Building a State-of-the-Art IoT Platform for Smart Homes

Executive Summary

RIoT Technology is a startup Residential IoT (RIoT) company bringing to market a SaaS platform and IoT network for smart homes. Their platform manages home automation IoT devices built into new Smart Homes. They deliver a custom experience for homeowners, builders and even vendors through visualization, analytics, and improved customer support.

RIoT partners with real estate developers and residential construction companies who incorporate their IoT devices and platform in the design and marketing of new Smart Homes which are designed from the ground-up to take advantage of data aggregation and cross-property analytics. But first, RIoT needed to design, build, and go to market with their IoT platform.

Client's Key Challenges

As a startup company, the client began with a clean sheet of paper, early-stage funding, and no software developers. VividCloud won their business and became RIoT's entire software development team. RIoT also needed to show early success in order to raise additional funding.

The key technical challenges which VividCloud faced on RIoT's behalf started with architecting a solution which would be cost-effective at very different points of scale, from single POC to wide-scale adoption. Identifying and securely allocating appropriate permissions to different classes of users was necessary to capture the different audiences while protecting private information. Finally and more important, the data solution design would need to uptake rapid advances in IoT communication standards, without requiring undue changes in the Data Layer as the data-capture opportunities we added in new app versions.

Architecting a cost-effective solution required sharp focus on RIoT's core value proposition: its data aggregation and analytics platform for end users. The solution will need to demonstrate high accessibility, availability, and resilience in order to win customer confidence; after all, the detection and response to a residential emergency will be a key use case for measuring success. Adoption of the platform is projected to increase rapidly after a certain threshold is reached. That threshold will be a narrow 'sales window opportunity' in which this platform must demonstrate a seamless ability to scale upon user demand. This platform must also demonstrate its utility in sales and emergency-response scenarios, so it must be flexible, performant, and ready to adapt to new market needs. Finally, the solution requires fine-grained and adaptable access control around potentially sensitive data. DynamoDb offers the perfect blend of strength, flexibility, and security for the data storage portion of the solution.

VividCloud's Solution

VividCloud implemented the RIoT platform in three stages, beginning with a Proof of Concept, progressing to an MVP, and finally developing the production ready Release 1.0. With the launch of the first production release, RIoT Technology began its sales work and is beginning to add partners within the homebuilder industry. The software solution has since continued to iterate in parallel, with the major 2.0 release adding features such as Homeowner customizations of their smart-home controls and automation, Builder custom device-enriched home plans on the fly, live XR visualizations of home events, cutting-edge system use of AWS infrastructure with tamper-proof security and embedded synthetic canaries within the IaC framework, and many more cloud-powered features.

Industry: Real Estate
                 Smart Homes

Location: Albuquerque NM

Website: www.riot-technology.com

A b o u t
R I o T   T e c h n o l o g y

RIoT Technology is a next-generation Residential IoT (RIoT) startup company that integrates sensors and devices through a gateway into new residential construction.

The RIoT Technology solution aims to become the next generation in smarter home building.

RIoT brings their platform to the market by partnering with Builders, Real Estate Developers, and others.

VividCloud's Proof of Concept implemented and successfully demonstrated to the client the key functionality of our proposed architecture. VividCloud's MVP provided the core features necessary to support an initial 40-home neighborhood of RIoT enabled Smart Homes. These features included:
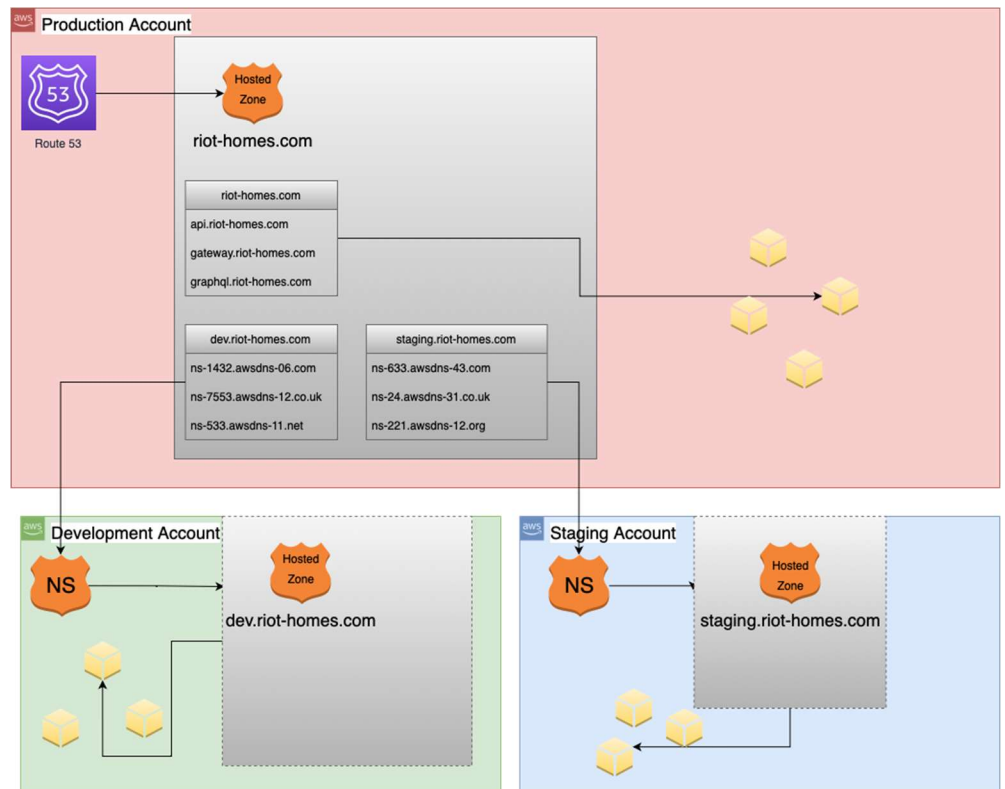
- A tablet-based in-home kiosk for the configuration and control of the RIoT system and for display of the data collected.

