



MBL205

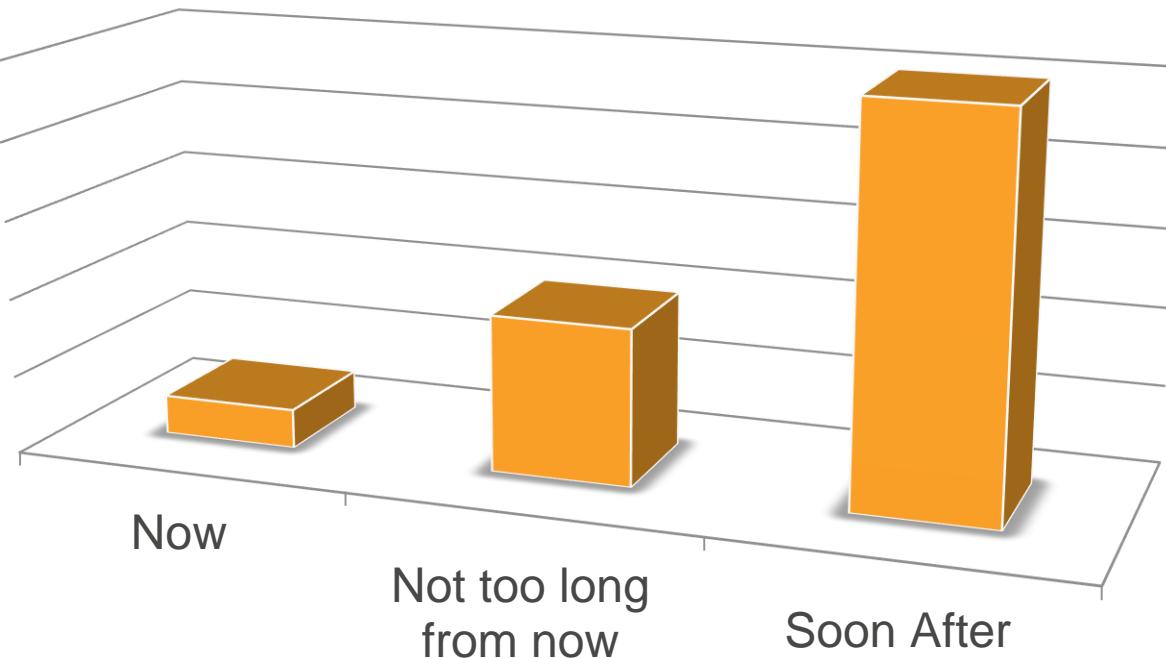
Everything You Want to Know About AWS IoT

