Citus™ IoT Ecosystem

This repository contains the Citus™ IoT Ecosystem bootstrap code which is used to provision an IoT Platform in Citus™ IoT Ecosystem using Docker Compose and AWS CloudFormation on AWS.

Fpt Software

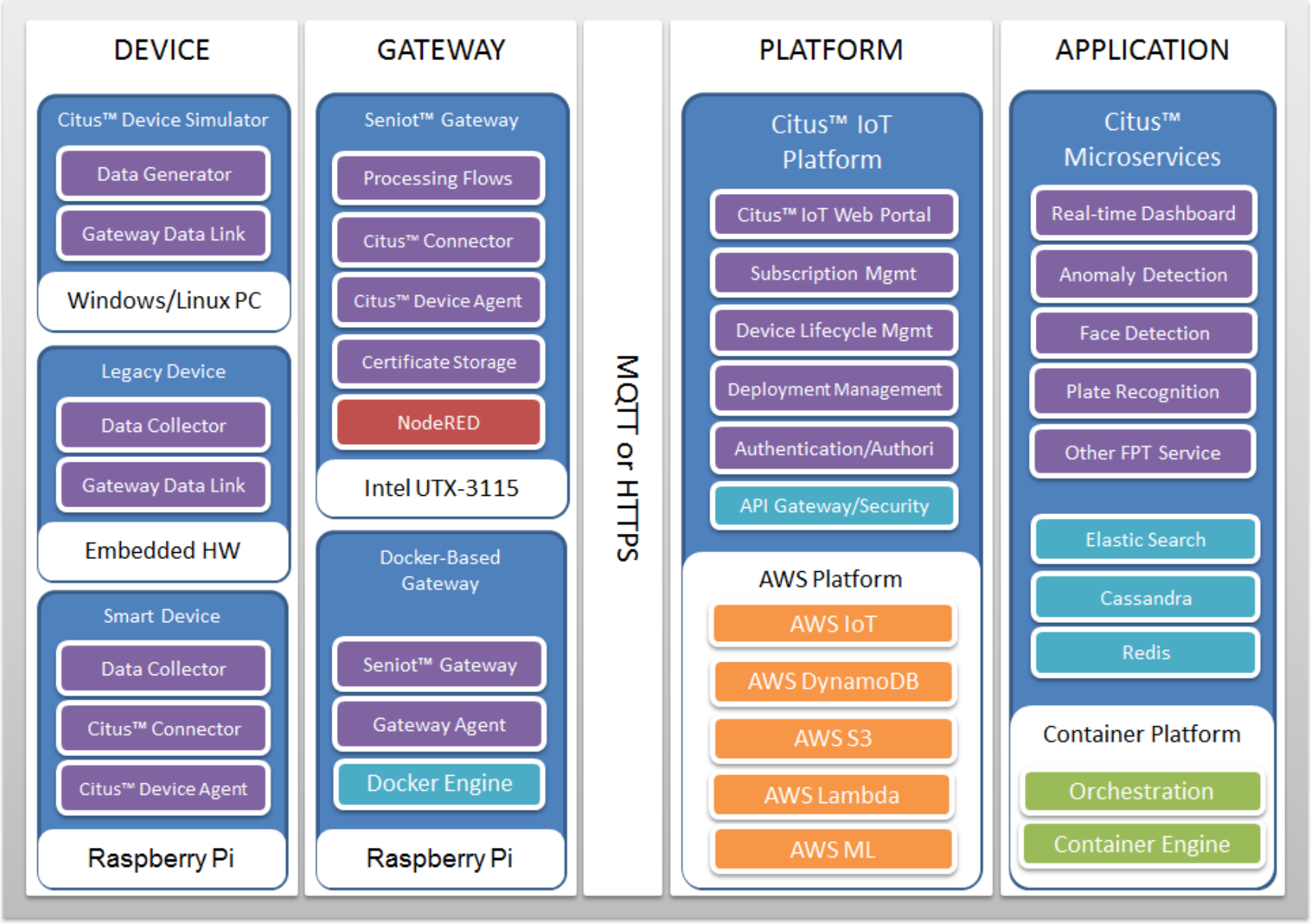
Description

Citus™ IoT Ecosystem (https://apps.citus.io/) is a complete IoT solution which allows consumers start to develop, integrate their IoT products, visualize sensors data in a centralized platform and rapidly building their own sharing economy business model through the Citus™ IoT Platform. It also supports dedicated infrastructure and shared infrastructure deployment.

