

AWS / 阿米巴 IoT 工作坊

John Chang

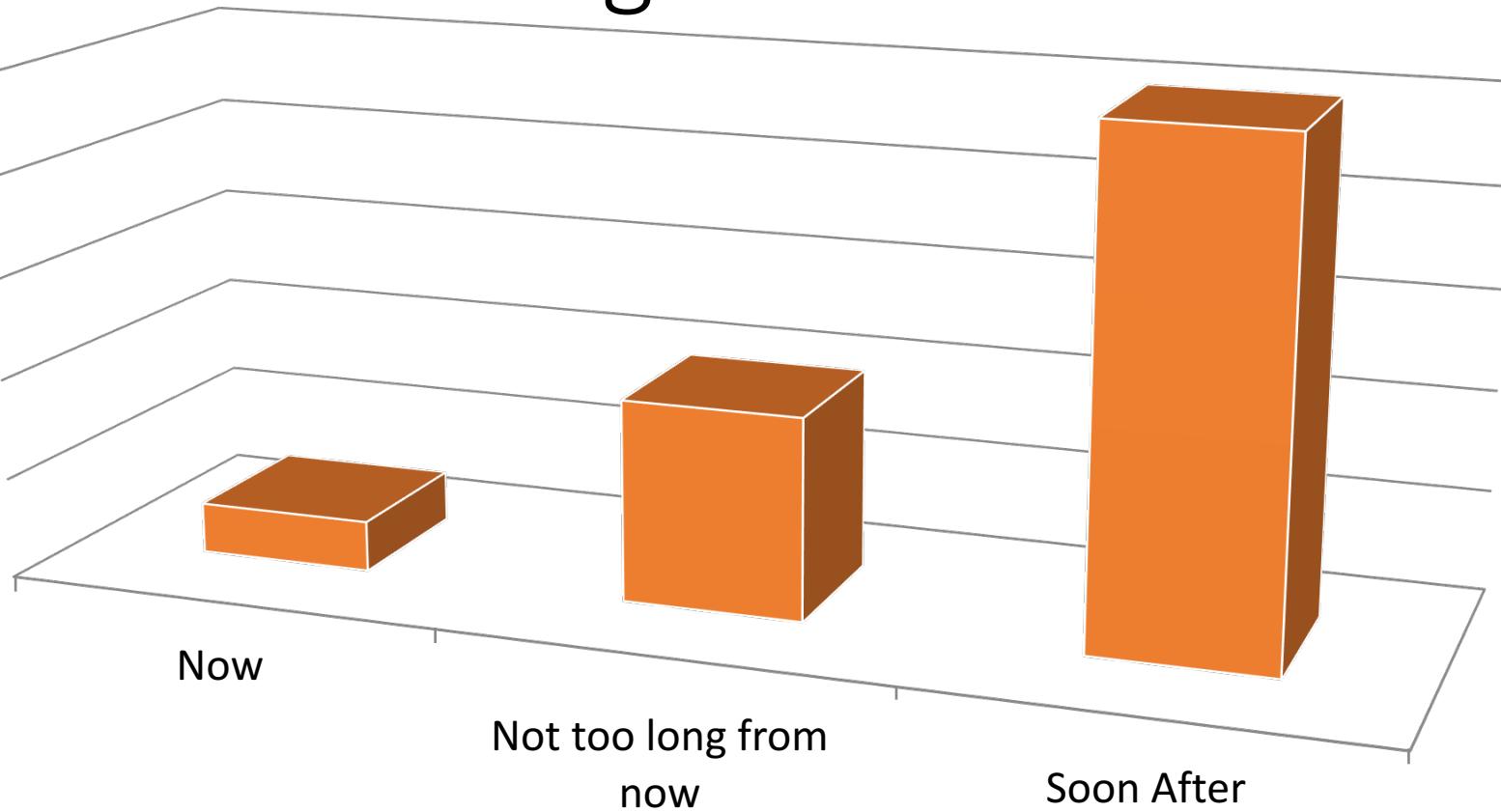
Technology Evangelist, AWS

December 2016

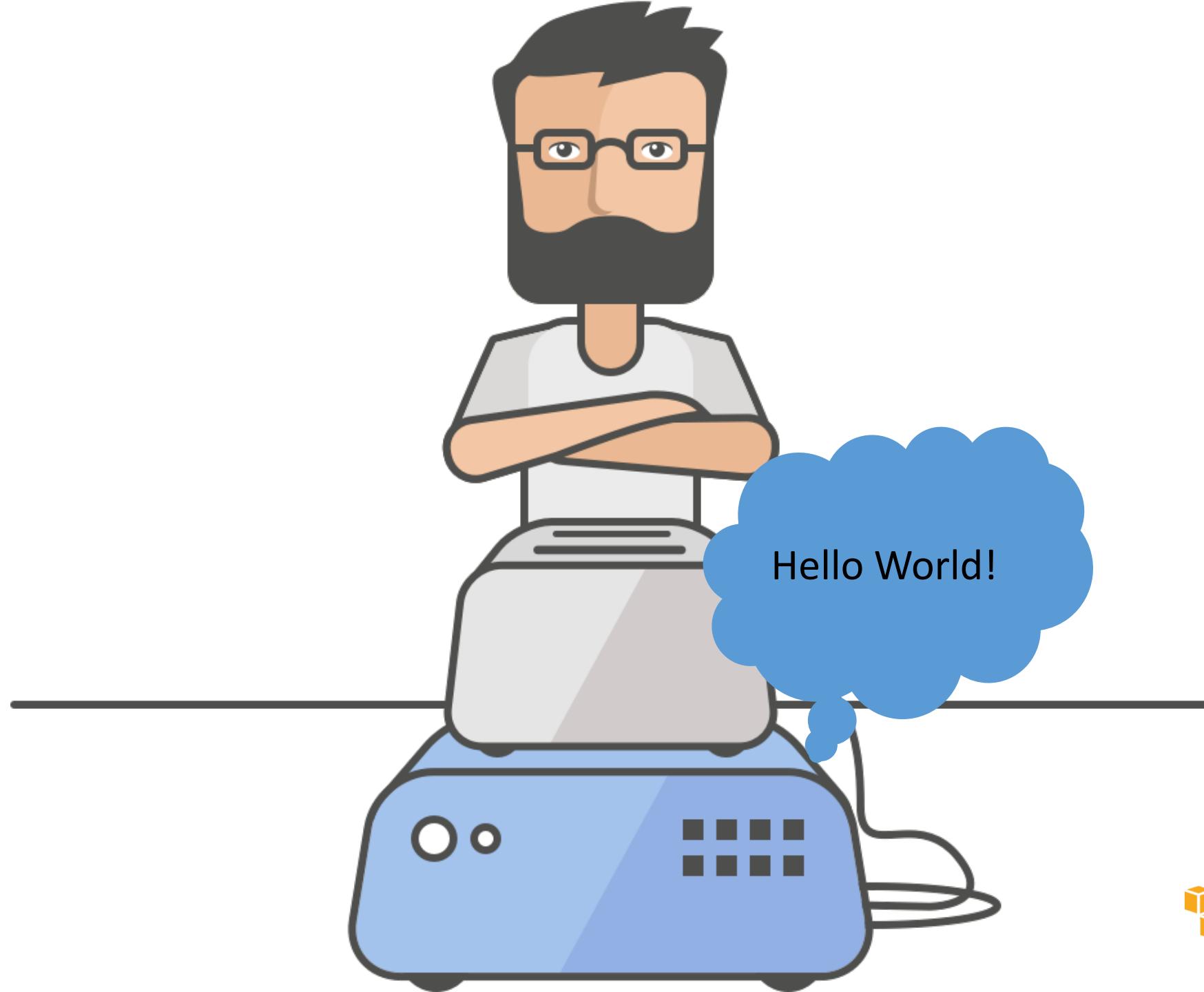
課程環境

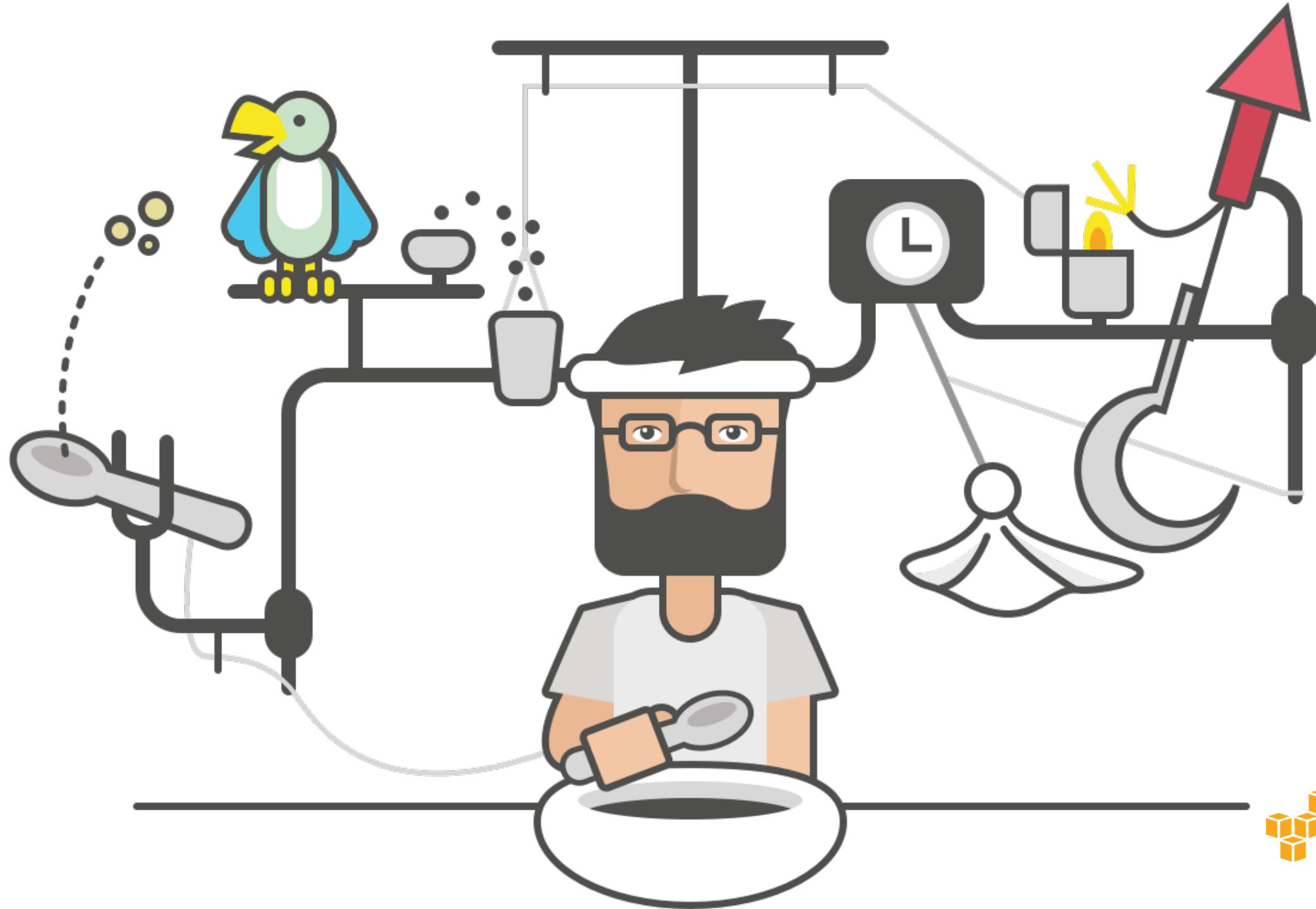
- 開通 AWS 帳號
 - IAM best practice: <http://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html#create-iam-users>
- 開通 Amazon Developer 帳號 (<https://developer.amazon.com>)
- 安裝 Arduino Studio
- 連接 Ameba 開發版 (<http://www.amebaitot.com/ameba-arduino-getting-started/>)

