

John Harwell

(651) 261-2862
john.r.harwell@gmail.com
https://jharwell.github.io
Google Scholar
LinkedIn
Github

Summary

Principal-level engineer specializing in R&D, system architecture, developer platforms, and reusable infrastructure. Builds declarative, correctness-oriented systems that reduce duplication and scale engineering workflows across commercial and open-source environments.

Technical Leadership

- Decision-Making** Primary technical decision-maker on critical components across embedded, algorithm, and platform domains; owned architectural risk and influenced direction with leadership and cross-functional stakeholders.
- Mentorship** Mentored engineers and researchers across academic and industry settings, from undergraduate students to junior engineers in production embedded environments.
- Process** Established software engineering guidelines, development methodologies, and CI/CD workflows adopted across teams.

Technical Skills



- Languages** **Expert:** C (embedded, 10+ yrs), C++20/23 with templates & concepts (13+ yrs)
Proficient: Rust, Python (9+ yrs)
- Systems** **Embedded OS:** Petalinux, FreeRTOS, RTEMS, bare-metal
Architectures: ARM Cortex-M7, SPARC LEON2
Protocols: UART, I2C, SPI, NMEA
- Software Dev** **Architecture:** Declarative systems design, compile-time correctness, plugin-based extensibility, embedded/platform tradespace analysis
DevOps: GitHub/GitLab CI/CD, Ansible, Docker
Toolchains: LLVM, Intel (icx, VTune), GNU; cmake, Bazel, Conan, gdb, valgrind
- Platforms** **HPC:** SLURM, PBS, Prefect
Robotics: ROS1/2, ARGoS, Gazebo, Turtlebot3
Libraries: STL, Boost, OpenMP, MPI, CMSIS, pandas

Experience

- 2025–present** **Principal Engineer, Architecture & Research, BOON LOGIC, Minneapolis, MN**
 - Defined technical direction and architecture for embedded deployment of a proprietary unsupervised ML clustering system across multiple domains (electronic warfare, smart grid monitoring), operating under high ambiguity and research-driven constraints.
 - Designed a flexible telemetry architecture based on composable *views* and *sinks* with compile-time schema enforcement, enabling multiple concurrent data projections, eliminating classes of runtime integration errors, and avoiding ~2–3 weeks of pipeline redesign.
 - Architected a compile-time, plugin-based logging framework with pluggable backends and automatic registration, enabling zero-overhead builds and consistent cross-system observability.
 - Led evaluation and selection of algorithmic approaches via literature review and first-principles analysis, shaping project roadmap and preventing pursuit of invalid approaches.

- 2024–2025 **Senior Algorithm Architect**, [EpiSci](#), Minneapolis, MN
- Directed algorithmic development for UAV systems operating in GPS-denied environments, applying task allocation and Mobile Ad Hoc Wireless Network (MANET) techniques to achieve decentralized coordination.
 - Reduced simulation times by up to 10× through computational optimization and software re-architecture, enabling 40% faster development cycles.
 - Drove migration from a large monorepo to distributed repositories, eliminating cross-team build coupling for a growing multi-project codebase.
- 2023–2024 **Embedded Development Lead**, [SATELLES](#), Minneapolis, MN
- Built a custom QEMU plugin for pre-silicon validation of a proprietary Position, Navigation, and Timing (PNT) ASIC, enabling software development and risk reduction months before hardware availability.
 - Established software engineering guidelines and mentored junior engineers on embedded practices and code review standards within a 10-person team, reducing onboarding time and raising overall code quality.
 - Ported an 80K SLOC embedded software framework for PNT receivers to a custom ASIC, owning bring-up, hardware/software co-design trade-offs, and integration.
- 2022–2023 **Postdoctoral Researcher**, [SIFT](#), Minneapolis, MN
- Engineered mathematical models of flocking behaviors for automatic control policy extraction, and redesigned in-house visualization tooling for multivariate spatio-temporal data of large-scale multi-agent systems.
- 2016–2022 **Doctoral Researcher**, UNIVERSITY OF MINNESOTA, Minneapolis, MN
- Drove independent research in multi-agent systems and collective intelligence, applying graph-theoretic and differential-equation methods to analyze emergent behavior at scale.
 - Published 9 peer-reviewed papers (6 as first author); see Google Scholar for full list.
 - Developed novel metrics for design principles of multi-agent systems, improving the utility and reproducibility of automated design methods across the research group.
 - Mentored 3–5 undergraduate and high school students per year on independent research projects, several of whom co-authored publications or presented at workshops.
- 2013–2016 **Research Engineer**, [SOUTHWEST RESEARCH INSTITUTE](#), San Antonio, TX
- Led flight software development on a NASA subcontract for the [Cyclone Global Navigation Satellite System \(CYGNSS\)](#), delivering the embedded software stack for an 8-satellite constellation in collaboration with the University of Michigan.
 - Implemented full embedded software stack on a SPARC LEON2 processor under RTEMS within a 4MB memory envelope: bootstrap/bring-up, device drivers (UART, I2C, SpaceWire, FPGA), and application-layer integration.
 - Engineered a NASA cFS-compatible prototype file system with configurable memory footprint and improved robustness for flash-based media.

Selected Infrastructure Projects

- 2022–present **Architect**, LIBRA: DECLARATIVE CMAKE BUILD AUTOMATION, 
- Built a declarative abstraction layer over **CMake** that transforms build configuration into intent-driven specifications, eliminating per-project boilerplate across C/C++ projects.
 - Standardized build and development workflows via a convention-driven system, reducing duplication and improving reproducibility.
- 2020–present **Architect**, SIERRA: RESEARCH EXPERIMENT ORCHESTRATION PLATFORM, 
- Built a declarative platform for large experimental campaigns, turning manual high-dimensional parameter exploration into automated, reproducible workflows.
 - Architected a modular, plugin-based system for experiment generation, execution, analysis, and visualization, enabling domain-specific extension without core changes.
 - Developed an end-to-end pipeline spanning input generation, distributed HPC execution, result aggregation, and automated artifact generation (graphs, videos).

Education

- 2016–2022 **Ph.D., Computer Science**, *University of Minnesota*, Twin Cities
Dissertation: Analysis of collective behavior in robot swarms
- 2016–2018 **M.S., Computer Science**, *University of Minnesota*, Twin Cities
- 2009–2013 **B.S., Computer Science and Engineering**, *University of Wisconsin*, Madison