AWS for IoT

Embedded Interface Design

with **Bruce Montgomery**

Learning Objectives

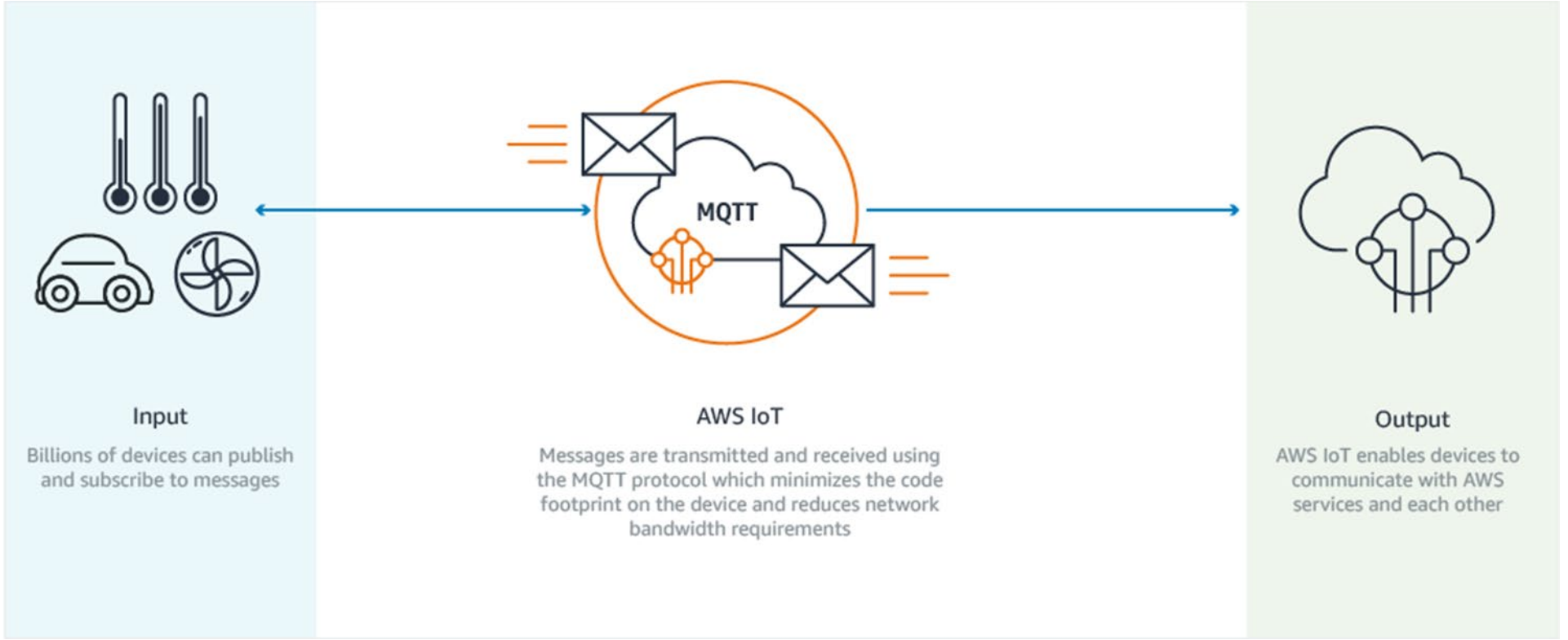
- Students will be able to…
  - Understand the elements of the AWS IoT services
  - Develop applications using the AWS IoT SDKs

