Timothy Banks

Principal Engineer — Blockchain Protocols | High-Performance C++ Systems | Distributed Architecture
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SUMMARY

Principal Engineer with 25+ years designing and delivering mission-critical, high-performance distributed systems across blockchain protocols, custody systems, consensus algorithms, developer-tooling ecosystems, GIS engines, UAV video pipelines, IoT/edge compute, and defense programs. Career-long C++ engineer with deep expertise in **C++11/14/17/20/23**, runtime architecture, WASM internals, compiler/LLVM tooling, PBFT-style consensus, deterministic state machines, MPC signing flows, and large-scale architectural redesigns.

Recognized for:

- Solving complex system-level problems quickly and permanently
- Architecting systems that eliminate entire classes of bugs or engineering effort
- Building internal tooling that dramatically elevates team productivity
- Raising engineering standards through strong mentorship and deep code-review culture
- Delivering critical systems under extreme deadlines and shrinking resources
- Owning end-to-end system design across multiple domains simultaneously

CORE COMPETENCIES

Languages: C++11/14/17/20/23, C, Python, Java
Blockchain: PBFT/Autobahn, CometBFT, Concord-BFT, EOSIO/DPoS, EVM, WASM, Bitcoin PoW
Protocols & Runtimes: Deterministic state machines, VM internals, execution layers
Tooling: LLVM/Clang AST tooling, static analyzers, WASM coverage (gcov/lcov), code-gen pipelines
Distributed Systems: Consensus correctness, validation rules, data pipelines, RPC, event systems
GIS: Raster/vector preprocessing, terrain algorithms, projections, OpenGL pipelines
Leadership: Architecture direction, mentoring, review-culture enforcement, cross-team alignment

NOTABLE SYSTEMS & PROJECTS

Blockchain & Protocol

- **Somnia PBFT/Autobahn L1 blockchain:** Principal engineer across consensus, execution, Hardhat compatibility, performance, and protocol safety.
- **Hardhat Cheatcode RPC Support:** Enabled Somnia to function as a Hardhat node, unlocking >7,000 test cases.
- **WASM VM context switching:** Added synchronous multi-contract calls to EOSIO-style runtimes.
- **Patent-pending SQL→KV semantic mapper:** SQL-style access to blockchain KV state; eliminated integration barriers.
- **Oracle networks:**
  - Somnia — decentralized HTTP-outcall + consensus validation
  - Bullish — rapid listing oracle minimizing infrastructure debt.
    Allowed for chain indexing, transaction creation and signing per on boarded protocol.

Developer Productivity & Tooling

- **WASM gcov/lcov coverage system:** Added true coverage metrics to WASM contracts — solved after multiple engineers failed.
- **Native macOS EOSIO builds:** Removed Docker/cloud VM dependency entirely.
- **Clang static analysis tools:** Automatically prevented migration-breaking contract patterns.
- **Clang AST binding generator (ESRI):** Multi-language automatic SDK binding tool saving months every release.

Defense, GIS & Visualization

- **DoD high-performance GIS engine:** Outperformed ESRI ArcObjects and FalconView on underpowered hardware.
- **UAV low-bandwidth streaming system:** Real-time drone video to iOS over extremely constrained tactical networks.
- **Chromalyzer:** 2D/3D palette engine w/ Lab/XYZ/HSV/RGB conversion, palette coverage algorithms, and image-based color matching.
- **Photosphere (co-founder):** Paint, flooring, and lighting simulation platform (later acquired by Chameleon Power).

EXPERIENCE

Somnia Protocol — Principal Protocol Engineer

2025 – Present

Autobahn PBFT Consensus & Protocol Architecture

- Principal engineer responsible for the protocol execution environment, validator rules, consensus message flows, block finality paths, and performance characteristics.
- Implemented multiple layers of deterministic guarantees, fork-safety checks, replay protection, and validator-sanity rules.

Hardhat Cheatcode RPC Support

- Added full cheatcode coverage for Somnia, enabling the chain to act as a Hardhat node.
- Result: >7,000 automated Hardhat tests now run against Somnia, dramatically expanding compatibility and developer confidence.

Decentralized HTTP-Outcall Oracle

- Designed and implemented an oracle network enabling EVM contracts to securely request off-chain data.
- Achieved consensus-verified results and safe on-chain callbacks.

Performance, Reliability & Engineering Culture

- Introduced protocol-level anti-DDoS mechanisms and validation safeguards.
- Championed **rigorous code-review culture** — no rubber-stamping, cross-team review participation, and a culture of open technical questioning.

Bullish — Principal Software Engineer, Custody

2023 – 2024

Custody Architecture Ownership

- Technical lead across custody pipelines, MPC signing, WASM contract execution, deterministic state machines, and cross-chain integrations.
- Delivered complete custody system under **fixed, funding-critical deadline**, despite declining team size.

