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.

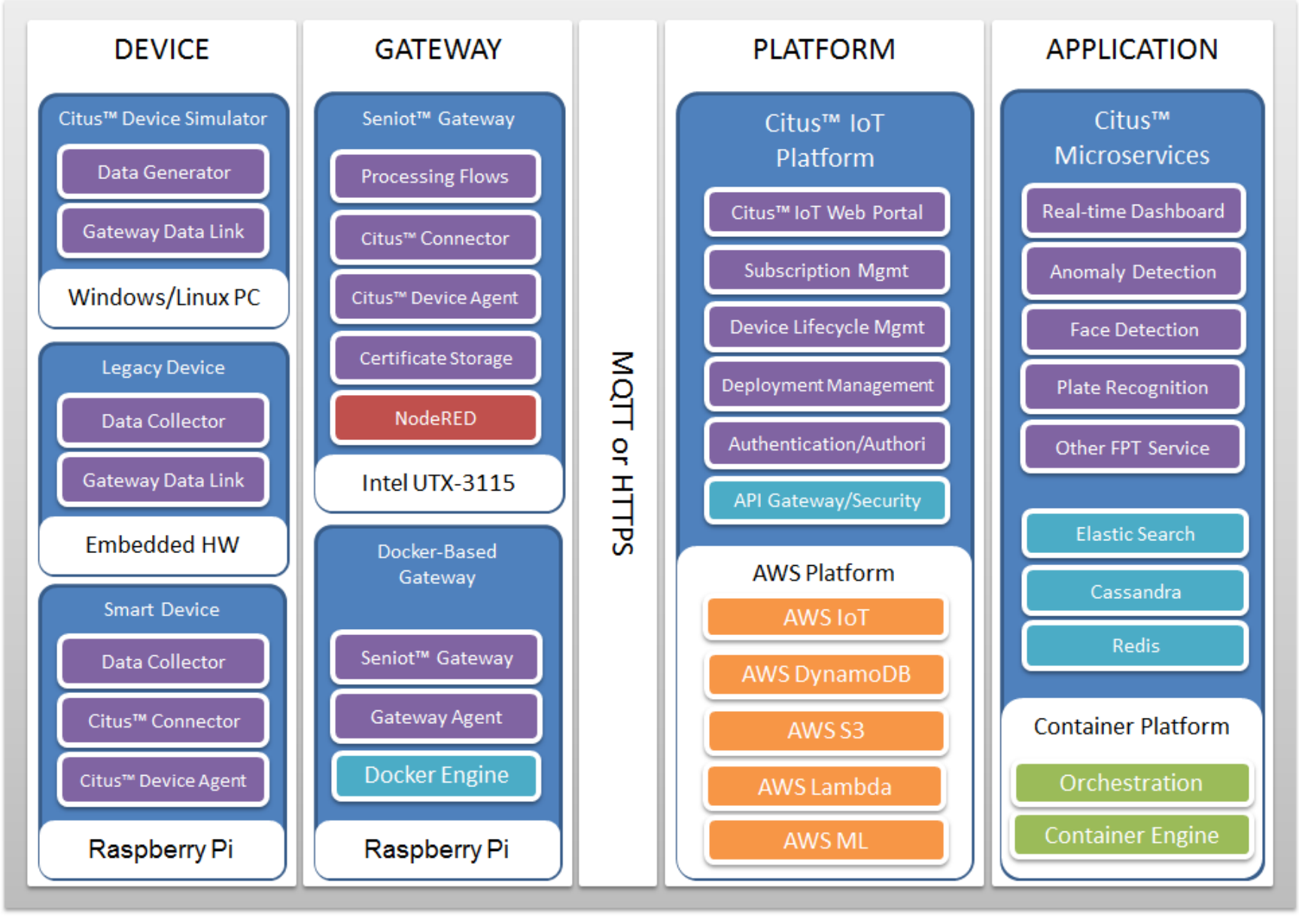
Fpt Software

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.	Micro-services	Pulls	Size
1	citus-iot-ecosystem-website	docker pulls 114	Image not found
2	citus-application-gateway	docker pulls 93	Image not found
3	device-lifecycle-service	docker pulls 157	34.9MB 23 layers
4	citus-elasticsearch-svc	docker pulls 231	
5	sensor-remote-dashboard	docker pulls 6k	48.4MB 11 layers
6	citus-sensor-analytics	docker pulls 95	
7	seniot-gateway	docker pulls 842	129.7MB 13 layers

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 Groups/Roles Management using Auth0 (https://auth0.com)
- Secured application access by API Gateway through Key Authentication

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 a Docker-based application
- Continuous Delivery Support w/ 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)

Analytics

Data analytics services that allow user consuming their IoT telemetry data into business instances such as anomaly detection, face detection or plate recognition.