AWS for IoT

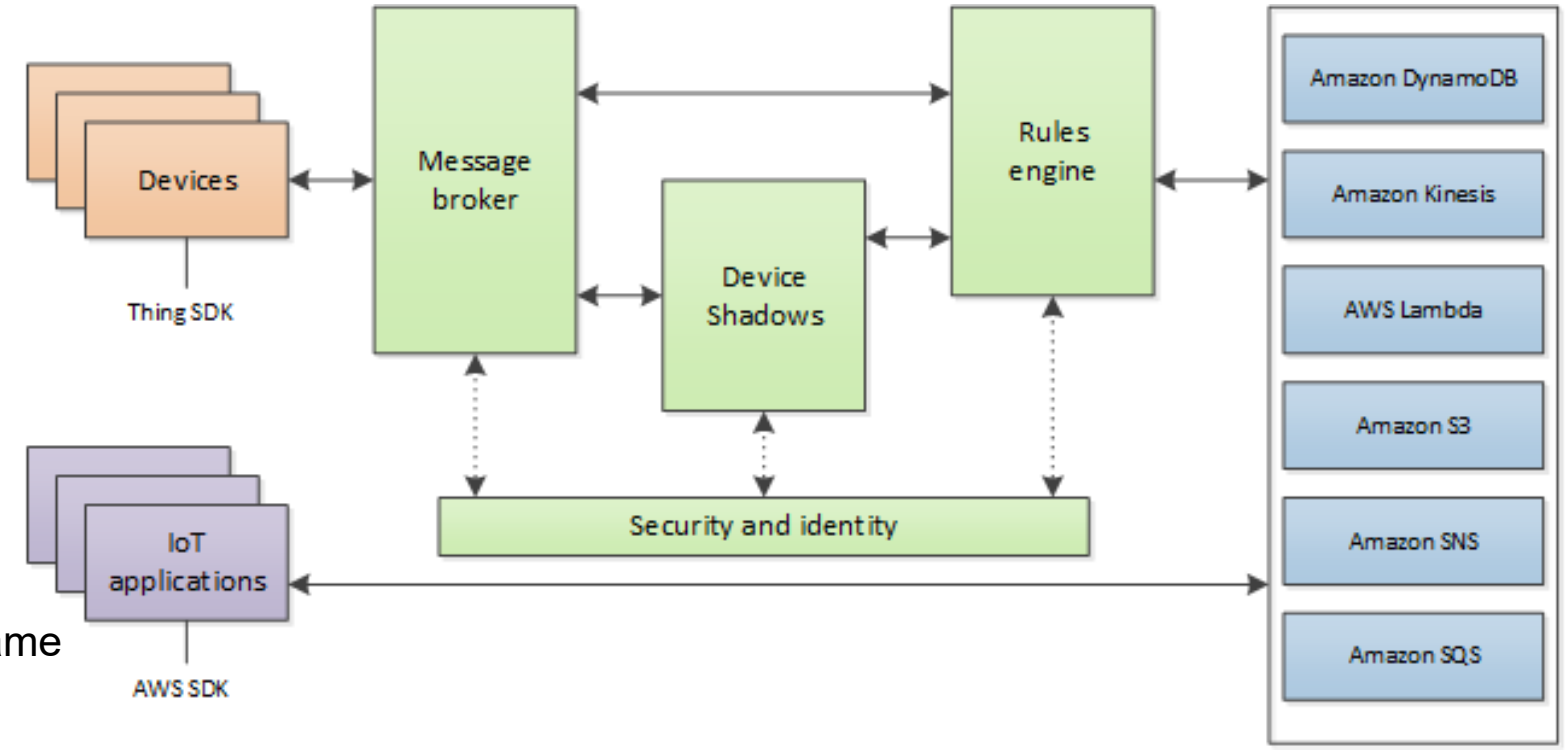
- Always expanding and changing…
- AWS IoT Core
- AWS SDKs
- AWS Lambda
- AWS Greengrass
- AWS IoT 1-Click and IoT Button
- Device Support
  - AWS IoT Device Management
  - AWS IoT Device Defender
  - AWS IoT Analytics
- Amazon FreeRTOS (later in class)

AWS IoT Core [1]

- Relatively new (10/8/15)
- $0.08 per minute of connection to IoT Core
- Pricing per message $1/million 5 KB messages
- Max message size 128 KB



