Lukas Humbel

Persistent and pragmatic system-level software engineer

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^2C** is a pervasive configuration bus. We developed an I^2C 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

2.2016–2.2022 **Computer Science Ph.D.**, *ETH Zurich*
Systems Group. Supervisor: Timothy Roscoe

2.2011–5.2013 **Computer Science Master**, *ETH Zurich*
Interests: Networks, Operating Systems, Algorithms. Grade: 5.59

Multicore Virtualization over a Multikernel, *Master Thesis*
Extending Barrelfishs virtual machine monitor to support multiple cores and investigate its performance

9.2007–2.2011 **Computer Science Bachelor**, *ETH Zurich*
Grade: 5.37

Work Experience

3.2022–3.2023 **Senior Software Engineer**, *Materialize*
Materialize is a streaming database that uses SQL. I worked on system observability and protocol development. Technologies: async Rust, tokio, Grafana, Kubernetes.

6.2017–9.2017 **Research Internship**, *HP Enterprise Labs*
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@gmail.com* • *www.lluki.me*
Ph.D. in Computer Science ETH

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, LaTeX, etc.

Hobbies and Travel

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

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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