No.	Primary Service	Hits	Image Info
1	citus-iot-ecosystem-website	docker pulls 114	136 MB|7 layers
2	citus-application-gateway	docker pulls 93	34.9MB 23 layers
3	device-lifecycle-service	docker pulls 157	27.7MB 10 layers
4	citus-elasticsearch-svc	docker pulls 231	370 MB|27 layers
5	sensor-remote-dashboard	docker pulls 6k	48.4MB 11 layers
6	citus-sensor-analytics	docker pulls 95	138 MB|11 layers
7	seniot-gateway	docker pulls 842	129.7MB 13 layers

Architecture

Citus™ IoT Ecosystem – System Architecture



Features

Web Portal

GUI Web Portal that concentrates users, devices and applications together in one place with separated workspace for each consumer or tenant user. *This feature is still in reviewing for multi-tenant security concern using kubernetes.*

- User Identity/User Groups/Roles Management using Auth0 (https://auth0.com) as an external service.
- Protect device/application accesses by API Gateway using API Secret Key Authentication feature.

Application Platform

Container-based application engine is designed for Microservices architecture which is easily to deploy on Docker-Compose, Docker Swarm or Kubernetes.

- Publish or consume Docker-based applications across users.
- Continuous Delivery Support w/ Docker Hub using Web Hook.

Manage Your Device

Device Lifecycle Management service and device security process that help you enhancing the device provisioning and communication security of the AWS IoT as well as providing Over-The-Air software update for IoT devices.

- Device Provisioning/Activation/Management.
- Device Software Update (OTA) with CI/CD.

Data Analytics

A set of featured (default) services that allow user consuming their IoT telemetry data into business instances such as anomaly detection, face detection or plate recognition.

- Statistical Anomaly Detection
- Plate Recognition (3rd Party)
- Face Detection (3rd Party)