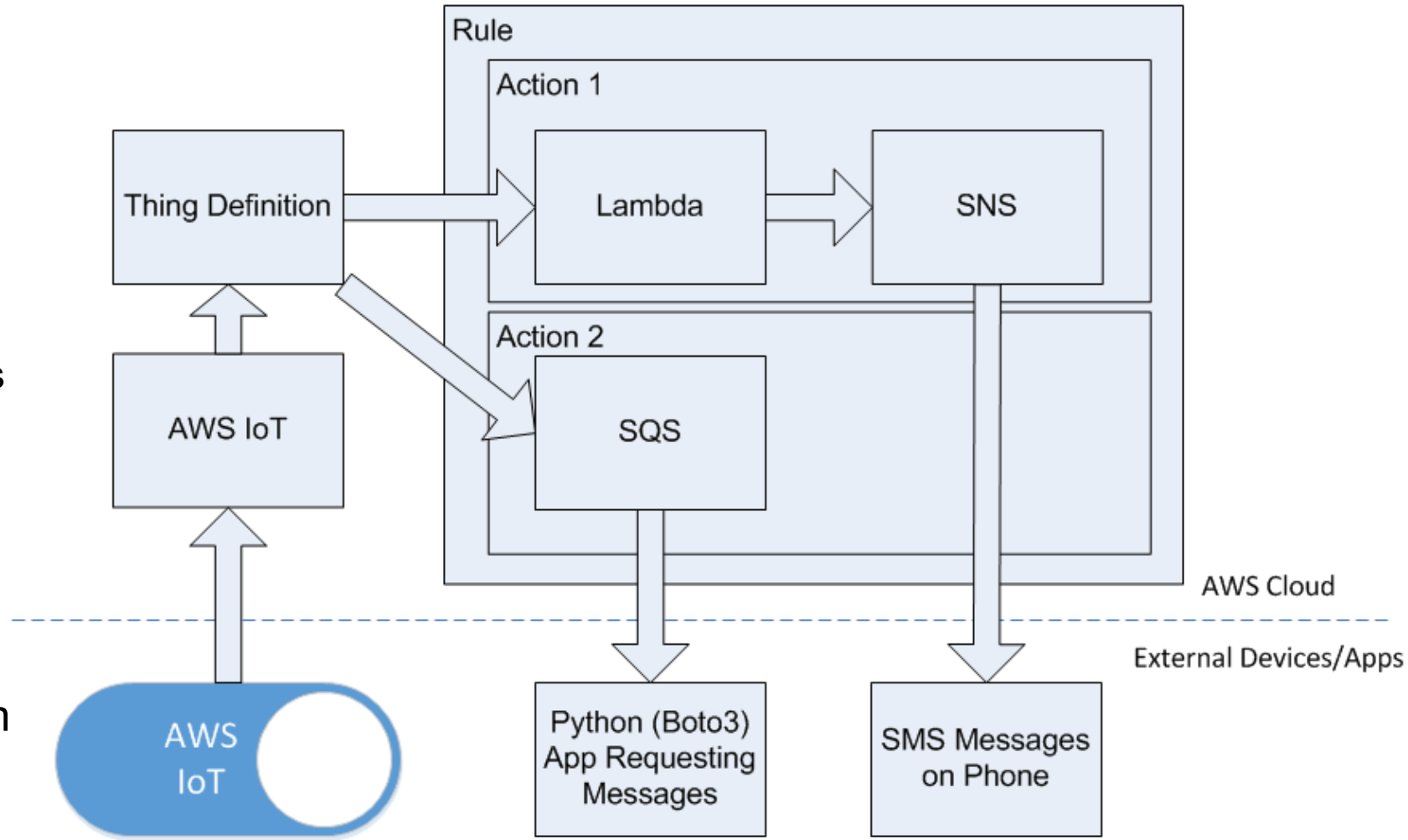
Key AWS IoT Service Elements [2]