- RIoT Cloud, the AWS based backend, and the Cloud Dashboard. The AWS backend architecture provides data handling and data storage, event capturing, notifications to homes/homeowners, and software updates. The Cloud Dashboard dynamically visualizes analytics and the data gathered over time.
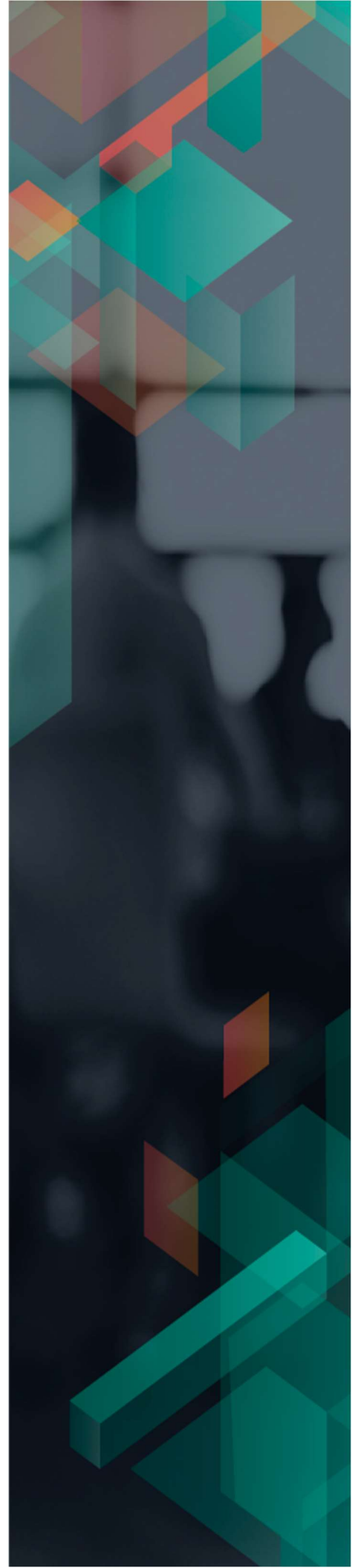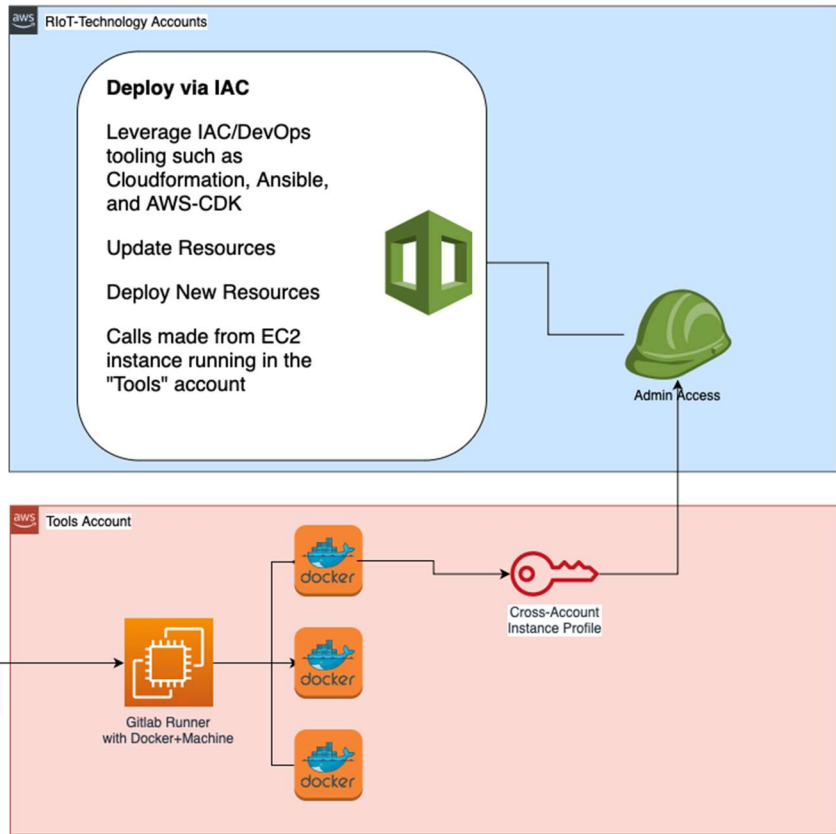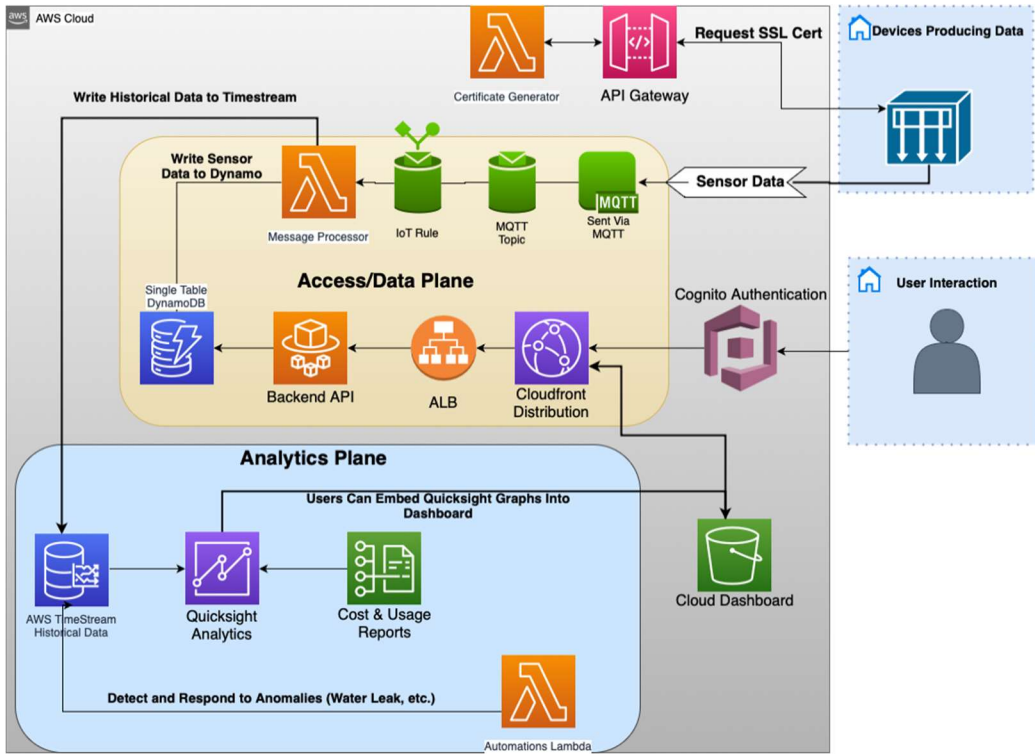
The MVP was an all-important milestone for VividCloud and RIoT. Close collaboration allowed VividCloud to identify and deliver the key capabilities to build investor confidence. VividCloud also prepared an investor focused presentation of the platform that helped RIoT secure their next round of funding.

