Tanjim Hossain

Contributor, Researcher and Innovator at Ālo Labs

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Tanjim is a software engineering leader with 10+ years of polyglot full-stack programming and 3+ years of research experience, across software engineering, architecture and DevOps. He can bring immediate value to a software organization by reducing costs, complexity and time-to-delivery with modern and next-generation approaches utilizing leading and emerging technologies. With a dynamic, problem solving, rapid value delivery mindset, he is keen to make instrumental contributions to future-focused organizations aspiring to be category leaders. He is a proactive learner, who believes in "Ubuntu - I am because we are".

EXPERTISE

SOFTWARE ENGINEERING

- Polyglot Programming
- Programming Idioms
- Design Patterns
- Domain Modeling
- DDD (Domain-Driven Design)
- BDD (Behavior-Driven Development)
- System Design
- Actor Model
- Capability-Based Security

SOFTWARE ARCHITECTURE

- Reactive Principles & Patterns
- Event-Driven Architecture
- SOA (Service-Oriented Architecture)
- Component-based Software Engineering and Component Models
- Cloud-Native & Edge Architecture
- Distributed Systems

DEVOPS

- Application Delivery, Orchestration & Remediation
- Continuous Integration
- Continuous Delivery
- GitOps
- Trunk-Based Development
- Multi-Cluster Kubernetes
- System Monitoring & Tracing

MISCELLANEOUS

- Event Processing
- Service Mesh
- API Technologies
- UI/UX Design
- Client-side Development
- In-Memory Computing
- Data-Compute Locality
- Systems Programming

SKILLSET

Programming Language	Scala, Rust, JavaScript, Typescript, Java, C/C++, Elixir, C#, WebAssembly, Dart, Python, PHP, Lisp, Smalltalk, Bash
Frameworks & Libraries	Akka, ScalaTest, Spring Boot & Reactive, Micronaut, RSocket, JMH, Flink Statefun, GraalVM Polyglot & Isolates, JSoniter, Axum, Tokio, Rayon, Itertools, NestJS, ExpressJS, Sequelize, TypeORM, Radash, Ramda, XState, Apollo GraphQL, ReactiveX, WAMR, Seastar, MiniAudio, GLFW, GoogleTest, Phoenix, Ecto, .Net Core 7, WASI, Django
UI/UX & Client-side	SvelteKit, TailwindCSS, PostCSS, Web Workers, Vue, React, Flutter, OpenGL, GLSL, QT, WPF, Vector Graphics
DevEx	Tilt, Scaffold, Dev Container, K3d, NeoVim, Linux (ptrace, socat, awk, etc.), Docker Compose, Valgrind, Vagrant, Git
DevOps	Kubernetes, KubeVela, Terraform, Pulumi, Argo, Keptn, Crossplane, Github Actions, Longhorn, OpenTelemetry, Jaeger, Grafana, Loki, Knative, LXC, Docker, Verrazzano, KubeSphere, CloudEvents, Prometheus, Ansible, K6, Traefik
Cloud and Edge	Amazon/Google/Azure/Oracle Cloud, VMs, Containers & Kubernetes Engine, Fly.io, Render, Railway, Vercel, Heroku, Cloudflare Workers, AWS Route 53, CodeCommit, Terraform Cloud, Google Apps Script, Twillo, Sendgrid
Data Engineering	Flink, YugaByteDB, PlanetScaleDB, ScyllaDB, Cassandra, PostgreSQL, Timescale, Pinot, Redis, Pravega, Kafka
Miscellaneous Areas	Neuromorphic Computing, Systems Science, Alan Kay's Real OOP, Inconsistency Robustness, Concurrency, Thread-Per-Core Architecture, CRDT (Conflict-free Replicated Data Type), Clustering & Sharding, CNCF Landscape Technologies, CEP (Complex Event Processing), Digital Twin, Formal Semantics, Arduino, Mentoring, Philosophy

HIGHLIGHTS

PROGRAMMING AND SOFTWARE ENGINEERING

- **10+ years** of programming experience in many diverse ecosystems - with a mindset to actively **seek** / **acknowledge** / **understand** the underlying engineering **principles**, **paradigms**, **approaches** and their **application**
- **Two-times National Medal Winner** in 2015 & 2016 National High School Programming Contest (NHSPC) in Senior Category, and **First Prize** winner globally in **HackHolyoke Hackathon** 2020, organized by Mount Holyoke College, USA
- Experience in a **diverse range of software engineering disciplines** including Full-Stack Web Development, DevOps, Cloud Computing, Platform Engineering, Distributed Systems, Systems Programming
- Developing **CompaaS** (**Comp**onent-**a**s-**a**-**S**ervice) Platform - a managed platform for managing the whole life-cycle of polyglot components, and their interconnectivity in a multi-cloud environment, in a highly scalable, secure, and efficient way
- **Maximum leveraging** and hands-on experience on modern tools and technologies
- **Fast Learning and Execution ability** in case of time-constrained tasks and projects
- Application of **non-mainstream** but powerful ideas and approaches, that proposes unique practical values, Demonstrating good technical and theoretical **understanding** of fundamental ideas and **passion** for Computer Science and Engineering
- **Up-to-Date** to the new technology stream, but also an advocate of "**Back-to-the-Future**" approach in Computer Science & Engineering