Kyle Roche | Jinesh Varia

@kyleroche | @jinman



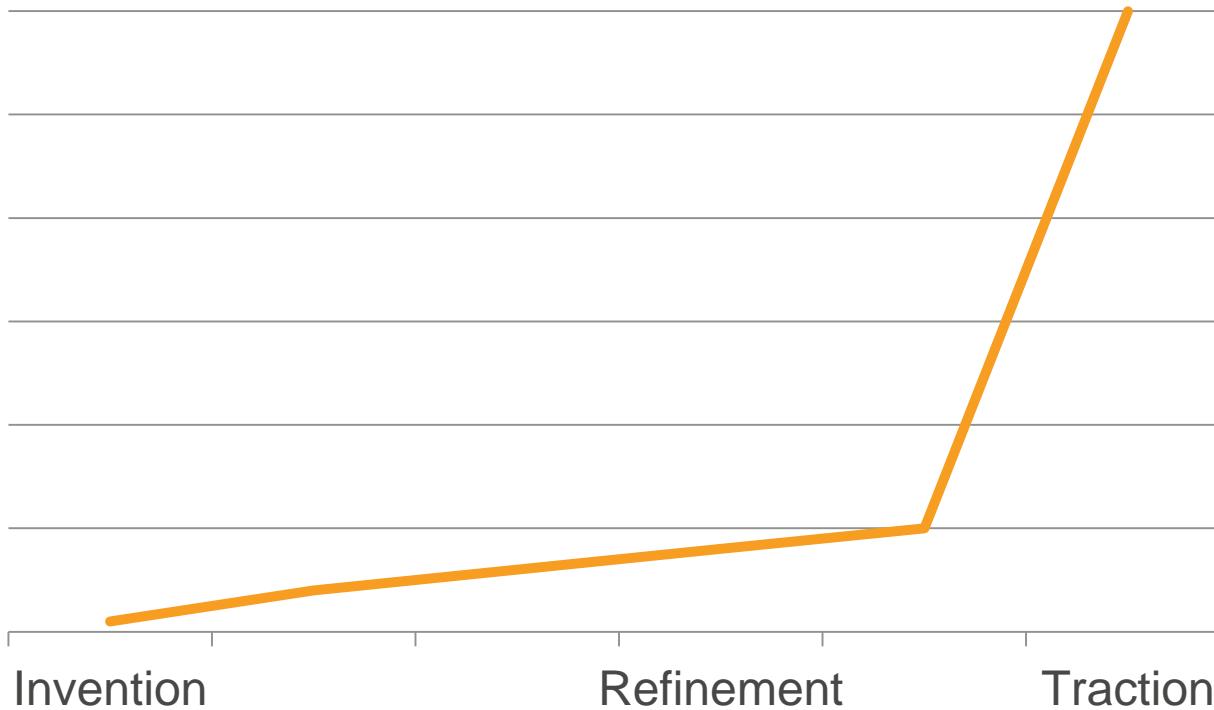
Things Are Becoming Connected

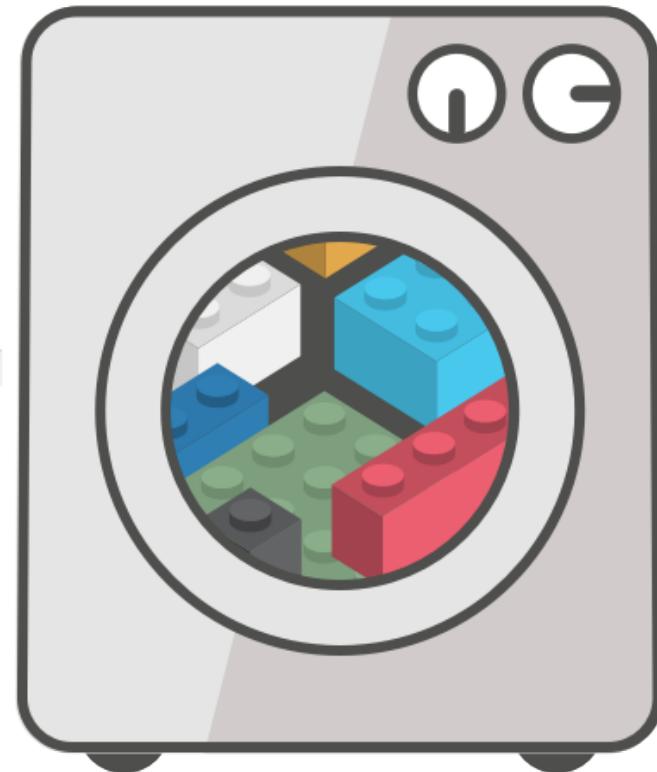


Source: Pretty much everyone

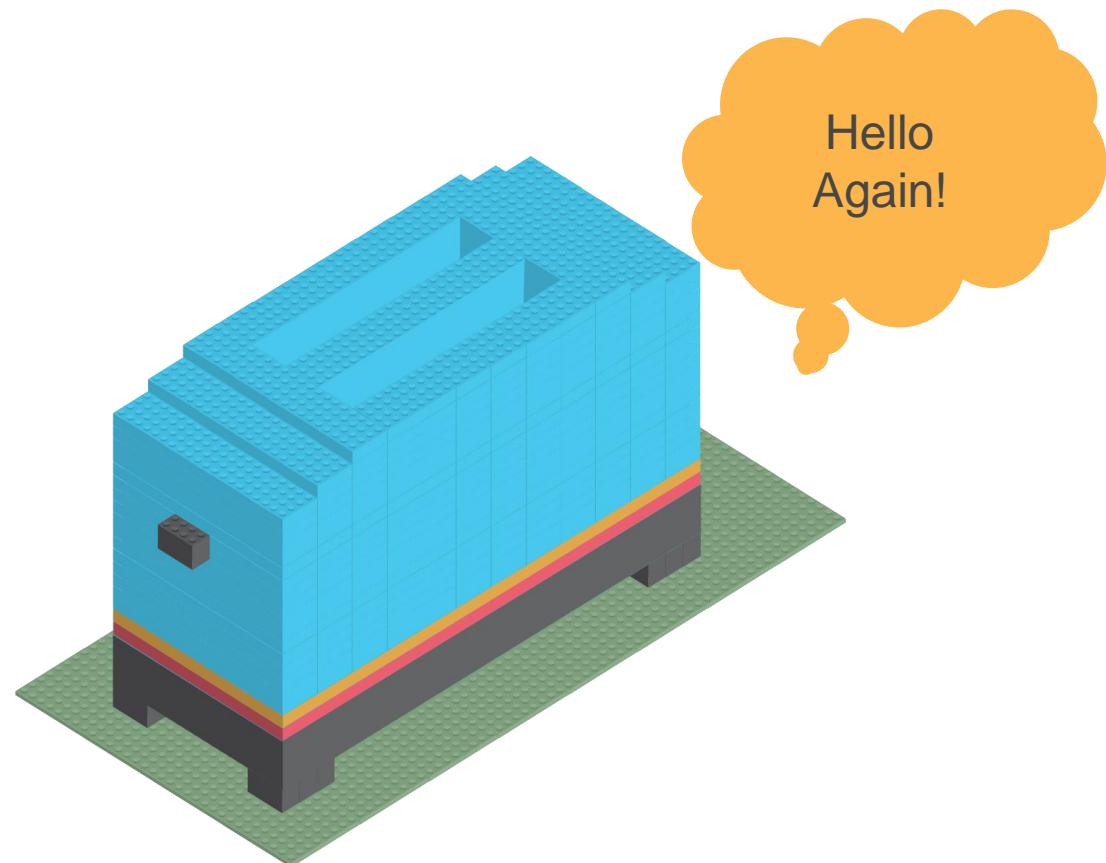


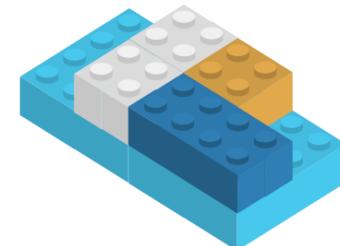
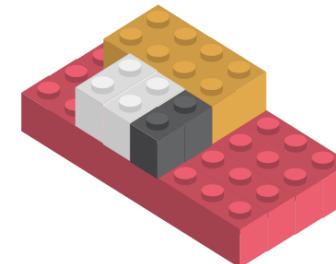
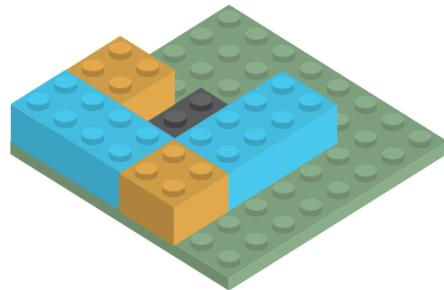
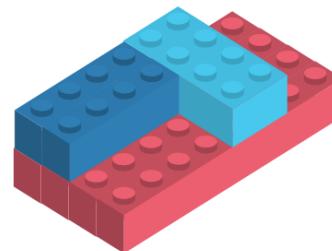
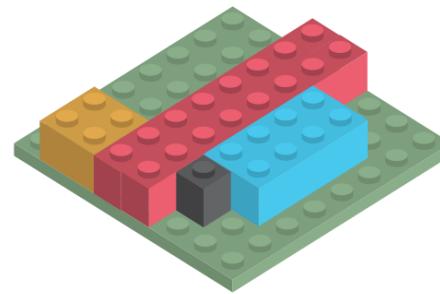
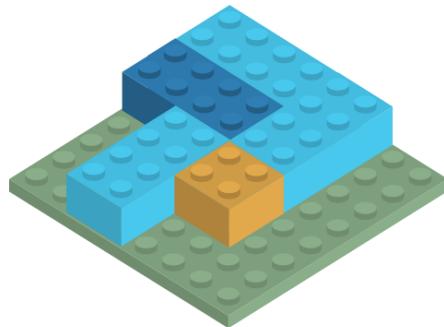
State of Acceleration / Growth



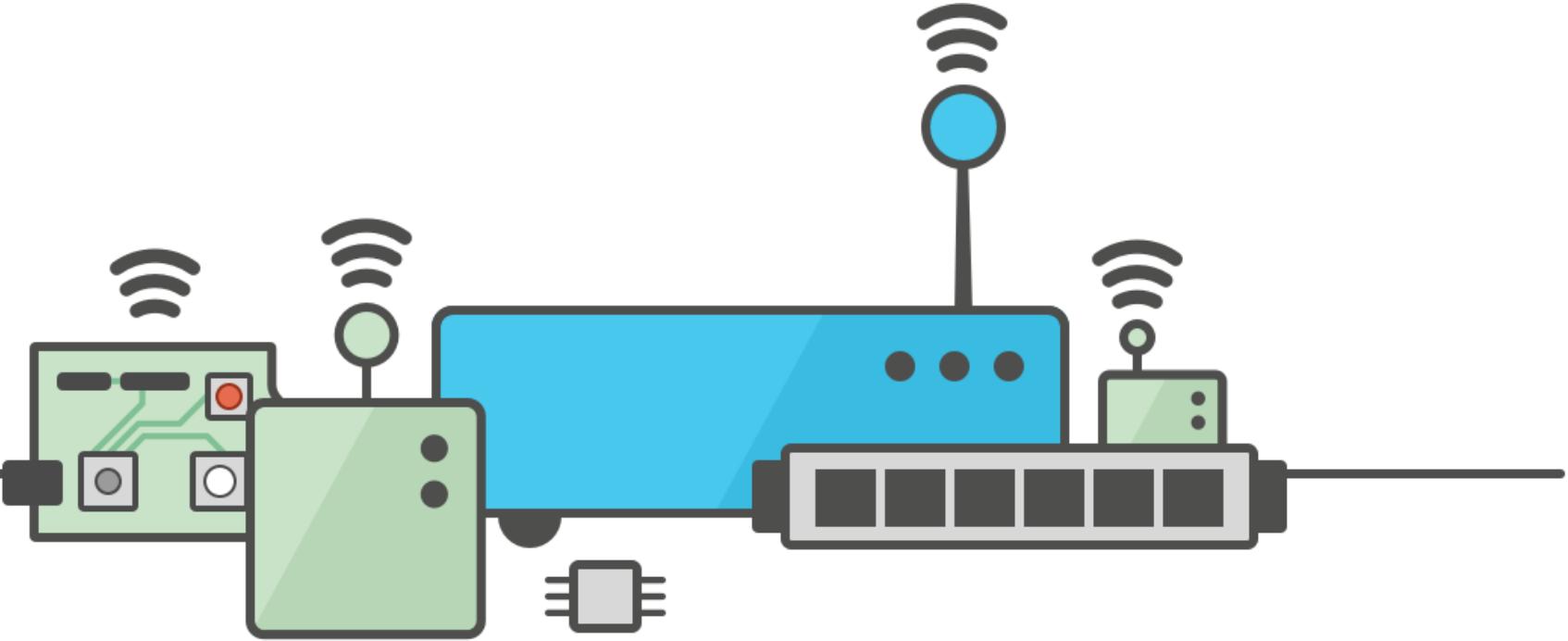


Source: Patrick Bergel @ ThingMonk 2014
based on research by Ingo Althöfer





Building Blocks for Innovation in IoT



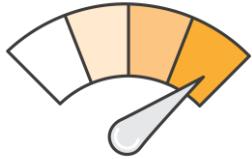
AWS IoT Makes Things Smarter

“A 10 year old product can do things that hadn’t been invented 10 years ago. Most importantly, going forward, people will expect your product to improve, and if it isn’t being updated and getting better, you’re literally being left behind.”

SONOS

How can we escape the *spin cycle*?

