

Getting Started with AWS IoT

Ian Massingham 2@IanMmmm Chief Evangelist (EMEA), AWS



Things are becoming connected



Source: Pretty much everyone

The next 3-5 years

Today's hype

Today's Things



Tomorrow's normal

Tomorrow's insights

Tomorrow's solutions



Today's definition of "at scale"

Today's cost reduction

Today's confusion









Tomorrow's blue print



Solved on the edge

Dwarfed by tomorrow's definition



Tomorrow's growth engine

AWS: hyperscale infrastructure for connected devices









AWS Lambda Run Code in Response to Events

Amazon DynamoDB Predictable and Scalable NoSQL Data Store

Amazon Kinesis Streaming Analytics

Amazon API Gateway Build, Deploy, and Manage APIs



Amazon Redshift Petabyte-Scale Data Warehouse



Amazon SNS Mobile Push and Notifications



Amazon Cognito User Identity and Data Synchronization

...and more

IoT isn't new to AWS with previous customer success









AWS Lambda Run Code in Response to Events



DynamoDB Predictable and Scalable NoSQL Data Store



Amazon Redshift Petabyte-Scale Data Warehouse

Amazon SNS Mobile Push and Notifications

Amazon Cognito User Identity and Data **Synchronization**

Amazon Kinesis Streaming Analytics

Amazon **API** Gateway Build, Deploy, and Mana **APIs**



...and more

AWS IoT: simplify and accelerate IoT development



AWS IoT Connect Devices to the Cloud

AWS IoT

"Securely connect one or one billion devices to AWS, so they can interact with applications and other devices"

AWS IoT



Message Broker



AWS-grade security



Rules engine



Device Shadows



Device Registry



Managed Platform



Seamless integration with all of AWS



AWS IoT Message Broker



AWS IoT Message Broker



Billions of devices can publish and subscribe to messages Example: Connect a device using MQTT





AWS IoT

Messages are transmitted and received using the MQTT protocol which minimizes the code footprint on the device and reduces network bandwidth requirements AWS IoT enables devices to communicate with AWS services and each other

MQTT

- OASIS standard protocol (v3.1.1)
- Lightweight, pub-sub, transport protocol that is useful for connected devices
- MQTT is used on oil rigs, connected trucks, and many more sensitive and resource-sensitive scenarios
- Customers have needed to build, maintain, and scale a broker to use MQTT with cloud applications

MQTT vs HTTPS:

- 93x faster throughput
- 11.89x less battery to send
- 170.9x less battery to receive
- 50% less power to keep connected
- 8x less network overhead

Source: <u>http://stephendnicholas.com/archives/</u> 1217



AWS IoT security: authentication and authorization



Securing and identifying Things



Securing and Identifying Things: Mutual Auth TLS



AWS IoT security

Example: Authenticate connections between sensors, a device and an application



command and turns on

above a threshold they turn on the fan

AWS IoT Rules Engine



AWS IoT Rules Engine

Example: Improve driver safety with connected cars



AWS IoT Rules Engine basics





SELECT * FROM 'things/thing-2/color' WHERE color = 'red'

Simple & familiar syntax

- SQL Statement to define topic filter
- Optional WHERE clause
- Advanced JSON support

Functions improve signal : noise

- String manipulation (regex support)
- Mathematical operations
- Context-based helper functions
- Crypto support
- UUID, Timestamp, rand, etc.

AWS IoT Rules Engine's flexibility





```
SELECT *, clientId() as MQTTClientId
FROM 'one/rule'
WHERE
startsWith(topic(2), 'IME33') AND
(state = 'INIT' OR hydro temp >
surface temp)",
"actions":
[ {
"republish": {
    "topic":
                          "controllers/
${substring(topic(3),
                          3, 5)}",
}]
```

AWS IoT Rules Engine





Complex Evaluations

Respond to the fleet, not just a single unit. Dozens of functions() available.

Multiple / Simultaneous Actions

Sometimes a situation requires you to take many actions.

AWS IoT Rules Engine actions



AWS IoT Rules Engine

Rules Engine connects AWS IoT to External Endpoints and AWS Services.

1. AWS Services (Direct Integration)

2. Rest of AWS (via Amazon Kinesis, Lambda, S3, and more)

EC2



S3 DDB Amazon Kinesis **RDS** Amazon Glacier Lambda SQS Amazon SNS Redshift **3. External Endpoints** (via Lambda and SNS)

AWS IoT Rules Engine Actions

Rules Engine evaluates inbound messages published into AWS IoT, and transforms and delivers to the appropriate endpoint based on business rules.

External endpoints can be reached ctions via Lambda and Simple Notification Service (SNS).