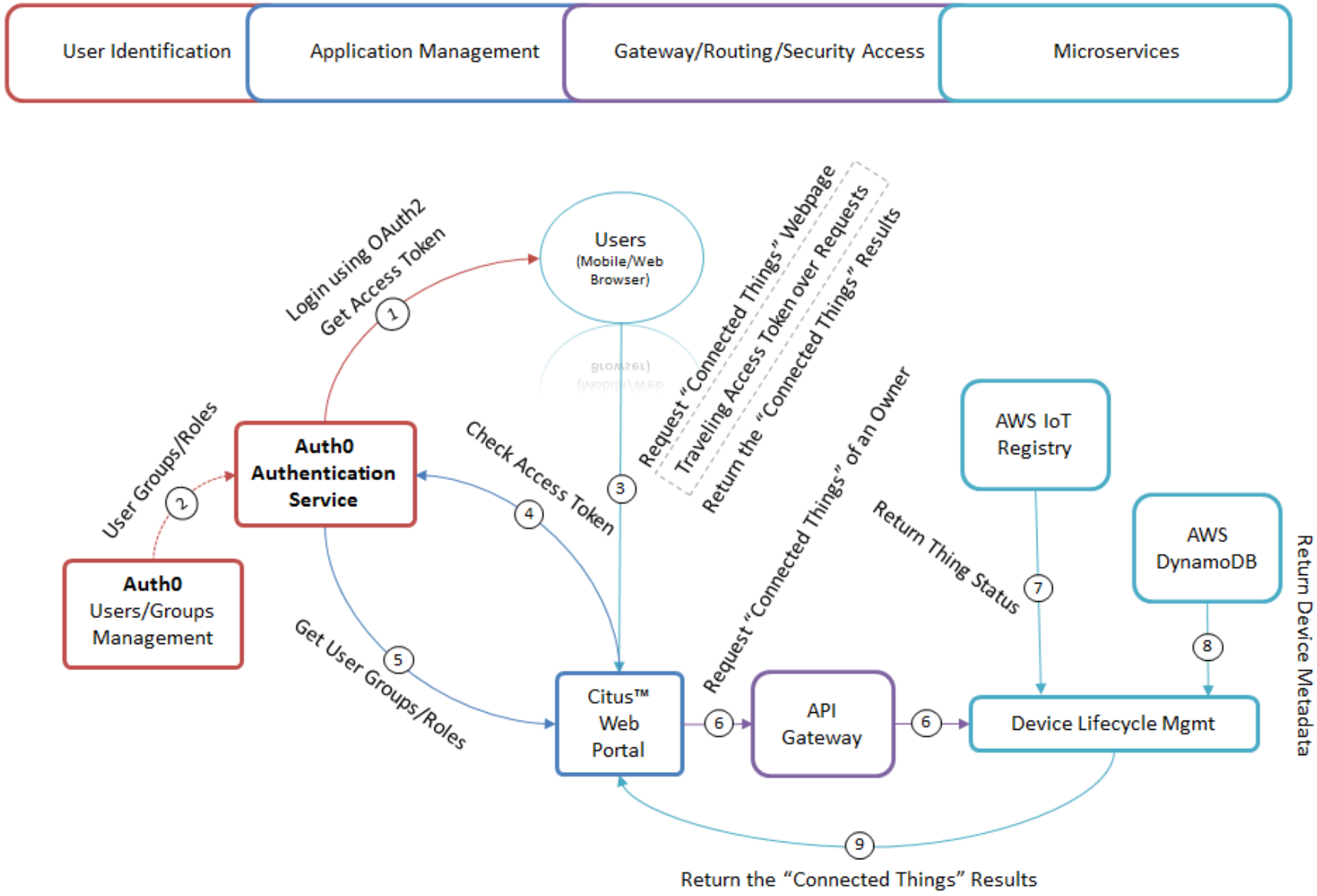
Monitoring & Control

A set of featured Real-time Dashboards which is used to display, monitor and control your IoT devices directly using Web Portal.

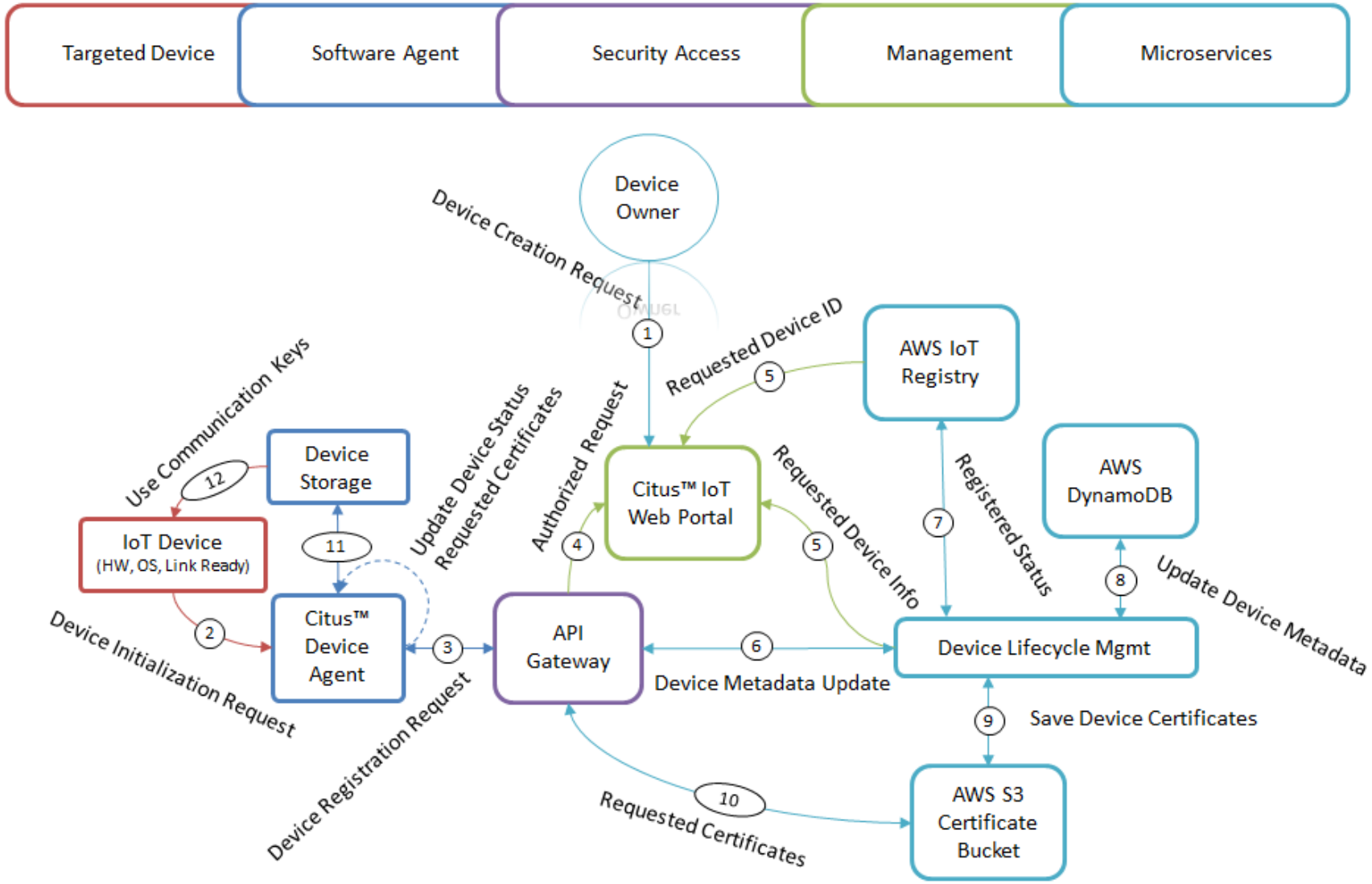
- Sensor Remote Dashboard
- Citus Sensor Analytics