1011011
1100110
1001000
01100110



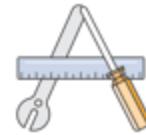
Alternate
Protocols

Scalability
&
Noise/Signal

Security &
Management

Integration with Cloud
and Mobile Apps and
Analytics

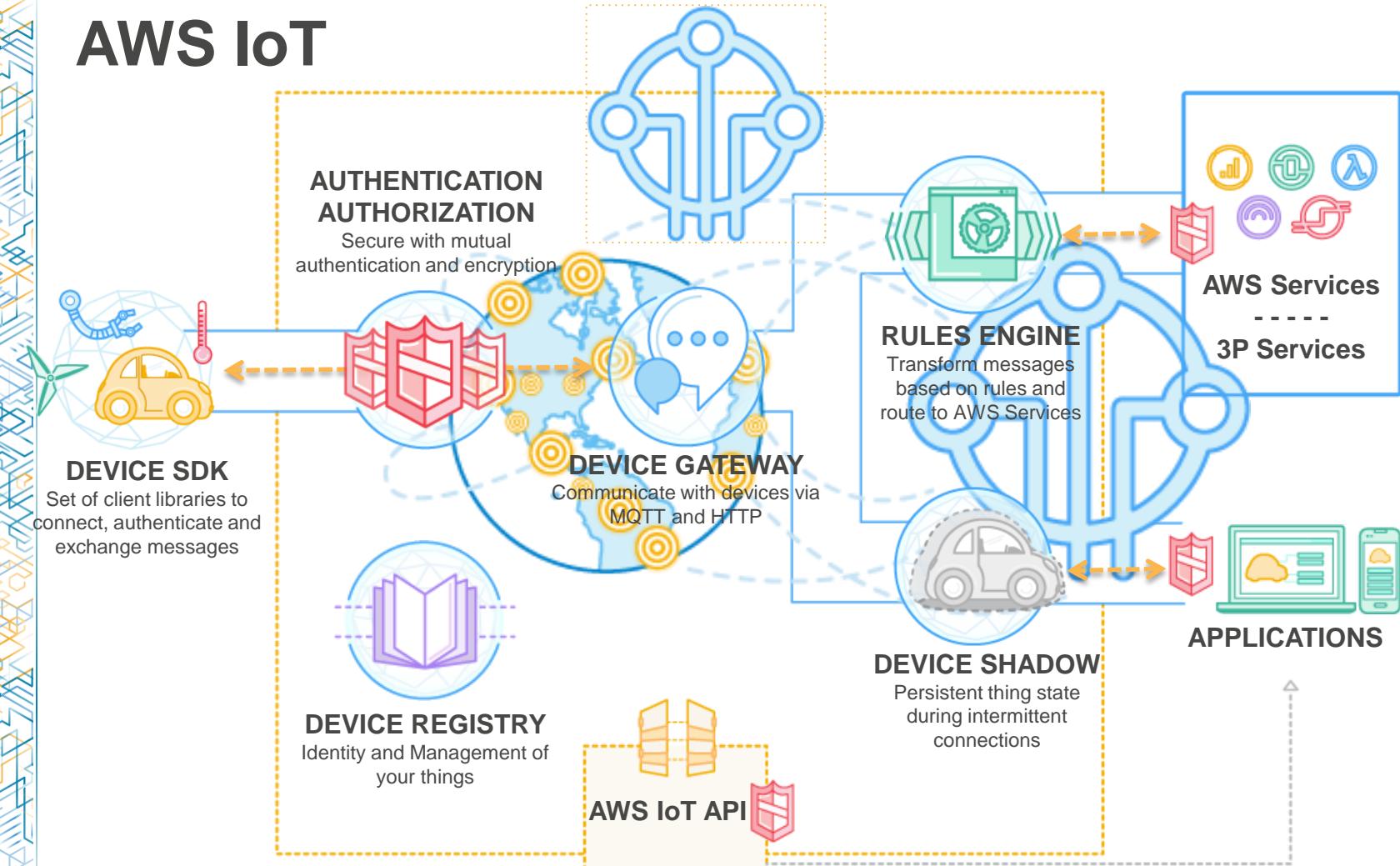
Many SDKs
& Tools



AWS IoT

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

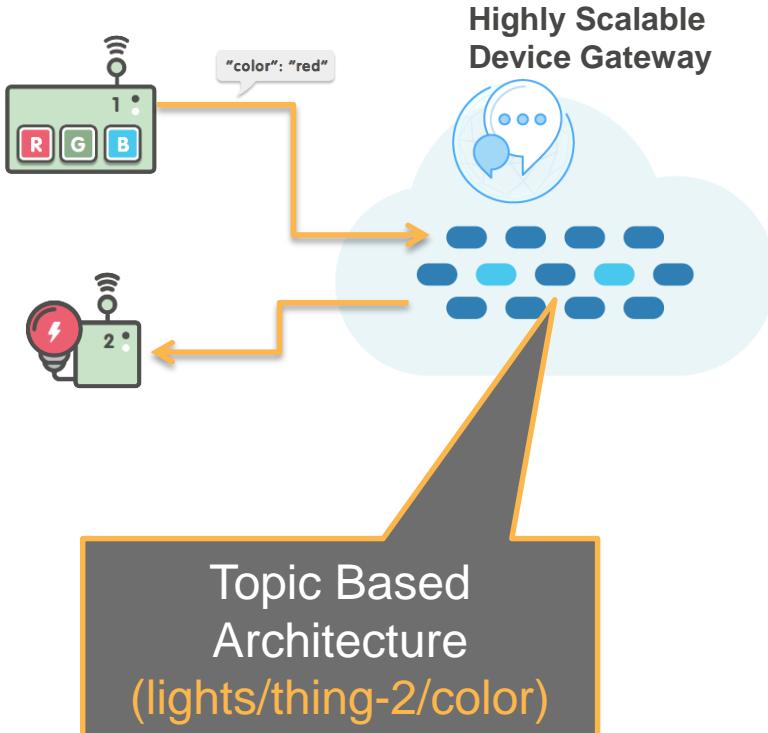
AWS IoT



AWS IoT Message Broker



AWS IoT Device Gateway



Standard Protocol Support (no lock-in)

Millions of devices and apps can connect over any protocol starting with MQTT and HTTP 1.1

Powerful Pub/Sub Broker with Long-lived bi-directional messages

Clients (Devices and Apps) can receive commands and control signals from the cloud

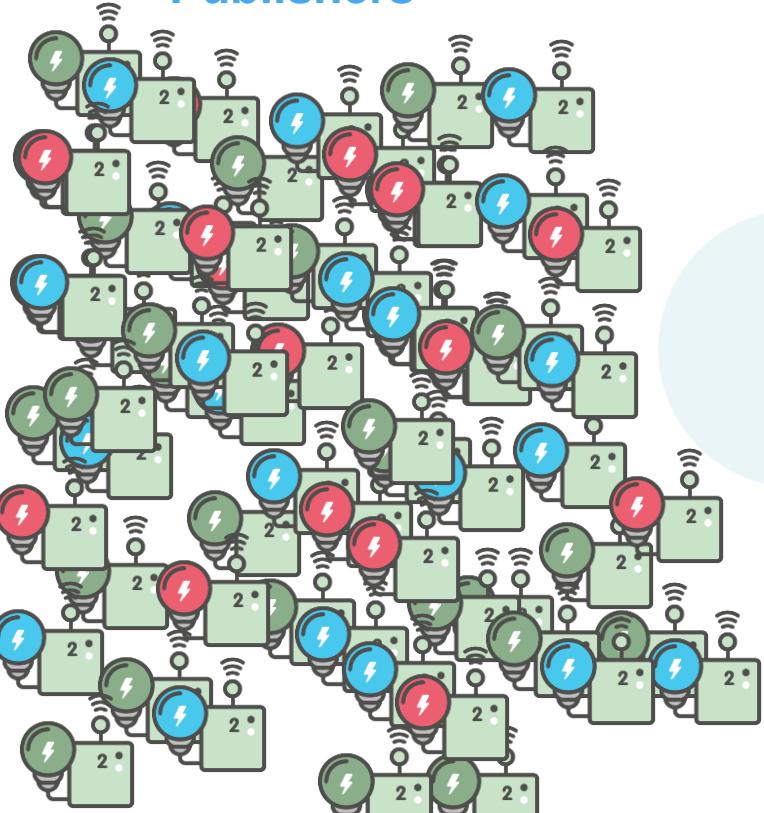
Secure by Default

Connect securely via X509 Certs and TLS 1.2 Client Mutual Auth

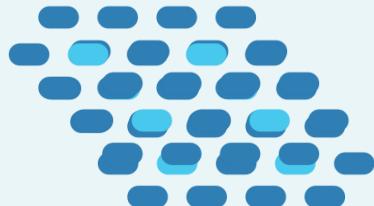
AWS IoT Message Broker : Managed Service



