

SURENDER SINGH

LAMBA

"In automation, we trust"

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WORK EXPERIENCE

- Oct '21 - Present
Technical Lead
- 5G Slice Orchestration - E2E Orchestrator** Rakuten Symphony Inc., 楽天シンフォニー, Tokyo
- Designed a cloudnative 5G slice orchestration system building upon the **Hierarchical Lifecycle Manager** to manage service orders and deployments of **eMBB**, **uRLLC**, **mmTc** based slices over **shared and non-shared** Networks Slice, Network Slice Subnet and Network Service deployments
 - Handled automated preparation and config push to subdomains in **Transport** networks via SDN controller and **Radio Access** Network, **Core** Network through Network service FSMs
 - Designed and Developed **dynamic path selection** capability in the FSM for various layers to achieve automated deployments in a declarative manner for **Helm** and other application packages on Kubernetes
 - Defined integration points for Correlation & Policy Engine to establish closed loop interaction at different layers of network topology to achieve **state maintenance** of the network elements
 - Product selected for integration in **Deutsche Telekom**, **NOKIA** and other MnCs.
- Mar '20 - Sep '21
Technical Lead
- Correlation & Policy Engine - E2E Orchestrator** Rakuten Mobile Inc., 楽天市場, Tokyo
- Designed a cloudnative **stream processing** system from scratch for **Complex Event Processing** and **Multi Layered Correlation** competing providing wider set of pattern specification than existing Bigdata CEP engines like **Apache Flink** while allowing rules to be inserted at **runtime** whereas Flink needs a complete stop due to **compiled patterns**
 - Designed a custom datastructure to create **partial pattern forests** enabling efficient pattern matching on the stream enabling Flat, **Topology** based and multi layered correlation by creating synthetic events after enrichment from Active Inventory of the system
 - Utilized kafka partitioning, lazy commits and key based **consistent hashing** alongside python's Processpool to create a stateless, fault tolerant and horizontally scalable system which enables **5k events/sec/core** with preliminary scale tests going to **110,000 events/sec**
 - Utilized WebAssembly System Interface (**WASI & WASM**) to bring in rust based evaluation system promising 20x speedup to existing system
 - CP Engine alongside Hierarchical Lifecycle Manager enables closedloop automation for various components in cloudnative 5G core, edge components to enable the vision for **Level 4 autonomous network** after enabling ML/DL based rule generation systems
- Mar '20 - Sep '21
Technical Lead
- Hierarchical Lifecycle Manager - E2E Orchestrator** Rakuten Mobile Inc., 楽天市場, Tokyo
- Designed and developed a generic FastAPI **ASGI** based LCM microservice to drive pluggable Finite State Machines in an **intent based** fashion to reach a particular state from the current being tolerant to faults following **SAGA pattern of distributed transactions**
 - The generic nature allows the user to bring in any network function, network service, slice, kubernetes cluster or baremetal element and define the FSM or a composed fsm of the above in **zero code** fashion enabling the vision for **zero touch provisioning and management of 5G core, edge, IoT** including closed loop automation alongside zero touch correlation policy engine
 - Designed the service to be fault tolerant and highly scalable by being stateless while offloading workflow execution to kubernetes jobs ensuring scalability
- Jan '20 - Mar '20
Software Developer
- Service Onboarding & Bundle Builder** Rakuten Mobile Inc., 楽天市場, Tokyo
- Designed and developed microservice based backend for 3rd party vendor's service application onboarding for cloudnative apps including a versioning and cold storage of bundles which contain artifacts including **HELM charts**, robin bundles, configuration files, observability **alarm libraries**
 - Integrated with self hosted **object storage** like Minio utilizing its **S3 api** for manipulating the bundles as well as enforcing access policies for the onboarding teams and vendors
 - Designed one touch deployment flows after the bundle is approved, to push observability configurations, prime the deployment clusters by **pre caching** images and other artifacts, pushing **Day0 and Day1 configuration** to CMaaS modules

Nov '19 - Jan '20
Software Developer

Internal Virtual Network Function Manager

Rakuten Mobile Inc., 楽天市場, Tokyo

- Designed and developed a **VNF manager** to handle lifecycle of Network Functions and Network Services including **Virtualized RAN for 4G** carrier grade networks on self hosted **openstack** clusters following ETSI MANO standard interfaces including triggers for Day0 and Day1 configurations
- Developed a two-tier microservice system including a synchronous flask WSGI framework to front requests from OSS maintaining **configurations of VNFs** in the network and a workflow system on Airflow to offload long running tasks increasing the overall throughput of the system
- Reduced time required to deploy VRAN for 4G from days in human effort to **5 minutes** and handled fortnightly parallel upgrades of qcow images and **auto healing** through reboot or redeploy across the distributed RDC and GC network in Japan

May '17 - Jul '17
Summer Intern

Samsung Pay Instrumentation

Samsung R&D Institute, Bangalore

- Automated functional UI testing of Samsung Pay app using **Android Espresso framework**
- Improved productivity by automatically documenting testing results for PayTM, UPI, and cards
- Achieved **30 percent** code coverage collateral to UI testing under various contextual events and overcame Espresso Framework limitations in Samsung Knox and QR scanning in device farm environments.