Things Are Becoming Connected

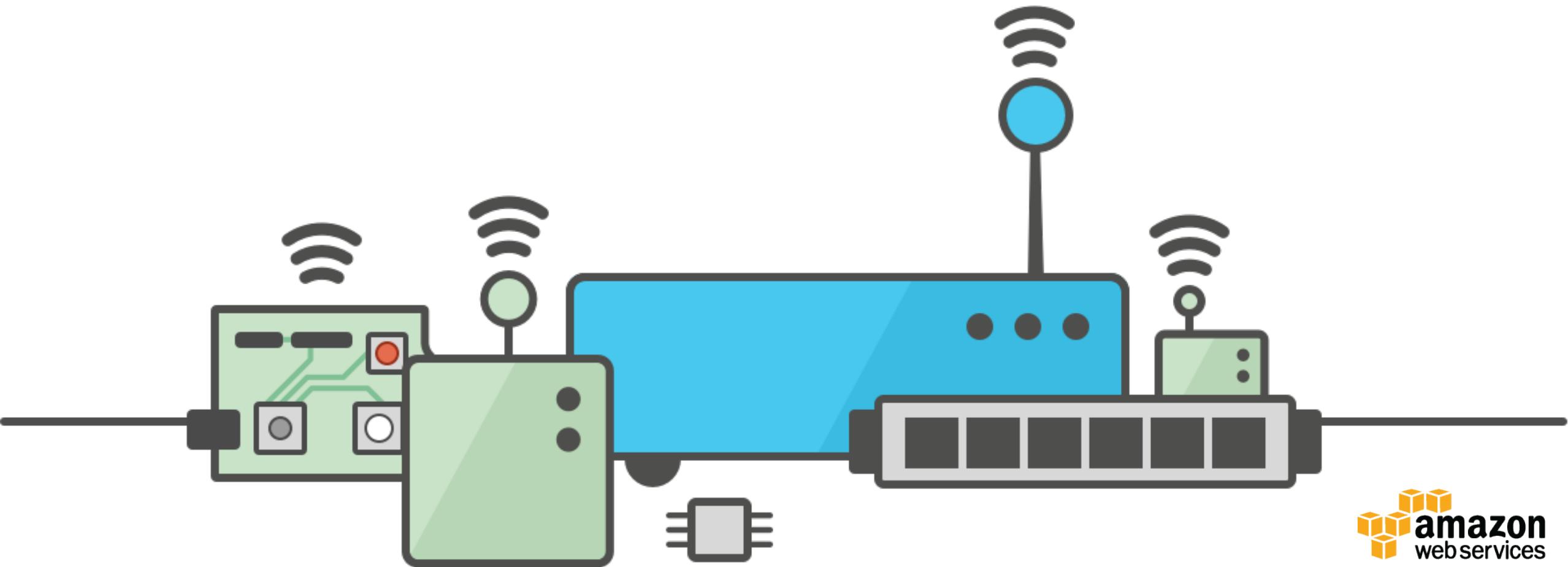


Source: Pretty much everyone





Building Blocks for Innovation in IoT



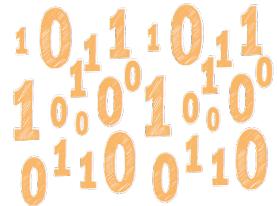
AWS IoT Makes Things Smarter

- “*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.*”

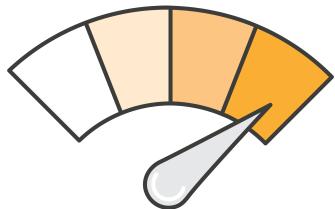
SONOS



How can we escape the *spin cycle*?



