Ralf Jung

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Education

PhD in Computer Science, MPI-SWS and Saarland University (2020)
Distinction: summa cum laude (the highest possible distinction)

Master in Computer Science, MPI-SWS and Saarland University (2019)

Bachelor in Computer Science, Saarland University (2013)

Research Experience

I am developing *formal foundations and tools* that establish *machine-checked guarantees* for *real-world software systems*. To achieve this, my work spans all the way from foundational and deeply theoretical to applied, from proving theorems to developing tools used by other researchers and software developers.

MIT

Post-doctoral research (2021 – present)
Advisors: Frans Kaashoek and Nickolai Zeldovich (PDOS group at CSAIL)

Max Planck Institute for Software Systems (MPI-SWS)

Post-doctoral research (2020 – 2021)
Advisor: Derek Dreyer

Doctoral research (2014 – 2020)
Thesis Title: *Understanding and Evolving the Rust Programming Language*
Advisor: Derek Dreyer

Mozilla Research

Internship and research assistantship (2017, 2018)
Mozilla offices: Portland and Berlin
Supervisors: Aaron Turon and Niko Matsakis
Worked with the Rust team on a better specification and tooling for unsafe code in Rust.

Saarland University

Research assistant (2014)
Computer graphics lab (Prof. Philipp Slusallek), compiler construction lab (Prof. Sebastian Hack)
Implemented a ray tracer in an experimental programming language (AnyDSL) geared towards partial evaluation.

Bachelor thesis research project (2012 – 2013)
Title: *An Intermediate Language to Formally Justify Memory Access Reordering*
Advisor: Sebastian Hack

Awards, Honors, and Scholarships

Honorable Mention for the **ACM Doctoral Dissertation Award** (2021)

Recipient of **SIGPLAN John C. Reynolds Doctoral Dissertation Award** (2021)

Recipient of **ETAPS Doctoral Dissertation Award** (2021)

Recipient of **Otto Hahn Medal** of the Max-Planck Society	(2021)
Recipient of Saarland University's Dr. Eduard Martin prize	(2021)
Selected as Saarland University nominee for GI dissertation award	(2021)
Selected participant for 6th Heidelberg Laureate Forum	(2018)
Admission into Studienstiftung des Deutschen Volkes	(2013)
FdSI Bachelor Award of Summer 2013 for an outstanding Bachelor's thesis	(2013)
Recipient of the "Deutschlandstipendium" Scholarship	(2011 – 2012)