User Story

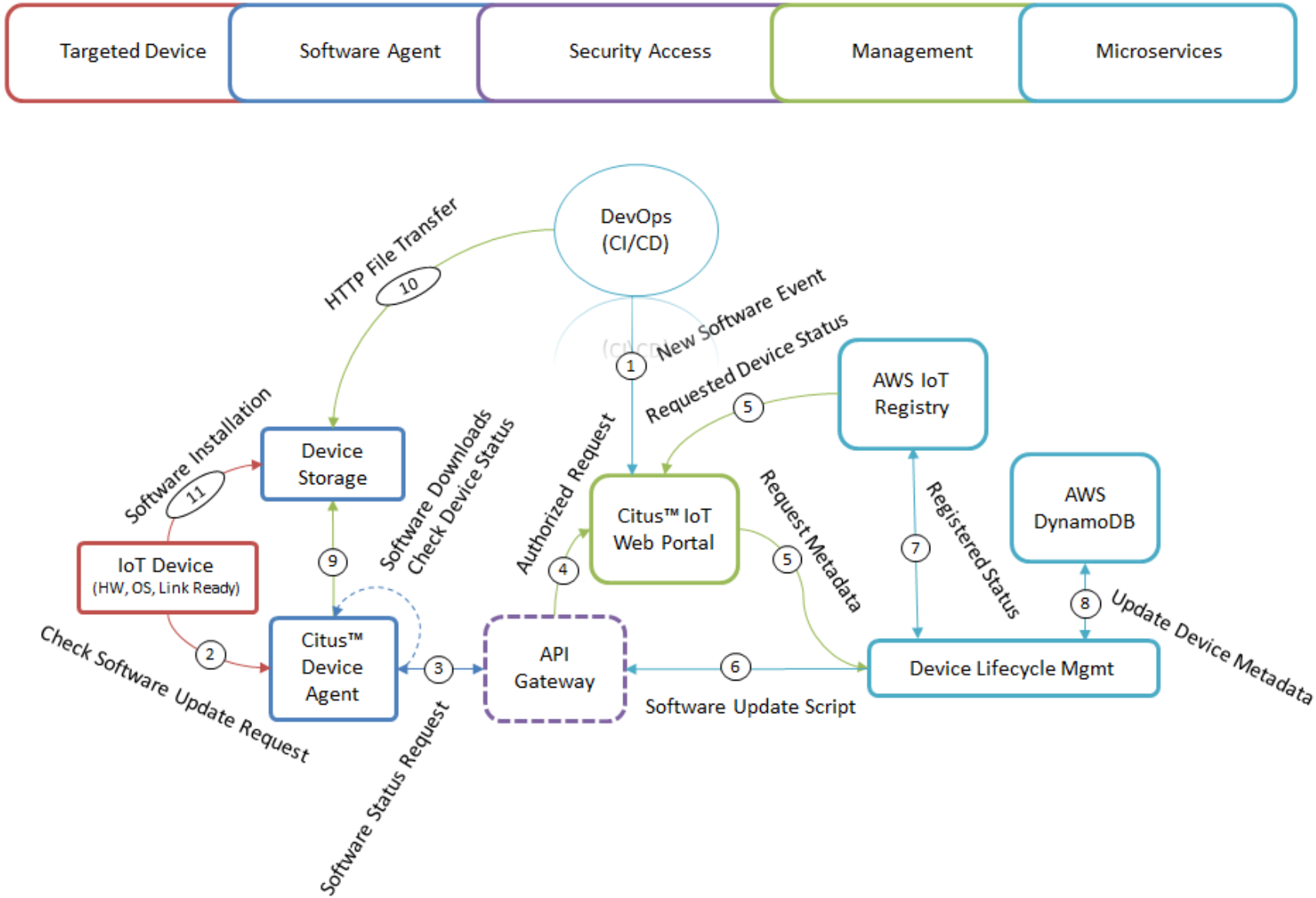
As an Embedded SE, I want to declare my device on the Citus™ IoT Platform.



