Keith Chester

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Education

Masters in Robotics Engineering **2021-present**
Worcester Polytechnic Institute (WPI)

- Attending online courses during my free time to earn a Masters in Robotics Engineering while continuing my career
- Courses completed include studying kinematics, inverse kinematics, system dynamics, controls, and motion planning, artificial intelligence, and computer vision.. Future courses cover navigation, sensor fusion, deep learning, and reinforcement learning.
- Course work includes detailed project work to emulate real world problems (see projects below)

Bachelors of Science in Robotics Engineering **2005 -2009**
Worcester Polytechnic Institute (WPI)

Osaro

Infrastructure Engineering Manager / Senior Infrastructure Engineer 2021 - Present

Acted as both manager to and senior engineer for the Infrastructure Team at a startup offering Robots as a Service (RaaS) customized pick and place cells. The Infrastructure Team built and maintained the cells' data pipeline, ensuring that robot position, status, and image data would be delivered to additional services and teams for processing and additional model training. Additionally we maintained tooling for automated deep learning model training, per cell software deployment and configuration, and supported domestic and international teams for any related needs.

- Managed the infrastructure team; planned sprints, balanced resource utilization, coordinated with other teams, and architected solutions for the needs for all engineering teams at Osaro
- Designed and implemented data pipeline improvements for stability, scalability, and visibility for movement of terabytes of data daily
- Built custom deep learning pipeline tooling for our machine learning team, providing automated model training via GPUs provided in our Kubernetes cluster
- Created a custom offline encrypted transfer mechanism to support securely transferring data needed for model training with little to no network connectivity
- Coordinated with international teams to provide support across the globe
- Worked across both AWS and GCP cloud providers

Technologies: GCP, AWS, Kubernetes, Cloud Run, Pub/Sub, Dataflow, Big Query, Firestore, Terraform, Circle CI, protobuf, GRPC, Python

Brain Corp

Senior Software Engineer 2018 - 2021

Architected and developed numerous systems responsible for the management, coordination, and control of a global fleet of over ten thousand robots. Developed code for a monolithic Golang application that provided a RESTful API for robot configuration and management, as well as a distributed state system for robot data. Later broke the monolith down to microservices and began migration to Google Cloud Platform (GCP).

- Led a team of engineers to architect and develop an efficient and scalable pipeline for data collection across Brain Corp's robotic fleet while providing tooling for application-level real time reaction to data via Apache Kafka. The pipeline optimized LTE data usage to manage fleet-wide costs and was designed to be both cloud agnostic (AWS and Azure targeted) and client-side applications were resilient to poor network connectivity
- Responsible for developing key features to improve scalability of the platform's simultaneous online devices from a hundred robots to tens of thousands. Developed an AWS RDS PostgreSQL database pooling system that distributed application server load evenly across replicas while removing overloaded databases. Developed an additional system to allow services to change behaviour based upon database load.
- Coordinated with the Data Analytics Team to design ETLs to migrate hundreds of gigabytes of monthly data from various services into Snowflake DB.
- Built an event-based notification and webhook system that handled over 100 million events a month.
- Implemented an authorization system on PostgreSQL and SQLite queries to provide multi-tenancy to our APIs and data collection.
- To gather requirements for internal services, routinely coordinated across multiple departments, including Research and Development, Robot Application Teams, Manufacturing, and more.

Technologies: AWS RDS, S3, Kinesis, Elasticache (Redis), PostgreSQL, Kubernetes, GCP Cloud Storage, Cloud Function, Pub Sub, Firestore, Apache Kafka, Terraform, protobuf, GRPC, Golang, Python

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Fusion Marketing

Senior Developer 2013 - 2018

Originally hired to be a full stack web developer, transformed the position into developing custom technological solutions - onsite interactive crowd pleasers, custom onsite CRM, social media sharing tools, and white-labelable products. Acted as a Research and Development Lead and then as a Senior Developer.

- Developed novel applications of technologies such as BLE beacons, computer vision, projection mapping, and IoT solutions towards client-oriented marketing products and services
- Created reusable microservice backends on AWS for quicker deployments and white-labeling of products
- Programmed and deployed client sites and service applications for dozens of clients as a full stack developer

Technologies: AWS EC2, DynamoDB, CouchDB, GCP Firebase, MySQL, Electron, Angular.JS, Embedded C, Typescript, node.js, Python, C#, Java Spring

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Hub City Media

Application Developer 2010 - 2013

Consulted with clients to design and develop identity management solutions for large enterprise businesses

- Coordinated teams (including international remote developers) in developing customized enterprise solutions
- Created, updated, and maintained several enterprise Java and C# applications in finance, healthcare, and government industries

Noteworthy Project Work

These are projects that I encourage you to ask about; not only is it a fun topic, but I also believe each highlights my ability to tackle unique problems with equally unique technological solutions.

Osaro

Osaro Data Pipeline

Existing data pipeline could not scale with a large increase in customers, and had issues with data disappearing for unknown reasons.

- Redesigned the data pipeline to utilize cloud services to increase scalability and created additional tracking of data throughout the pipeline for visibility into the pipeline. Also prepared us to swap to upload data upon request due to network limitations.
- Utilized GCP Pub/Sub, Cloud Run, Dataflow, and SQLite

Encrypted Offline File Transfer

Customer sites with little to no network connectivity required additional tooling to support acquisition of data required for training.

