles and Tools group. July–September 2012.
- **JetBrains Inc.**, Saint Petersburg, Russia  
*Software Engineer*. IntelliJ IDEA. September 2006–November 2008.
- **OpenWay**, Saint Petersburg, Russia  
*Summer School Intern*. June 2006–September 2006
- **Informational Systems for Business**, Saint Petersburg, Russia  
*Software Engineer*. August 2005–June 2006.

## 3 Selected Publications and Manuscripts

### 3.1 Journal articles

- J3 **Modular, Higher-Order Cardinality Analysis in Theory and Practice**  
Ilya Sergey, Dimitrios Vytiniotis, Joachim Breitner and Simon Peyton Jones  
*Journal of Functional Programming*, volume 27, e11, January 2017.
- J2 **Pushdown Flow Analysis with Abstract Garbage Collection**  
J. Ian Johnson, Ilya Sergey, Christopher Earl, Matthew Might and David Van Horn  
*Journal of Functional Programming*, volume 24, issue 2-3, pages 218–283, May 2014.
- J1 **A correspondence between type checking via reduction and type checking via evaluation**  
Ilya Sergey and Dave Clarke  
*Information Processing Letters*, volume 112, issue 1-2, pages 13–20, January 2012.

## 3.2 Articles in international conference proceedings

- C16 **Fast Static Race Detection at Scale**  
Sam Blackshear, Nikos Gorogiannis, Peter O’Hearn, and Ilya Sergey.  
In **OOPSLA 2018 (A\*)**, 60/216  $\approx$  28% accepted.
- C15 **Paxos Consensus, Deconstructed and Abstracted**  
Álvaro García Pérez, Alexey Gotsman, Yuri Meshman and Ilya Sergey.  
In **ESOP 2018 (A)**, 36/114  $\approx$  32% accepted.
- C14 **Mechanising Blockchain Consensus**  
George Pirlea and Ilya Sergey. In **CPP 2018**, 22/51  $\approx$  43% accepted.
- C13 **Programming and Proving with Distributed Protocols**  
Ilya Sergey, James R. Wilcox, and Zachary Tatlock. In **POPL 2018 (A\*)**, 66/271  $\approx$  24% accepted.  
This paper was featured in **The Morning Paper** on 22 January 2018:  
<https://blog.acolyer.org/2018/01/22/programming-and-proving-with-distributed-protocols/>
- C12 **Concurrent Data Structures Linked in Time**  
Germán Andrés Delbianco, Ilya Sergey, Aleksandar Nanevski and Anindya Banerjee.  
In **ECOOP 2017 (A)**, 27/81  $\approx$  33% accepted.
- C11 **Programming Language Abstractions for Modularly Verified Distributed Systems**  
James R. Wilcox, Ilya Sergey and Zachary Tatlock. In **SNAPL 2017**.
- C10 **Hoare-style Specifications as Correctness Conditions for Non-linearizable Concurrent Objects**  
Ilya Sergey, Aleksandar Nanevski, Anindya Banerjee and Germán Andrés Delbianco.  
In **OOPSLA 2016 (A\*)**, 52/203  $\approx$  26% accepted.
- C9 **Experience Report: Growing and Shrinking Polygons for Random Testing of Computational Geometry Algorithms**  
Ilya Sergey. In **ICFP 2016 (A\*)**, 37/118  $\approx$  31% accepted.
- C8 **Mechanized Verification of Fine-grained Concurrent Programs**  
Ilya Sergey, Aleksandar Nanevski and Anindya Banerjee. In **PLDI 2015 (A\*)**, 58/303  $\approx$  19% accepted.
- C7 **Specifying and Verifying Concurrent Algorithms with Histories and Subjectivity**  
Ilya Sergey, Aleksandar Nanevski and Anindya Banerjee. In **ESOP 2015 (A)**, 33/115  $\approx$  29% accepted.
- C6 **Communicating State Transition Systems for Fine-Grained Concurrent Resources**  
Aleksandar Nanevski, Ruy Ley-Wild, Ilya Sergey and Germán Andrés Delbianco.  
In **ESOP 2014 (A)**, 27/109  $\approx$  25% accepted.
- C5 **Modular, Higher-Order Cardinality Analysis in Theory and Practice**  
Ilya Sergey, Dimitrios Vytiniotis and Simon Peyton Jones. In **POPL 2014 (A\*)**, 51/220  $\approx$  23% accepted.
- C4 **Monadic Abstract Interpreters**  
Ilya Sergey, Dominique Devriese, Matthew Might, Jan Midtgaard, David Darais, Dave Clarke and Frank Piessens. In **PLDI 2013 (A\*)**, 46/267  $\approx$  17% accepted.
- C3 **Introspective Pushdown Analysis of Higher-Order Programs**  
Christopher Earl, Ilya Sergey, Matthew Might and David Van Horn.  
In **ICFP 2012 (A\*)**, 32/88  $\approx$  36% accepted.
- C2 **Calculating Graph Algorithms for Dominance and Shortest Path**  
Ilya Sergey, Jan Midtgaard and Dave Clarke. In **MPC 2012 (B)**, 13/27  $\approx$  48% accepted.
- C1 **Gradual Ownership Types**  
Ilya Sergey and Dave Clarke. In **ESOP 2012 (A)**, 28/88  $\approx$  32% accepted.

