

# Kaining Zhong

kaining6@illinois.edu | (447) 902-2049 | github.com/PRESIDENT810

## EDUCATION

University of Illinois, Urbana Champaign - Computer Engineering, MEng.

Aug. 2022 – May. 2024

The Chinese University of Hong Kong - Computer Science, BEng.

Aug. 2017 – May. 2021

## SKILLS

**Programming languages:** C++, Python, Golang, Rust, TypeScript, Java, SQL

**Tools:** AWS, LLVM, Bazel, Git, PyTorch, Relational DBMS, CUDA, Linux, Xcode, Docker

## Work Experience

**Tesla** - Software Development Engineer Intern, Vehicle Software

August. 2023 – December. 2023 (Expected)

**Mobile App Infra**

Docker, Jenkins, GitHub Actions

- Improved React Native's building efficiency by offloading Android builds from Mac Mini servers to Linux servers using Docker on GitHub Actions & Jenkins CI/CD pipeline.

**Amazon** - Software Development Engineer Intern, AWS CloudFront

May. 2023 – August. 2023

**Control Plane - Realtime Logging**

Java, C++, AWS Kinesis, AWS EC2, AWS CloudWatch

- Developed, tested and deployed an integral component of AWS CloudFront's realtime metrics monitoring system, focusing on **leveraging Google FlatBuffers to serialize realtime metrics** collected from CloudFront's Nginx & Squid caching servers, and **utilizing zstd to compress serialized binary byte stream**, which 48% size of serialized data stored on Kinesis
- Employed AWS C++ SDK to feed data on realtime metrics processing cluster to **AWS Kinesis streaming system**, and employed AWS Java SDK to consume realtime metrics and display it on **AWS CloudWatch monitoring service**.

**TikTok** - Software Development Engineer, iOS Infrastructure

July. 2021 – July. 2022

**LLVM Compiler Infrastructure & Xcode Toolchain**

C++, Xcode, FaaS, Object Storage

- Improved Xcode debugging experience by optimizing Apple's LLDB, and deployed Xcode toolchain bundled with customized LLDB to multiple iOS APP's development team, **reducing initialization time for debugging from 200s to 30s**
- Fixed bugs for LLVM's LLD linker and migrated from Apple's LD64 linker to LLD linker, enabling faster linking for iOS applications including Lark & Toutiao; **reducing linking time from 120s to 60s in average**.
- Implemented a LLDB performance analyzing tool by dynamically rebinding exposed C++ Script Bridge API symbols in LLDB bundled in Xcode, reporting statistics such as time for loading images, variable evaluation, etc.
- Maintained a backend service implemented by **ByteFaaS serverless** that managed Xcode toolchains compiled from internal fork of Apple's Swift repository, using TOS as Object Storage Service to store toolchains.

**Bazel Build System**

Bazel, Xcode

- Collaborated in migrating TikTok and Toutiao's build system from xcodebuild to Bazel and transformed the overall project structure to monorepo, **reducing building time from 11min to 6min on average**.

## PROJECTS

**Needle, a PyTorch-like deep learning framework**

Python, C++, CUDA

- Implemented a PyTorch style deep learning framework with components including **dynamic computation graph, backward automatic differentiation, dataloader, optimizer, some widely used neural network modules, and backend operators including a img2col optimized convolution operator supported by C++ and CUDA**.
- Trained ResNet9 model on CIFAR-10 dataset, and LSTM model on Penn Treebank dataset entirely relying on Needle framework.

**Bustub, a Relational Disk Based Database**

C++, GTest, SQL, Relational DBMS

- Implemented a **concurrent B+ tree index** for faster data retrieval, which supports high concurrency access using latch crabbing to avoid unnecessary multi-thread synchronization, along with a **buffer pool manager** using **extendible hash table** and **LRU replacement policy**.
- Implemented **volcano model operators** that execute SQL query plans, supporting a subset of SQL syntax including sorting, joining and aggregation.
- Implemented a **transaction manager to support concurrent SQL queries**, which supports isolation levels up to Repeatable Read, along with a **deadlock detector** that aborts transaction when deadlocks are detected.

**Distributed, Fault-tolerant KV NoSql Database**

Golang, Raft, RPC

- Built a fault-tolerant Key-Value NoSQL database **based on Raft consensus algorithm** using Golang's concurrency & RPC packages, supporting Put, Get, Append operations, and guaranteeing **Consistency & Partition tolerance**.
- Implemented optimizations including fast log recovery and **Snapshot persistence mechanism**.

## Open Source Related

- YCSB**: implemented a etcd binding using jetcd to benchmark etcd's CRUD performance.
- LLVM Project**: reported issues and fixed bugs, including thin archive support in LLDB, and Dtrace support in LLD
- Ray**: fixing bugs on ray core's ActorPool, and attempting to extend a Future API for easier use.