Akhilesh Moghe

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Blog

An Agile-Result-oriented software engineer focused on the Architecture, Design and implementation of IoT/Edge device/Cloud applications for devices updates & data management. Successfully delivered 2 IoT projects in last 3.5 years with AWS IoT, Azure IoT, Ayla IoT, Mender.io platforms on ARM, x86 & STM32 devices. Overall, 10 years of IT services & Product development experience in IoT, Cloud & Multimedia domains.

Software Development:
Broker Architecture, Client-Server Architecture, Multithreaded-Multiprocessor-distributed Architecture, Agile, Test Driven Development, Design Patterns, REST, Service Oriented Architecture
Technologies Frameworks:
NodeJS, Robot Operating Systems (ROS1 & ROS2)
Cloud Platforms:
AWS, Azure, Ayla IoT Platform, Firebase, PubNub, Mender.io
AWS Cloud Services:
AWS IoT, Greengrass, Robomaker, Lambda, Kinesis, API Gateway, SNS, S3, EC2, EKS
Azure Cloud Services:
Azure IoT Hub, IoT Edge, Device Update, Azure Stack Hub, ML Deployment, Storage, Container
Programming Languages:
C, C++, C++11, Python, JavaScript, Shell Script
IoT Protocols:
MQTT, D-Bus, DDS, ZeroMQ, AMQP, Serial, MAVLink, TCP-IP, UDP, HTTPS
Multimedia Formats:
H264, ***VP8 codecs***, ***WebM*** *Packetizer*, ***WebRTC*** *Framework*
Databases:
MongoDB, MongoDB Realm, InfluxDB, SQLite
Build Tools, *Continuous Integration*, *Continuous Deployment:*
Make, CMake, ***Git, Docker, Kubernetes***, ***Ubuntu Snaps***

Soft Skills: *Attention to details, Connecting the dots, Analyzing and inferencing, Time Management, Communication, Teamwork, Technical Blogging, Presentation, Effort Estimations*

Experience:

- Senior Engineering Lead at Persistent Systems (Oct 2021 – Present)
- Engineering Lead at Persistent Systems (Jan 2019 – Sept 2021)
- Module Lead at Persistent Systems (Jan 2016 – Dec 2018)
- Senior Software Engineer at Persistent Systems (June 2014 – Dec 2015)
- Software Engineer at Persistent Systems (July 2011 – May 2014)

Education:

- **Post Graduate Diploma in Embedded Systems and Design**
  Centre for Development of Advanced Computing (CDAC), Hyderabad
- **B.E. in Electronics and Telecommunication**
  Rashtrasant Tukadoji Maharaj Nagpur University

Projects:

1. **Edge IoT Framework primarily for Life Sciences Use-cases**
   - **Role:** Solutions Architect (3 Months)
   - **Accomplishments:**
     - Currently evaluating ***AWS Outpost***, ***AWS EKS***, ***Kubernetes***, Containerized deployments, ***Apache Kafka***, ***Pravega***, Scalable ***MQTT brokers*** deployment to address high volume sensors, high-definition video data use-cases in ***5G*** Edge Computing scenarios.
     - Worked on common ***Edge IoT use-cases***, various possible scenarios considering data flows, data types, data restrictions, privacy, latency, bandwidth consumptions, connectivity restrictions, etc., primarily revolving around Life Sciences projects and devices.
     - Evaluated Open-Source Edge Projects such as ***KubeEdge***, ***ioFog***, ***EdgeX, LF-Edge*** Umbrella projects against identified use-cases.
     - Evaluated suitability of ***AWS IoT Greengrass*** and ***Azure IoT Edge*** + other ***AWS/Azure on-premises services*** for various Edge computing scenarios, presented pros & cons of both public cloud platforms and created various possible use-cases architecture/design with AWS/Azure as primary components of framework.
     - Architecting a common framework based on open-source Edge projects which can complement the public cloud services in on-premises Edge computing scenarios.

2. **NVIDIA Jetson Nano based Healthcare IoT Device as a Guided Pipetting Tip Sensing System**
   - **Role:** Systems Engineer (6 Months)
   - **Accomplishments:**
     - Carried out PoC tasks like ***flashing boards*** to simulate mass flashing at factory.
     - Multiple PoCs to understand *customizing* ***RootFS***, ***Secure Boot***, ***Bootloader Splash Screen***.
     - Interfacing ***Bluetooth module*** with NVIDIA L4T BSP software for *Jetson Nano*. All these PoC tasks resulted in a concrete plan to be executed at factory manufacturing.
     - Evaluated, Designed and implemented *Firmware update* and *OS update* mechanism based on ***Mender-Yocto*** Open-Source project.
     - Designed and implemented device side ***C++ & Python***, ***RESTful*** HTTP protocol-based ***multiprocessor-distributed*** IoT connectivity application for features like *device identity & registration*, *status*, *user-device association*, *certificates management*, *device shadow*.
     - Evaluated different ***inter-process communication*** tools, ***RPC*** mechanisms as ***ROS1***, ***ROS2***, ***D-Bus***, ***ZMQ*** to Architect & Design multiprocessor-distributed application.