- AWS IoT Device SDKs
- Device Gateway
- Message Broker
- Device or Thing Registry
  - Things
    - ARN – Amazon Resource Name
    - Description
    - Searchable Attributes
- Security and Identity Service
- Device Shadows and Service
  - JSON documents with state information (8K maximum)
- Rules Engine
  - Description
  - Query (select Attribute from Topic Filter with Condition)
  - Actions

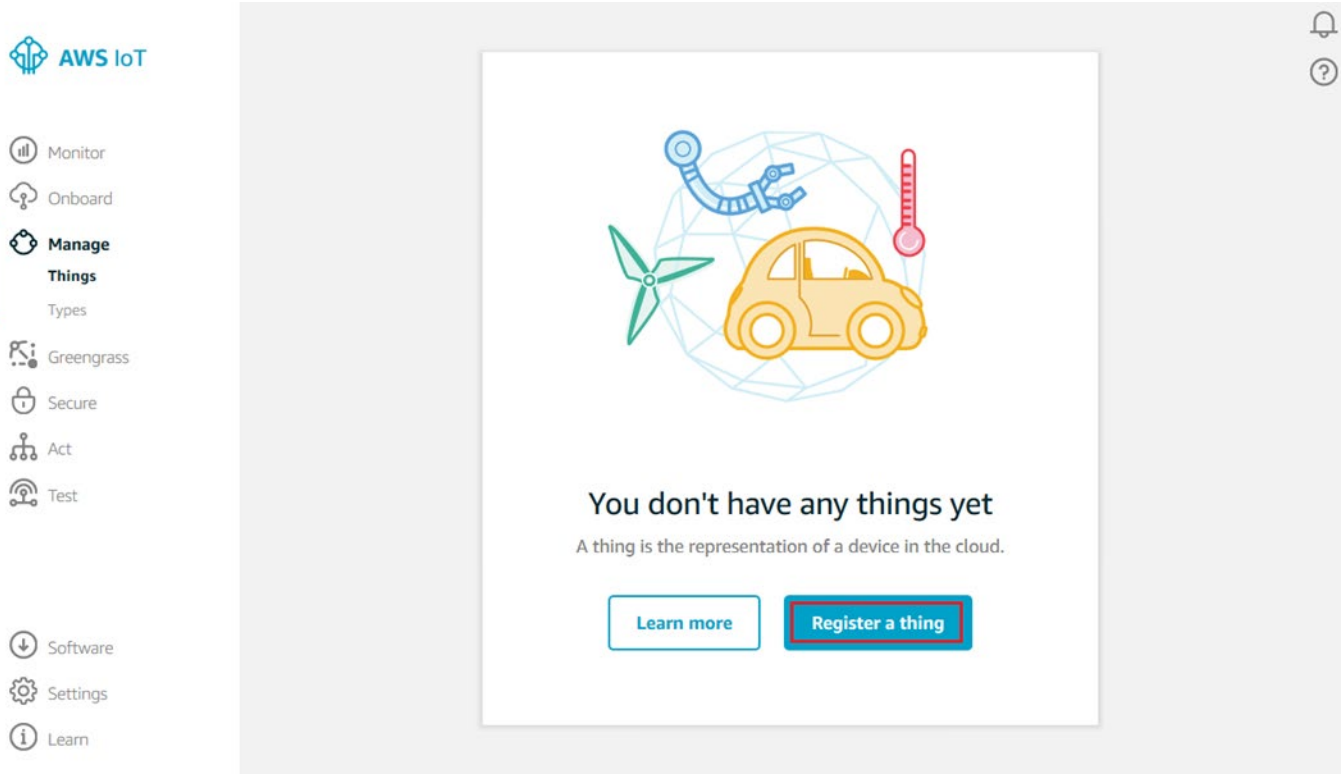
Example: AWS IoT Button

- AWS IoT provides default actions for triggers to
  - API Gateway
  - AWS IoT
  - Alexa Skills Kit
  - Alexa Smart Home
  - Cloudwatch Events & Logs
  - Cognito Sync
  - Dynamo DB
  - Kinesis
  - S3
  - SNS
  - SQS
- AWS IoT (Dash) Button from Amazon for $20 [3]
- WiFi-compatible