## 3.3 Peer-reviewed articles in international workshop proceedings

- W7 **A Concurrent Perspective on Smart Contracts**  
Ilya Sergey and Aquinas Hobor. *1st Workshop on Trusted Smart Contracts (WTSC 2017)*  
This paper was featured in **The Morning Paper** on 30 August 2017:  
<https://blog.acolyer.org/2017/08/30/a-concurrent-perspective-on-smart-contracts>

- W6 **Deriving Interpretations of the Gradually-Typed Lambda Calculus**  
Álvaro García Pérez, Pablo Nogueira and Ilya Sergey. In **PEPM 2014**.
- W5 **Fixing Idioms – A recursion primitive for applicative DSLs**  
Dominique Devriese, Ilya Sergey, Dave Clarke and Frank Piessens. In **PEPM 2013**.
- W4 **Towards Gradual Ownership Types**  
Ilya Sergey and Dave Clarke. In **IWACO 2011**.
- W3 **From type checking by recursive descent to type checking with an abstract machine**  
Ilya Sergey and Dave Clarke. In **LDTA 2011**.
- W2 **Automatic refactorings for Scala programs**  
Ilya Sergey, Dave Clarke and Alexander Podkhalyuzin  
*The First Scala Workshop — Scala Days 2010*
- W1 **A semantics for context-oriented programming with layers**  
Dave Clarke and Ilya Sergey. In **COP 2009**.

### 3.4 Technical Reports and Software Specifications

- T1 **SCILLA: a Smart Contract Intermediate-Level Language**  
Ilya Sergey, Amrit Kumar and Aquinas Hobor.  
Featured in **The Bitcoin Exchange Guide**: <https://bitcoinexchangeguide.com/scilla/>

### 3.5 Monographs

- M1 **Programs and Proofs: Mechanizing Mathematics with Dependent Types**  
Ilya Sergey. *Lecture notes with exercises*, available at <http://ilyasergey.net/pnp>.

### 3.6 Book chapters

- B1 **Ownership Types: A Survey**  
Dave Clarke, Johan Östlund, Ilya Sergey and Tobias Wrigstad.  
*Aliasing in Object-Oriented Programming: Types, Analysis and Verification*, Springer, 2013.

## 4 External Funding

1. Google Faculty Research Award 2017. **\$59,925**. February 2018, 152/1033  $\approx$  15% acceptance rate.  
One-year project on the topic *Distributed System Optimizations as Network Semantics Transformations*.
2. Grant of Research Institute in Verified Trustworthy Software Systems (VeTSS). **£55,561**. August 2017.  
8-month project on the topic *Automated Reasoning with Fine-Grained Concurrent Collections*.
3. EPSRC First Grant. **£101,009**. September 2016. 18-month project on the topic  
*Program Logics for Compositional Specification and Verification of Distributed Systems*.

## 5 Appearances in Press

### 5.1 Online media

- **Scilla – A Formal Verification Oriented Contract Language**  
*Epicenter*, video interview. 6 June 2018.  
<https://epicenter.tv/episode/238/>
- **Ethereum’s smart contracts are full of holes**  
*MIT Technology Review*. By Mike Orcutt, 1 March 2018.  
<https://www.technologyreview.com/s/610392/ethereums-smart-contracts-are-full-of-holes/>

- **Millions of Dollars In Ethereum Are Vulnerable to Hackers Right Now**  
*Motherboard, Vice.* By Jordan Pearson, 22 February 2018. <https://goo.gl/Z68sbr>

## 6 Academic Supervision

### PhD students

- **Maria A Schett**, PhD student. Started in November 2017.