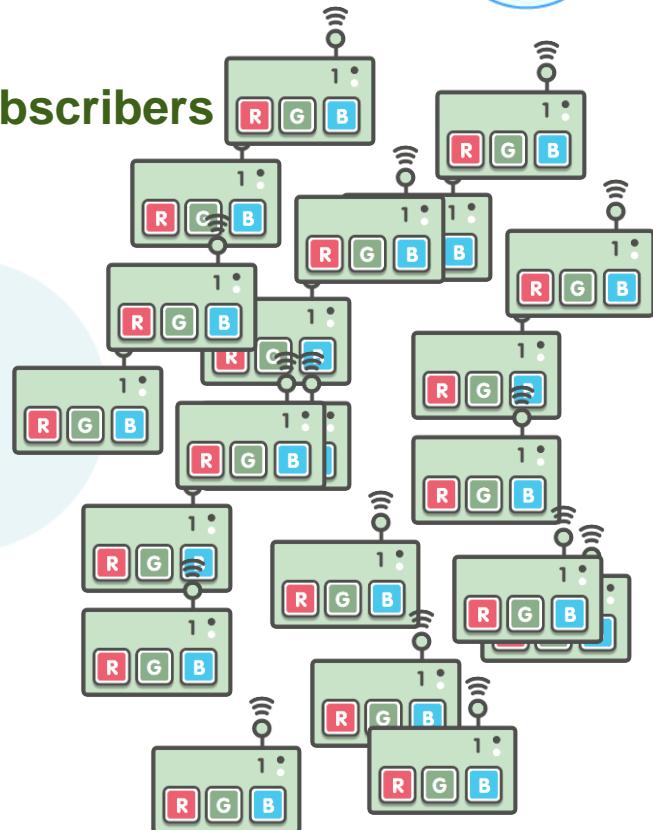
Publishers



Highly Scalable
Device Gateway

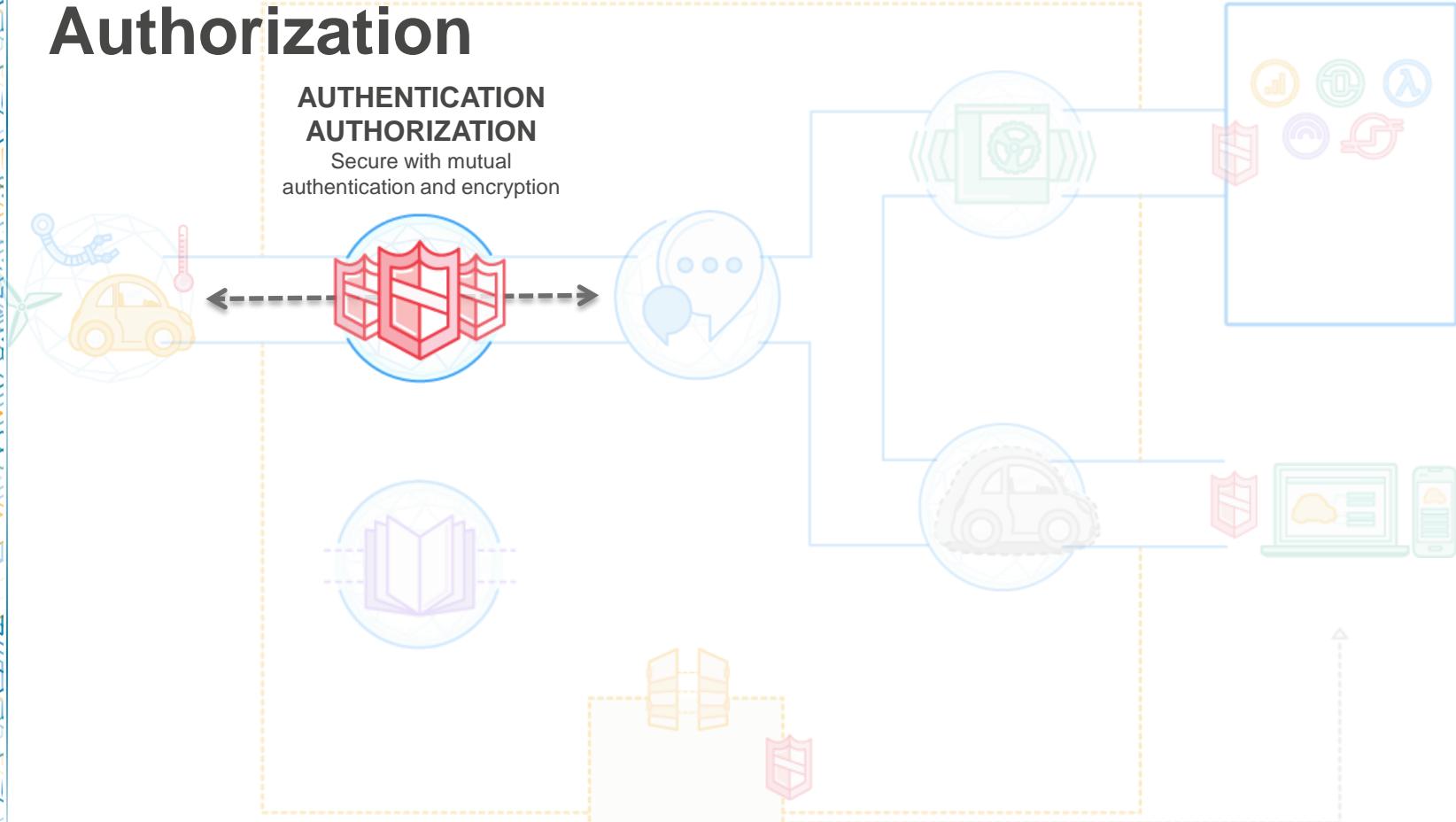


Subscribers



Millions of devices
sending billions of
messages

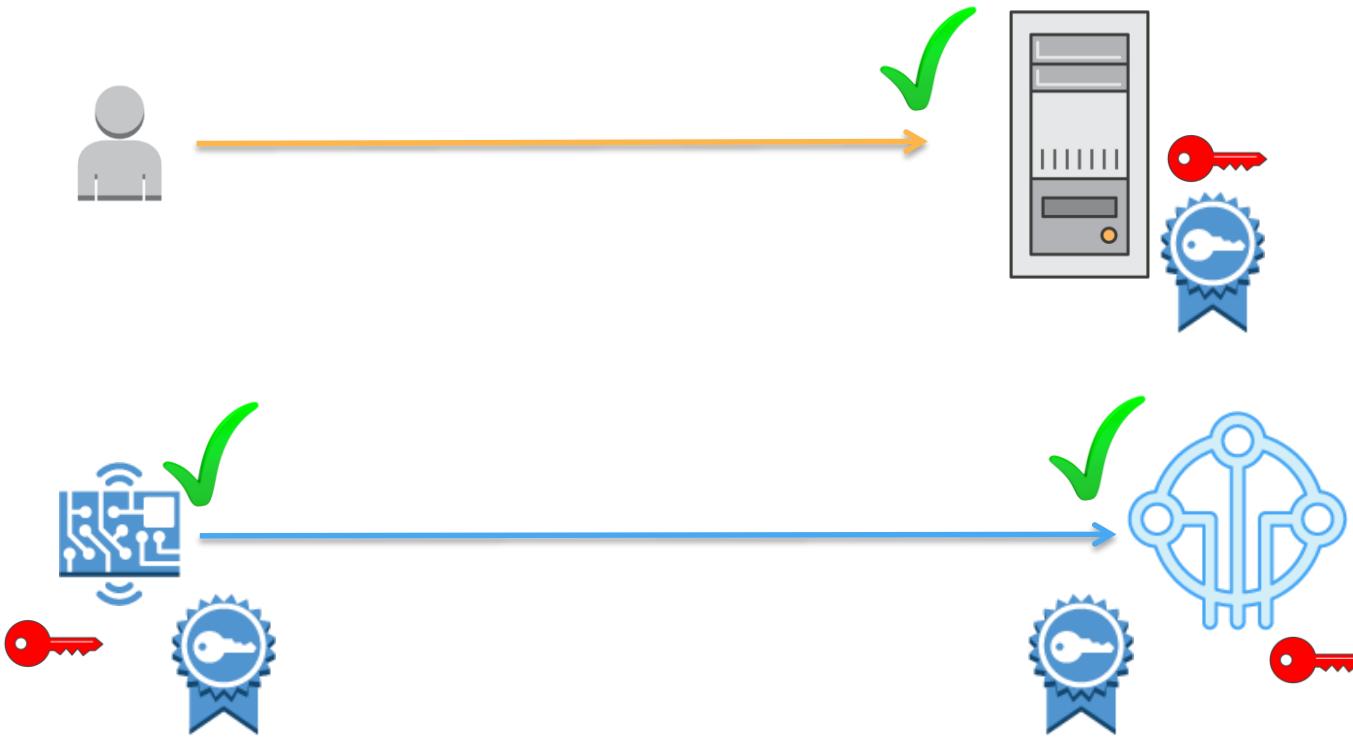
AWS IoT Security: Authentication and Authorization



One Service, Two Protocols

NEW		MQTT + Mutual Auth TLS	AWS Auth + HTTPS
Server Auth	TLS + Cert	TLS + Cert	
Client Auth	TLS + Cert	AWS API Keys	
Confidentiality	TLS	TLS	
Protocol	MQTT	HTTP	
Identification	AWS ARNs	AWS ARNs	
Authorization	AWS Policy	AWS Policy	

Mutual Auth TLS



Provisioning and Security



Secure Communications with Things

- Single API call to **CreateKeysAndCertificate()**
- Client Generated **CreateCertificateFromCSR(CSR)**

Fine-grained Authorization for:

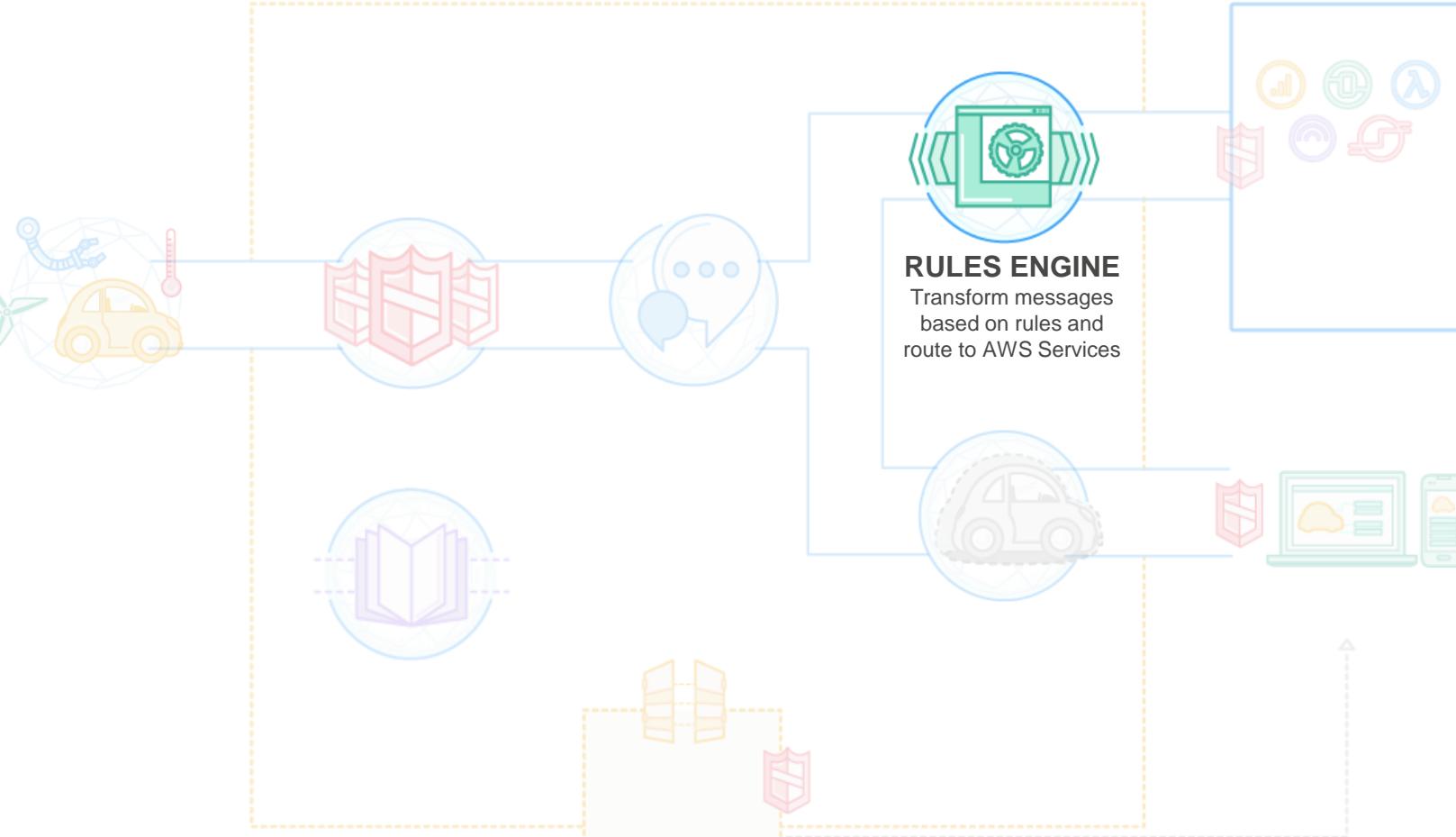
Thing Management

Pub/Sub Data Access

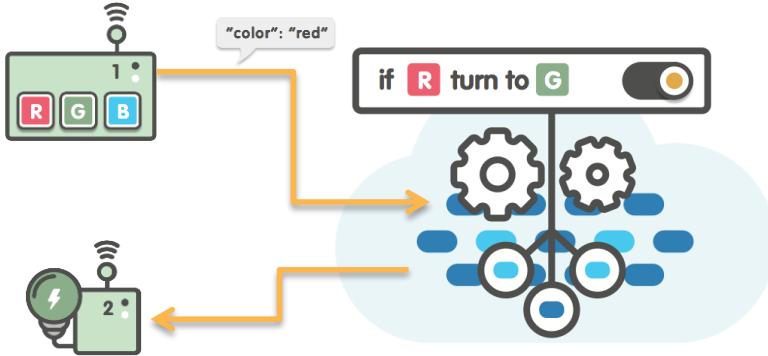
AWS Service Access

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Effect": "Allow",  
            "Action": ["iot:Publish"],  
            "Resource":  
                ["arn:aws:iot:us-east-  
                 1:123456972007:topic/foo"]  
        },  
        {  
            "Effect": "Allow",  
            "Action": ["iot:Subscribe"],  
            "Resource":  
                ["arn:aws:iot:us-east-  
                 1:123456972007:topicfilter/foo/bar/*"]  
        }]  
}
```

AWS IoT Rules Engine



AWS IoT Rules Engine Basics



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

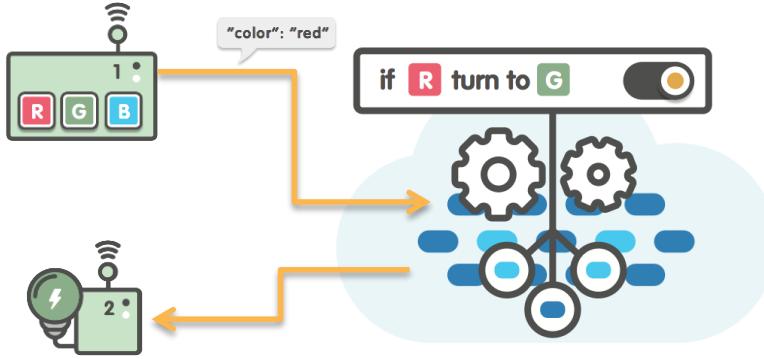
Simple & Familiar Syntax

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

Functions improve signal : noise

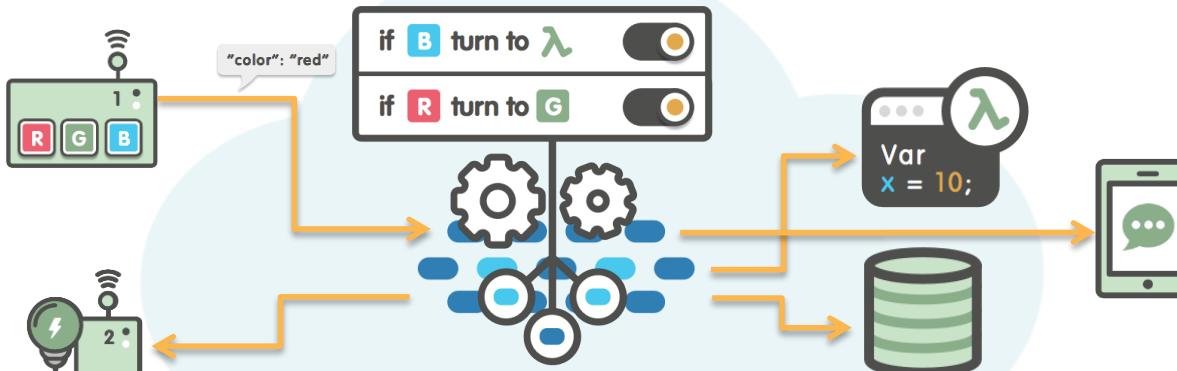
- String manipulation (regex support)
- Mathematical operations
- Context based helper functions
- Crypto support
- UUID, Timestamp, rand, etc.

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



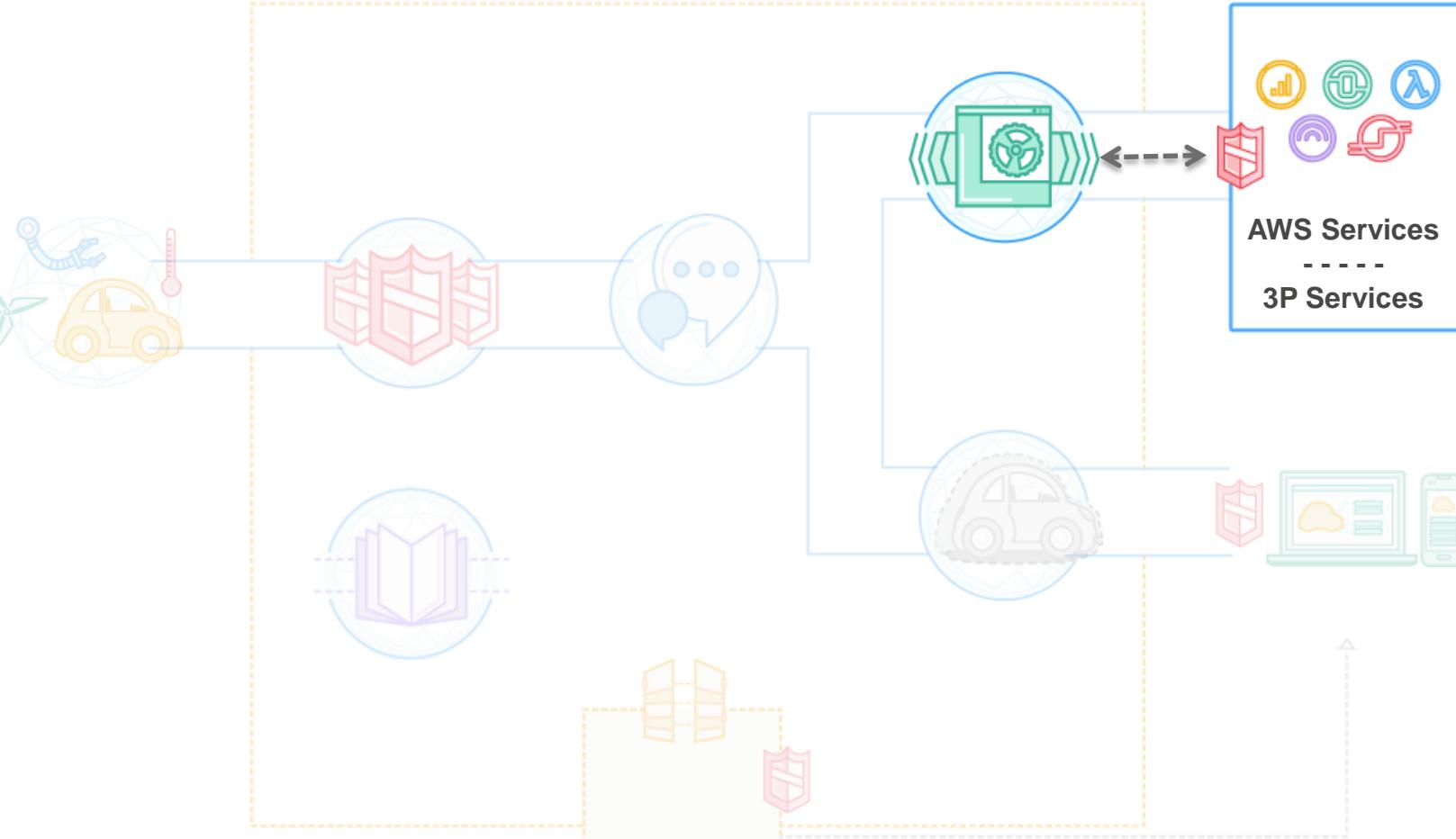