Typical Steps for an AWS IoT Setup [11]

- In the AWS IoT Console, Manage Things, use Register a Thing
- Create and Attach your Pi as a Thing
- Create a Security Certificate
- Creates a certificate, a public key, and a private key
- Also provides a link for a root CA for AWS IoT
- Create a New Policy
- Attach the Policy to the Certificate
- Attach the Thing to the Certificate
- Configure and Test Rules for Communication to Services
- Let's look at the console…



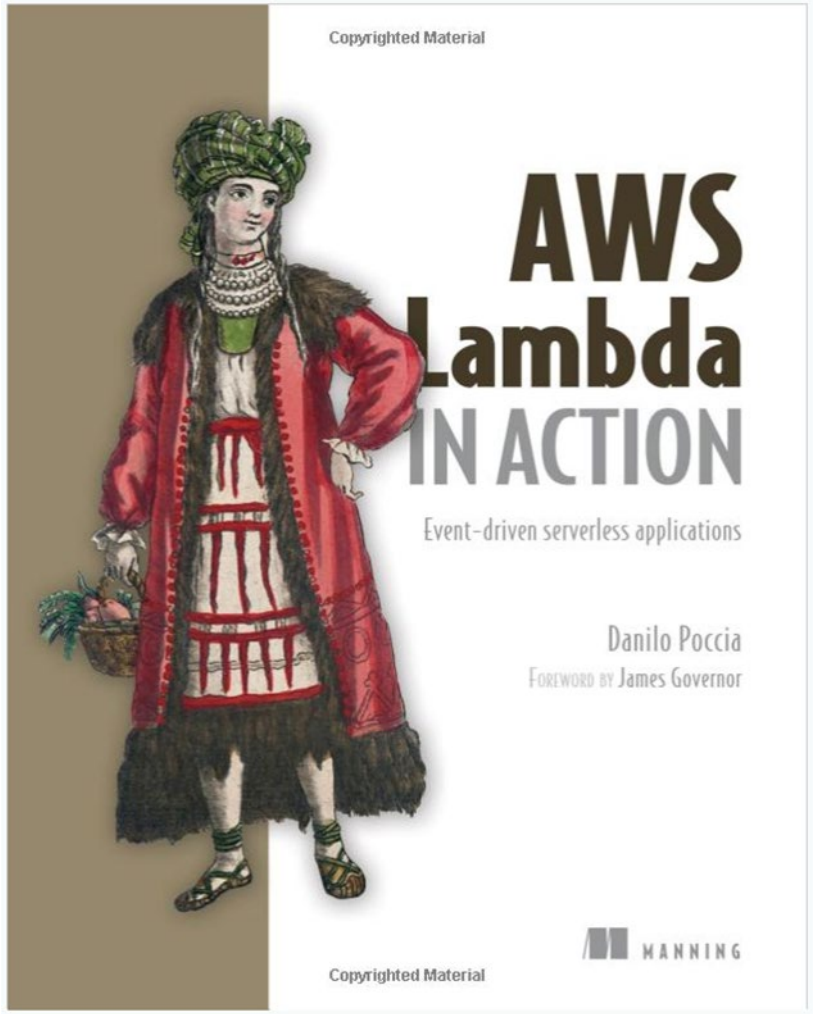
Boto 3 – AWS SDK for Python

- Native support for Python 2.x, 3.5+
- Waiters – tools to automatically poll for changes in AWS resources
- Requires credentials from AWS IAM to run
- Online SDK Support [4]
- SQS Example [5]
- Available services list [6]
- Also an SDK for Node.js [7]
- Example Code from [8]

```
#!/usr/bin/env python

import boto3
import boto3.session
from botocore.exceptions import ClientError
import sys

session = boto3.session.Session()

s3client = session.client('s3',
        region_name='eu-west-1',
        endpoint_url='http://s3-eu-west-1.amazonaws.com')

try:
    response = s3client.list_buckets()
except ClientError as e:
    print e.message
    sys.exit(0)

for bucket in response['Buckets']:
    print bucket['Name']
```