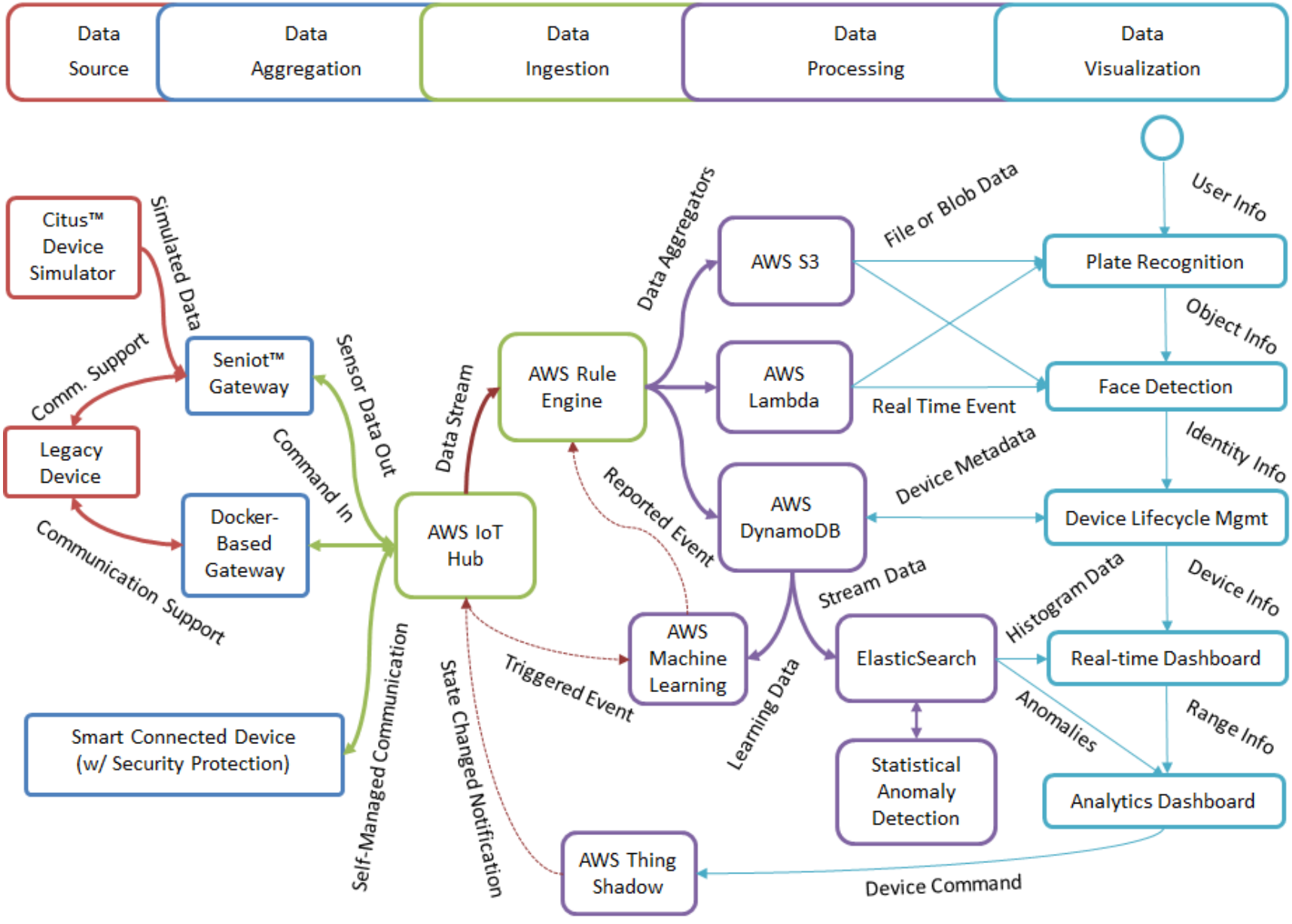
- Statistical Anomaly Detection
- Plate Recognition (3rd Party)
- Face Detection (3rd Party)

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

Citus™ IoT Ecosystem – "Connected Things" Telemetry Data Flow w/ AWS



Technologies

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

- Kubernetes
- Cassandra
- Node-RED
- NodeJS
- AngularJS
- D3JS
- Nginx
- Python
- Bash Shell

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)

Deployments

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 IoT environment with AWS IoT Policy, AWS IoT Rule, AWS DynamoDB with Stream Enabled to use with this platform. For more information, please contact us by email: cuongdd1@fsoft.com.vn!

Author

DUONG Dinh Cuong