Smart Contract Architecture Redesign

Delivered a full redesign of the custody contract stack (C++ targeting EOSIO/WASM), achieving:

- All future business requirements satisfied **with zero new contract code**
- Nearly zero bugs post-launch
- Vastly reduced maintenance & triage load
- Predictable, easily audited system behavior

Developer Tooling Breakthroughs

- Built **Clang AST–based static analyzers** identifying migration-danger patterns before they could enter production.
- Designed and integrated **WASM gcov/lcov coverage** instrumentation.
- Added **WASM VM context switching** to support synchronous contract → contract calls.

Protocol & Blockchain Integrations

- Built **rapid-listing oracle** simplifying the onboarding of new assets, dramatically reducing engineering overhead.

macOS Native EOSIO Toolchain

- Ported EOSIO to compile natively on macOS — completed in one morning after engineering management estimated three months.
- Eliminated Docker/cloud VM dependence → significantly faster iteration cycles.

Engineering Leadership

- Actively enforced a high-standard review culture, stepping in when review quality regressed.

Bullish — Lead Software Engineer, Smart Contracts

2021 – 2023

- One of the first engineers implementing custody smart contracts in C++/WASM.
- Built deterministic state machines for onboarding, compliance checks, custodial flows, and controlled execution.
- Led team of 5 engineers to deliver the **January 2022 Bullish Exchange launch**.
- Enhanced debugging, build systems, contract execution flows, and developer ergonomics.

Block.one — Blockchain Engineer

2020 – 2021

EOSIO Protocol Engineering

- Maintained and enhanced the EOSIO core engine: WASM execution pipeline, deterministic state transitions, multi-index DB behavior, and block validation rules.
- Implemented protocol upgrades and performance improvements across Chainbase, fork-choice logic, and execution determinism guarantees.
- Diagnosed subtle race conditions, replay inconsistencies, VM faults, and corrupted state transitions across multiple execution paths.

RocksDB Storage Integration

- Integrated **RocksDB** as an alternative backend to Chainbase, enabling more flexible disk-based storage, lower RAM pressure, and improved operational reliability for resource-constrained deployments.

Review Culture & Debugging Leadership

- Set high standards for correctness in consensus-critical code reviews.
- Stepped in to evaluate complex defects spanning VM execution, networking, serialization, and on-chain determinism.

Amazon — Software Engineer (AWS Greengrass / IoT Edge)

2019 – 2020

SCIF / Offline Compute

- Built secure offline-capable IoT computation layers used in SCIF-restricted environments with no outbound network access.
- Designed predictable, reproducible execution models for edge devices with intermittent connectivity.

Runtime & Language Migration

- Ported Python 2.x systems to Python 3.x while maintaining compatibility across embedded Linux targets.
- Maintained C/C++ integration layers enabling low-latency device communication.

Reliability & Platform Hardening

- Improved dependency resolution, sandboxing, and isolation for AWS Greengrass components.
- Streamlined build and packaging pipelines for multiple architectures.

ESRI — Principal Software Engineer

2013 – 2019

C++ Runtime SDK Architecture

- First engineer on the modern C++ Runtime SDK rewrite, replacing legacy code with a cross-platform, modular architecture supporting Windows, Linux, macOS, Android, iOS, and Qt.

LLVM/Clang AST Binding Generator

- Designed and built an advanced AST-driven tool to automatically generate high-level bindings for:
  - Java

- Swift
- .NET
- Objective-C
- Qt
- Python

- This eliminated months of manual engineering effort every release, ensuring consistency across platforms.

Rendering & Data Layers

- Architected async operation models, error propagation frameworks, and rendering subsystems for 2D/3D maps.
- Contributed to performance-critical components in geometry, features, layers, and networked GIS workflows.

Chameleon Power — Lead Software Engineer

2013 – 2014

C++ Visualization Engine (8× Performance Boost)

- Completely rewrote the company's visualization engine in modern C++.
- Delivered **8× speedup** enabling high-resolution, interactive room visualization on commodity hardware.

Visual Transformation Capabilities

- Implemented:
  - Paint recoloring
  - Tile and flooring replacement
  - Lighting transformations (noon, dusk, incandescent, fluorescent)
  - Material blending & masking
- Created accurate reflectance and illumination simulation models for photorealistic results.

Chromalyzer — Lead Software Engineer

2013 – 2014

Color-Science Engine

Built a professional-grade color-analysis and visualization suite featuring:

- **2D and 3D color-space visualization**
- Conversions between **Lab, XYZ, HSV, RGB**
- Ability to import photos and perform nearest-color matching
- Palette coverage algorithms ensuring good distribution across perceptual space
- Tools to help paint manufacturers design color lines with optimized perceptual spacing

General Dynamics — Staff Software Engineer

2004 – 2012

High-Performance GIS Engine (C++)

Lead engineer and architect for a **complete GIS engine** built in modern C++ for multiple DoD situational-awareness programs.