**Alternate
Protocols**



**Scalability
&
Noise/Signal**



**Security &
Management**



**Integration with Cloud
and Mobile Apps and
Analytics**



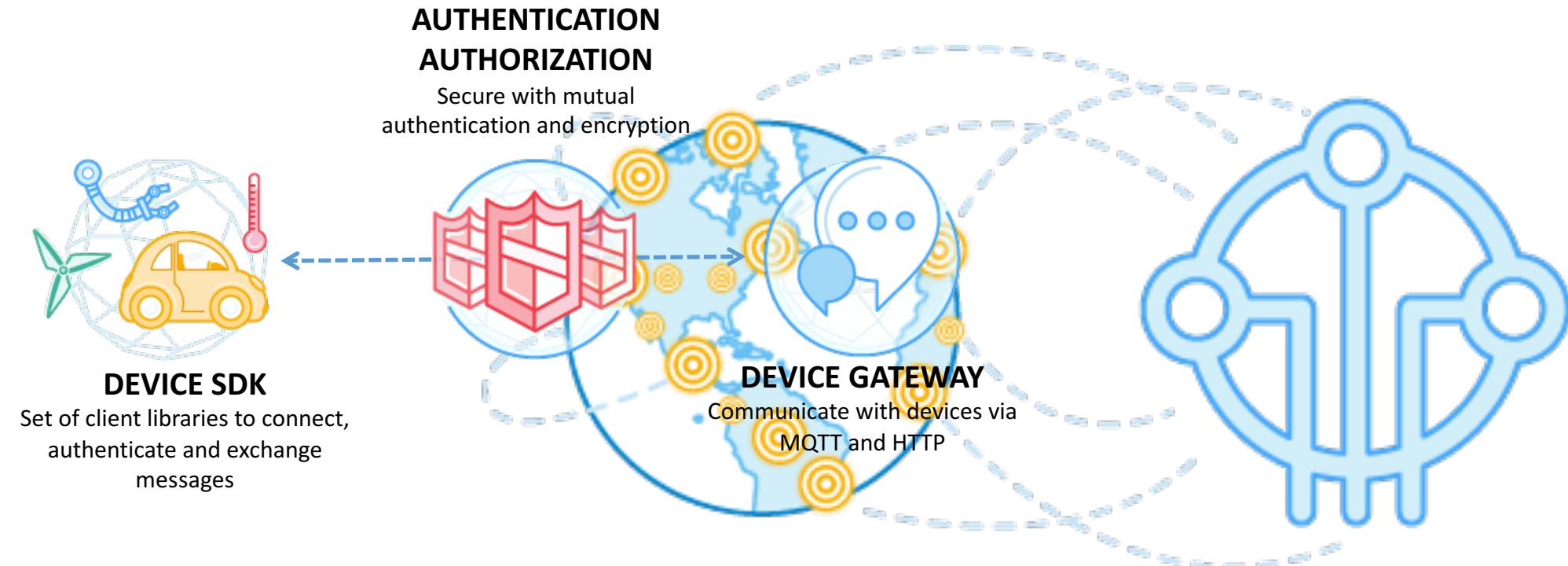
**Many SDKs
& Tools**

AWS IoT

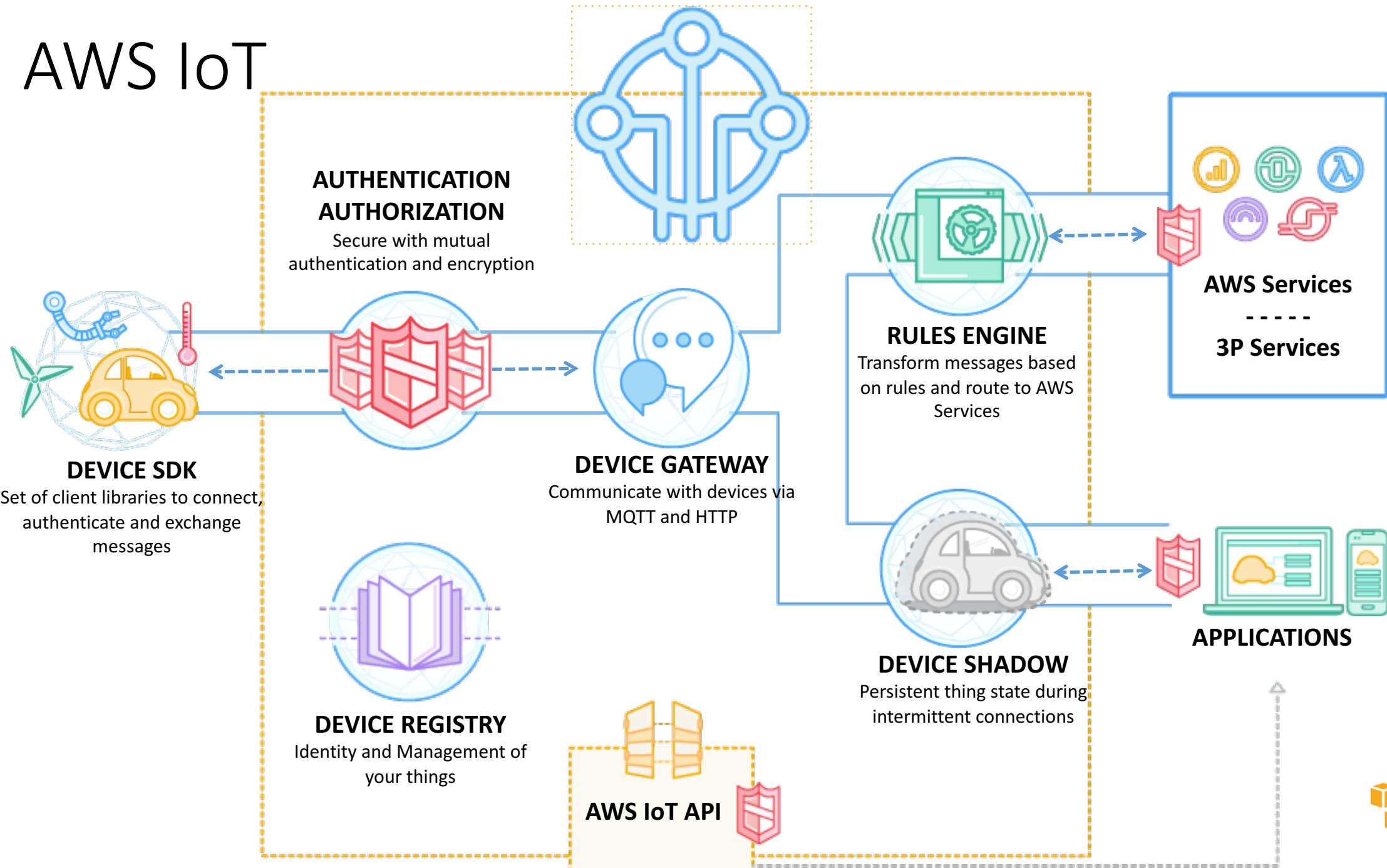
“Securely connect one or one billion devices to AWS,
so they can interact with applications and other devices”