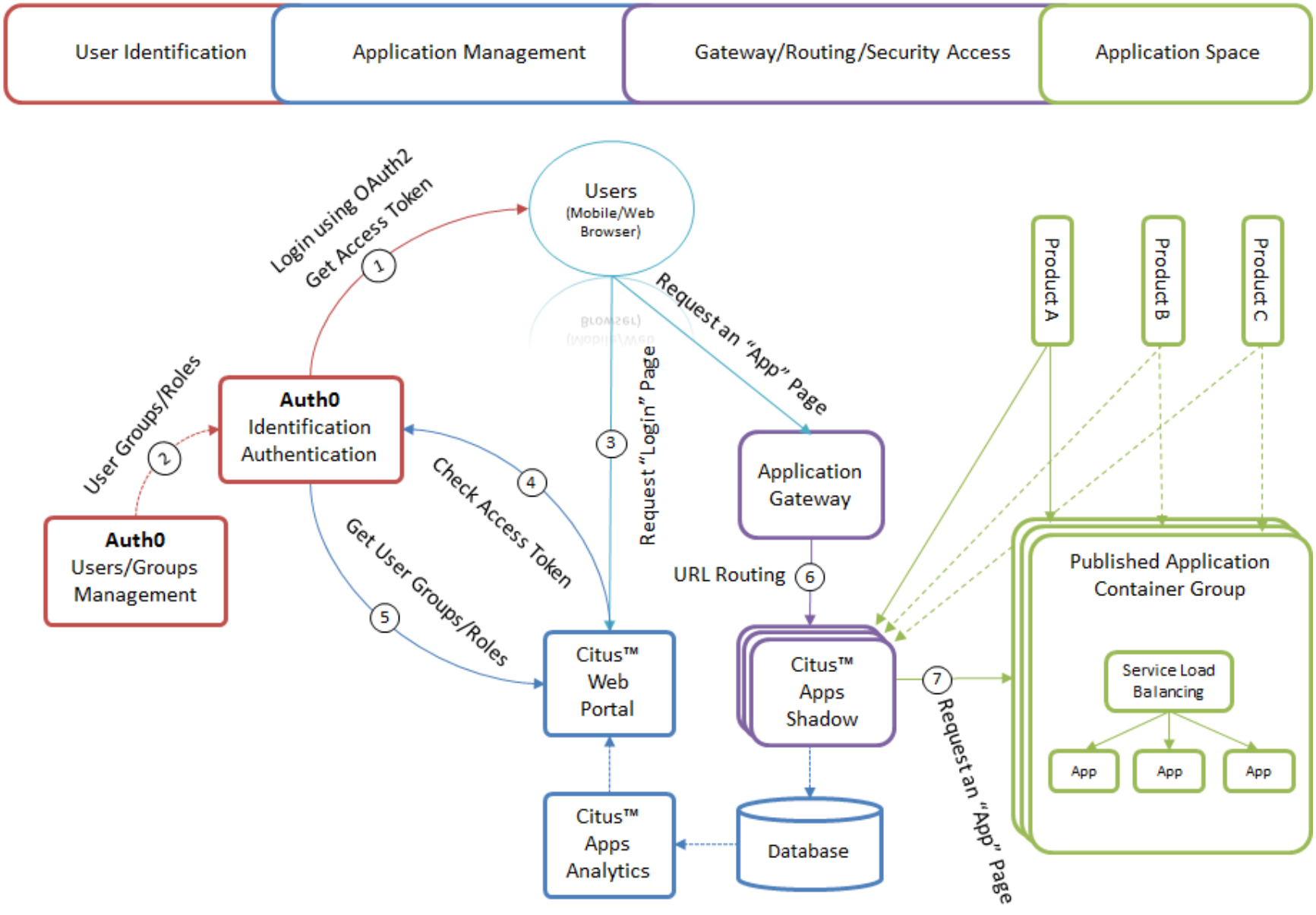
As an Embedded SE, I want my device be able to connect to Citus™ IoT Platform easily.



