



Using Rust for Playing Soccer With Robots at RoboCup



Hendrik Sieck
HULKs

zühlke
empowering ideas

RoboCup

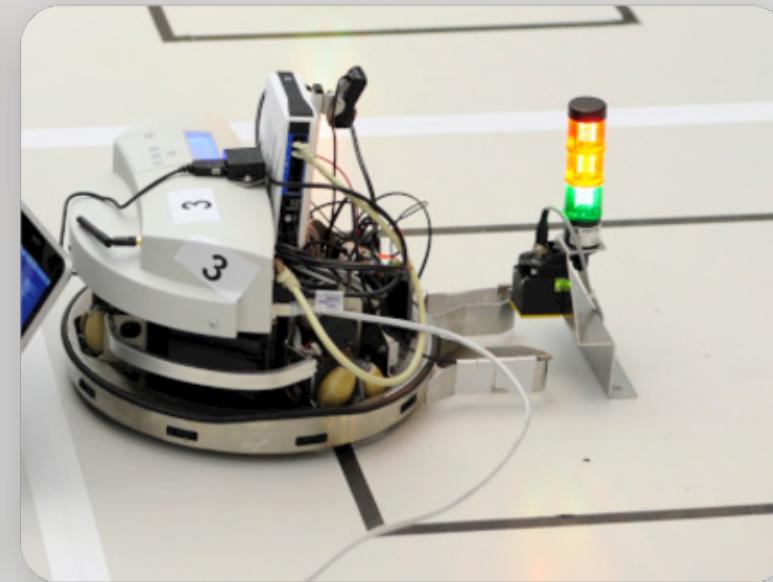
Rescue



At Home



At Work



Logistics



Soccer



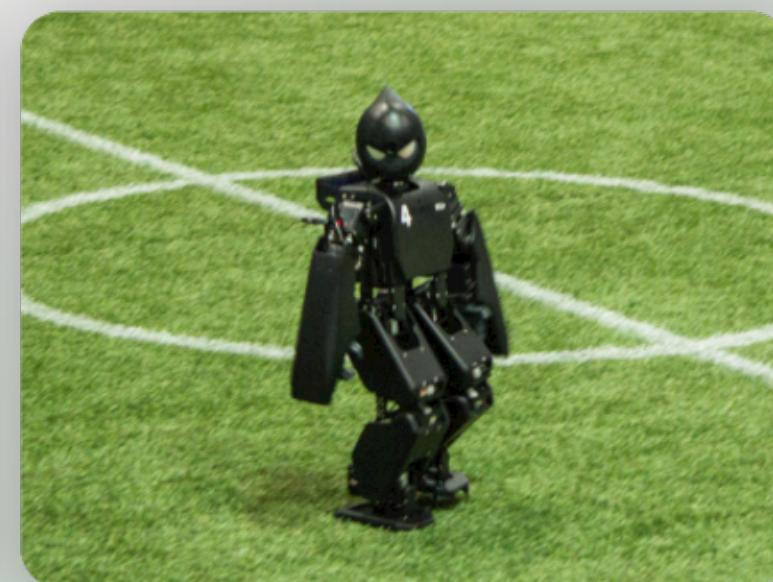
Small Size



Mid Size



Humanoid



Simulation



Standard Platform

Goal: Robots vs. Humans in 2050

Standard Platform League (SPL)

- 7 vs. 7 or 5 vs. 5
- Fully autonomous
- Identical robots, only software differs