3. **STM32 MCU based Portable COVID-19 Diagnostic device kit**
   - **Role:** Firmware Developer (4 Months)
   - **Accomplishments:**
     - Designed and Implemented *STM32F407* based MCU ***firmware*** to achieve ***USB communication*** with Android app using ***Virtual COM Port***, ***Flash memory read/write*** and ***PWM generation***.
     - Created a dummy *test application in Python* to automate the testing of STM32 firmware.
     - Received "***Bravo Award***" For the delivering the project in *3 months*.
     - Client Received $2 Million funding to continue development based on our Project

4. **OTA Firmware Updates for a STM32 MCUs and full OS Updates for x86 carrier boards**
   - **Role:** IoT Developer (14 Months)
   - **Accomplishments:**

- Designed and implemented ***custom bootloader*** with ***Dual bank*** strategy for *STM32F407 MCU* to achieve robust *Firmware update* requirements. ***MAVLink*** communication protocol and *Signature & checksum verification* were few of the other key features implemented.
- Designed & developed ***C++ & Python*** based ***multithreaded multiprocessor-distributed*** application to achieve ***OTA firmware update*** for multiple STM32 MCUs. ***AWS IoT Jobs***, ***Device Shadow***, ***Secure communication*** and UART based *serial communication* were key features.
- PoC for ***full OS image*** and ***Application update*** using ***Mender.io*** Open-Sorce project. *Full OS OTA updates* with Mender server hosted on EC2. Also, same kind of *updates with USB and over LAN* were also achieved with local Python server.
- Evaluated and finalized ***Ayla IoT platform*** for early market release without full fledge cloud development. *Device provisioning*, *status*, *firmware updates* to multiple devices, sensor *data streaming* were key features achieved in *4 months duration*.
- Designed and implemented a ***NodeJS module*** for *Data Synchronization* between device and cloud using ***MongoDB Realm*** and ***MongoDB Atlas*** cloud databases. Understanding of new platform and successful delivery was achieved in *3 months*.

5. Drone-based Asset Inspection with AWS IoT Greengrass & AWS Robomaker Services

- **Role:** Robotics, IoT Developer (8 Months)
- **Accomplishments:**
  - Demos were successfully showcased at CERAWeek 2019 and AWS re:MARS 2019 events
  - Drone simulation around oil-rig running in background in AWS official Tech Talk
  - Understanding of the new to be launched or recently launched **AWS Services** like ***Robomaker***, ***Greengrass***, ***AWS IoT*** and their use-cases for Robotics projects were achieved in *3 months* with demonstratable applications as an outcome.
  - ***Robotics framework ROS*** based ***distributed application*** had *Machine Learning* features like *Rust and leakage detection models* that were deployed with ***AWS IoT Greengrass*** to multiple devices as ***NVIDIA Jetson TX2*** (*drone*), *mobile robots* and *x86 machines*. ***AWS IoT device shadow*** updates and ***IoT Jobs*** for *firmware update* were also used.
  - ***AWS Lambda*** functions were deployed to AWS IoT Greengrass to run ML inference.
  - Robotics application was able to *capture and upload* the ***thermal*** and normal ***camera videos*** to ***AWS S3*** buckets, which were consumed by ***AWS Sagemaker*** for Machine Learning training.
  - ***NodeJS***, ***JavaScript*** based Web Application running on ***AWS EC2*** was developed to control Robots with commands, to trigger firmware updates, and to initiate ML training in Sagemaker.
  - Camera Live video streams were transmitted to ***AWS Kinesis Video Streams*** and the same were rendered on Web Application in ***HLS format***.

6. WebMeeting (Screen Sharing Application) for MAC and Windows

- **Role:** Backend Developer (26 Months)
- **Accomplishments:**
  - Received "***You Made a Difference Award***" for the extensive work done in the initial phase of the project, which helped the team to scale up and gain Client's Confidence.
  - Understood the ***Chromium Open-Source Project*** relevant modules, build systems which can be reused to create a ***cross-platform*** (Windows & MAC) Screen Sharing application which used ***VP8 video codec*** and ***WebM packetizer***. Demonstrated the key functionality of screen sharing in *3 months*.
  - Evaluated and ***AWS S3***, Dropbox, Google Drive for *file sharing* capabilities, but Client did not pursue another cloud platform and file share was implemented with Firebase & PubNub.

- Designed and developed ***HTTP transport module*** for *screen sharing data* + *Chats* + *File sharing* modules with **Firebase** & **PubNub** cloud platforms.
- Later, it was developed into a full-fledged product with multiple browsers supports + Chat, file share, recording capabilities. The core screen sharing product is still in production.
- PoC application was developed for ***Image & Text Detection*** in screen share data using an open-source library.

7. Porting WebRTC based GChat Application on Linux & Android Platforms

- **Role**: Backend Software Developer (20 Months)
- **Accomplishments**:
  - *The product was successfully showcased in CES2012-13 by the customers*.
- Responsibilities:
  - Set Top Box, ***TI BeagleBone, Panda ARM board bring*** up with Linux/Android OS images.
  - Building & Porting ***WebRTC*** code for different ***Linux, Android Set top boxes***.
  - Dealing with all kinds of compile and run-time errors on every platform.
  - Modifying WebRTC GYP build structure for integrating platform specific Codec and Camera Libraries.
  - Integrating ***H264 Decoder-Renderer*** APIs with WebRTC code.
  - Integrating/Testing Quanta and Maxim Camera modules in the applications.
  - Debugged ***H264*** Decoder, ***YUV-RGB Render*** modules for Linux, Android platforms.
  - Thorough Unit Testing & Bug Fixing.

8. Robotics Device Management Effort Estimation & Proposal Creation based on Azure Cloud

- **Role**: Developer (2 Months)
- **Responsibilities**:
  - Understand the Product Requirements
  - Understand various ***Azure IoT*** & other Cloud services and mapping them to Product Requirements.
  - Create an Overview ***ROS*** & Azure Cloud based ***Architecture*** using ***Docker Container***.
  - Create ***Docker Containerized ROS Demo applications*** running on x86 Linux machine accessing connected peripheral devices, file system.
  - Create ***complexity sheet*** with various modular tasks to arrive at an ***effort estimation***.
  - Coordinate with other Product teams involved.