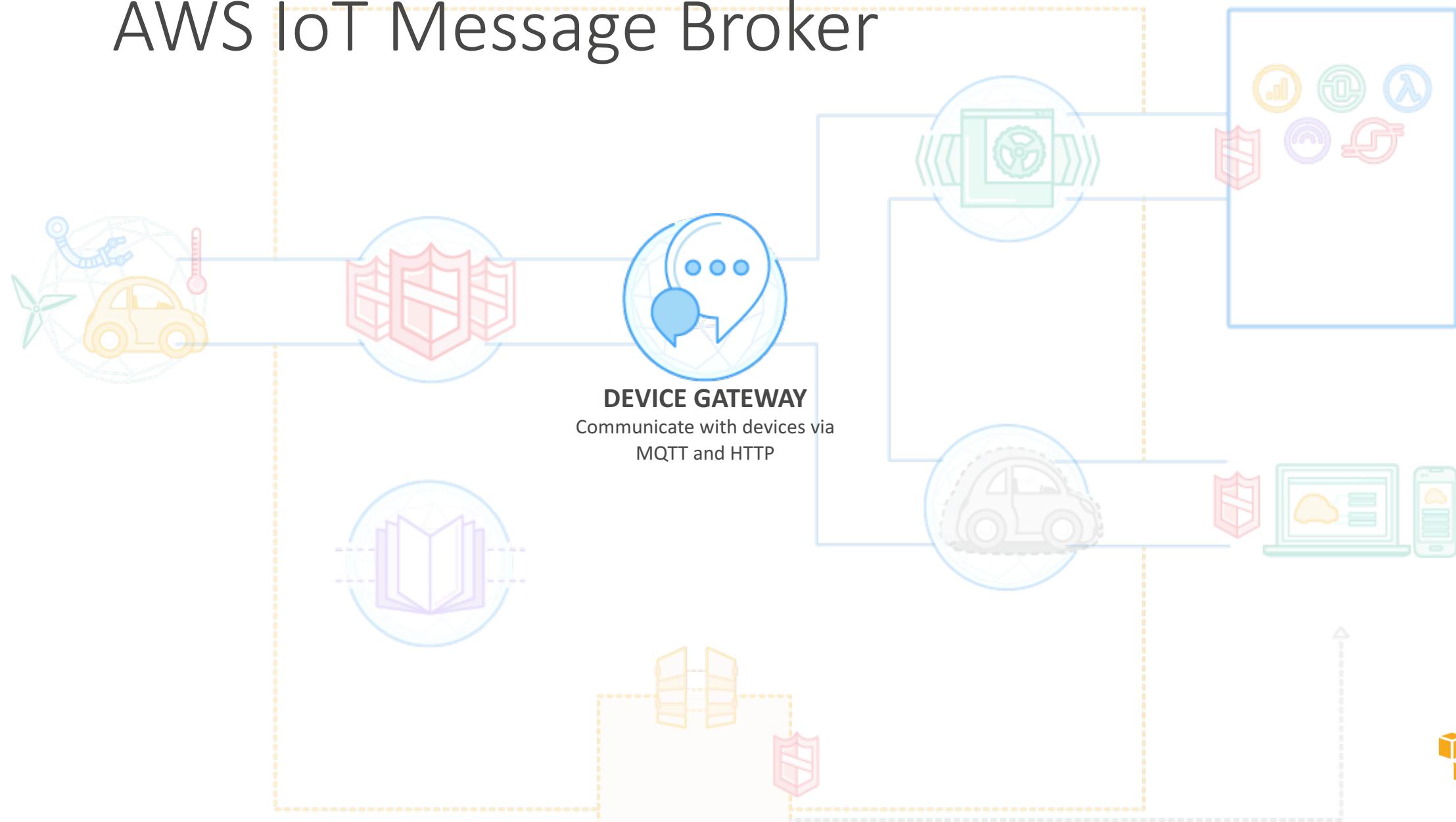
AWS IoT



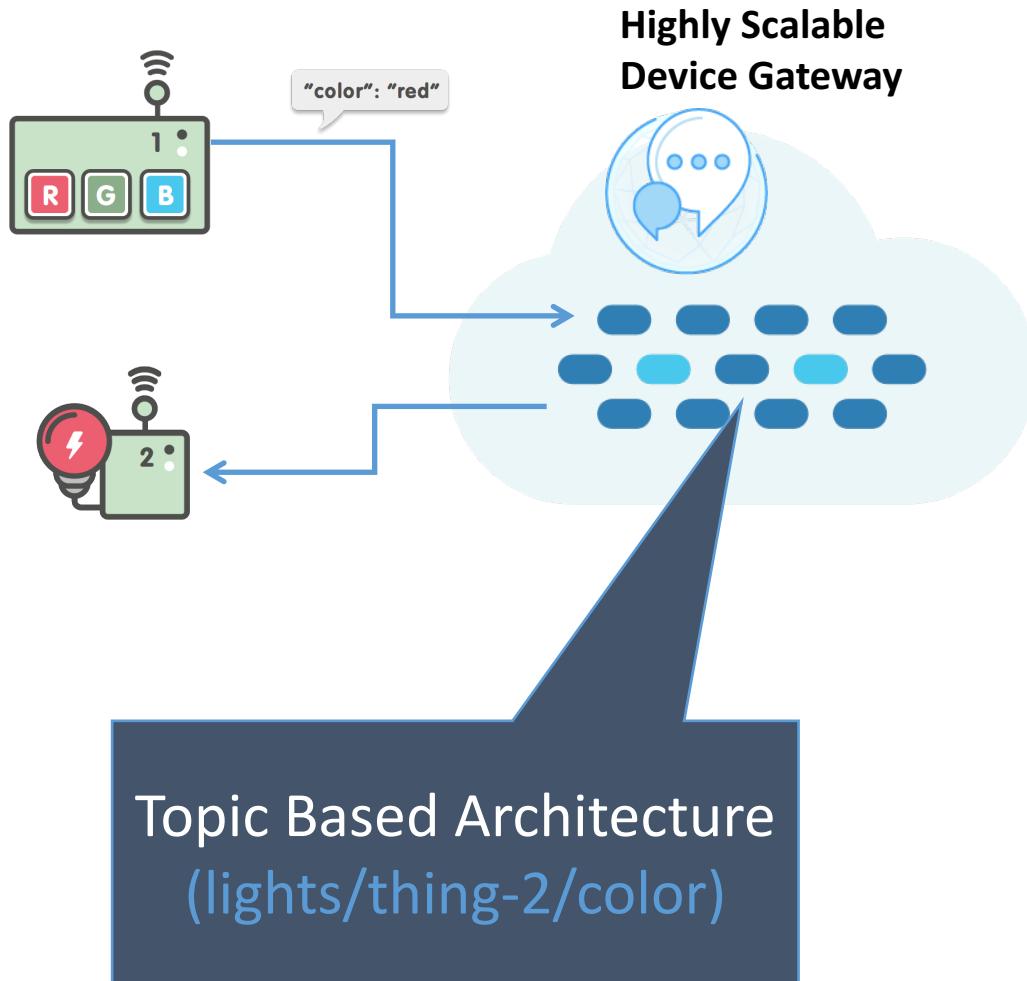
AWS IoT



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

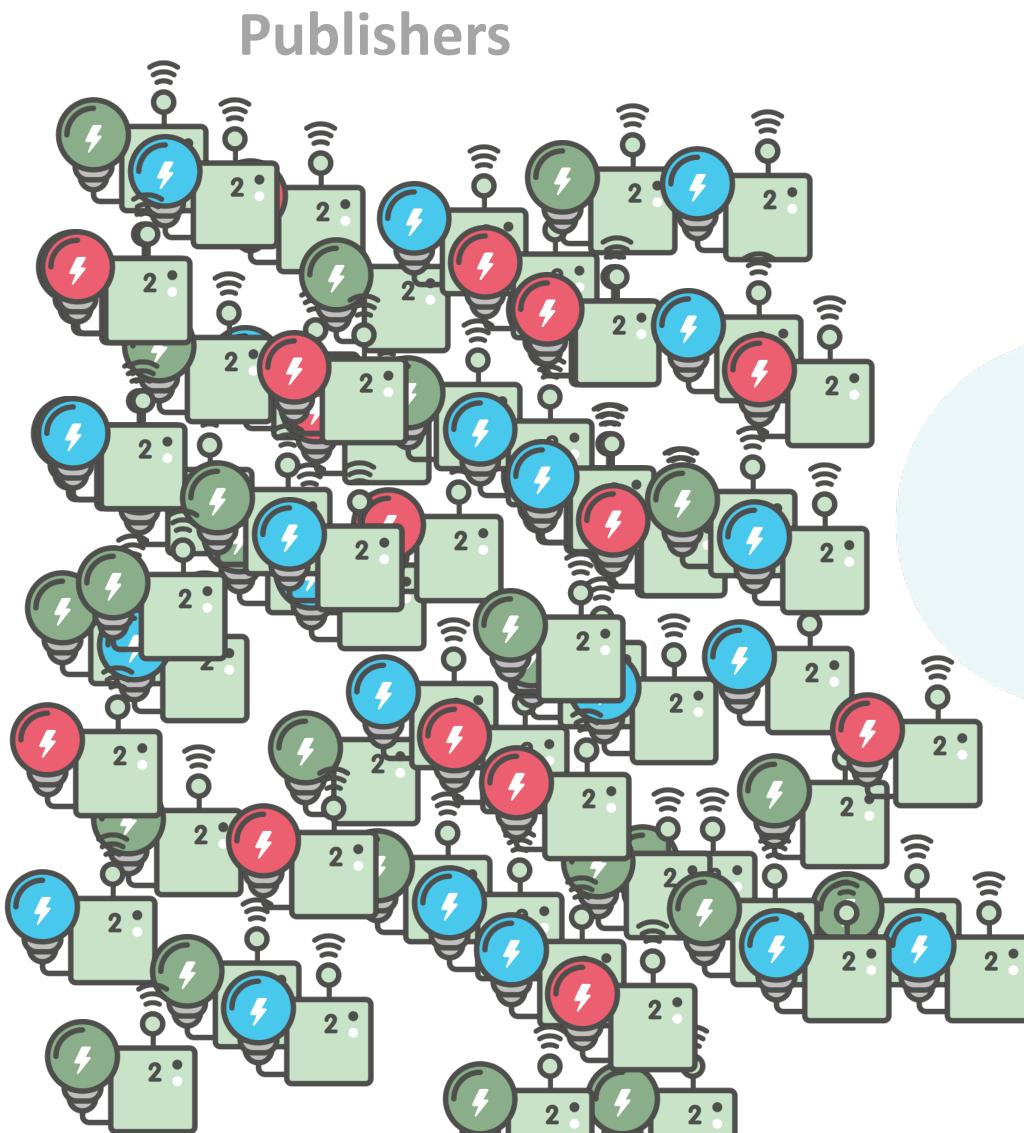
Powerful Pub/Sub Broker with Long-lived bi-directional messages