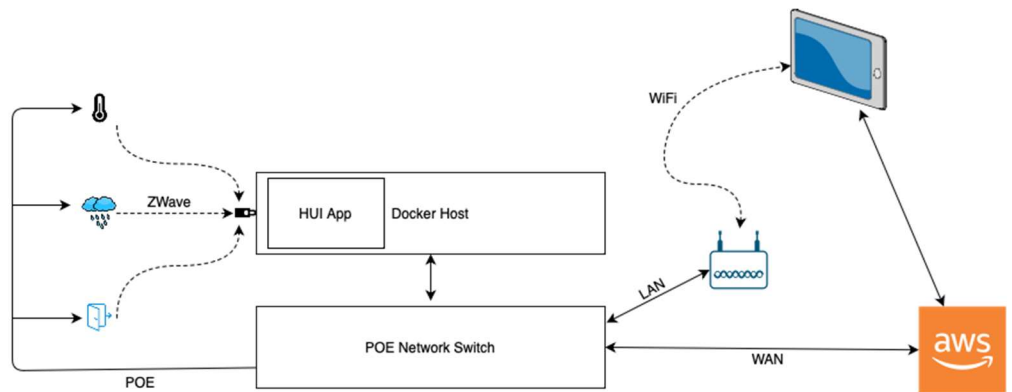After the MVP, VividCloud completed the RIoT R1.0 initial release, providing RIoT, the homebuilders, and the homeowners (end customers) with dashboards, in-home wall mounted Kiosks, and an XR enabled system to monitor and manage individual homes, all homes per builder, and all RIoT homes built.

