Mert Sefa AKGUN

Lead Software Engineer — Full-Spectrum Systems & AI
Real-time AI agents | Backend & platform | Linux/kernel networking | Embedded/RTOS | Mobile & frontend | Infrastructure
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FULL-SPECTRUM / SYSTEMS / CRAFT

Profile

Lead Software Engineer with **7+ years across every layer of the stack** — from bare-metal firmware and kernel-space eBPF to real-time AI agent platforms, mobile apps, frontend SvelteKit sites, and production infrastructure. Currently leads architecture for a **real-time multimodal AI agent platform** at VYVO. Career spine: **infrastructure → embedded/RTOS → kernel networking → real-time AI systems**, with side practice in **OS development, programming language design, game engines, crypto/auth, and web**. Not a specialist who knows one layer — an engineer who has shipped production code across all of them, and brings that breadth to every architecture decision.

Recruiter Signal

BEST-FIT ROLES	Lead Software Engineer; Senior Backend/Platform Engineer; Real-Time AI Systems Engineer; Systems Software Engineer; Full-Stack Infrastructure Engineer.
SECTORS SHIPPED	AI/ML platforms, kernel networking, embedded firmware, access-control/security, mobile (Flutter/Dart), web frontend (Svelte/Vue/TS), reverse proxy/WAF, game dev (WASM/WebGPU), infrastructure operations.
DIFFERENTIATOR	7+ years from sysadmin to lead AI engineer. Has built operating systems, programming languages, raytracers, and production AI agent platforms. Treats mobile, frontend, backend, kernel, and firmware as one continuum, not separate worlds.

Professional Experience

VYVO — **Oct 2024 – Present**
Lead Software Engineer — *Dec 2025 – Present | U.S. (Remote)*
Software Engineer — *Oct 2024 – Nov 2025*

- Own architecture and production hardening for a **real-time multimodal agent platform** spanning voice, text, tools, state, memory, retrieval, persistence, and operational surfaces.
- Build **streaming STT → LLM/tools → TTS pipelines** with hot-swappable providers and Python asyncio concurrency tuned for low tail latency, cancellation safety, responsive interruption handling, and backpressure.
- Implement **multimodal RAG and long-lived memory** using PostgreSQL plus Qdrant, SurrealDB, ChromaDB, and LanceDB, with embeddings, keyword retrieval, ranking, caching, and storage lifecycle concerns.
- Design **idempotent transcript and event flushing** so sessions recover from retries, partial failures, races, reconnects, and shutdown paths without duplicate writes or inconsistent state.
- Deliver WebRTC communication behind reverse proxies and harden long-running sessions against jitter, disconnects, provider stalls, partial failures, lifecycle leaks, and degraded dependencies.
- Add structured logs, **OpenTelemetry tracing**, task supervision, and review standards around async lifecycles, state machines, tool-call flows, persistence correctness, and production observability.
- Lead refactors and code reviews that improve runtime safety, testability, and maintainability while preserving product-facing behavior.

Tech: Python, asyncio, PyTorch, NumPy, LiveKit, Pipecat, WebRTC, PostgreSQL, Qdrant, SurrealDB, ChromaDB, LanceDB, OpenTelemetry, Docker, Linux

Professional Experience, Continued

Baykar **Mar 2024 – Jun 2024**
Systems Software Developer *Istanbul, Turkiye (On-site)*

- Developed a custom real-time Layer 2 networking stack for aerial vehicles using **IEEE 802.1 TSN** concepts.
- Implemented IEEE 802.1CB Frame Replication and Elimination for Reliability with **eBPF/XDP** to minimize fast-path overhead.
- Worked with IEEE 802.1AS (PTP), 802.1Qbv (Time-Aware Shaping), and 802.1Qbu (Frame Preemption) for time-sensitive networking.
- Built Rust kernel-space components with Aya and libbpf-rs and produced custom Linux kernels with Yocto and Buildroot.

Tech: Rust, eBPF, XDP, Aya, libbpf-rs, Linux, Yocto, Buildroot, IEEE 802.1AS/Qbv/Qbu/CB

Fora (Mavisoft) **Mar 2022 – Mar 2024**
Embedded Systems Software Developer *Istanbul, Turkiye (Hybrid)*

- Developed bare-metal and RTOS firmware for access-control and security products across multiple device lines.
- Built a C/C++ implementation of **SIA OSDP (Open Supervised Device Protocol)** for secure supervised access-control communication.
- Implemented symmetric encryption and authentication in C for **constrained, non-TLS-capable devices**; the implementation was validated by an external security audit.
- Built a real-time indoor localization system with **UWB TDoA/TWR and BLE**, including EKF filtering, calibration/debugging tooling, and a Tauri visualization/configuration application.
- Debugged production firmware across card readers, relays, sensors, field integrations, undefined behavior, constrained resources, and latency-sensitive failures.
- Worked across UART/I2C/SPI, Modbus, RS232/RS485, TCP/IP, peripheral control, field setup, protocol integrations, and constrained-resource targets.

Tech: C/C++, Zephyr, NuttX, FreeRTOS, UWB, BLE, UART/I2C/SPI, Modbus, RS232/RS485, TCP/IP, Tauri, TypeScript

Independent Infrastructure & Systems Work **Jan 2017 – Present**
System Administrator / Infrastructure Operator *Remote*

- Operate production systems on dedicated servers and AWS, GCP, Azure, and Hetzner.
- Build secure access and recovery patterns with VPNs, tunnels, SSH jump hosts, reverse proxies, hardened deployments, monitoring, and disciplined backups.
- Manage virtualization, storage, and firewalling with Proxmox, QEMU/KVM tuning, RAID10, Ceph, OPNsense, WireGuard, and OpenVPN.
- Maintain reproducible deployments with an operator mindset: observability, backup discipline, segmented access, incident debugging, recovery paths, and follow-up hardening.
- Built and operate a **reverse proxy and WAF platform** (ProxyPanther) managing public-facing routing, TLS termination, and security filtering for multiple domains.