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

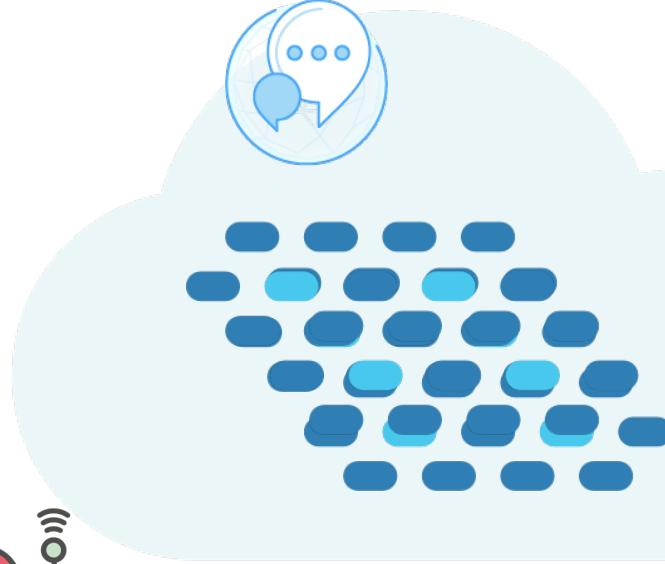
Secure by Default

Connect securely via X509 Certs and TLS 1.2 Client Mutual Auth

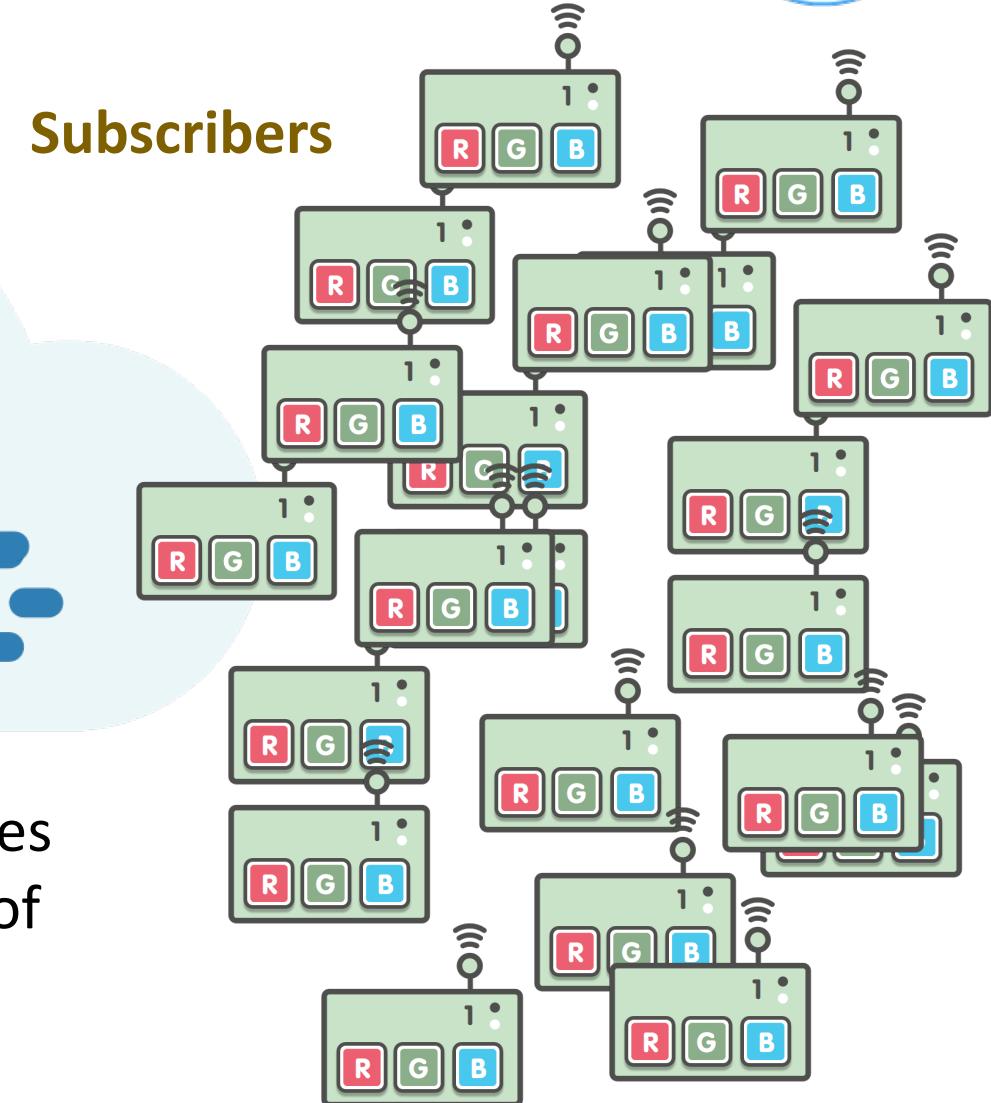
AWS IoT Message Broker : Managed Service