High Level Architecture and Deployment

It's useful to view the overall architecture of the RIoT Cloud platform and deployment pipeline:

AWS Cloud

Request SSL Cert

Certificate Generator — API Gateway

Devices Producing Data

Write Historical Data to Timestream

Write Sensor Data to Dynamo

Message Processor — IoT Rule — MQTT Topic — Sent Via MQTT

Sensor Data

Access/Data Plane

Single Table DynamoDB

Backend API — ALB — Cloudfront Distribution

Cognito Authentication

User Interaction

Analytics Plane

Users Can Embed Quicksight Graphs Into Dashboard

AWS TimeStream Historical Data — Quicksight Analytics — Cost & Usage Reports

Cloud Dashboard

Detect and Respond to Anomalies (Water Leak, etc.)

Automations Lambda

RIoT-Technology Accounts

Deploy via IAC

Leverage IAC/DevOps tooling such as Cloudformation, Ansible, and AWS-CDK

Update Resources

Deploy New Resources

Calls made from EC2 instance running in the "Tools" account

Admin Access

Tools Account

Commit to Repo

RIoT-Technology Git Repository

Gitlab Runner with Docker+Machine

Cross-Account Instance Profile

Results and Benefits

With VividCloud's successful delivery of RIoT's R1.0 system, the client has:

- Raised an additional round of funding to continue executing their growth plan.

- Deployed an operational platform ready to support the initial community of Smart Homes currently under construction - a neighborhood of 40 new homes that will showcase the benefits of RIoT's technology.

- Proven the ability to market their technology to other large scale residential home builders throughout the country.

- Emplaced powerful tools to help their home builder partners sell new smart homes to prospective homeowners. because of RIoT's technology-differentiated value in the market.

With the rollout of RIoT's R2.0 the client has met with some of the leading residential homebuilders in the country, spoken with governmental energy commissions, and joined the drive to move towards smarter, more data-driven and self-healing living standards. RIoT Technology is poised to lead the way in developing new standards for residential homebuilders, third-party vendors, and the homeowner experience of the future.

AWS Services

The following services and capabilities of AWS are used in this solution:

- AWS **Route 53** registered domain, routing to public facing services, and cross-account nameserver mapping

- AWS **Quicksight** to visualize and draw inferences from IoT data

- AWS **DynamoDB** with a single-table design for the primary data store of the application. Automated PITR backups and TTL for removing stale data

- AWS **Step-Functions** for long running and scheduled tasks such as snoozing user notifications and monitoring individual property health

- AWS **Lambda** for independent components such as device certificate generation or in-home automations, as well as processing data from devices and creating user notifications

- AWS **SSM** parameter store for developer environment configuration, mock-user credentials, and in-home device initial configuration

- AWS **Certificate Manager** to terminate HTTPS on the ELBv2

- AWS **IoT Core** MQTT broker with topic rules for routing device data, secure communication with SSL certificates, and a billing group for each property

- AWS **S3** for private/public object storage and front-end website hosting

- AWS **Cognito User Pools, Identity Pools** to house the user base

- AWS **KMS** CMK for encrypting Timestream tables

- AWS **SNS** notifications are sent when app errors or ops-items arise

- AWS **Pinpoint** toll-free number registration for sending end-user SMS notifications

- AWS **Cloudwatch** logs and metric filters for error notifications and debugging

- AWS **Events** provide Lambda schedules and SNS notifications to work in conjunction with Application Insights

aws
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Services

About VividCloud

VividCloud is a software development company focused on cloud and IoT. AWS is our cloud platform of choice, and we are an Advanced Tier APN Consulting Partner. We bring fully managed teams that free our clients from day-to-day oversight responsibilities. VividCloud is based in Brunswick Maine, with 100% of our people onshore in the US.

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