Andrea Lattuada

Curriculum vitae

✉ andrea@lattuada.me
🌐 https://andrea.lattuada.me
📞 +41 798523694

Research

My background is a mix of Systems, Databases, Programming Lanugages and Formal Methods.

I worked with Frank McSherry and my advisor Mothy Roscoe at ETH Zurich on (big-)data processing with a distributed dataflow system (Naiad/timely-dataflow). I focused on new and efficient re-scaling, re-partitioning, and high-availability mechanisms for these systems. I helped verify the distributed coordination component of the dataflow system in Isabelle, and I am currently working on a new dataflow-inspired programming model for Serverless systems as part of a collaboration with ETH Zurich.

During my PhD I started looking to systems verification as a way to substantially improve the safety and reliability of our software systems. I helped build a relatively big system with the Dafny verification language with Jon Howell at VMware and colleagues at CMU: this has been cited as one of the largest verified codebases to date. Working on this project we encountered the scalability limits of Dafny's dynamic frames memory reasoning. To address those, we integrated a linear type system in Dafny. I also helped develop a techinque for reasoning about shared-memory concurrent programs by leveraging this linear type system in Dafny.

From that experience, we concluded that Rust would be the right foundation for a Dafny-style verification tool focused on scaling to bigger systems projects: Chris Hawblitzel (MSR) and I (with input from others) started Verus in 2021, and the Verus project then expanded to involve other colleagues from VMware, ETH Zurich, CMU, MSR, and more. Anton Burtsev's group at the University of Utah is using Verus to verify a new microkernel, Microsoft Research is using it to verify persistent memory logs, and other groups in academia are planning to use it for their next Systems verification projects. With colleagues at VMware Research and ETH Zurich I have also been exploring how to specify and verify a concurrent OS for server-class systems with the goal of providing a verified interface to the client applications rather than just focusing on isolation and security properties.

Education

2017-2022	**Doctorate in Computer Science**, *Systems Group (Institute for Computing Platforms), Dept. of Computer Science, ETH Zurich*, Zürich, Switzerland. Thesis: *You May Not Need Coordination (in Streaming Systems)*
2013–2016	**Master's Degree in Computer Science - Distributed Systems Track**, *ETH Zurich*, GPA 5.63/6.00 (cohort avg. 5.34, stddev. 0.26), Zürich, Switzerland. Thesis: *Programmable Scheduling in a Stream Processing System*
2008–2012	**Laurea in Ingegneria Informatica (Bachelor's Degree in Engineering of Computing Systems)**, *Politecnico di Milano*, Milano, Italy.

Industry Experience

Jan 2023– present **Researcher, VMware Research Group**, *VMware Switzerland GmbH*, Zürich, Switzerland.

Pursuing research in Systems and Formal Verification. Co-lead of Verus, an open-source tool for verifying the correctness of code written in Rust (https://github.com/verus-lang/verus). I collaborate with researchers in many institutions, and have taught a course on distributed protocol verification offered to VMware engineers. I have been on various hiring committees for prospective researchers in the group.

Jun 2020– Aug 2020 **Intern, VMware Research Group**, *VMware Switzerland GmbH*, Zürich, Switzerland.

Mentors: Jon Howell and Rob Johnson.

Prototyped changes to the Dafny verification language to support linear typing, which improved developer efficiency and verification performance. This work is reported as part of the paper **Linear Types for Large-Scale Systems Verification**, Distinguished Paper Award at OOPSLA'22.

Jun 2019– Sep 2019 **Intern, VMware Research Group**, *VMware, Inc.*, Bellevue, WA, United States.

Mentors: Jon Howell and Rob Johnson.

Part of a research project on practical program verification for systems software. Contributed new verification methodologies, code, and proofs. Part of this work is reported in the paper **Storage Systems are Distributed Systems (So Verify Them That Way!)**, accepted at OSDI'20.

2013–2016 **Co-Founder, Software Engineer**, *Buildo*, Milan, Italy.

Founded a consultancy company focusing on providing technical advice and software design and development services to startups and enterprises. As a founding partner, tackled both the technical and entrepreneurial challenges of the company's growth.