Supported:

- Dozens of raster formats: **ASRP, CADRG, CIB, DTED, GeoTIFF, JPEG2000, MrSID, NITF**, etc.
- Vector formats: **VPF, KML, GPX**, military overlays, tactical symbology
- Projections: **WGS84, Mercator, Transverse Mercator, Equirectangular, UTM, UPS, BNG**
- Grid systems: **MGRS**, full precision and conversion routines

Benchmark Superiority

Independently benchmarked to outperform:

- **ESRI ArcObjects**
- **FalconView**

while running on **resource-constrained military hardware**.

Terrain & Spatial Analysis

Implemented advanced spatial algorithms:

- Intervisibility / line-of-sight
- Dead-ground detection

- Terrain-based routing
- Raster pyramiding & tiling
- Raster/vector fusion
- Preprocessing pipelines for massive datasets

OpenGL Renderer

- Built custom real-time rendering engine: GDI → DirectDraw → OpenGL migration
- Enabled smooth pan/zoom, multi-layer overlays, tactical symbology, and hardware acceleration

UAV Low-Bandwidth Video System

- Architected a system for streaming drone video over extremely constrained tactical networks
- Delivered real-time feeds to **iOS devices**
- Designed adaptive bitrate / resilience mechanisms for unstable battlefield links

Android Platform Migration

- Proposed and led migration from **Windows CE → Android**
- Solved severe development and deployment limitations
- Produced an Android mapping SDK that **outperformed ESRI's mobile SDK** in independent testing

Program Support

Supported and delivered across multiple major systems:

- **ComBAT**
- **Spartan**
- **TiGR**
- **TWV**

Work spanned:

- Mapping engines
- Video systems
- Tactical overlays
- Data-exchange formats
- Field tests and validation with military units

EDUCATION

Purdue University

- **M.S. Mathematics**
- **B.S. Computer Science**
- **B.S. Information Systems**

Photosphere — Co-Founder / Lead Engineer

2002 – 2004

Early Photographic Visualization Platform

Co-founded Photosphere to build an advanced photo-based visualization engine enabling:

- Wall-colors to be changed from an uploaded photo
- Flooring materials to be swapped (wood, carpet, tile)
- Lighting conditions to be simulated (incandescent, fluorescent, daylight progressions)

Acquired by Chameleon Power

Technology became the basis for Chameleon Power's visualization suite used by major paint and construction brands.

SolutionPoint — Software Engineer

1999 – 2002

Web 2.0 Applications

- Built dynamic ASP.NET, JavaScript, and C++ applications during early adoption of interactive "Web 2.0" design.
- Developed data-driven architectures, UI components, and workflow systems for enterprise customers.

TECHNOLOGIES

Languages & Systems:

C++11/14/17/20/23, C, Python, Java, Rust

Blockchain / Protocol / Cryptography:

EOSIO, EVM, WASM, PBFT/Autobahn, CometBFT, Concord-BFT, Bitcoin PoW, MPC signing, deterministic runtimes, RocksDB, Chainbase, merkle proofs, replay protection

Tooling / Compiler / Build Systems:

LLVM, Clang, AST tooling, static analysis, gcov, lcov, CMake, Ninja, sanitizers, AST-driven code generation

GIS / Graphics / Imaging:

OpenGL, GDAL, raster/vector pipelines, terrain analysis, routing, projections, color-space transformations (Lab, XYZ, HSV, RGB), segmentation, illumination models

Cloud / DevOps / Infrastructure:

AWS, GCP, Kubernetes, Docker, Linux, macOS, CI pipelines, distributed systems monitoring

Other:

Hardhat testing framework integration, Android architecture, iOS streaming, UAV telemetry, low-bandwidth adaptive protocols

KEYWORDS

C++11 • C++14 • C++17 • C++20 • C++23 • Modern C++ • C • Python • Java • Rust • Blockchain • Protocol Engineering • PBFT • Autobahn • CometBFT • Concord-BFT • WASM • EOSIO • EVM • Solidity Integration • Smart Contracts • MPC Signing • Consensus Algorithms • Deterministic Execution • RocksDB • LLVM • Clang • AST • Static Analysis • WASM Coverage • gcov • lcov • Developer Tooling • SQL→KV • Oracle Networks • Blockchain Indexing • High-Performance Computing • Distributed Systems • Runtime Architecture • Virtual Machines • GIS • UAV Streaming • Raster/Vector • OpenGL • Debugging • Performance Optimization • Memory Management • Multithreading • Real-Time Systems • Defense Software • Tactical Systems • Android • iOS • Edge Compute • IoT • SCIF Environments • Cloud Platforms • Kubernetes • Docker • cmake • Linux • macOS