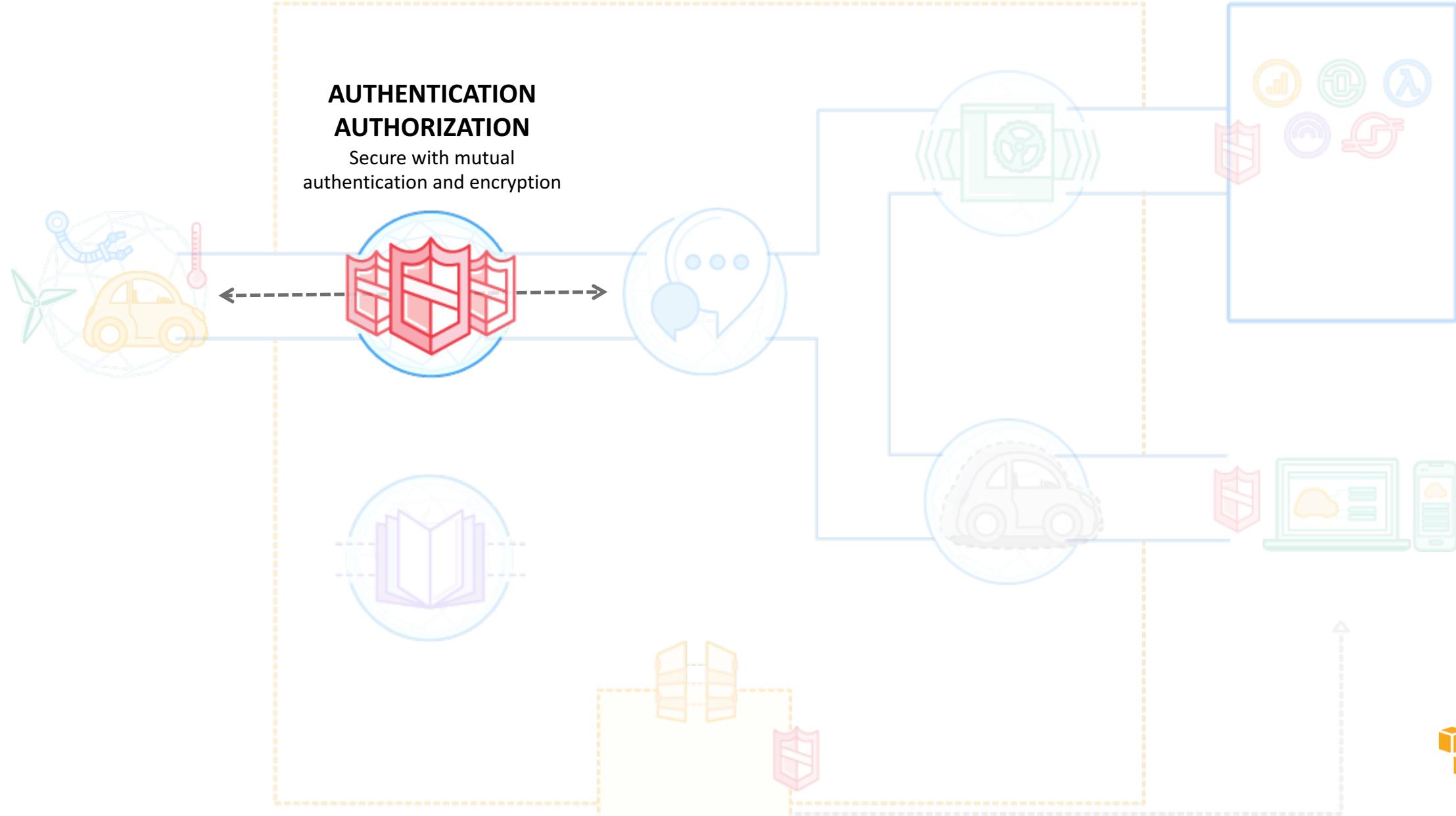
Highly Scalable
Device Gateway



Millions of devices
sending billions of
messages



AWS IoT Security: Authentication and Authorization



One Service, Two Protocols

	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

Provisioning and Security

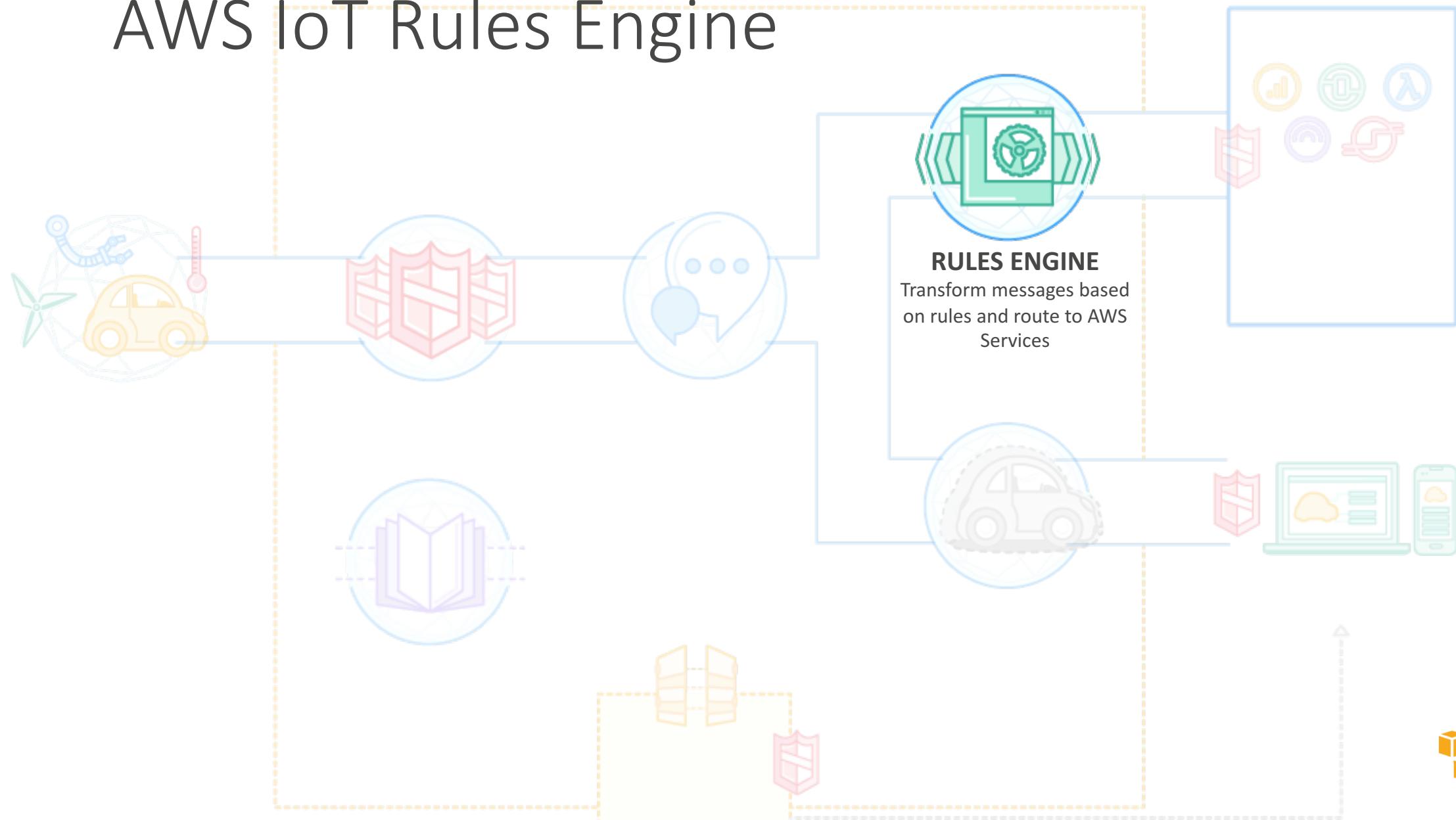


- Secure Communications with Things
 - Single API call to **CreateKeysAndCertificate()**
 - Client Generated **CreateCertificateFromCSR(CSR)**
- Fine-grained Authorization for:
 - Thing Management
 - Pub/Sub Data Access