Designed and implemented (open-sourced) software libraries that served as a foundation for multiple products; coordinated various cross-project efforts; designed and productionized a PaaS-based, container-based deployment infrastructure; interviewed and selected the first employees; helped define the hiring process.

Aug 2013– Nov 2013 **Software Engineer Intern on the Production Engineering - Cache team**, *Facebook, Inc.*, Menlo Park, CA, United States.

Built an automated tool to progressively resize a *memcache* cluster (add or remove machines) while monitoring the cluster's health, key client metrics, and the load on back-end services.

Sep 2012– Nov 2012 **Engineering Intern on the Core Server Team**, *10gen, Inc. (now MongoDB, Inc.)*, New York, NY, United States.

Built metric collection and visualization tools for MongoDB's database data layout.

Oct 2010– Jan 2011 **Site Reliability Engineering Intern**, *Google Switzerland GmbH*, Zürich, Switzerland.

Built a statistical data-mining tool for one of Google's storage teams responsible for large-scale backup and archiving.

2009–2013 **Web Developer**, *Freelancer*, Italy.

2008–2010 **Software Developer**, *Omnilab S.r.l.*, Milano, Italy.

Peer-Reviewed Publications

OOPSLA 2023 — **Verus: Verifying Rust Programs using Linear Ghost Types**, *Andrea Lattuada, Travis Hance, Chanhee Cho, Matthias Brun, Isitha Subasinghe, Yi Zhou, Jon Howell, Bryan Parno, Chris Hawblitzel*, Proceedings of the ACM on Programming Languages, https://doi.org/10.1145/3586037.

HotOS 2023 — **Beyond Isolation: OS Verification as a Foundation for Correct Applications**, *Matthias Brun, Reto Achermann, Tej Chajed, Jon Howell, Gerd Zellweger, Andrea Lattuada*, The 19th Workshop on Hot Topics in Operating Systems, https://doi.org/10.1145/3593856.3595899.

OSDI 2023 — **Sharding the State Machine: Automated Modular Reasoning for Complex Concurrent Systems**, *Travis Hance, Yi Zhou, Andrea Lattuada, Reto Achermann, Alex Conway, Ryan Stutsman, Gerd Zellweger, Chris Hawblitzel, Jon Howell, Bryan Parno*, 17th USENIX Symposium on Operating Systems Design and Implementation, https://www.usenix.org/conference/osdi23/presentation/hance.

OOPSLA 2022 — **Linear Types for Large-Scale Systems Verification**, *Jialin Li, Andrea Lattuada, Yi Zhou, Jonathan Cameron, Jon Howell, Bryan Parno, Chris Hawblitzel*, Proceedings of the ACM on Programming Languages, https://doi.org/10.1145/3527313.
🏆 **Distinguished Paper Award**

ITP 2021 — **Verified Progress Tracking for Timely Dataflow**, *Matthias Brun, Sára Decova, Andrea Lattuada, Dmitriy Traytel*, Interactive Theorem Proving, https://drops.dagstuhl.de/opus/volltexte/2021/13905/pdf/LIPIcs-ITP-2021-10.pdf.

OSDI 2020 — **Storage Systems are Distributed Systems (So Verify Them That Way!)**, *Travis Hance, Andrea Lattuada, Chris Hawblitzel, Jon Howell, Rob Johnson, Bryan Parno*, 14th USENIX Symposium on Operating Systems Design and Implementation, https://www.usenix.org/conference/osdi20/presentation/hance.

VLDB 2020 — **Shared Arrangements: Practical Inter-query Sharing for Streaming Dataflows**, *Frank McSherry, Andrea Lattuada, Malte Schwarzkopf, Timothy Roscoe*, Proceedings of the VLDB Endowment, Volume 13, No. 10, http://www.vldb.org/pvldb/vol13/p1793-mcsherry.pdf.

VLDB 2019 — **Megaphone: Latency-conscious State Migration for Distributed Streaming Dataflows**, *Moritz Hoffmann, Andrea Lattuada, Frank McSherry, Vasiliki Kalavri, John Liagouris, Timothy Roscoe*, Proceedings of the VLDB Endowment, Volume 12, 2018-2019, http://www.vldb.org/pvldb/vol12/p1002-hoffmann.pdf.