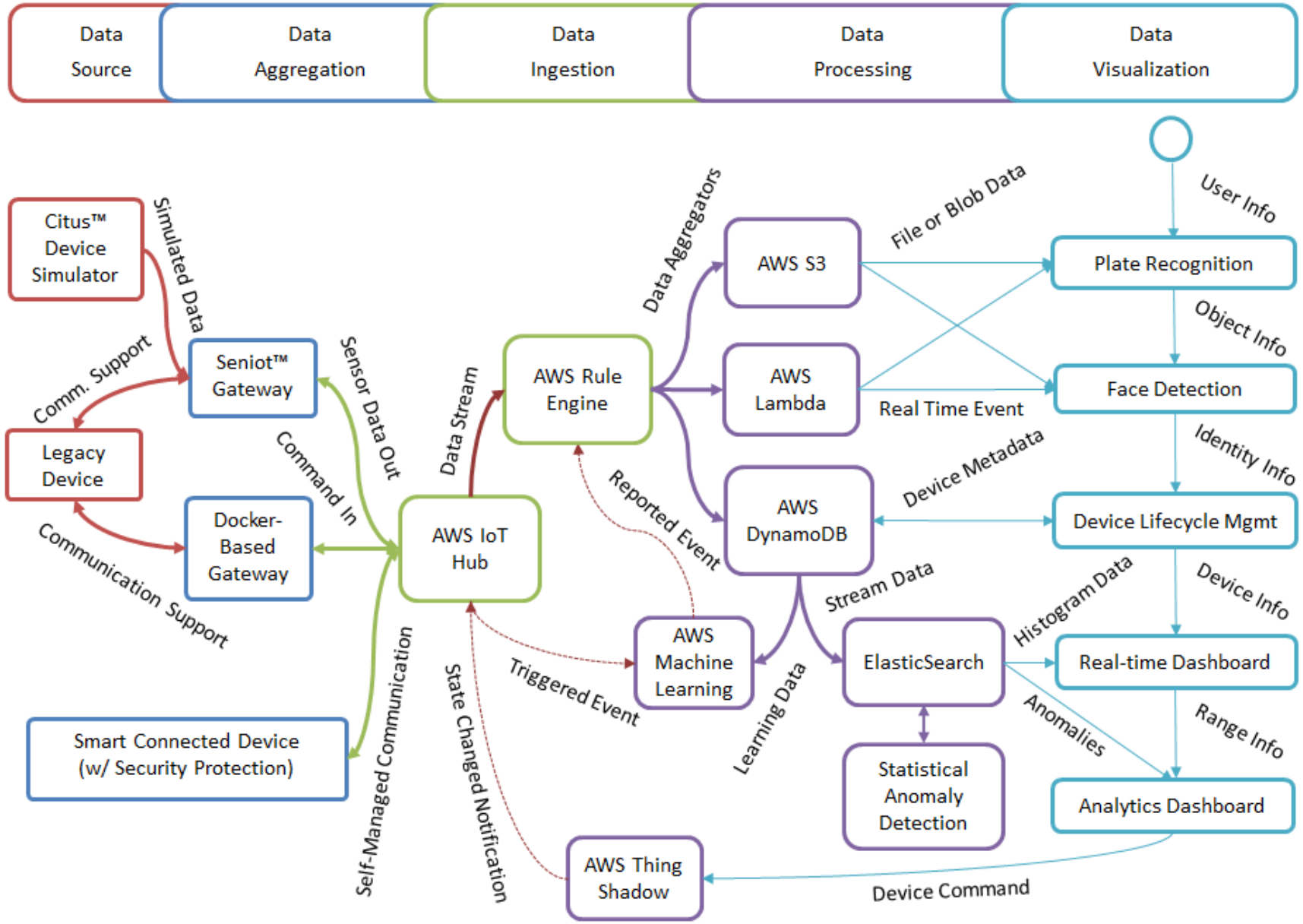
As an Embedded SE, I want to update my software over-the-air when it has a new version.