2 Cameras

NAO

Intel Atom (2013)
4GB RAM
32GB Flash

Ultrasonics
Accelerometer
Gyroscope

Pressure
Bumpers

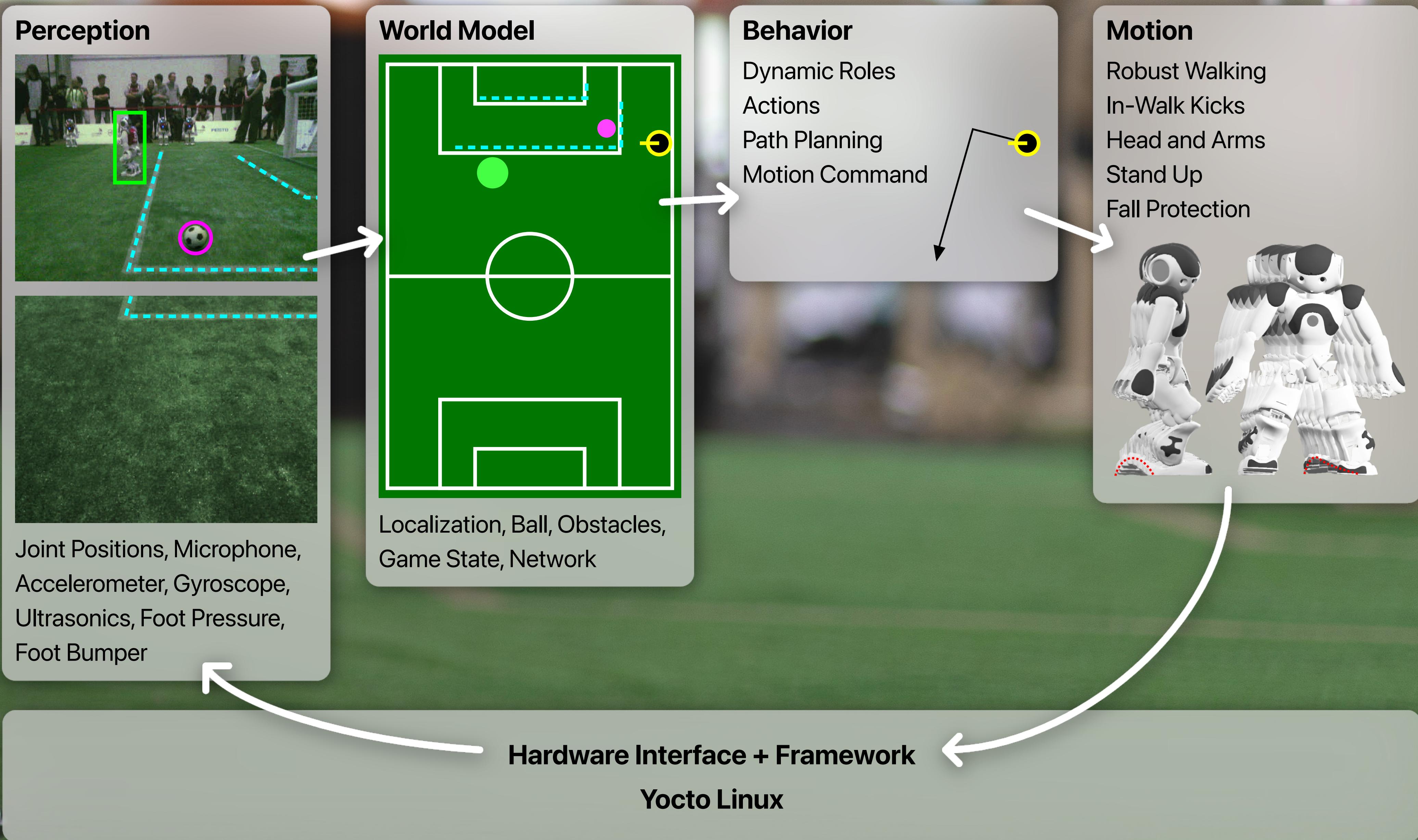
26 Joints



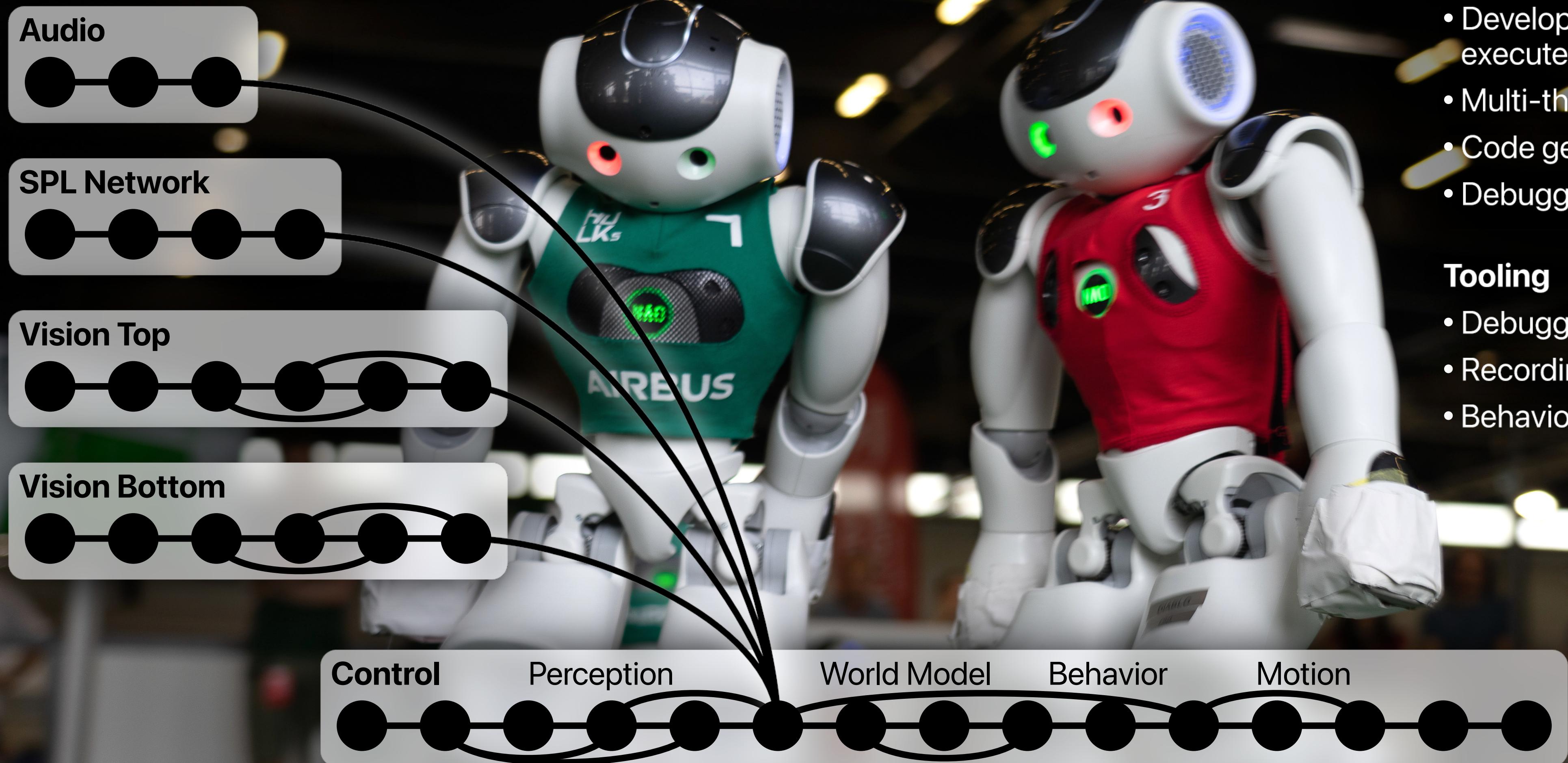
Team HULKs



Robot Control Software



Software Design



Framework

- Developer writes nodes, framework executes
- Multi-threading
- Code generation
- Debugging server