Complex Evaluations

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

Multiple / Simultaneous Actions

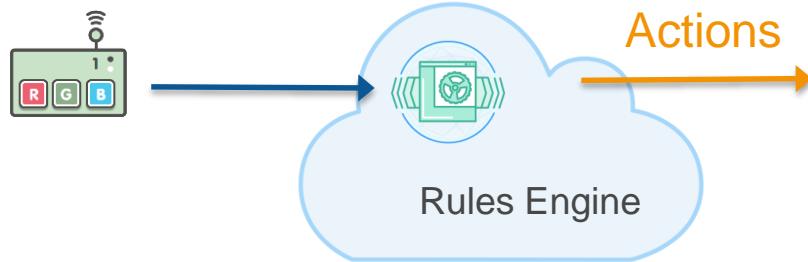
Sometimes a situation requires you to take many actions

AWS IoT Rules Engine Actions



AWS IoT Rules Engine

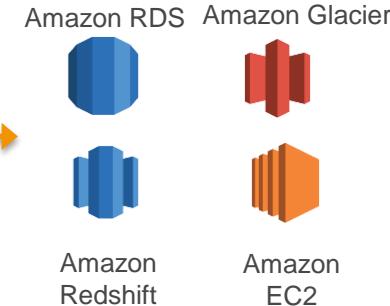
Rules Engine connects AWS IoT to External Endpoints and AWS Services.



1. AWS Services (*Direct Integration*)



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



3. External Endpoints (via Lambda and SNS)



AWS IoT Rules Engine Actions

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



Actions

External endpoints can be reached 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

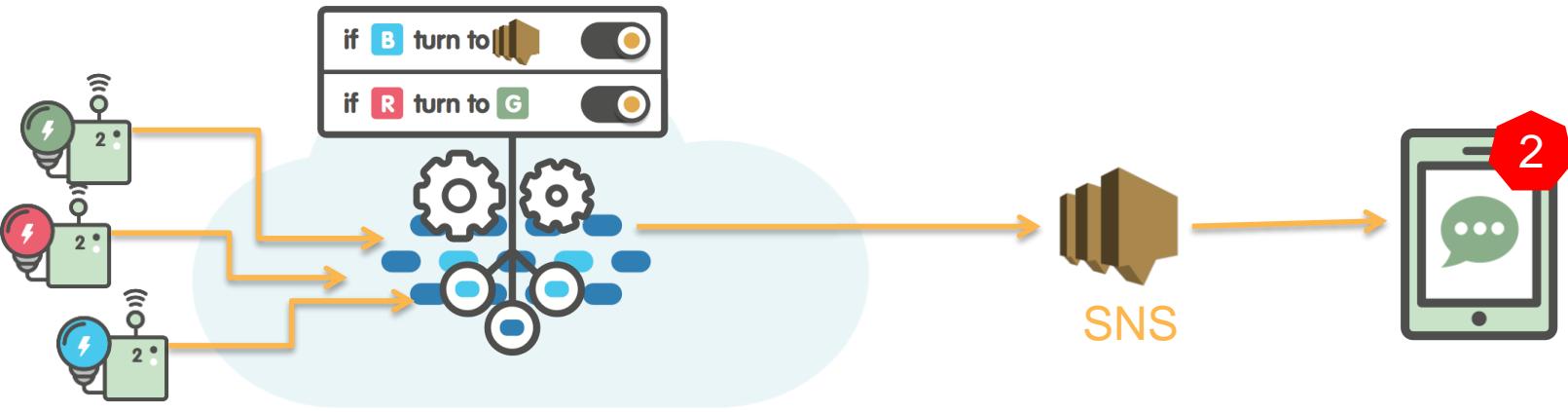


Amazon Kinesis Firehose



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 3rd party endpoints through SNS with subscription and retry support

AWS IoT Button - “Hello World” of AWS IoT



- Based on the Amazon dash button hardware (Stateless Wi-Fi Button)
- Code in the Cloud; no device specific code or flashing required
- Learn Rules, Shadows and Topics

Build Cool Stuff



You already have competition!

