

ZACHARY HUMES

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Lead Software Engineer. Rust, distributed systems, applied cryptography, ML systems.

EXPERIENCE

Lead Software Engineer, [HyperSphere Technologies, Inc.](https://hypercube.io) (Atlanta, GA, remote)

Jan 2026 to present

Seed-stage security startup. DNA: S3-compatible encrypted storage proxy for cloud or on-premises, sold on [AWS Marketplace](https://aws.amazon.com/marketplace).

Architecture and platform

- Rebuilt the Erlang/Elixir production backend in Rust/Axum in 30 days. The API was undocumented; reverse-engineered its 33 HTTP endpoints (S3 and REST) from the static TypeScript frontend. Led five interns on the rewrite; productionized it the next month.
- For a five-engineer team, owned architecture, code review, and all technical documentation (decision records, threat models).
- Eliminated the runtime PostgreSQL dependency in response to customer operability and risk concerns, replacing it with an S3-backed write-ahead log that stores metadata and ciphertext in the proxy's own bucket with no decryption material, so appliances are stateless.
- Crash recovery and active/passive failover sit on that same log, with monotonic fencing tokens: zero RPO and a measured 24 ms failover.
- The whole deployment is now one 22 MB systemd-managed binary, down from 26 GB, for cloud or on-premises; it installs in 15 minutes.
- Pipelined hardware-accelerated encryption over Tokio channels to 2 to 4 GB/s, so network bandwidth is the bottleneck; nodes scale out.
- Designed and built the new admin frontend (CORS presigned URLs, in-browser S3 client), an API-complete CLI, licensing, and CI/CD.

Cryptography and security

- Architected and implemented the cryptographic substrate: AES-256-GCM, KMAC, and hybrid Ed25519 and ML-DSA-65 signing.
- Designed the deterministic ephemeral key hierarchy (keys derive in memory, never stored) and wrote its provisional patent application.
- Generalized a proprietary multiparty-computation construction to arbitrary participant counts for k-of-n key custody.
- Built all of the company's pentest tooling (about 20 tools) and ran the audits; found and closed two JWT auth-bypass classes.

Delivery and leadership

- Passed the AWS Foundational Technical Review and Well-Architected review with no revisions. Launched on AWS Marketplace.
- Delivered a \$100K OEM engagement for a defense customer. Presented product architecture as technical authority for a \$500K investor close; the company raised \$3.3M in seed funding.
- Wrote the trust-boundary analysis for a partner's SBIR Phase I proposal and presented as its security expert; awarded. Ran discovery with about 24 CTOs, CISOs, CIOs, and security architects.

Founding Engineer, then Lead Software Engineer, Thalasso Therapeutics LLC (Carmel, IN, remote)

May 2024 to Jan 2026

Medical-device startup: AI-assisted intraoperative spinal imaging. Software lead on the FDA 510(k) submission; now technical advisor.

- Built CT-free 3D spine reconstruction from two orthogonal X-rays: a GAN predicts per-vertebra point clouds, then hardware-accelerated surface reconstruction and registration. About 5 mm accuracy, near clinical for planning.
- Cut 3D registration from 700 s to 4 s (175×) by reformulating it as a constrained interior-point optimization.
- Led a 140M-parameter transformer cGAN for real-time fluoroscopy enhancement, 24 fps at 720p from C-arm to OR display. Built custom CUDA inference kernels for Jetson Nano, then quantized and pruned it for edge inference on Intel i5 and Hailo-8 so PHI stays on site.
- Directed the team building the full product stack (capture-card ingestion, inference servers, touchscreen workstations) while owning the ML research on style transfer and projective geometry.
- Researched correction of perspective distortion and quantum noise in X-ray and fluoroscopy images. Shipped an MVP using style transfer trained on quaternion-parameterized synthetic views.
- Built the geometry-aware synthetic data engine: a quaternion-parameterized camera over CT volumes produces paired projections and 3D ground truth (TotalSegmentator, synthetic X-ray artifacts, domain randomization). Output was 3 TB base and over 10 TB augmented.
- Ran distributed FP8/FP16 training on Slurm and Lambda Labs with parallel grid-search hyperparameter optimization, W&B tracking, and SSIM and MS-SSIM regression validation. Cut GPU cloud cost 66%.
- Authored the FDA 510(k) eStar software documentation. Managed three engineers; delivered three products in under three months.

Machine Learning Intern, Rose-Hulman Ventures (Terre Haute, IN)

Sep 2023 to May 2024

- Built Thalasso's 3D reconstruction GAN in two months; it became the founding product. TensorFlow MVP, then PyTorch.

OPEN SOURCE

Loam (github.com/throgsoft/loam). Rendering and physics engine in Rust and WASM where curvature and dimension are type parameters: one Space trait drives rendering and physics across Euclidean, hyperbolic, spherical, and 4D space.

EDUCATION

Rose-Hulman Institute of Technology, B.S. Computer Science and Mathematics. Cum Laude, Merit Scholar.

May 2024

SKILLS

Languages: Rust, Python, TypeScript, C/C++, CUDA, Java, C#, Swift, SQL

Systems: systems design, distributed systems, distributed storage, high availability, multi-tenancy, Tokio, Axum, React

Infrastructure and DevOps: Linux, Docker, systemd, AWS, Terraform, Ansible, CI/CD, GitHub Actions, Prometheus and Grafana

Security: applied cryptography, post-quantum cryptography, key management, multiparty computation, OIDC, pentesting, threat modeling

ML: PyTorch, TensorFlow, CUDA, TensorRT, distributed training, mixed precision, Slurm, transformers, GANs, quantization, 3D vision