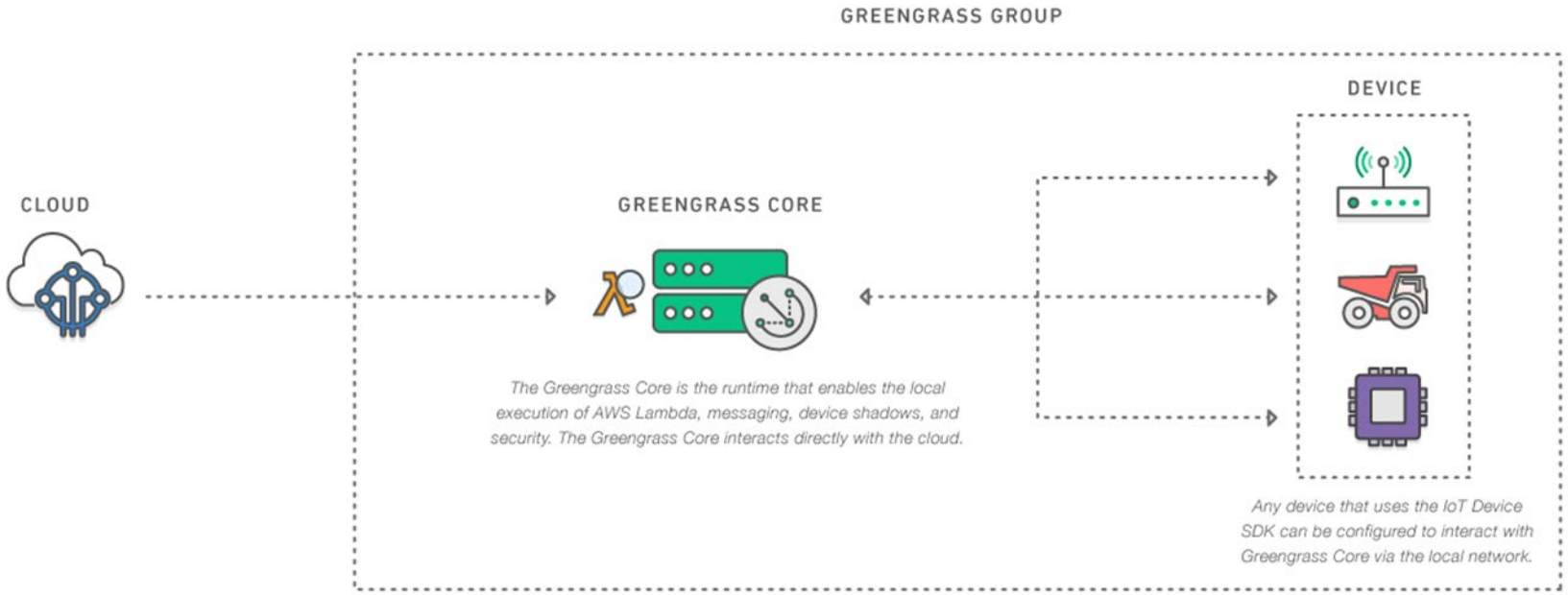
Amazon Lambda

- Allows code to be executed based on events without provisioning a VM (serverless applications)
- Good support on line for basic examples of integration with IoT and other AWS services
- Lambda supports Python, Node.js, C#, and Java applications
- The Lambda function tool on line incudes many “blueprints” for typical Lambda actions (in Python and Node.js) also application examples
- The Poccia book (shown) does a deep dive into developing and using Lambda with many examples
- In particular, information on security and development tools
  - Development tools outlined include:
    - Chalice and Apex – for creating, deploying, and managing apps
    - Serverless Framework – for more complex app deployment
    - Lambda-test-harness – for inline unit testing