- Built tooling for both steps of transfer - one that would transfer AES256-GCM (with appropriately signed headers and digest) to a portable USB medium, and another that would allow controlled cloud access to upload data to appropriate systems
- Data would be validated and then decrypted, finally passed to other systems as if it was normally uploaded. Care was taken that cloud systems would stream decrypt and write files to prevent memory overutilization.

Brain Corp

GCP Architecture Migration

Involved in a complete architecture redesign to support the migration of all services and data from the AWS cloud to GCP.

- For development velocity, adopted hosted services in GCP to power previously cloud agnostic designs.
- Developed a data reactive architecture to allow services to react and respond to data from our fleet of robots in real time

Data Pipeline

Architected a solution for and then led a team of engineers to create a data pipeline system for the vast amount of data collected by our robotic fleet

- Key features allow easily indexing generated data to allow our internal application and R&D teams to search for data across the fleet, even a robot never uploaded the data
- As our robotic fleet works over LTE, features to minimize bandwidth consumption were developed to minimize costs
- The new system can handle significantly more data throughput than prior avenues

- Data is passed through an evented stream system allowing real time data transformation or function triggers based on what the robot fleet encounters

Scaling Improvements

To rapidly bring a product to market, Brain Corp's initial cloud efforts had growing pains during its fleets' explosive growth. When brought on board, I sought to improve performance

- Over the course of several internal projects took a rapidly developed prototyped system from struggling to deal with scale of a few hundred robots to a system that can handle tens of thousands
- Custom database pooling and thresholding logic to handle database replica traffic loads

Multi-Tenant Authorization

Brain Corp provides robotic solutions to a number of manufacturers; this creates a need to securely silo and provide data to manufacturers while maintaining scalable systems

- Gathered requirements to match business use cases and design an appropriate authorization system around it
- Designed automated query filtering to prevent data leaks and to provide secure virtual isolation of customer's and manufacturer's data

Fusion Marketing

GigaSnap

Created a white label brand-able product that would create dynamic zooming selfies. which consisted of an animated image ranging from a close up shot to a half-mile wide-angle shot by stitching together an array of automated cameras.

- Created a reliable half-mile range network using ZigBee radio to allow remote execution and automation of target camera systems
- Developed and deployed a series of automated cloud services that would quickly generate these images by automating Adobe Suite products such as Adobe After Effects

Launchpad

Fusion regularly deployed dozens of tablets across multiple clients for simultaneous activations with custom software built for each tablet. Maintaining each tablet with the appropriate software and most recent version was a tedious time consuming task for developers. To solve this, I created Launchpad as a side project.

- Launchpad is a series of node.js powered applications that streamlined the deployment process of Fusion's site-deployed applications
- Provided development tools for marking what tablets should have what copies of software - on-tablet software would sync with the cloud and begin installing and updating all necessary software upon establishing a network connection

Open Source and Personal

https://github.com/hlfshell/

Robotics

Evolving Cars

To explore evolutionary algorithms on problem solving, I created a rudimentary racing game in Python and then created an algorithmic approach to evolve neural networks to solve the racing game.

Global and Local Planner

A homemade simulation of an urban environment with static and dynamic obstacles to experiment with combining a global and local planner. The global planner is a street-map aware graph search; the local planner utilizes kinematic primitives to plan across a continuous space. The resulting paths would be generated asynchronously, guiding a delivery robot from a central grocery store to assigned delivery addresses.

Traffic Light Autonomous Agent Trained through Genetic Algorithms

Utilized genetic algorithms to train a series of neural network agents that controlled a grid of traffic lights in a traffic research simulator of Chicago traffic.

Deep Q Network

Recently I have been exploring deep reinforcement learning - DQNs, REINFORCE, and A3C. The Deep Q Network repository is my recent in-depth exploration for training techniques for DQNs specifically. It has mastered several OpenAI gyms.

Open Source Projects

SafeStop

A golang module for handling multiple safe-shutdown procedures for large applications with multiple operating services. SafeStop allows a singular shutdown call to proliferate to each service and safely await (with timeout) for each service to wind down.

serial-synapse

For several projects - both professional and personal - the ability to coordinate multiple microcontrollers with a host embedded Linux system with a network connection became necessary. To this end I developed *serial-synapse* to modularize this process

- *serial-synapse* allows node.js users to bridge communication to and coordinate several microcontroller devices while being able to maintain time-critical local code execution on the microcontrollers
- Handles asynchronous communication between devices and automatically generates a dynamic and easy to use API for developers
- Powered dozens of real world products and projects during my time at Fusion Marketing
- When paired with *serial-synapse-socket* - another open source module - the generated dynamic API is exposed automatically via websockets for easy networking and IoT-ization of electronic projects

CanThey

- *CanThey* is an authorization library that compares provided ACL style strings against permission objects to determine access allowance
- Used in several production applications during time at Fusion Marketing
- Optional express plugin allowed easier integration for node.js developers

Other Interesting Facts

- Founded Rho Beta Epsilon, WPI's Robotics Engineering Honors Society that exists to this day
- Founding member of FUBAR Labs - NJ's first hackerspace. I taught courses on embedded system development, web development, and encouraged people to make their own DIY technology projects
- Organized and ran node.jSTL, j.STL, and Build STL - meetups that would have monthly educational talks about node.js, Javascript, and DIY tech, respectively. Regularly gave lectures as well.
- Stubbornly forced myself to surpass 100 kilometers a month for a total of 777.7 miles in 2021
- An avid reader, reading dozens of books each year
- Has a long history of weird and unique DIY technology builds (and pranks) that I'll be happy to talk about