Tweet Something

Call an Uber cab

Slack it

Count things

Call customer service

Order pizza

Start a car

“Like” something on Facebook

Track Things

Poke someone on Facebook

Approve Expense reports

Mayday button

AWS IoT Mega Contest by Hackster.io

hackster.io

Projects ▾

Platforms

Challenges

...

Search

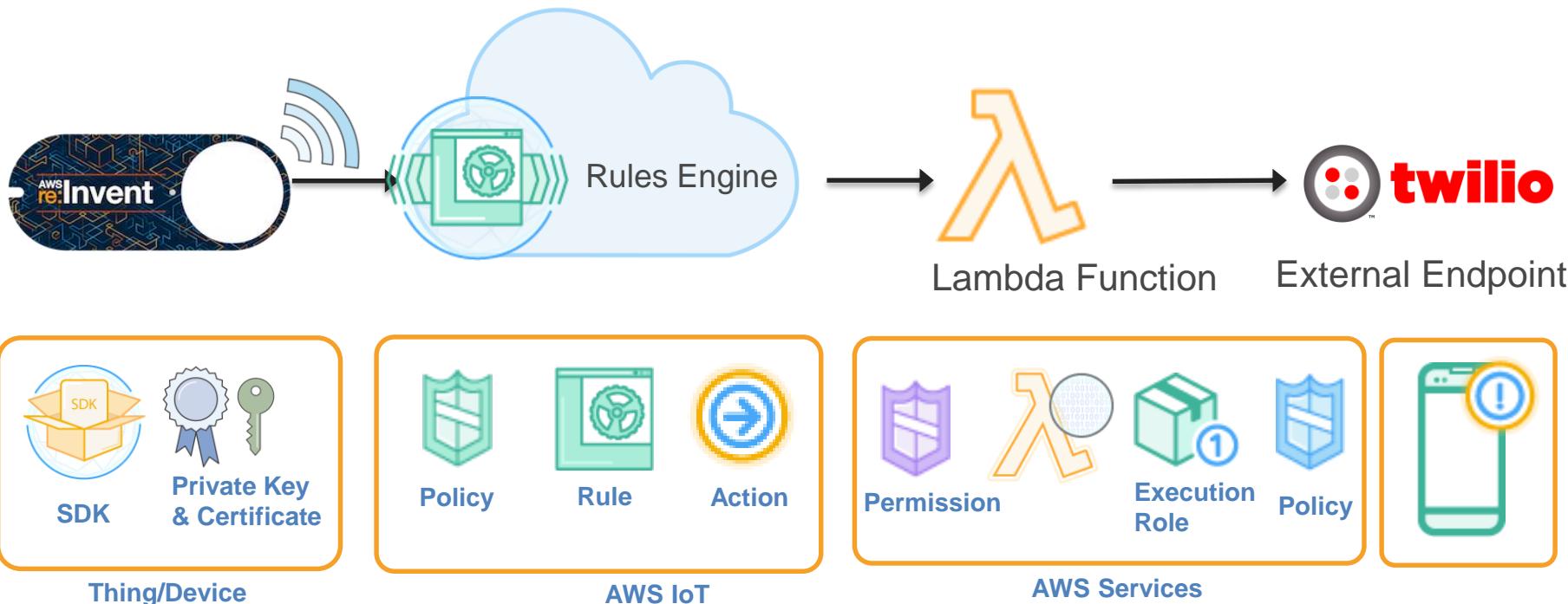


Step 1: Go to Hackster.io/Challenges (AWS)

Step 2: Submit your idea (by 11/8)

Step 3: Submit your project (by 1/8)

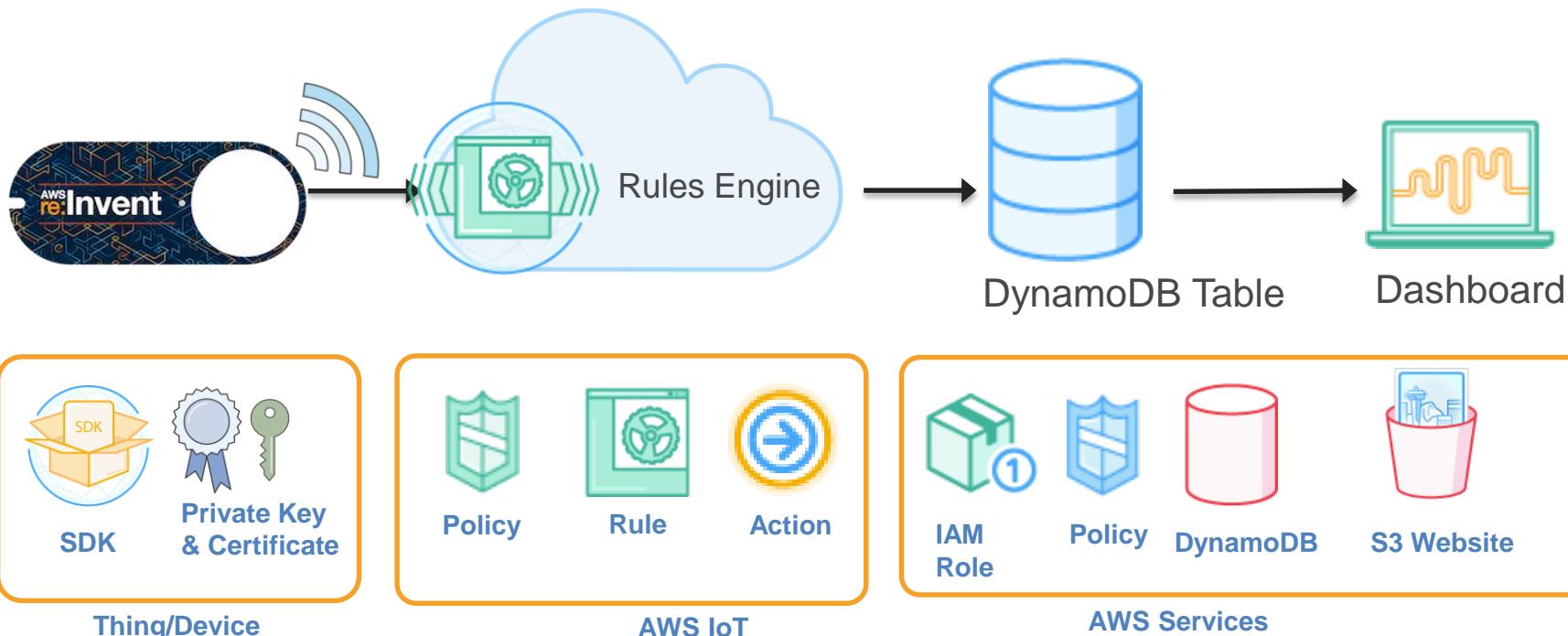
AWS IoT to AWS Lambda to and External Endpoint



Select * from 'iotbutton/+'

Demo: AWS IoT Button Publish

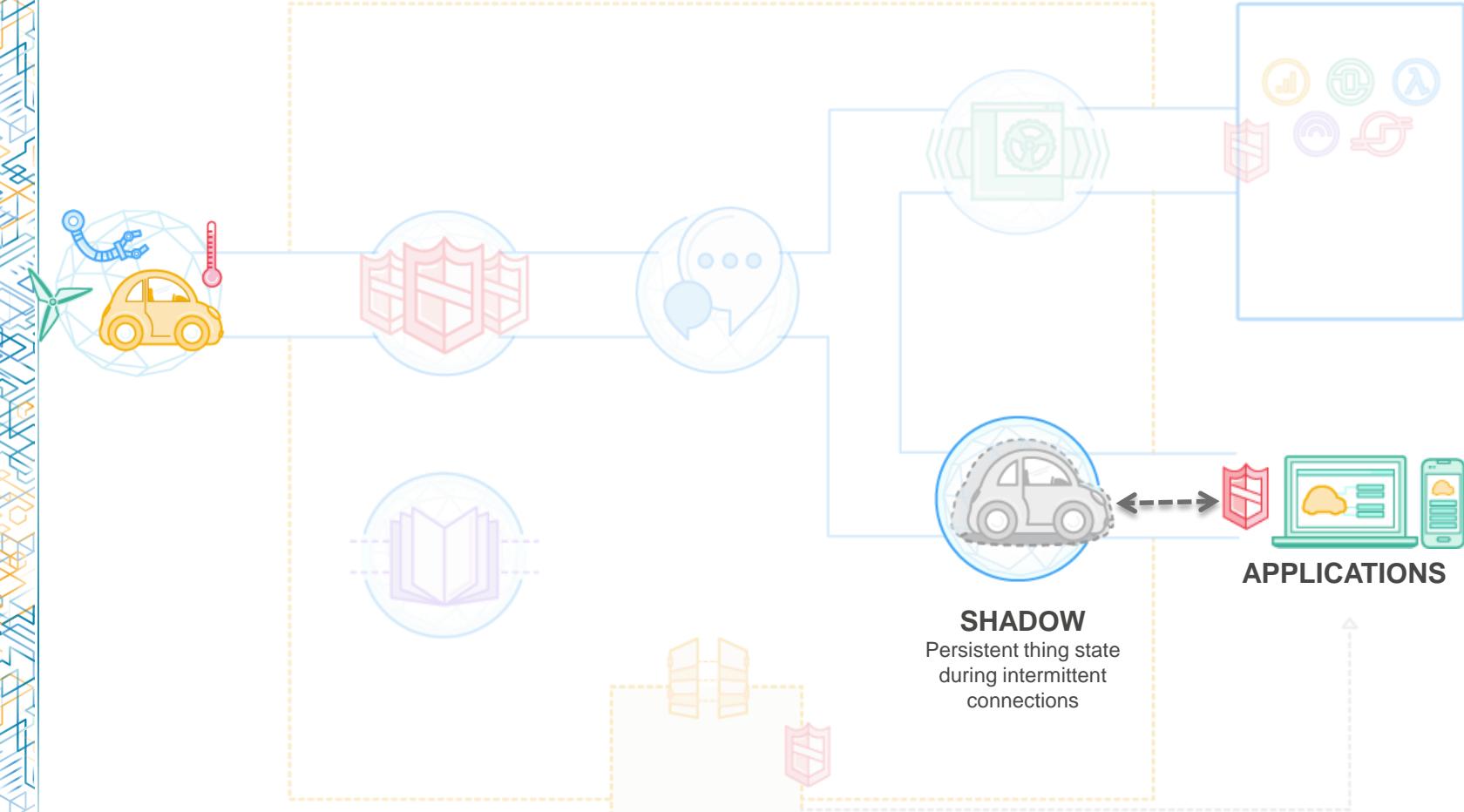
AWS IoT to Amazon DynamoDB to Dashboard



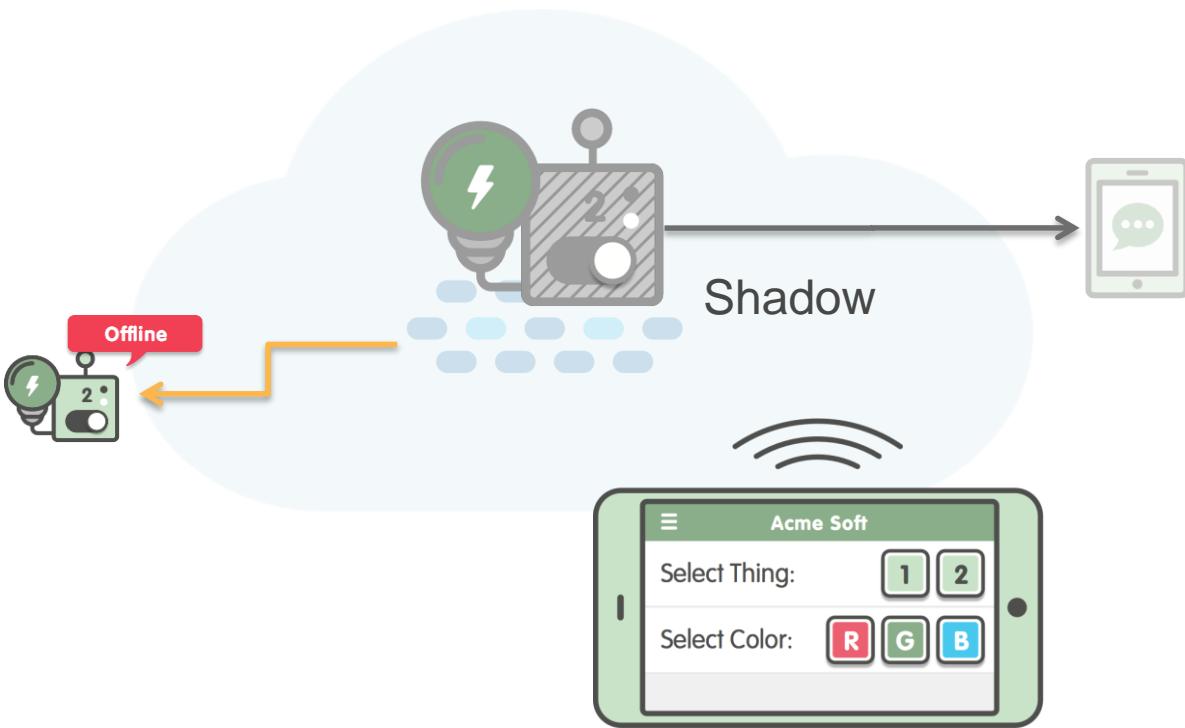
Select * from 'iotbutton/+'

Demo: AWS IoT Button Dashboard

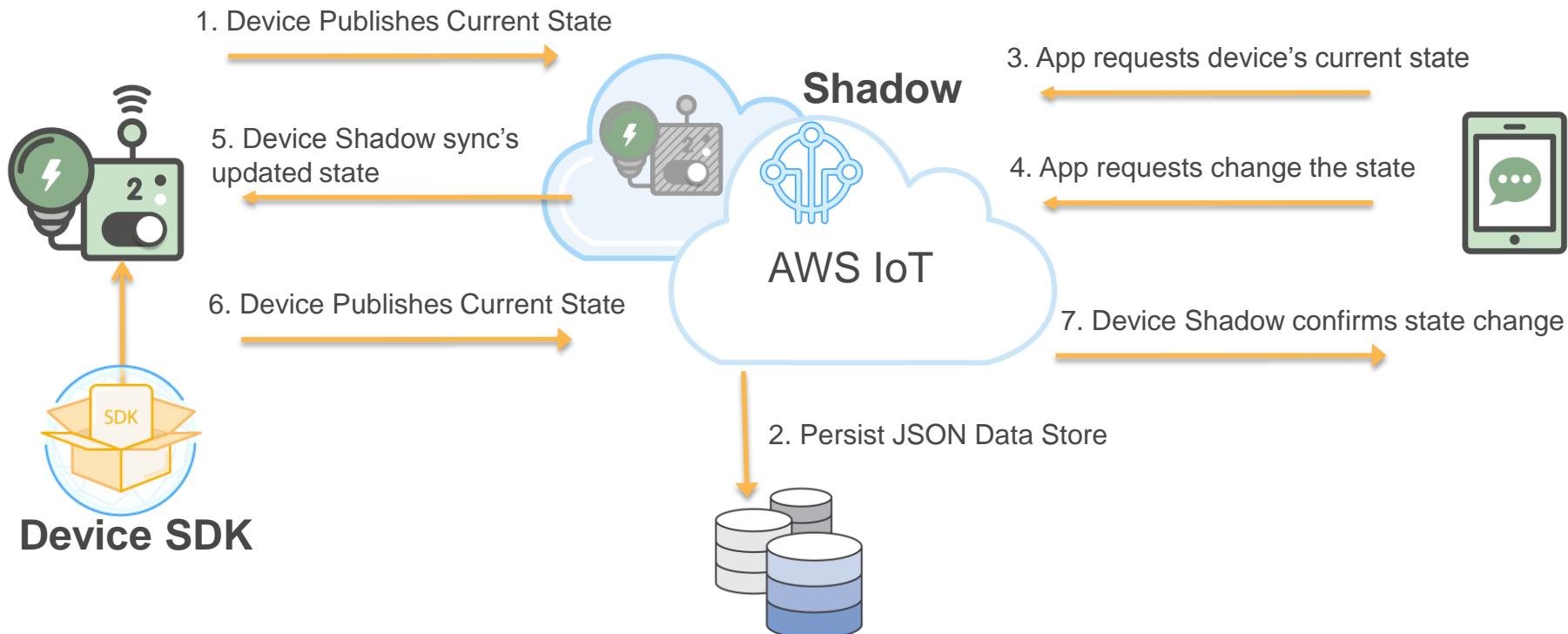
AWS IoT Thing Shadow



AWS IoT Thing Shadow



AWS IoT Shadow Flow



AWS IoT Device Shadow - Simple Yet Powerful



Thing

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



Shadow

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



Mobile App

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