RESEARCH AND DEVELOPMENT

- **3+ years** of R&D experience and contribution as a core member in **Ālo Labs**
- Invented fundamentally important, **first-principles based computer science and software engineering concepts and methods** based on General Systems Theory, Systems Science, Logic, Philosophy and Neuromorphic Computing that have potential to bring a paradigm shift to **increase reliability, security, intelligence and reuse** in large-scale, complex, distributed software, while simultaneously **reducing cost, effort and development time**, particularly addressing and eliminating the current mainstream accidental complexities of software architecture, cloud and edge computing
- **Developing a Secure-by-Design, composable software primitive** unifying general-purpose computing and **neuromorphic AI/ML**, high-concurrency Actor Model of computation, Capability-based Security and General Systems Theory that can be used to secure software components and digital assets at a fundamental level in a more powerful way than the current ACL-based paradigm
- Developing an end-to-end, open source, versatile, cloud-agnostic, framework-agnostic **SaaS Reference Architecture** with next-generation scalability, availability and security properties, incorporating the concept of Data Mesh, leveraging data from sources and sinks like Data Lakes and Data Warehouse
- Extensive research on the past **100+ years** of Computer Science and associated fields, such as Systems Science, Philosophy

TRAINING AND MENTORING

- **Founded an online community and mentored 100+ school-university students** in their journey to programming and Computer Science

INDUSTRY VOLUNTEERING

- Helped the local **Linux community** grow substantially through organizing events and workshops

PROFESSIONAL EXPERIENCE

DevOps Engineer
Fortune 500 Systems Integrator
UTC Associates, Inc. (UTC), USA
July '23

UTC Associates, Inc. (UTC) is a solutions-based business and technology consulting firm focusing on key aspects of technology innovation, application development, design, testing, implementation,

Worked on:

- **Pre-Sales Process**, response to **RFP**, issued by **Consolidated Edison(ConEd),** a **fortune 300** company in the Utilities industry, striving to bolster its DevOps capabilities, and technology modernization.
- **Assessment** of ConEd development practices, applications and deployment models, and **Planning** a detailed DevOps implementation that aligns with their business objectives
- **Selecting** best of Suite and Hybrid set of **tools in CI/CD and SDP** category, and assessing the **integration strategies** - that meets the application needs, security requirements, and compliance standards

managed support and services.

- Planning an efficient **Staffing Model**, with value-adding roles, and sorting resumes

Skills: Presales, Request for Proposal (RFP), Screening Resumes, Staffing Plans, DevOps

Software Engineer
EdTech SaaS
CodersTrust, USA
February '23 - present

CodersTrust is a global EdTech company innovating new ways to upskill/reskill the untapped youth of emerging markets with in-demand skills so that they can join the evolving global virtual workforce and realize their full potential.

Worked on:

- **CodersTrust.Global**, The new revamped website of CodersTrust
- **JobReady**, a Job Portal / Marketplace - a new offering from CodersTrust, where employers can discover and hire part-time/full-time remote talents globally.

Technologies Used: Php, PlanetScale, Fly.io, AWS Route 53, CodeCommit, Elementor, Wordpress, Hostinger etc.

Researcher - Applied Innovations
R&D Lab focused on Scalable Reliability, Security & Reuse for Enterprise, SaaS and Mobile Apps
Ālo Labs, Australia
Oct '20 - Present (2 y +)

Ālo Labs is a non-profit, community-driven, first-principles based research and innovation lab creating groundbreaking open source tech, with a mission to reduce by 10x the cost, complexity and effort of envisioning, developing, operating and maintaining complex, modern, large-scale, distributed software - by unifying, simplifying and amplifying the synergistic power of surprisingly under-leveraged concepts and methods of last 100 years of Systems Sc, Computer Sc, Systems Eng and Software Eng

Innovated:

- **Ālo OS**, a truly next-generation, universally deployable "overlay OS" (Single System Image - Distributed OS) that can launch maximally reusable, mobile, intelligent, polyglot "nanoservice agents" 1000x faster than any alternatives (e.g. FaaS), hosting up to 5M in-memory agents serving 5M standard microservice-class calls equivalent event-reactions/sec concurrently on ordinary $60/month VM instances, scaling from IoT & user devices incl browsers to Edge & Cloud. Runs WebAssembly on any device
- **Fluid Computing**, a new compute paradigm that unifies multi-cloud IaaS, CaaS, FaaS, CDNs, edge, user device, IoT and decentralized infra in a single system image compute substrate that abstracts away distributed computing complexity, provides autoscaling, process offloading & migration and ensures maximal data locality through dynamic provisioning and orchestration
- **Bloom**, a high-level microkernel, that runs on cloud, edge, user devices, IoT and decentralized infra, unifies the OS concept of process with systems-theoretic agents, provides eventing-based IPC and a distributed state store-backed virtual memory. Bloom also introduces the concept of "exo-processes" and can drive remote processes in any remote compute infra, e.g. FaaS, CaaS and Kubernetes-based containerized processes. Bloom also acts as a Virtual Kubelet for Kubernetes and is compatible with Knative API. Also provides a WebAssembly WASI-like systems API.
- **ĀloScript**, a PITL (Programming-in-the-Large) scripting language on top of Scala, that brings Smalltalk-like expressiveness and productivity to distributed applications programming powered by a meta-recursive, self-describing primitive and language kernel based on the Systems Model of Computation developed at Ālo
- **Crux**, a cross-platform, reactive UX framework that reifies UX-level primitives that are currently neglected in typical UI frameworks and provides a reusable single-effort UX substrate for apps to drive UI of different devices

Technologies Used: Java, Scala, Dart, Rust, JavaScript, Erlang, Elixir, NodeJS, Deno, GraalVM, SubstrateVM, Erlang OTP & BEAM, WebAssembly, Akka, Akka Streams, AkkaJS, Flink, Pravega, Kafka, Flutter, Kubernetes, Knative, AWS, GCP, Azure Cloud, OCI (Oracle Cloud Infrastructure), etc.

Researcher - Theoretical Advancements

Innovated:

Ālo Labs, Australia
June ‘20 - Present (3 y +)

- **STEPS (Systems-Theoretic Engineering Paradigm for Software)**, a powerful new paradigm that unifies the most powerful yet neglected concepts of Systems Science and Computer Science that caters to the changed needs of modern distributed software
- **Systems Model of Computation**, a fundamental model of computation that improves upon and unifies Lambda Calculus, Lisp Model, Actor Model and Alan Kay's Object-Orientation, radically simplifying modern computing needs and is based on the mathematical foundations of Systems Science
- **SODA (Semantics-Oriented Development Approach)**, a powerful semantic approach to software reuse and component-based development that unifies Philosophy, Systems Sc, Logic, Lambda Calc and Type Theory with denotational, axiomatic and interaction semantics, resulting in maximized reuse, quality and security - all centered around the well-established concept of Term (as in Logic, Lambda Calc and Mathematics)
- **SeMA (Semantic Modeling & Analysis)**, a domain modeling method for applying SODA using STEPS, that completely eliminates the currently existing cognitive impedance mismatch between an analysis model vs design model vs solution model vs programming model vs computational model vs deployment model, leading to unprecedented TTM (Time-to-Market) of features while maximizing developer independence & ownership of a feature
- **Semantic Containers**, a novel ultra light-weight, semantics-based security isolation method for isolating untrusted components/agents that provides semantic guarantees and is an additional sandboxed container above and beyond capability-based security, language-based isolation, VM Isolates-based isolation and more conventional container-based isolation
- **Alpha Architecture**, which improves over Kappa and Lambda Architectures of distributed applications and unifies the currently heterogenous OLTP, OLAP, ML and AI architectural approaches with an end-to-end homogenous, agent primitive-based architecture

EDUCATION

American International University - Bangladesh

Bachelor of Science (Honors), Computer Science and Engineering **148 credits**

PROJECT EXPERIENCE

CompaaS
American International University - Bangladesh
Initiated - Oct ‘22

Component-as-a-Service Platform, Inspired by Actor-Model and Component Based Software Engineering (CBSE)

- Applying CBSE, Evaluate existing Component Models
- Evaluate and Extract ideas from existing FaaS Platforms (e.g., Knative, OpenWhisk, OpenFaas, AWS Lambda, Serverless, Apache Nifi, Enso)
- Use of the whole Akka Actor Toolkit (including clustering, sharding, projection, streams, persistence, http, etc.)
- **Technologies Used**: Scala/Akka, Java, Kubernetes, KubeVela, Pulumi, OCI, Flink, YugabyteDB, Svelte, WebAssembly, Python, TypeScript, Tilt, Skaffold, DevContainer, Minikube, JMH, ScalaTest, RSocket, SvelteKit, PostCSS, Graal Polyglot Api, Isolates & Native Image etc.
- **Link**: https://github.com/audacioustux/compaas