Invoke a Lambda function



Put object in an S3 bucket



Insert, Update, Read from a DynamoDB table



Publish to an SNS Topic or Endpoint



Publish to an Amazon Kinesis stream



Amazon Kinesis Firehose



Republish to AWS IoT



AWS IoT Rules Engine & Amazon SNS



Push Notifications

Apple APNS Endpoint, Google GCM Endpoint, Amazon ADM Endpoint, Windows WNS

Amazon SNS -> HTTP Endpoint (Or SMS or Email)

Call HTTP based third-party endpoints through SNS with subscription and retry support

AWS IoT Thing Shadow



AWS IoT Device Shadows

۰Þ

INTERMITTENT CONNECTION

Example: Analyze chemicals in a sample with a mass spectrometer



Connected mass spectrometer reports its state and readings throughout a multi-hour cycle



The spectrometer goes offline when its cycle completes, but its last-reported state persists in AWS IoT

RESTAPIS

Technicians can use mobile apps to set new desired states (e.g. pause the cycle), or query the last reported state of the spectrometer

AWS IoT Thing Shadow





AWS IoT Shadow Flow



AWS IoT Device Shadow - Simple Yet Powerful





Report its current state to one or multiple shadows Retrieve its desired state from shadow



Shadow reports delta, desired and reported states along with metadata and version

Shadow



Set the desired state of a device Get the last reported state of the device Delete the shadow

Mobile App

```
"state" : {
      "desired" : {
          "lights": { "color": "RED" },
          "engine" : "ON"
      },
      "reported" : {
          "lights" : { "color": "GREEN" },
      "engine" : "ON"
      },
      "delta" : {
          "lights" : { "color": "RED" }
       } },
```

Il consistent + 10

AWS IoT Device Shadow Topics (MQTT)

Thing SDK (C-SDK, JS-SDK)

makes it easy for you to build shadow functionality into your device so it can automatically synchronize the state with the device.

	Sensor	Reported	Desired	Delta
'	LED1	RED	YELLOW	LED1 = Yellow TEMP = 60F
	ACCEL	X=1,Y=5,Z=4	X=1,Y=5,Z=4	
	TEMP	83F	60F	

UPDATE: \$aws/things/{thingName}/shadow/update DELTA: \$aws/things/{thingName}/shadow/update/delta GET: \$aws/things/{thingName}/shadow/get DELETE: \$aws/things/{thingName}/shadow/delete



AWS IoT Registry



AWS IoT Registry

- Static attributes associated to Thing
 - Firmware version
 - Serial Numbers
 - Device Type
 - Device Group
 - Device Description
 - Sensor description
- Support and Maintenance
 - Reference Manual URL
 - Part # reference
- Reference to external support system

AWS IoT – Device Management



- Ability to update global or within a Region
- Rules Engine keeps state of updates and tracks progress in a DynamoDB Table
- Store Version in Registry Entry

S3 Holds Versioned Firmware Distributions

Organize and secure your firmware binaries in S3

Message Broker notifies groups of the fleet using Topic Patterns

Alert the fleet (or part of it) of the update, and send the URL to the S3 download



Pricing



AWS IoT

- Pay as you go. No minimum fees.
- \$5 per million messages published to, or delivered by, AWS IoT.
- AWS IoT does not charge for deliveries to the following AWS services: <u>Amazon S3</u>, <u>Amazon</u> <u>DynamoDB</u>, <u>AWS Lambda</u>, <u>Amazon Kinesis</u>, <u>Amazon SNS</u>, and <u>Amazon SQS</u>.
- <u>Free Tier</u>: 250,000 messages per month for 12 months.

Get Started with the AWS IoT Device SDK









C-SDK (Ideal for embedded OS) JS-SDK (Ideal for Embedded Linux Platforms)

Arduino Library (Arduino Yun) Mobile SDK (Android and iOS)

Official IoT Starter Kits, Powered by AWS

Launched 10 Starter Kits, Powered by AWS



Seeeduino Cloud (by Seeed Studio)

amazon.Prime



Beaglebone Green (by Seeed Studio)

amazoncom



Dragonboard 410c (by Arrow)

amazoncom



Marvell EasyConnect (By Marvell)

amazon.Prime



Ti Launchpad (By Ti)



Intel Edison (by Seeed Studio)



MediaTek LinkIt One (by Seeed Studio)

amazon Prime



Broadcom BCM4343W (by Avnet)





Microchip WCM (by Microchip)



Renesas RX63N (by Micrium)



Thank You

Ian Massingham 2@IanMmmm Chief Evangelist (EMEA), AWS