### Postdocs

- **Thomas Sibut-Pinote**, Research Associate, funded by EPSRC First Grant. Started in November 2017.

### Research Visitors

- **Kristoffer Just Andersen**, visiting PhD Researcher from Aarhus University, January–June 2018.

### Undergraduate and MSc students

- **Anirudh Pillai**, BSc student at UCL, 2017/2018 Academic Year.  
Worked on formal verification of Paxos consensus protocols.
- **Jorge Botelho Dias De Ayala Botto**, MSc student at UCL, 2016/2017 Academic Year.  
Worked on formal verification of LLVM optimisations.

### Interns

- **Kiran Gopinathan**, Intern at UCL, Summer 2018.  
Worked on probabilistic reasoning about blockchain protocols.
- **Oscar King**, Intern at UCL, Summer 2018.  
Worked on reasoning about state models for blockchain.
- **George Pirlea**, Intern at UCL, Summer 2017.  
Worked on verification of blockchain consensus protocols in Coq, conference paper: **C14**.
- **Benedict Loh**, Intern at UCL, Summer 2017.  
Worked on implementing a program synthesis engine, based on Separation Logic.
- **Georgi Georgiev**, Intern at UCL, Summer 2016.  
Worked on verification of a concurrent garbage collector in the Coq proof assistant.
- **Anton Podkopaev**, Intern at IMDEA Software Institute (main supervisor: Aleks Nanevski), 2015.  
Worked on operational semantics for C/C++11 concurrency.

## 7 Advisory Appointments and Knowledge Transfer

- **Zilliqa Inc.** Research Advisor. Started in March 2018.  
<https://www.zilliqa.com/team.html>

## 8 Academic Service

### 8.1 Chair/Organiser

- The Fifth International Workshop on Coq for Programming Languages (CoqPL 2019), January 2019, Lisbon, Portugal. *Co-chair (with Robbert Krebbers)*
- The Fourth International Workshop on Coq for Programming Languages (CoqPL 2018), January 2018, Los Angeles, CA, USA. *Co-chair (with Yves Bertot)*
- ICFP 2017, September 2017, Oxford, UK. *Student Research Competition Chair*

- 6th South of England Regional Programming Language Seminar (S-REPLS 6), May 2017, London, UK. *Organiser*. Event web page: <http://srepls6.cs.ucl.ac.uk>. The meeting has attracted speakers from 10 institutions from France, New Zealand, Singapore, UK, USA, and has been attended by approximately 90 researchers, students, and industry practitioners.

## 8.2 Programme Committee Member for International Conferences

- PLDI 2019: *40th ACM SIGPLAN Conference on Programming Language Design and Implementation*
- OOPSLA 2019: *34th ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications*
- ECOOP 2019: *33rd European Conference on Object-Oriented Programming*
- POPL 2019: *46th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*
- APLAS 2018: *16th Asian Symposium on Programming Languages and Systems*
- ICFP 2018: *23rd ACM SIGPLAN International Conference on Functional Programming*
- APLAS 2017: *15th Asian Symposium on Programming Languages and Systems*
- Scala 2017: *Scala Symposium 2017*
- SAS 2017: *24th Static Analysis Symposium*
- POPL 2017: *44th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*
- TMPA 2017: *4th International Conference on Tools And Methods of Program Analysis*
- Scala 2016: *Scala Symposium 2016*
- SEIM 2016: *1st Russian Conference on Software Engineering and Information Management*
- ESOP 2016: *25th European Symposium on Programming*
- PPDP 2014: *16th International Symposium on Principles and Practice of Declarative Programming*

## 8.3 PC Member for International Workshops

- HOPE 2018: *The 6th ACM SIGPLAN Workshop on Higher-Order Programming with Effects*
- WTSC 2018: *2nd Workshop on Trusted Smart Contracts*
- WTSC 2017: *1st Workshop on Trusted Smart Contracts*
- PEPM 2017: *ACM SIGPLAN 2017 Workshop on Partial Evaluation and Program Manipulation*
- TAPAS 2016: *The Seventh Workshop on Tools for Automatic Program Analysis*
- STOP 2015: *International Workshop on Scripts to Programs*
- Scala 2014: *The Fifth Annual Scala Workshop*

## 8.4 Reviewing for Journals

- Journal of Automated Reasoning (JAR) (2017)
- ACM Transactions on Programming Languages and Systems (TOPLAS) (2014, 2015 × 2, 2016, 2017)
- Philosophical Transactions of the Royal Society of London (2017),
- Journal of Functional Programming (JFP) (2015)
- Formal Aspects of Computing (2015).