Publications

- Lennard Gäher, Michael Sammler, Simon Spies, **Ralf Jung**, Hoang-Hai Dang, Robbert Krebbers, Jeehoon Kang, and Derek Dreyer. "Simuliris: A separation logic framework for verifying concurrent program optimizations". In: *POPL*. To appear. 2022. URL: https://iris-project.org/pdfs/2022-popl-simuliris.pdf.
- Joshua Yanovski, Hoang-Hai Dang, **Ralf Jung**, and Derek Dreyer. "GhostCell: Separating permissions from data in Rust". In: *PACMPL* 2.ICFP (2021). DOI: 10.1145/3473597.
- Tej Chajed, Joseph Tassarotti, Mark Theng, **Ralf Jung**, M. Frans Kaashoek, and Nickolai Zeldovich. "Gojournal: A verified, concurrent, crash-safe journaling system". In: *OSDI*. USENIX Association, 2021. URL: https://www.usenix.org/system/files/osdi21-chajed.pdf.
- **Ralf Jung**, Jacques-Henri Jourdan, Robbert Krebbers, and Derek Dreyer. "Safe systems programming in Rust: The promise and the challenge". In: *CACM* (2021). DOI: 10.1145/3418295.
  This article comes with a video at https://vimeo.com/514402648.
- **Ralf Jung**, Hoang-Hai Dang, Jeehoon Kang, and Derek Dreyer. "Stacked Borrows: An aliasing model for Rust". In: *PACMPL* 4.POPL (2020). DOI: 10.1145/3371109.
- **Ralf Jung**, Rodolphe Lepigre, Gaurav Parthasarathy, Marianna Rapoport, Amin Timany, Derek Dreyer, and Bart Jacobs. "The future is ours: Prophecy variables in separation logic". In: *PACMPL* 4.POPL (2020). DOI: 10.1145/3371113.
- Juneyoung Lee, Chung-Kil Hur, **Ralf Jung**, Zhengyang Liu, John Regehr, and Nuno P. Lopes. "Reconciling high-level optimizations and low-level code in LLVM". in: *PACMPL* 2.OOPSLA (Oct. 2018). DOI: 10.1145/3276495.
- **Ralf Jung**, Robbert Krebbers, Jacques-Henri Jourdan, Aleš Bizjak, Lars Birkedal, and Derek Dreyer. "Iris from the ground up: A modular foundation for higher-order concurrent separation logic". In: *Journal of Functional Programming* 28 (2018). DOI: 10.1017/S0956796818000151.
- Robbert Krebbers, Jacques-Henri Jourdan, **Ralf Jung**, Joseph Tassarotti, Jan-Oliver Kaiser, Amin Timany, Arthur Charguéraud, and Derek Dreyer. "MoSeL: A general, extensible modal framework for interactive proofs in separation logic". In: *PACMPL* 2.ICFP (2018). DOI: 10.1145/3236772.
- **Ralf Jung**, Jacques-Henri Jourdan, Robbert Krebbers, and Derek Dreyer. "RustBelt: Securing the foundations of the Rust programming language". In: *PACMPL* 2.POPL (2018). DOI: 10.1145/3158154.
- Robbert Krebbers, **Ralf Jung**, Aleš Bizjak, Jacques-Henri Jourdan, Derek Dreyer, and Lars Birkedal. "The essence of higher-order concurrent separation logic". In: *ESOP*. vol. 10201. LNCS. 2017. DOI: 10.1007/978-3-662-54434-1_26.
- Joseph Tassarotti, **Ralf Jung**, and Robert Harper. "A higher-order logic for concurrent termination-preserving refinement". In: *ESOP*. vol. 10201. LNCS. 2017. DOI: 10.1007/978-3-662-54434-1_34.
- **Ralf Jung**, Robbert Krebbers, Lars Birkedal, and Derek Dreyer. "Higher-order ghost state". In: *ICFP*. 2016. DOI: 10.1145/2951913.2951943.
- **Ralf Jung**, David Swasey, Filip Sieczkowski, Kasper Svendsen, Aaron Turon, Lars Birkedal, and Derek Dreyer. "Iris: Monoids and invariants as an orthogonal basis for concurrent reasoning". In: *POPL*. 2015. DOI: 10.1145/2676726.2676980.

Theses

- **Ralf Jung**. "Understanding and evolving the Rust programming language". PhD Thesis. 2020. URL: https://www.ralfj.de/research/thesis.html.
- **Ralf Jung**. "Higher-order ghost state". Master's Thesis. 2019. Based on the paper with the same title.
- **Ralf Jung**. "An intermediate language to formally justify memory access reordering". Bachelor's Thesis. 2013. URL: https://www.ralfj.de/research/bachelor/bachelor.pdf.

Service

Program committee (PC) member of **PLDI 2022**, **OOPSLA 2022**, **CPP 2022**, **ICFP 2021**, **Coq Workshop 2021**, **IWACO 2020**.

Reviewer for **ICFP 2019**, **ESOP 2019**, **OOPSLA 2018**, **ITP 2018**, **POPL 2017**, **ESOP 2015**, **JFP** (2020, 2015), and **TOPLAS** (2015).

Artifact evaluation committee (AEC) member of **CAV 2017**, **POPL 2017**.