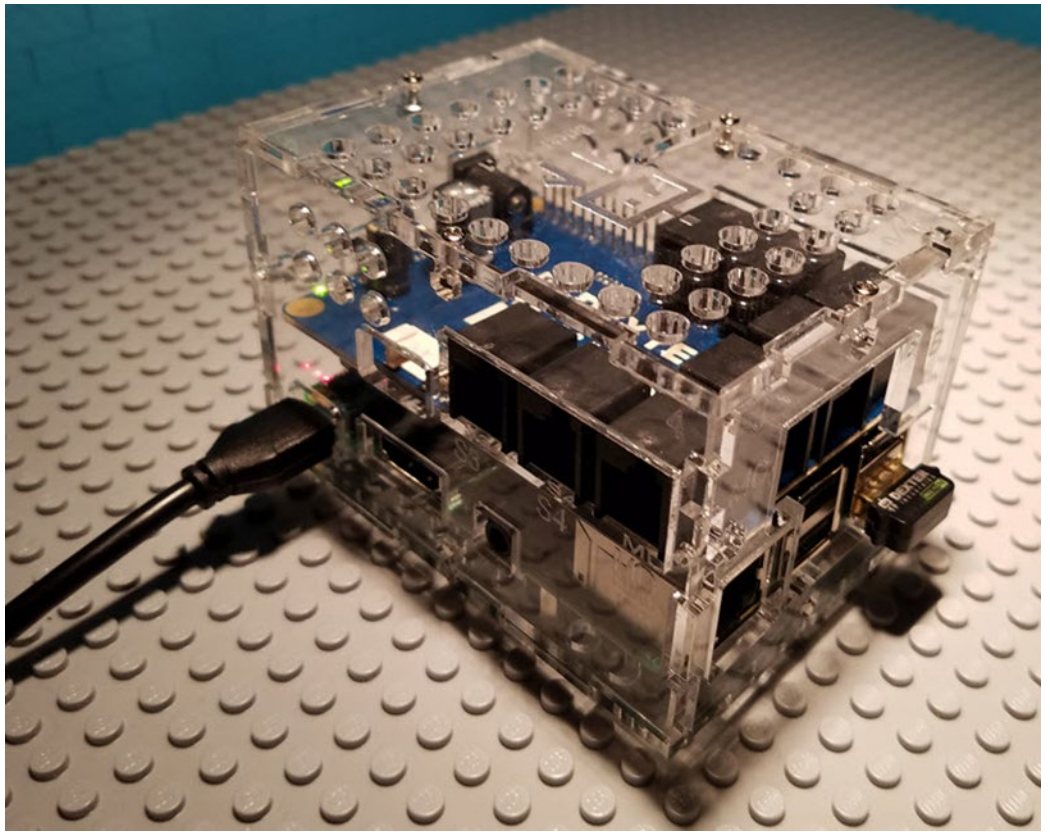
Amazon Greengrass – local Lambda for Edge devices

- Announced 11/30/16 (Limited Preview); general release 6/7/17
- Allows for local devices to run Lambda functions, AWS security, messaging, and shadows whether connected or not
- Devices using ARM or x86 and Linux can use the Greengrass Core and act as a local hub for other devices running AWS IoT Device SDK



Amazon Greengrass – on a Raspberry Pi

- Example for a Pi [10]
  - Setup a Greengrass Group
  - Setup AWS security
  - Associate to IoT Thing
  - Create Lambda function on Pi
  - Receive MQTT messages at AWS MQTT client
- Using Greengrass core on up to three devices is free
- 3 – 10000 devices are $0.16/device/month and annual fee of $1.49/device/year



Other AWS IoT Support

- Device Management
  - Onboarding and provisioning
  - Organizing into groups
  - OTA updates
- Device Defender
  - Audits configurations
  - Monitors for anomalies
  - Connects to CloudWatch and SNS for alerts
- Analytics
  - Integrates Matlab, Octave analysis
  - SQL queries
  - Machine learning tools

References

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