## 8.5 Additional Conference and Workshop Refereeing

CONCUR 2018, ECOOP 2018, ICALP 2018, PLDI 2018, S&P (Oakland) 2018, TYPES 2017 (Post-proceedings), PLDI 2017, TACAS 2017, ESOP 2017, ATVA 2016, CONCUR 2016, DISC 2015, ECOOP 2015, ESOP 2015, POPL 2015, GPCE 2014, ICFP 2014, CSF 2014, PROLE 2013, SAIRP 2013, CC 2013, ESOP 2013, POPL 2013, CPP 2012, ECOOP 2012, NFM 2012, ESOP 2012, DSL 2011, IWACO 2011, Coordination 2010, Coordination 2009.

## 8.6 Other Service

- SPLASH 2017 Workshops, *Workshop Program Committee member*
- ICFP 2016, Student Research Competition, *Selection Committee member*
- ECOOP 2014, *Artifact Evaluation Committee member*

## 9 Awards and Fellowships

- **Google Faculty Research Award** recipient (2017). Google Inc.
- **Fellow** of the UK Higher Education Academy (2017).
- **Vladimir Potanin Fund Scholarship** recipient (2004, 2005, 2007). The Vladimir Potanin Foundation.

## 10 Invited Keynote Talks

1. April 2017. Keynote speaker at *Russian National Conference on Programming Languages and Compilers* Rostov-on-Don, Russia. <http://plc.sfedu.ru>  
Talk title: *Dependent Types for Verification of Real-World Programs*
2. September 2013. Keynote speaker at *15th International Symposium on Principles and Practice of Declarative Programming (PPDP 2013)*, Madrid, Spain.  
Talk title: *Monadic Abstract Interpreters*

## 11 Teaching

### 11.1 Teaching at UCL

- Spring 2018: **ENGS102P – Design and Professional Skills** (147 students), *Scenario Project Organiser*
- Spring 2018: **COMP104P – Theory 2, Analysis of Algorithms** (172 students), *Lecturer*
- Autumn 2017: **COMP214P – Systems Engineering** (116 students), *Scenario Project Designer*
- Spring 2017: **COMP104P – Theory 2, Analysis of Algorithms** (142 students), *Lecturer*
- Spring 2017: **COMP203P – Software Engineering and HCI** (124 students), *Scenario Project Designer*
- Spring 2016: **COMP104P – Theory 2, Analysis of Algorithms** (155 students), *Lecturer*
- Spring 2016: **COMP203P – Software Engineering and HCI** (94 students), *Scenario Week Designer*
- Spring 2016: **COMP2012 – Directed Reading** (11 students), *Second Examiner* (with James Brotherston)

### 11.2 Teaching at summer schools and seminars

- August 2014: **Programs and Proofs: Mechanizing Mathematics with Dependent Types**  
**Saint Petersburg State University**, Saint Petersburg, Russia  
*Course Designer, Summer School Lecturer*

### 11.3 Teaching at KU Leuven

- Fall 2011: **B-KUL-H04L5A – Comparative Programming Languages**, *Teaching Assistant*
- Fall 2010: **B-KUL-H04H8B – Formal systems and their applications**, *Teaching Assistant, 2nd Lecturer*
- Fall 2009: **B-KUL-H04H8B – Formal systems and their applications**, *Teaching Assistant, 2nd Lecturer*

## 12 Selected Projects and Software Contributions

### 12.1 Contributions to large open source projects

- **Facebook Infer static analyzer**  
<http://fbinfer.com>
- **Glasgow Haskell Compiler (GHC)**  
<https://github.com/ghc/ghc>

### 12.2 Research-related and personal projects

- **TOYCHAIN**, a minimalistic blockchain consensus implemented and verified in Coq.  
Related paper: **C14**. Sources available at <https://github.com/certichain/toychain>.