Selected Talks

- Invited guest lecture on *Iris* at **Universidade de Lisboa** (2021).
- Invited talk *RustBelt: A Quick Dive Into the Abyss* with Michael Sammler at **Rust Verification Workshop 2021**.
- Invited talk *Stacked Borrows: An Aliasing Model for Rust* at **PRiML 2020** (Workshop on Programming Research in Mainstream Languages).
- Invited talk *Logical Atomicity in Iris: The Good, the Bad, and the Ugly* at **Iris Workshop 2019**.
- Seminar talk *Understanding and evolving the Rust programming language* at **Cornell University**, **University of Pennsylvania**, **Northeastern University**, and **MIT** (2019).
- Seminar talk *Stacked Borrows: An Aliasing Model for Rust* at **University of Cambridge** (2019).
- Workshop talk *Rust(Belt)* at **CSL Automation Workshop by Facebook**, London (2017).
- Seminar talk *The Lifetime Logic – A logic for Rust-style borrowing* at **Aarhus University** (2016).
- Seminar talk *Unifying Worlds And Resources* at **Aarhus University** (2015).
- Invited talk *Iris: Monoids and Invariants as an Orthogonal Basis for Concurrent Reasoning* at **Birmingham University** (2015).

Outreach

- [Podcast] Ralf Jung on GhostCell and Working as a PL Researcher. *Building with Rust, June 2021*. https://anchor.fm/building-with-rust/episodes/Building-with-Rust-e12auje
- My **research blog** serves as an opportunity to describe my research to a wider audience and engage in discussions beyond the research community. URL: https://ralfj.de/blog/categories/research.html

Teaching Experience

Individual Mentoring

Graduate student mentor (MIT): Yun-Sheng Chang (2021 – present)
Project: Using Iris to verify distributed systems with durable state.

Graduate student mentor (MIT): Upamanyu Sharma (2020 – present)
Project: Using Iris to verify distributed systems.

SIGPLAN long-term mentoring: Zixian Cai (2020 – present)
Non-technical mentoring on grad student work and life.

Graduate student mentor (MPI-SWS): Michael Sammler (2019)
Project: Modeling low-level languages in Iris.

Graduate student internship mentor (MPI-SWS): George Pirlea (2019)
Project: Equipping RustBelt with support for pinning.

Graduate student internship mentor (MPI-SWS): Marianna Rapoport (2018)
Project: Encoding prophecy variables into Iris.

Conference Tutorials

Iris tutorial at POPL (2021)

MPI-SWS

Rust course (2015)
Designed and instructed a Rust tutorial running weekly for about two months.
(https://ralfj.de/projects/rust-101/main.html, >200 stars on GitHub)

Saarland University

Teaching assistant and recitation instructor (2015 – 2016)
Undergraduate and graduate course: *Semantics*
Lecturers: Gert Smolka, Derek Dreyer
Led an exercise group, helped students in office hours, designed and graded weekly tests, designed weekly homework, designed and graded exam.

Recitation instructor (2013)
Undergraduate and graduate course: *Introduction to Computational Logic*
Lecturer: Gert Smolka
Led an exercise group, helped students in office hours, graded weekly tests and exam.

Recitation instructor (2011 – 2012)
Undergraduate course: *Programmierung 1* ("Programming 1")
Lecturer: Holger Hermanns
Led an exercise group, helped students in office hours, graded weekly tests and exam.

Recitation instructor (2010 – 2011)
Undergraduate course: *Programmierung 2* ("Programming 2")
Lecturer: Sebastian Hack
Led an exercise group, helped students in office hours, graded exam.

Selected Free Software Contributions

Member (and since 2020 leader) of Rust's Unsafe Code Guidelines Working Group (2018 – present)
(https://github.com/rust-lang/unsafe-code-guidelines)

Maintainer of Miri (https://github.com/rust-lang/miri) (2017 – present)

Contributor to the Rust compiler and language development (2015 – present)
(Contributor rank according to GitHub:[1] #8)

One of now three lead developers of Iris, a program logic with an interactive proof mode in Coq (https://iris-project.org/) (2014 – present)

Sysadmin and developer of the Freifunk mesh WiFi community in Saarland, Germany (2016 – present)
(https://saar.freifunk.net)

Contributor to the KDE window manager and some KDE libraries (2012 – 2013)

For a more complete list, see my website at ralfj.de/projects and my GitHub profile at github.com/RalfJung.

[1] https://github.com/rust-lang/rust/graphs/contributors as of 2021-10-25