```
{  
  "state" : {  
    "desired" : {  
      "lights": { "color": "RED" },  
      "engine" : "ON"  
    },  
    "reported" : {  
      "lights" : { "color": "GREEN" },  
      "engine" : "ON"  
    },  
    "delta" : {  
      "lights" : { "color": "RED" }  
    } },  
  "version" : 10  
}
```

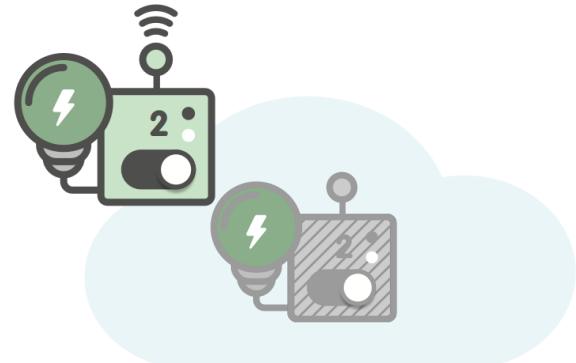
AWS IoT Device Shadow Topics (MQTT)



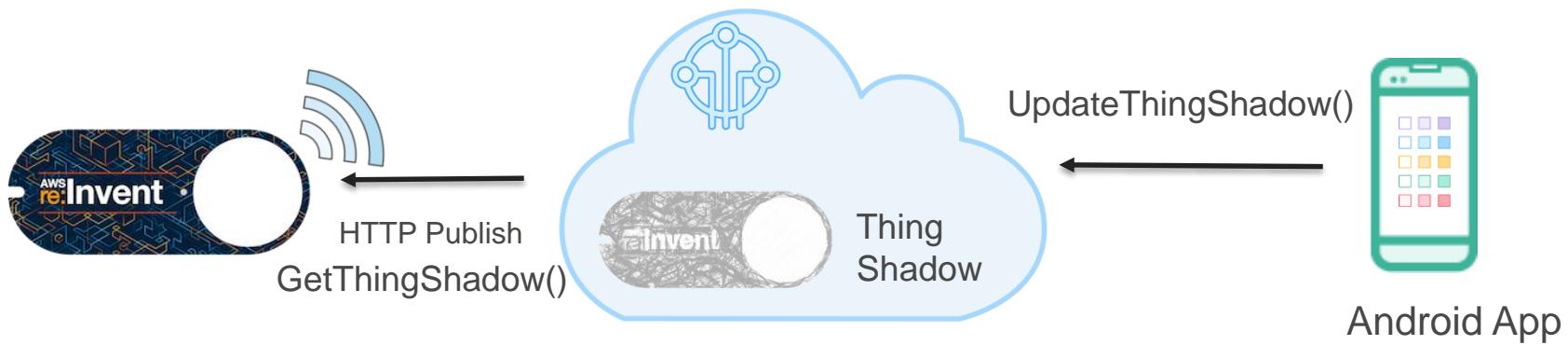
Thing SDK (C-SDK, JS-SDK)
makes it easy for you build shadow functionality into your device so it can automatically synchronize the state with the device.

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



Reported:
Blue, White, Cyan
"b,w,c"

Desired:
Purple, Yellow, Green
"p,y,g"

Demo: AWS IoT Button Device Shadow

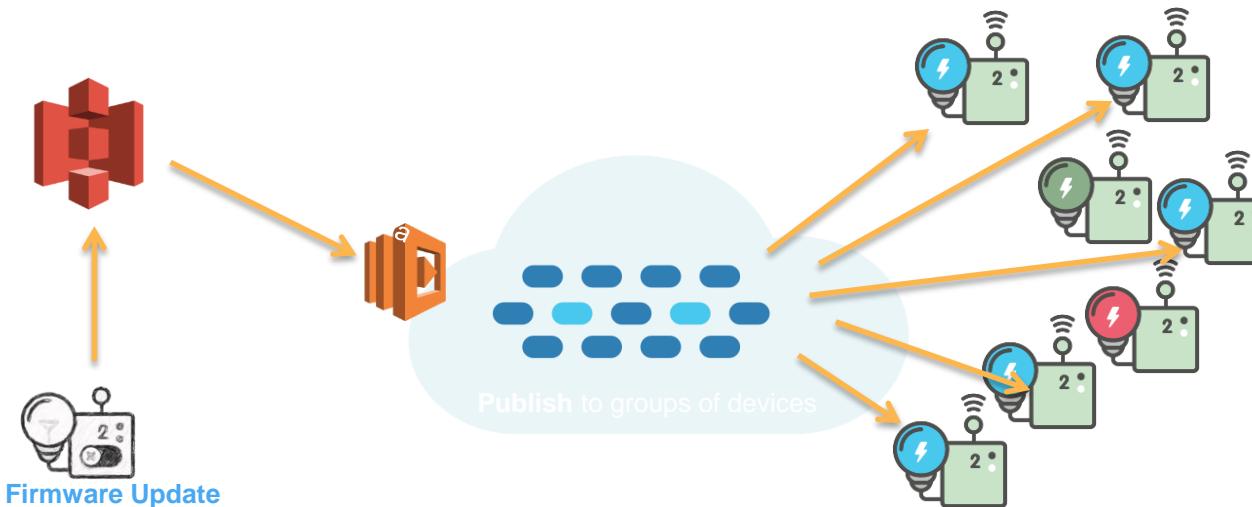
AWS IoT Registry

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

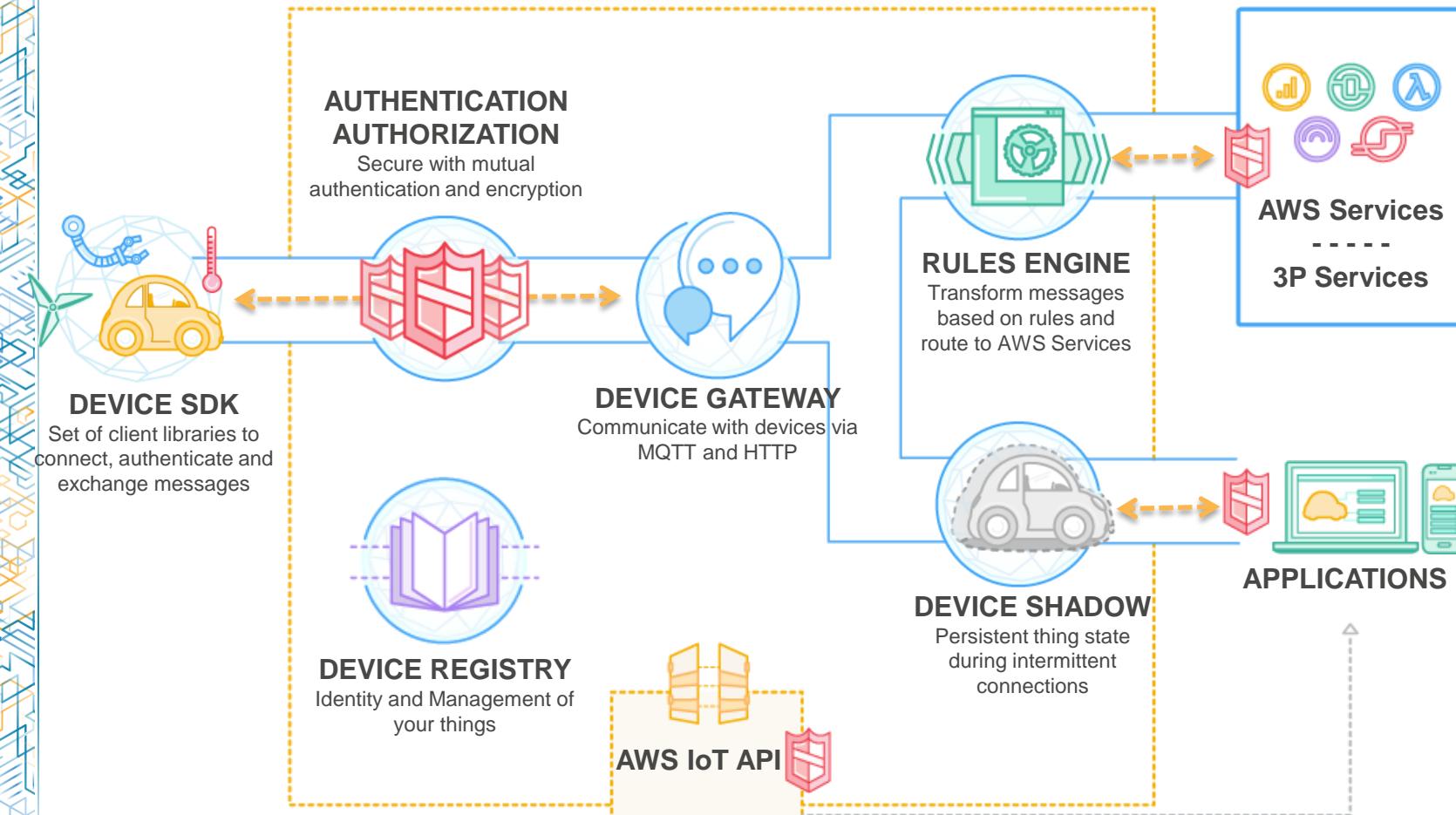
S3 Holds Versioned Firmware Distributions

Organize and secure your firmware binaries in S3

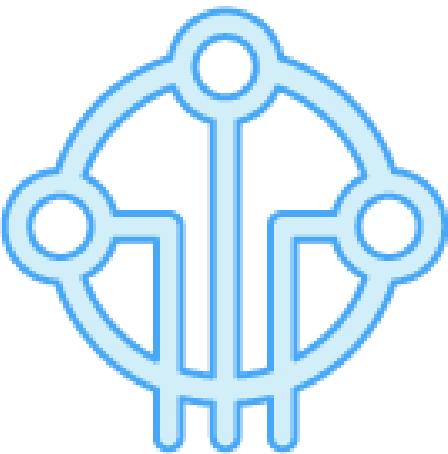
Message Broker notifies groups of the fleet using Topic Patterns

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

AWS IoT



Simple Pay as you go and Predictable Pricing



AWS IoT

- Pay as you go. No minimum fees
- **\$5 per million** messages published to, or delivered in US East (N. Virginia), US West (Oregon), EU (Ireland) **\$8** in Asia Pacific (Tokyo)

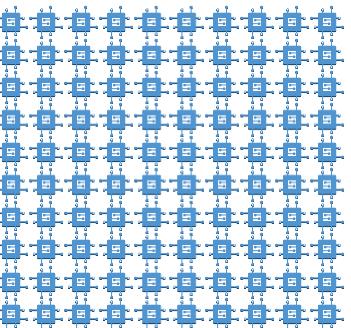
Free Tier

250,000 Messages Per Month Free for first 12 Months

Pricing Example

100 Sensors:

Publishing 1x/minute



$100 \text{ sensors} * 30 \text{ days}$
 $* 24 \text{ hours} * 60$
 $\text{minutes} =$
4.38 million messages



AWS IoT

Metering Unit: Receives all Sensor Data



$1 \text{ meter} * 100 \text{ readings} * 30$
 $\text{days} * 24 \text{ hours} * 60$
 $\text{minutes} =$
4.38 million messages

DynamoDB Table: Receives all Sensor Data



$1 \text{ table} * 100 \text{ readings} * 30$
 $\text{days} * 24 \text{ hours} * 60$
 $\text{minutes} =$
4.38 million messages

4.38 million publishes from sensors: $4.38 * \$5 = \21.90
4.38 million deliveries to a metering unit: $4.38 * \$5 = \21.90
4.38 million deliveries to DynamoDB: **\$0**

Get Started with 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)



Launching AWS IoT Hardware Program

The AWS IoT Hardware Program helps AWS customers build connected products using any hardware platform.

IoT Hardware Partners reduce the time to market and improve customer experiences by providing necessary tools, SDKs and sensors to connect their devices to AWS.

The program is designed for partners that provide hardware (semiconductors, connectivity modules, sensors, actuators) to customers and are interested in connecting their hardware platform to AWS.



Partner Network

[Login to the APN Portal](#)

[Apply for IoT Hardware Partner Program](#)

[Find AWS IoT Hardware Partners](#)

Official IoT Starter Kits, Powered by AWS



Official IoT Starter Kits on Variety of Platforms

Broadcom WICED
BCM4343W
On Threadx/Netx



Marvell
EZConnect
MW302
On FreeRTOS



Renesas RX63N
On Micrium OS



TI CC3200
On TI-RTOS



Microchip WCM
PIC32 Platform



Intel Edison
on Yocto Linux



Mediatek
LinkOne
on Linkit OS



Dragonboard
410c on
Ubuntu



Seeeduino
Arduino on
openWRT



Beaglebone
Green on
Debian



AWS IoT Always Growing Ecosystem Partners

IoT Management Platform



IoT Operating Systems



IoT Analytics Platform



IoT Communication



IoT Systems Integrators



Booz | Allen | Hamilton

delivering results that endure



Anyone can now build a device quickly and scale

AWS IoT

Device Gateway
Rules Engine
Device Shadow
Registry
Security

Easy to get started

AWS IoT Device SDK
AWS IoT Button
Hackster Contest
Free Tier

Partners and Ecosystem

AWS IoT Starter Kits
AWS IoT Partners

Still incomplete

You don't want to miss these deep dive sessions

MBL311 **AWS IoT Security** - Palazzo A 1:30 PM

MBL312 **Rules and Shadow** - Palazzo A 2:45 PM

MBL313 **Devices SDK and Kits** - Palazzo A 4:15 PM

MBL303 **Mobile Devices and IoT** - Delfino 4005 4:15 PM

MBL203 **Devices in Motion** - Delfino 4005 Friday 10:15 AM

MBL305 **IoT Data and Analytics** - Delfino 4005 Friday 11:30

We can't wait to see what you invent with AWS IoT

hackster.io

Projects ▾

Platforms

Challenges

...

Search



Step 1: Go to Hackster.io/Challenges (AWS)

Step 2: Submit your idea (by 11/8)

Step 3: Submit your project (by 1/8)



Thank you!

Kyle Roche @kyleroche
Jinesh Varia @jinman



**Remember to complete
your evaluations!**