Tech: Linux, Docker, NGINX, Proxmox, Ceph, OPNsense, WireGuard, OpenVPN-DCO, PostgreSQL, MySQL, MongoDB

Selected Projects & Range

Beyond professional work, I build across every layer to understand systems from first principles. Selected personal projects:

- **Operating system:** bare-metal aarch64 OS in Rust — boot, memory management, scheduling, syscall interface.
- **Programming language:** custom language built from scratch in Rust — lexer, parser, type system, codegen.
- **Game engine & graphics:** WASM/WebGPU roguelike, Rust raytracers, Mandelbrot/Voronoi renderers, GPU/FFI generative art.
- **Mobile:** Flutter/Dart mobile applications and Svelte-based UAV ground control software with telemetry visualization.
- **Frontend & web:** `msakg.com` (SvelteKit), Vue/TypeScript dashboards, ambient-sound and breathing-exercise web apps.
- **Crypto & security:** JWT auth servers (Rust/Axum), OSDP protocol libraries (ANSI C), reverse-proxy/WAF with security filtering.

THROUGH-LINE 7+ years from sysadmin to lead AI engineer. Not a specialist in one layer — a veteran who has shipped across firmware, kernel, backend, AI runtime, mobile, frontend, and infrastructure.

Technical Skills

Languages	C/C++, Rust, Python; production: JavaScript/TypeScript, Dart, Java, C#, Lua, Elixir.
AI & Backend	Streaming STT/LLM/TTS, LiveKit, Pipecat, asyncio, tool orchestration, state machines, RAG/multimodal RAG, provider abstraction, evaluation harnesses.
Data & Retrieval	PostgreSQL, SQL, schema design, performance tuning, Qdrant, VectorChord, SurrealDB, ChromaDB, LanceDB, MongoDB, embeddings, vector and BM25-style keyword retrieval.
Systems/Networking	Linux, TCP/IP, WebRTC, eBPF/XDP, TSN, IEEE 802.1CB/AS/Qbv/Qbu, reverse proxies, profiling, concurrency, scheduling, backpressure.
Embedded	Bare-metal, FreeRTOS, Zephyr, NuttX, UART/I2C/SPI, Modbus, RS232/RS485, UWB, BLE, peripherals, constrained crypto/authentication.
Mobile & Frontend	Flutter/Dart, Svelte/SvelteKit, Vue, TypeScript, WASM/WebGPU, Tauri, HTML/CSS, responsive design.
Infra/Security	NGINX, Proxmox, Ceph, OPNsense, WireGuard/OpenVPN, Docker, Yocto, Buildroot, Aya, libbpf-rs, OpenTelemetry, CI/CD, JWT auth, WAF, OSDP, symmetric crypto, backups.
Graphics & Maker	Raytracers, Mandelbrot, Voronoi, WASM/WebGPU roguelike, GPU/FFI, hardware/software prototyping, electronics, 3D modeling, audio production, sound design.

Engineering Practice & Research

- **Real implementations:** prefer production paths over toy demos; build, benchmark, debug, and operate systems that survive messy networks, hardware, dependencies, and field conditions.
- **Systems from scratch:** built an OS, a programming language, raytracers, and protocol libraries — not just consumed frameworks, but understood and built the layers underneath.
- **Search and optimization:** study evolutionary algorithms and genetic programming, with interest in AI-agent autonomy and optimization-driven approaches to system design.
- **Taste under constraint:** music production, embedded systems, networking, and outdoor practice all reinforce sensitivity to timing, feedback, resilience, iteration, and physical-world failure modes.

Leadership & Operating Style

- Own technical direction from design through implementation, rollout, maintenance, incident debugging, and follow-up hardening.
- Improve runtime safety and maintainability through focused refactors, code reviews, pair-debugging, explicit integration contracts, and practical runbooks.
- Work across product, infrastructure, ML, embedded, mobile, frontend, and systems boundaries while keeping reliability and observability central.
- Bring breadth into architecture decisions: when you have built the OS, the language, the firmware, and the frontend, you see trade-offs that specialists miss.
- Set engineering standards around async/task lifecycles, state-machine boundaries, persistence correctness, testability, review quality, and production readiness.

Creative Practice & Personal Signal

- **Taste as engineering judgment:** cares about invisible details that shape user trust: timing, cancellation, feedback, defaults, debugging affordances, and operational clarity.
- **Maker-led engineering:** end-to-end prototyping across software, hardware, electronics, 3D modeling, firmware, visualization tools, client tooling, and deployment.
- **Audio and interaction taste:** audiophile listening, EDM sound design, and music production—including rumble kicks, trance synths, dynamics, and texture—sharpen sensitivity to latency, timing, feedback, and user-perceived quality.
- **Systems taste:** prefers real implementations over toy demos; enjoys building, benchmarking, debugging, and operating systems that survive contact with messy environments.
- **Outdoor resilience:** cycling, hiking/camping, climbing, and snowboarding reinforce exploration, risk reading, adaptation, iteration, and calm under difficult conditions.

Education & Community

Cumhuriyet University — Bachelor's Degree **2020 – 2024**
Selected coursework: Operating Systems, Computer Networks, Embedded Systems, Data Structures & Algorithms.
Google Summer of Code 2020 — Python Fury.
Teknofest: 2021 Unmanned Underwater Vehicle finalist (7th); 2021 International Unmanned Air Vehicle finalist; 2022–2023 International Fighter Unmanned Air Vehicle participant.