- **DISEL: Distributed Separation Logic**, a mechanized framework for compositional verification of distributed systems, *primary contributor*. Related papers: **C11, C13**. Sources available at <https://github.com/DistributedComponents/disel>.
- **FCSL: Fine-grained Concurrent Separation Logic**, a verification tool for fine-grained concurrent programs, *primary contributor*. Related papers: **C6, C7, C8, C10, C12**. Project site: <http://software.imdea.org/fcsl>.
- **Geometry Testing**, a QuickCheck-style framework for randomized testing of geometric algorithms, *sole implementer*. Related paper: **C9**. Available at <https://github.com/UCL-PPLV/geometry-testing>.
- **Pushdown k-CFA**, a pushdown context-sensitive control-flow analysis with optional Abstract Garbage Collection for LambdaJS and a subset of Scheme programming language, *sole implementer*. Related papers: **C3, J2**. Available at <https://github.com/ilyasergey/reachability>.
- **La Clojure** plugin for IntelliJ IDEA, *founder and maintainer* (discontinued). Sources available at <http://github.com/JetBrains/la-clojure>.

### 12.3 More software on GitHub

- <http://github.com/ilyasergey>
- <http://github.com/certichain>

## 13 Selected Invited Seminar Presentations and Technical Talks

- **Scilla: Foundations for Verifiable Decentralised Computations on a Blockchain**  
The Blockchain Connector, London Blockchain Developer Meetup, London, UK (May 2018); PLEMM 2018: Programming Language Enthusiasts Mind Melt, Bellevue, WA, US (May 2018); University of California San Diego, CA, US (May 2018).
- **Mechanising Blockchain Consensus**  
University of Utah, UT, US (May 2018).
- **Programming and Proving with Distributed Protocols**  
University Paris Diderot – Paris 7, France (April 2018); Microsoft Research, Cambridge, UK (November 2017); National University of Singapore (October 2017); Heriot-Watt University, UK (July 2017); IMDEA Software Institute, Spain (June 2017); Aarhus University, Denmark (May 2017); University of California San Diego, CA, US (May 2017); Imperial College London, UK (November 2016).
- **Guarding a Gallery with Sleepy Robots**  
Yale-NUS College, Singapore (October 2017).
- **Programming and Proving with Concurrent Resources**  
University of York, UK (October 2016); University of Cambridge, UK (June 2016); Aarhus University, Denmark (June 2016); MPI-SWS, Germany (May 2016); Imperial College London, UK (May 2016); Middlesex University, UK (May 2016); University of Birmingham, UK (January 2016); Queen Mary University of London, UK (December 2015); University College London, UK (April 2015); Microsoft Research, Cambridge, UK (March 2015).
- **Reasoning about non-linearizable concurrent objects**  
Dagstuhl Seminar 16201, Germany (May 2016); University of Kent, UK (April 2016).
- **Anatomy of mechanized reasoning about fine-grained concurrency**  
Dagstuhl Seminar 15191, Germany (May 2015).
- **Programming with Proofs**  
Google, London, UK (April 2015); Russian Academy of Sciences, St Petersburg, Russia (August 2014).
- **Communicating State Transition Systems for Fine-Grained Concurrent Resources**  
IMDEA Software Institute, Spain (April 2014); Concurrency Yak, San Diego, US (January 2014); HOPE 2013 Workshop, Boston, US (September 2013).
- **Static Analysis and Code Optimizations in Glasgow Haskell Compiler**  
St Petersburg Functional Programming meetup, Russia (December 2012)
- **Gradual Ownership Types**  
IMDEA Software Institute, Spain (July 2012); Aarhus University, Denmark (December 2011).
- **Scripting an IDE for DSL awareness**  
Devovx 2009, Antwerp, Belgium (November 2009)

- **Clojure support in IntelliJ IDEA**  
The Bay Area Clojure User Group meetup, San Francisco, US (June 2009).
- **Cross-Language Development in IntelliJ IDEA**  
JAX 2009, Mainz, Germany (April 2009).
- **Cross-Language Development Experience on the JVM**  
Devoxx 2008, Antwerp, Belgium (December 2008).

## 14 Language Skills

English (fluent, IELTS 8.0, C1 CEFR), Spanish (fluent, B1 CEFR), Dutch (good, B2 CEFR, NT2 complete), French (good, B2 CEFR), Danish (basic, A1 CEFR), Russian (mother tongue).