JobReady
CodersTrust, USA
Initiated - Feb '23

A Global Talent and Job Marketplace

- Compared & Evaluated well-known and upcoming PaaS (e.g., Render, Railway, Vercel, Netlify, Fly, etc.) and DBaaS solutions in terms of price and featureset
- Deployed on fly.io and planetscaleDB for high scalability with low cost
- **Technologies Used**: PHP, Fly.io, PlanetScaleDB, AWS Route 53, CodeCommit, Namecheap Hosting
- **Link**: jr.coderstrust.global

Bloom
Ālo Labs
Initiated - June '21

Component Scheduler on top of GraalVM and Akka

- Benchmarking
  - Graal WASM/JS/Python/Espresso throughput and memory usage
  - Akka Actor Scheduling Perf and Memory usage per Actor
  - Lunatic, Wasmtime, Wasmer
- Evaluate Graal Polyglot API and Isolates Capabilities
- Compare Akka and Flink Statefun in terms of Scalability
- Schedule polyglot components as Akka Actors
- **Technologies Used**: Scala, Java, Rust, Akka, GraalVM, JMH, Jcmd, VisualVM
- **Link**: https://github.com/audacioustux/alo-pocs

WAMR - Benchmark
Ālo Labs
Initiated - July '22

For comparison with other WASM Runtimes, and find out the least memory overhead of WASM VMs

- Measure CPU & Memory overhead for WASM Module Instances in the WebAssembly Micro Runtime
- **Technologies Used**: C/C++, Rust, CMake, WAMR, WASI-SDK, WABT, Binaryen, Emscripten, AssemblyScript
- **Link**: https://github.com/audacioustux/wamr-poc

Cloud Configs
Open-Source
Initiated - April '22

Simple GitOps Repo / Template for Home-Server and Cloud Provisioning & Deployments

- Cloud Provisioning with Terraform Cloud
- CI/CD with Argo
- DNS Configuration via GitOps
- Declarative Programming
- **Technologies Used**: Argo, Terraform, Ansible, RSync, K3S, LongHorn, Traefik, Cert-Manager, Helm, Kustomize
- **Link**: https://github.com/audacioustux/cloud-configs

HelpDebugGov
American International University - Bangladesh
Initiated - Dec '22

A Asp.Net Core Project, With Authn & Authz implementation and REST API

- Implemented Dynamic PBAC & RBAC, Mediator Pattern, Emailing, Validation, Logging, REST API
- **Technologies Used**: ASP.NET 7, EntityFrameworkCore, DevContainer, FluentEmail, FluentValidation, MediatR, AutoMapper, Serilog, Swagger, JWT, SvelteKit, TailwindCSS, Pnpm, TurboRepo
- **Link**: https://github.com/audacioustux/HelpDebugGov

Dotfiles
Open-Source
Initiated - Oct '20

.rc/Config files of common tools on mac/linux as Template / Reference

- Complete setup of NeoVim as primary IDE, for Elixir, Rust, JS, Java and few other languages
- Optimal setup for terminal interface, with fast responsiveness and high functionality
- Remote Linux Containers setup
- **Technologies Used**: Tmux, Zellij, Alacritty, OMZ, NeoVim, PowerLevel10k, FZF, Zoxide, Asdf, LXC
- **Link**: https://github.com/audacioustux/dotfiles

AloBlog

American International University - Bangladesh
Initiated - Oct ‘20

A Blogging Platform - written in vanilla PHP7

- Write simple request router implementation
- JSON Schema based validation
- Typical web framework like structure / pattern
- **Technologies Used**: PHP7, Composer, Docker Compose, Phinx, JSON Schema, Vue3
- **Link**: https://github.com/audacioustux/uni-assignments

Survey Bot

American International University - Bangladesh
Initiated - Oct ‘20

Arduino based robot - project for surveying remote environment

- Collect, filter/denoise, and emit multiple sensor data to mobile client via bluetooth interface
- Control individual motors remotely
- **Technologies Used**: Arduino, Adafruit Libraries
- **Link**: https://github.com/audacioustux/MAES_FINAL_PROJECT

Dementor

Open-Source
Initiated - Oct ‘20

Discord like Profile/Account management in Elixir/Phoenix

- **Technologies Used**: Elixir, Phoenix, Postgres, Partial Index, Dialyxir, Credo, Argon2
- **Link**: https://github.com/audacioustux/nobinalo-ex-dementor