May '16 - Jul '16
Summer Intern

Learning Management System

Stratbeans Consulting Pvt. Ltd., Gurgaon

- Developed an iOS app for a large LMS, offering offline content and quizzes, and a VR app coordinating with the LMS Android app for solving quizzes that got featured in **mLearnCon '16**.
- Created a Nodejs-based Facebook ChatBot for company support automation, augmenting their existing **Elasticsearch** engine.

GITHUB PROJECTS

Unlimited Ranged Remote Control Car

- Designed and implemented a remotely controlled car using an Arduino board and live video streaming over a 4G network through a peer-to-peer connection.
- Created a remote command module using FastAPI websockets and a Zerotier Managedip VPN, with video streaming peered over GoRtc using Twilio SDK to enable real-time control of drive motors with minimal latency.

RedHat Openstack Nova extensions - LINE Inc, Japan

- Deployed devstack instance on GCP compute and provided VM creation life cycle in Nova from request to creation by libvirt, network attach and VM coming up on Nova compute
- Implemented changes in Nova API and Compute code to support webhooks with an external third-party API system, before VM can be successfully created in various stages of lifecycle

Software framework for Serverless/Function as a service

- Developed a software framework to create a Docker swarm cluster using consumer hardware and host a user-defined function with managed provisioning, telemetry, and auto-scaling.
- Implemented closed-loop scaling of user-defined functions using dockerd, cadvisor, custom golang-based server, and prometheus-based alert manager with adaptive scaling and cost reduction
- Compiled function binaries resulting in image sizes **under 10 MB** allowing for low bootstrap times and faster teardowns. Now archived as part of the **Github Arctic Vault**

AirStore - lightweight, fault tolerant object store

- Implemented robust Object Storage solution with erasure coding for data recovery, fault-tolerant metadata encoding, hashing algorithms, and node crash emulation using libjerasure, reedsolomon.

Markerless Augmented Reality Android

- Created an AR app with smart graffiti, cached nearby content and utilized AWS for multimedia content streaming.

VibeConnect

- Developed a remote tactile system on Android devices using vibration module and Google Firestore tables for communication of touch intensity and frequency between connected users.

Resource Inventory

- Designed and implemented YANG model ingestion into Neo4J, including data validation, code generation of pydantic models

KEY ACCOMPLISHMENTS

Patents

- *Static And Dynamic Non-Deterministic Finite Automata Tree Structure Application Apparatus And Method* [US11563625B1 · Granted 2023-01-24]
- *Method And Apparatus For Constructing A Network Service* [US2022300296A1 · Published 2022-09-22]
- *Multi-Layered Correlation Policy Management Apparatus And Method* [US2023022787A1 · Published 2023-01-26]
- *Non-Deterministic Finite Automata Tree Structure Application Apparatus And Method* [US2023104304A1 · Published 2023-02-23]
- *Network Service Construction Graphical User Interface, Apparatus And Method* [US2023067168A1 · Published 2023-03-02]

Other Notable Work

- Built 5G Slice Orchestration Engine for Intrusion detection system,
[NEDO (国立研究開発法人) · 2022]
[Japan's Ministry of Economy, Trade and Industry (METI) (経済産業省)]
Designed and developed python based microservice to orchestrate a multicluster ultra low latency slice utilizing various containerized network functions (CNFs). Alongside a closed loop system, this enables on-demand high bandwidth 4K video on intrusion detection, enabling a human to get clear video feed only when needed.

EDUCATION

2019

Bachelor of Technology
Computer Science & Engineering

Indian Institute of Technology, Bombay

TECHNOLOGIES USED

Extensive usage: Python, Android(Java), Bash, \LaTeX , Redis, MongoDB, MySQL, Airflow, FastAPI, Flask, Django, Hypercorn

Familiar usage: C, C++, C#, Java, Robot Framework, FluxCD, ArgoCD

Exploratory usage: Rust, Golang, AWS, GCP, Apache Flink, Apache Spark, Jmeter

Platforms: Kubernetes, Docker, Linux, Ubuntu, Android, iOS, Arduino