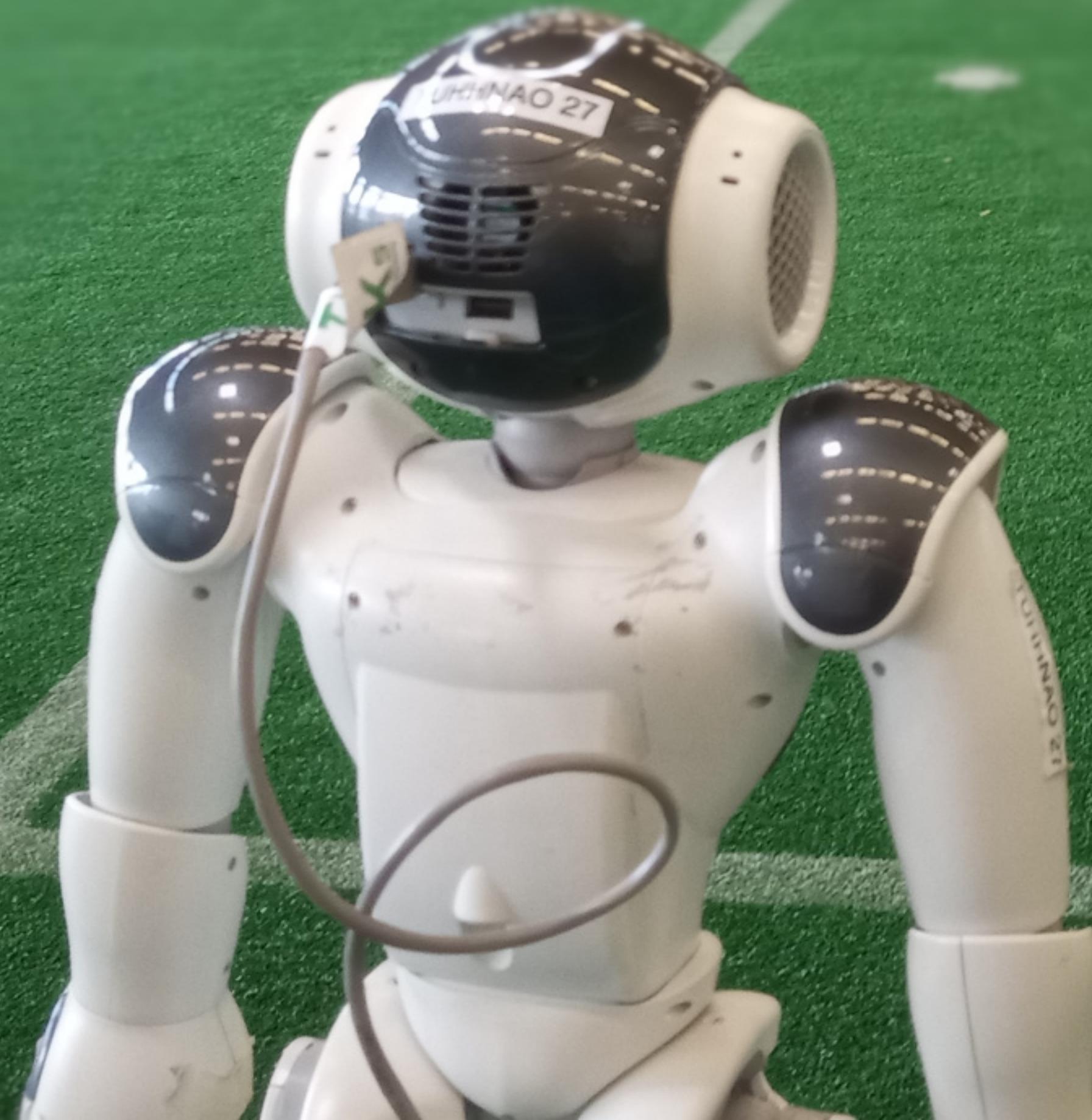
Tooling

- Debugging clients
- Recording & Replay
- Behavior simulator

Transitioning from C++ to Rust

Why?

- Decrease technical debt, rethink main concepts
- Knowledge transfer, newbie motivation
- Learn a new language
- Fun ;)



Timeline

- November 2021: Start of concept and design
- January 2022: Working framework prototype
- April 2022: Technical demonstration at GORE 2022
Scored 3 goals! 1 in the opponent goal ;)
- July 2022: Quarter finals reached at RoboCup 2022
Scored 17 goals!
- ... 2nd and 3rd iteration of framework

Learnings

- Compiler + tooling → fearless change, velocity, risk taking
- Language and standard library has richer feature set
- Development feels longer, but then it just works
- No SEGFAULT infrastructure, high prototype quality
- Focus on domain and real problems, not optimization
- To infinity and beyond: GUI, Web, Embedded, ...