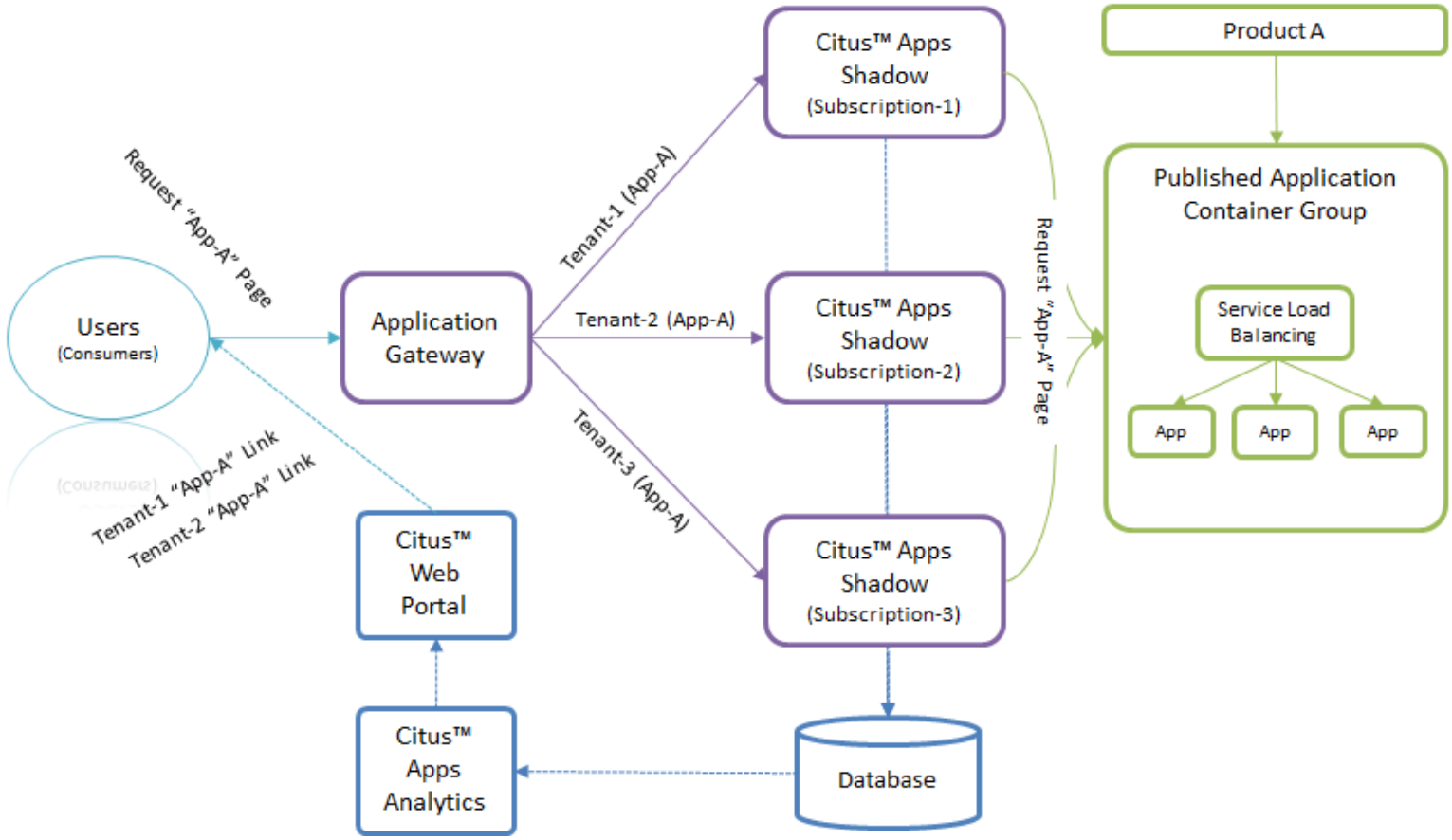
As a Software Developer, I want to submit my application into the Citus™ IoT Platform.



As a Consumer, I want to ingest my sensor data in the cloud to be consumed later on.



As a Consumer, I want to analyze my sensor data using published application of the platform



Technology

Platforms

- AWS Cloud Computing Basic Services (VPC, EC2, Route53, Elastic IP, IAM, S3)
- AWS IoT (Hub, Registry, Rule Engine, ThingShadow)
- Cassandra/DynamoDB w/Streamming
- ElasticSearch/Logstash
- Kong API Gateway
- Docker/DockerHub
- Docker-Compose
- Docker Swarm
- Kubernetes
- Node-RED

Languages

- HTML5/CSS3
- NodeJS
- AngularJS
- D3JS
- Nginx
- Python
- Bash Shell

Deployment

Prerequisites

I. AWS Environment

(Supported Region: *ap-northeast-1* as default if using template)

1. Create AWS IAM User and manage Access Key
2. Setup DynamoDB Table with Stream Enabled

Property	**Value**
Database name	your-dynamodb-table-name
Table name	telemetry-sensors (default)
Primary partition key	topic (String)
Primary sort key	epoch (Number)
Stream enabled	Yes (used for citus-elasticsearch-svc)
View type	New and old images

