

I have worked in data stream processing at Materialize and in operating systems during my Ph.D. at ETH Zurich. At Materialize, I contributed to the protocol design and observability of the compute engine. During my Ph.D. I applied formal methods to configure and represent various hardware subsystems in operating systems:

- **Interrupt Controller Configuration** The interrupt topology in a modern system is a complex network of forwarding controller nodes. Each controller has its own set of configuration options. We formalized a model in Isabelle/HOL [3, 4] and used this model and a solver to configure the interrupt subsystem in a real operating system [6].
- **I<sup>2</sup>C** is a pervasive configuration bus. We developed an I<sup>2</sup>C stack that seamlessly integrates and verifies device-driver interactions with partially compliant devices, automatically generates driver software and controller hardware from a system description specified in a custom DSL [7].
- **Memory** We developed memory protection schemes for heterogeneous hardware [5, 2] and applied solver-based techniques for generating page-tables [1].

### Personal Information

Address Katzenbachstrasse 60, 8052 Zurich, Switzerland  
Mobile +41 77 407 6226  
Hometown Boniswil AG  
Date of birth 12.10.1987

### Education

2.2016– **Computer Science Ph.D., ETH Zurich**  
2.2022 Systems Group. Supervisor: Timothy Roscoe  
2.2011– **Computer Science Master, ETH Zurich**  
5.2013 Interests: Networks, Operating Systems, Algorithms. Grade: 5.59  
**Multicore Virtualization over a Multikernel, Master Thesis**  
Extending Barrelfish's virtual machine monitor to support multiple cores and investigate its performance  
9.2007– **Computer Science Bachelor, ETH Zurich**  
2.2011 Grade: 5.37

### Work Experience

3.2022– **Senior Software Engineer, Materialize**  
3.2023 Materialize is a streaming database that uses SQL. I worked on system observability and protocol development. Technologies: async Rust, tokio, Grafana, Kubernetes.  
6.2017– **Research Internship, HP Enterprise Labs**  
9.2017 I worked on memory protection schemes for disaggregated memory.  
Older **Triboni, UMS.ch, Wuala**  
Before starting my Ph.D. I worked as software developer at Triboni. During my Masters, I worked as a software engineer at UMS.ch and did an internship at Wuala.

Katzenbachstrasse 60 – 8052 Zürich, Switzerland

📞 +41 77 407 62 26 • ✉ [lukas.humbel@inf.ethz.ch](mailto:lukas.humbel@inf.ethz.ch) • 🌐 [www.lluki.me](http://www.lluki.me)  
Ph.D. in Computer Science ETH

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## Skills

Guru in Rust, C, Python, Linux, operating systems  
Pretty good Haskell, X86 and ARM assembly, Prolog, Isabelle/HOL, Kubernetes  
Speaks German, English  
Knows The usual user space tools: git, vim, make,  $\text{\LaTeX}$ , etc.

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## Hobbies and Travel

Likes Sci-Fi Books, Star Trek, Cycling, Hiking, Skiing, Electronics  
8.2014 – Bicycle tour through Spain, France, Switzerland, Argentina, Chile, Bolivia, Paraguay and  
9.2015 Brasil

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## Publications

- [1] Reto Achermann, David Cock, Roni Haecki, Nora Hossle, Lukas Humbel, Timothy Roscoe, and Daniel Schwyn. Generating correct initial page tables from formal hardware descriptions. In *11th Workshop on Programming Languages and Operating Systems (PLOS2021)*, 2021. \* Authors in alphabetical order.
- [2] Reto Achermann, David Cock, Roni Haecki, Nora Hossle, Lukas Humbel, Timothy Roscoe, and Daniel Schwyn. Mmapx: Uniform memory protection in a heterogeneous world. In *Proceedings of the Workshop on Hot Topics in Operating Systems*, pages 159–166, Ann Arbor Michigan, June 2021. ACM. \* Authors in alphabetical order.
- [3] Reto Achermann, Lukas Humbel, David Cock, and Timothy Roscoe. Formalizing Memory Accesses and Interrupts. *Electronic Proceedings in Theoretical Computer Science*, 244:66–116, March 2017.
- [4] Reto Achermann, Lukas Humbel, David Cock, and Timothy Roscoe. Physical Addressing on Real Hardware in Isabelle/HOL. In Jeremy Avigad and Assia Mahboubi, editors, *Interactive Theorem Proving*, Lecture Notes in Computer Science, pages 1–19, Cham, 2018. Springer International Publishing.
- [5] Leonid Azriel, Lukas Humbel, Reto Achermann, Alex Richardson, Moritz Hoffmann, Avi Mendelson, Timothy Roscoe, Robert N. M. Watson, Paolo Faraboschi, and Dejan Milojicic. Memory-Side Protection With a Capability Enforcement Co-Processor. *ACM Transactions on Architecture and Code Optimization*, 16(1):5:1–5:26, March 2019. \* Leonid Azriel and Lukas Humbel contributed equally to this work.
- [6] Lukas Humbel, Reto Achermann, David Cock, and Timothy Roscoe. Towards Correct-by-Construction Interrupt Routing on Real Hardware. In *Proceedings of the 9th Workshop on Programming Languages and Operating Systems*, PLOS'17, pages 8–14, New York, NY, USA, October 2017. Association for Computing Machinery.
- [7] Lukas Humbel, Daniel Schwyn, Nora Hossle, Roni Haecki, Melissa Licciardello, Jan Schaer, David Cock, Michael Giardino, and Timothy Roscoe. A model-checked I2C specification. In Alfons Laarman and Ana Sokolova, editors, *Model Checking Software*, pages 177–193, Cham, 2021. Springer International Publishing.

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☎ +41 77 407 62 26 • ✉ [lukas.humbel@inf.ethz.ch](mailto:lukas.humbel@inf.ethz.ch) • 🌐 [www.lluki.me](http://www.lluki.me)  
Ph.D. in Computer Science ETH