Current State & Tools



Newbie Education

Monorepo

Workspace Dependencies (cargo)

Yocto Integration (depp, cargo-bitbake)

Additional Tooling (clap, indicatif)

CI Setup (test, clippy, rustfmt)

UI Tools (egui, tungstenite + Web)

Profiling (VTune, pprof)

Linear Algebra Libraries (nalgebra)

Error Handling (anyhow, eyre, color-eyre)

Serialization (serde)

Coordinate Systems

Machine Learning (CompiledNN, OpenVINO)

Interfacing to C++ and other stuff (bindgen, mlua)



Live Demo

HULKs Code

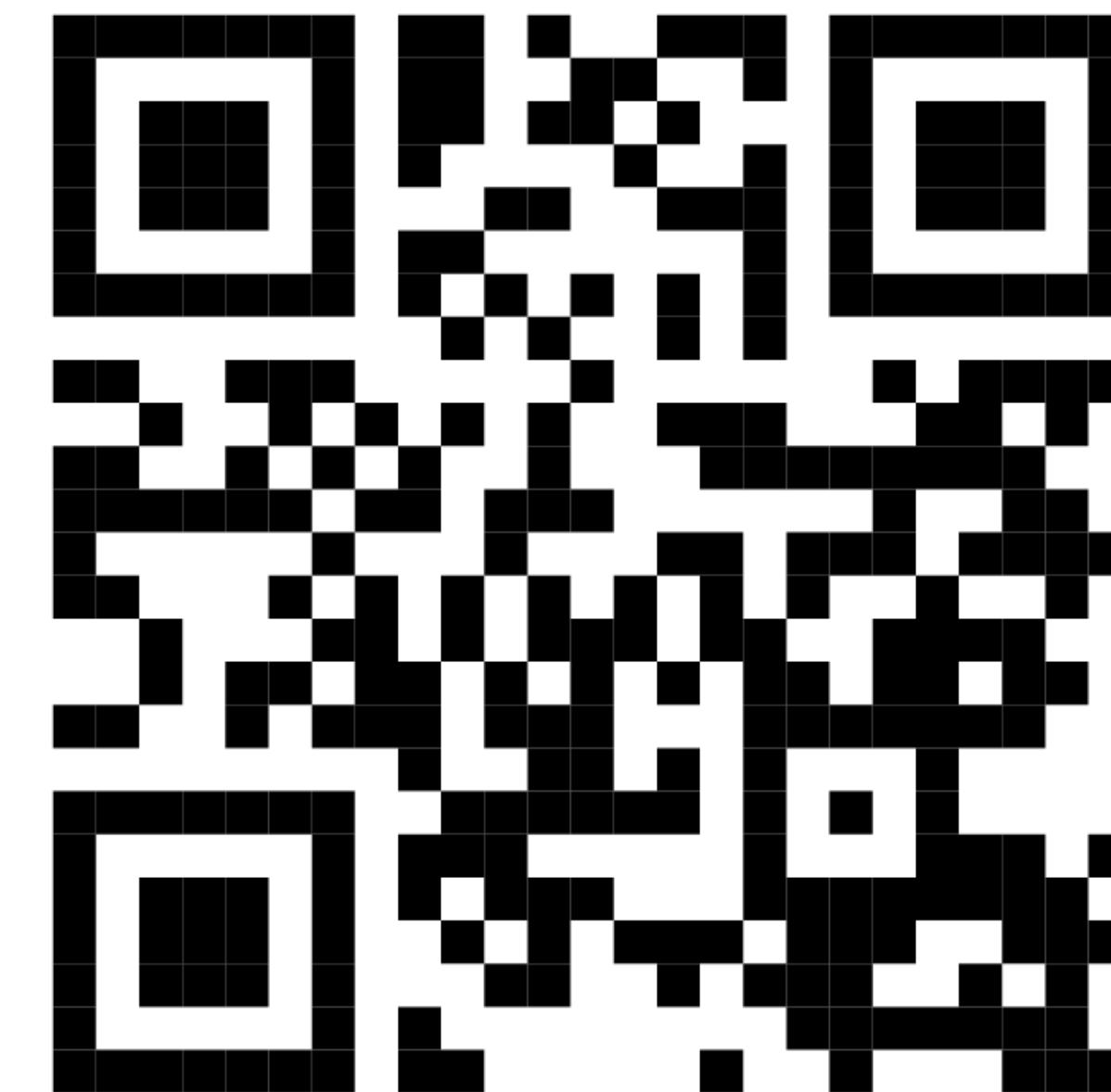


<https://github.com/HULKs/hulk>



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Slides and other Talks



<https://github.com/h3ndrk/talks>