3. Create AWS IoT Policy with at least iot:Publish, iot:Receive permissions for IoT devices sending and receiving MQTT topic messanges. Then named as *your-iot-thing-policy-name*

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "iot:*",
      "Resource": "*"
    }
  ]
}
```

4. Create AWS IoT DynamoDB Rule to store telemetry sensor data into DynamoDB.
5. Create a AWS S3 Bucket and named as *your-s3-certificate-bucket-name*
6. Launch a VPC with (YOUR-VPC-ID) and at least one public subnet (YOUR-VPC-SUBNET-ID)
7. Create a Hosted Domain with YOUR-ROUTE53-DOMAIN-NAME and retrieve YOUR-ROUTE53-HOSTED-ZONE-ID

II. Kubenetes Environment

1. Setup Container Cluster on AWS using kube-aws
2. Configure this cluster to use for Citus™ IoT Ecosystem (TBD)

Step By Step

I. Setup Development Environment

1. Install Docker Engine and Docker Componse following this link https://docs.docker.com/compose/install/.
2. On Windows or Mac OSX Operating System: Launch Kitematic to start docker machine then run

```
$ eval "$(docker-machine env default)"
```

3. On Ubuntu/RHEL/CentOS: execute shell command "$ docker-compose --version" to make sure it's running.
4. Checkout this repository **git clone** https://github.com/cuongquay/citus-iot-ecosystem.git or download the zipped package and extract to a folder.
5. Setup the shell environment variables which will be used by *docker-compose.yaml*

```
export AWS_DEFAULT_REGION=ap-northeast-1
export AWS_ACCESS_KEY_ID=your-s3-iot-hub-access-key-id
export AWS_SECRET_ACCESS_KEY=your-s3-iot-hub-secret-key
export AWS_IOT_CERT_BUCKET=your-s3-certificate-bucket-name
export AWS_IOT_DEVICE_POLICY=your-iot-thing-policy-name
export AWS_DYN_TABLE_NAME=your-dynamodb-table-name
```

6. Start deploying by running this shell command

```
$ cd citus-iot-ecosystem-bootstrap
$ docker-compose up -d --force-recreate
```

7. Wait for cluster is initialied and stable. It takes about 5 minutes to pull docker images and initialize states.

8. Access to the Web Portal at http://192.168.99.100/ on Windows/Mac OSX or http://127.0.0.1 on Ubuntu/RHEL/CentOS.

9. Terminate the system by running this shell command

```
$ docker-compose down
```

II. Run on AWS Cloud Formation Stack

Download Cloud Formation Stack Template

You need to change these parameters before applying the AWS CloudFormation template:

1. YOUR-ROUTE53-HOSTED-ZONE-ID
2. YOUR-AWS-EC2-SSH-KEYPAIR
3. YOUR-DNS-PREFIX-xxx1/2/3
4. YOUR-ROUTE53-DOMAIN-NAME
5. YOUR-VPC-SUBNET-ID
6. YOUR-VPC-ID

Update your AWS Credentials for your AWS IoT Hub by encoding the script below into into Base64 format

```
#!/bin/bash
set -e -x

export AWS_DEFAULT_REGION=ap-northeast-1
export AWS_ACCESS_KEY_ID=your-s3-iot-hub-access-key-id
export AWS_SECRET_ACCESS_KEY=your-s3-iot-hub-secret-key
export AWS_IOT_CERT_BUCKET=your-s3-certificate-bucket-name
export AWS_IOT_DEVICE_POLICY=your-iot-thing-policy-name
export AWS_DYN_TABLE_NAME=your-dynamodb-table-name

yum update -y
yum install git -y

git clone https://github.com/cuongquay/citus-iot-ecosystem-boot
cd /usr/share/citus-iot-ecosystem
chmod +x setup.sh
./setup.sh
```

Replace the **Base64UserData.Default** with the encoded value in the Cloud Formation template above.

```
"Base64UserData": {
        "Type": "String",
        "Default": "IyEvYmluL2Jhc2gNCnNldCAtZSAteCANCg0KZXhwb3J
}
```

You need to setup a corrected AWS IoT environment for AWS IoT Policy, AWS IoT Rule, AWS DynamoDB (Stream Enabled) to use with this platform. For more information, please contact us by email: cuongdd1@fsoft.com.vn!

Author

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