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Willem Vanhulle

Experience

OTIV (Railway automation) — Ghent, Belgium
Software engineer — *Apr. 2024 - June 2025*

- **Distributed systems:** Remote freight train control system, async iterator toolkit, real-time connectivity monitoring, video and telemetry streaming, state machines. (`Rust`, `Tokio`)
- **Developer tooling & IDE integration:** Created custom declarative tooling to integrate Rust LSP, Clippy linting, and formatting with Bazel build system. Implemented lint-on-save functionality. Led achitectural migration from Bazel to Cargo for better developer experience. (`Rust`)
- **Real-time user interfaces:** Architect multi-monitor desktop application, create live-streaming data tables for operators. (`Rust`, `Slint`)
- **Embedded systems:** Developed software interfaces with real-time hardware control for trains (touchscreens, physical levers, sensors).

Inbiose (Biotechnology) — Ghent, Belgium
Software engineer — *June 2021 - April 2024*

- **Collaborative scientific interfaces:** Built large-scale collaborative web application for biotechnological process data management. Real-time multi-user data grids, D3.js time-series visualizations, automated data parsing from scientific instruments. (`TypeScript`, `JavaScript`, `Svelte`, `D3.js`)
- **Industrial control:** Automatic control industrial fermentation robot, integrate optical sensors. (`Python`, `Rust`, `C++`)

Independent & school (Education) — Brussels & Leuven, Belgium
Part-time mathematics lecturer & tutor — *Nov. 2014 - Jan. 2021*

- **Mathematics education:** Taught analysis, statistics, and linear algebra as tutor. (`Python`, `LaTeX`)

Major professional projects

Emergency breaking mechanism - OTIV — *Sept. 2024 - Mar. 2025*

- **Real-time monitoring:** Heartbeat system detecting connection failures.
- **Stream processing:** Stream aggregator to trigger emergency breaking.

Fermentation robot - Inbiose — *Oct. 2023 - April 2024*

- **Cross-language development**: Comprehensive error handling and testing.
- **Real-time industrial control:** Control 48h fermentation process.

Formal verification & theorem proving

Lean community building: Started first Lean event in Ghent through workshop. Active on official Lean communication channels (Zulip). (`Lean`)

Lean metaprogramming: Developed probability arithmetic library for formal mathematics. To be merged in Mathlib. See GitHub. (`Lean`, `Mathlib`)

Educational theorem proving: Created interactive problem-solving workshop using dependent types. Implemented custom elaboration, delaboration, and unexpanders. See GitHub. (`Lean`)

Research & publications

Academic writing & technical blogging: Published master's thesis on cubical type theory and active technical blog covering formal methods and programming. See thesis and blog. (`Agda`, `Coq`)

Conference presentations & community leadership: Presented at EuroRust 2025 conference about advanced stream processing in Rust (video). Founded and organizes technical communities (sysghent.be). Regular speaker at technical meetups.

Open-source contributions

NixOS ecosystem contributions: Active contributor to NixOS nixpkgs repository. Packaged MCP server for Lean LSP integration with Claude Code. See pull request. (`Nix`)

Published libraries & tools: Functional stream processing library using async iterators. Conference talk at EuroRust. See crate and talk. (`Rust`)

Spoken languages

English, Dutch: Native

Education

University of Utrecht (Summer School) — Utrecht, Netherlands
Formalizing mathematics in Lean — *July 2025 - July 2025*
Thesis: Formal bayesian inference in Monty Hall

- **Courses:** Lean, Proof-assistants, Dependent type theory, Formal methods and Functional programming.

KU Leuven (University) — Leuven, Belgium
Master Pure Mathematics — *Sep. 2017 - June 2019*
Thesis: Models of univalence in cubical sets - one year research at DistriNet on formalising algebra using cubical type theory

- **Courses:** Cubical type theory, Category theory, Mathematical logic, Algebra, Topology, Formal methods and Programming language semantics.
- **Volunteering:** Coordinator student association.

VUB (University) — Brussels, Belgium
Bachelor of Science in Mathematics, Minor Computer Science — *Sep. 2013 - Aug. 2017*
Thesis: Functional analysis and machine learning

- **Courses:** Functional programming (Lisp, Scheme), Philosophy of mathematics (presented on Coq), Compiler construction (Haskell), Algorithms and data-structures, Mathematical logic, Analysis and Algebra.
- **Volunteering:** Managing computer rooms and mathematics tutoring.

Hobbies

Community founder: Founder of sysghent.be. Talks, workshops, networking in Ghent about systems and functional programming.

Electronics: Assemble electronical circuits with simple sensors. Some experience with ARM and RISC-V boards such as ESP32c6, Arduino Uno (AVR), Raspberry Pico (RP2040).

Linux: Declarative Linux operating system configuration with NixOS. Advanced functional shell scripting with NuShell, setting up SystemD services, software packaging and Linux driver management.