BeyondMR 2018 — **Latency-conscious Dataflow Reconfiguration**, *Moritz Hoffmann, Frank McSherry, Andrea Lattuada*, Proceedings of the 5th ACM SIGMOD Workshop on Algorithms and Systems for MapReduce and Beyond, https://doi.org/10.1145/3206333.3206334.

NSDI 2018	**SnailTrail: Generalizing Critical Paths for Online Analysis of Distributed Dataflows**, *Moritz Hoffmann, Andrea Lattuada, John Liagouris, Vasiliki Kalavri, Desislava Dimitrova, Sebastian Wicki, Zaheer Chothia, Timothy Roscoe*, Proceedings of the 15th USENIX Symposium on Networked Systems Design and Implementation, https://www.usenix.org/conference/nsdi18/presentation/hoffmann.
BeyondMR 2016	**Faucet: a User-level, Modular Technique for Flow Control in Dataflow Engines**, *Andrea Lattuada, Frank McSherry, Zaheer Chotia*, Proceedings of the 3rd ACM SIGMOD Workshop on Algorithms and Systems for MapReduce and Beyond, http://doi.org/10.1145/2926534.2926544.

Workshop Talks

January 2024	Co-author of **Domesticating Automation**, *Dafny 2024 Workshop at POPL 2024*, Paris, France, To be presented by Pranav Srinivasan, University of Michigan.
April 2023	**Rust Ghost Code**, *Rust Verification Workshop (RW2023) at ETAPS 2023*, Paris, France.
October 2022	**Verus – SMT-based verification of low-level systems code**, *New England Systems Verification Day*, MIT CSAIL, Cambridge, Massachusetts, USA.
March 2022	**Verus – SMT-based verification of low-level systems code**, *Rust Verification Workshop (RW2022) at ETAPS 2022*, Munich / Garching, Germany.

Awards

2022	**Distinguished Paper Award**, *Linear Types for Large-Scale Systems Verification*, Proceedings of the ACM on Programming Languages (OOPSLA'22).
2018-2022	**Recipient of the 2018 Google PhD Fellowship for Systems and Networking**.
2017-2022	**SOSP'17, OSDI'18, OSDI'22 Student Grant**.

Peer-review Service

2024	**NSDI'25**, Program Committee, (accepted invite).
2023	**Dafny'24 Workshop**, Program Committee.
2023	**ASPLOS'24**, Program Committee.
2022	**ASPLOS'22**, External Review Committee.
2021	**OSDI'21**, Artifact Evaluation Committee.
2017	**VLDB Journal**, Invited reviewer.

Teaching and Mentoring

2023	**Research Project Mentor**, *VMware Research*.
	· Pranav Srinivasan, Research Intern (part of this work will be presented by Pranav at the Dafny 2024 Workshop at POPL 2024, another part of this work is under submission).

2023	**Instructor**, *VMware*.
	· "Protocol Verification Course" using Dafny offered to VMware engineers.
2017-2022	**Teaching Assistant**, *ETH Zurich*.
	· "Internet Architecture and Policy"
	· "Introduction to Computer Science" (3 iterations)
	· "Information Retrieval" (3 iterations)
	· "Information Systems for Engineers" (2 iterations)
2017-2022	**Research Project Mentor**, *ETH Zurich*.
	· Nazerke Seidan, ETH Student Summer Research Fellow
	Visualizing distributed dataflow computations
	· Lorenzo Martini, Master Thesis
	Performance implications of a Dataflow System's Communication Plane
	· Sára Decova, Master Thesis
	Modeling and Verification of the Timely Dataflow Progress Tracking Protocol
	· Lorenzo Selvatici, Master Thesis
	A Streaming System with Coordination-Free Fault-Tolerance
	· Matthias Brun, Master Thesis
	Verified Paging for x86-64 in Rust

Selected Community Talks

June 2023	**Verus – Verified Rust for low-level systems code**, *Zürich Rust Meetup*, ETH Zurich, Zürich, Switzerland.
February 2019	**Containing the RDMA plasma**, *Rust Devroom at FOSDEM*, Brussels, Belgium.
September 2017	**A hammer you can only hold by the handle**, *Rustfest*, Zürich, Switzerland.

References

Timothy Roscoe, ETH Zurich

Chris Hawblitzel, Microsoft Research

Jon Howell, VMware Research Group