 - AWS Service Access

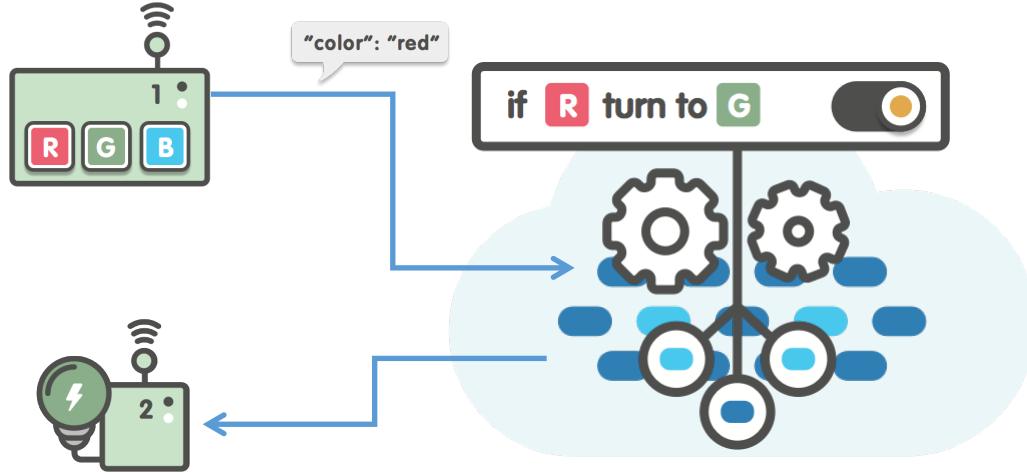
```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Action": ["iot:Publish"],  
      "Resource":  
        ["arn:aws:iot:us-east-  
         1:123456972007:topic/foo"]  
    },  
    {  
      "Effect": "Allow",  
      "Action": ["iot:Subscribe"],  
  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

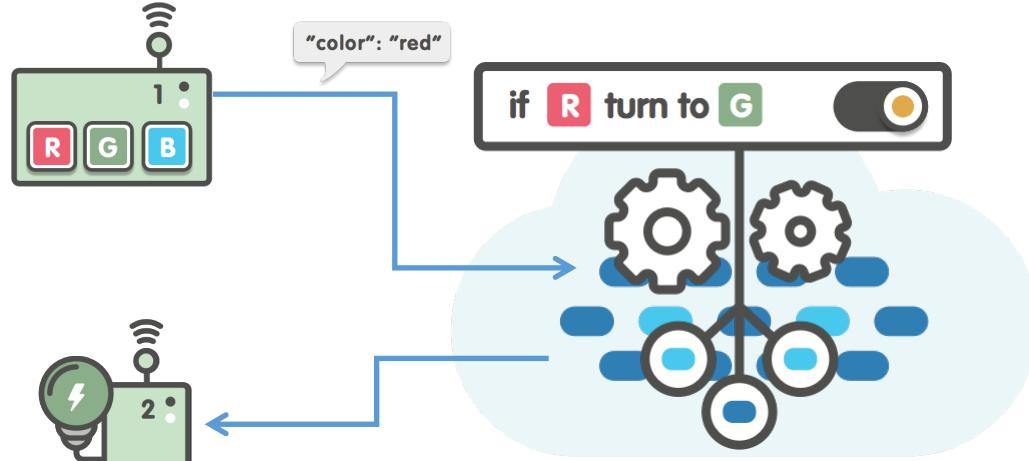
Simple & Familiar Syntax

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

Functions improve signal : noise

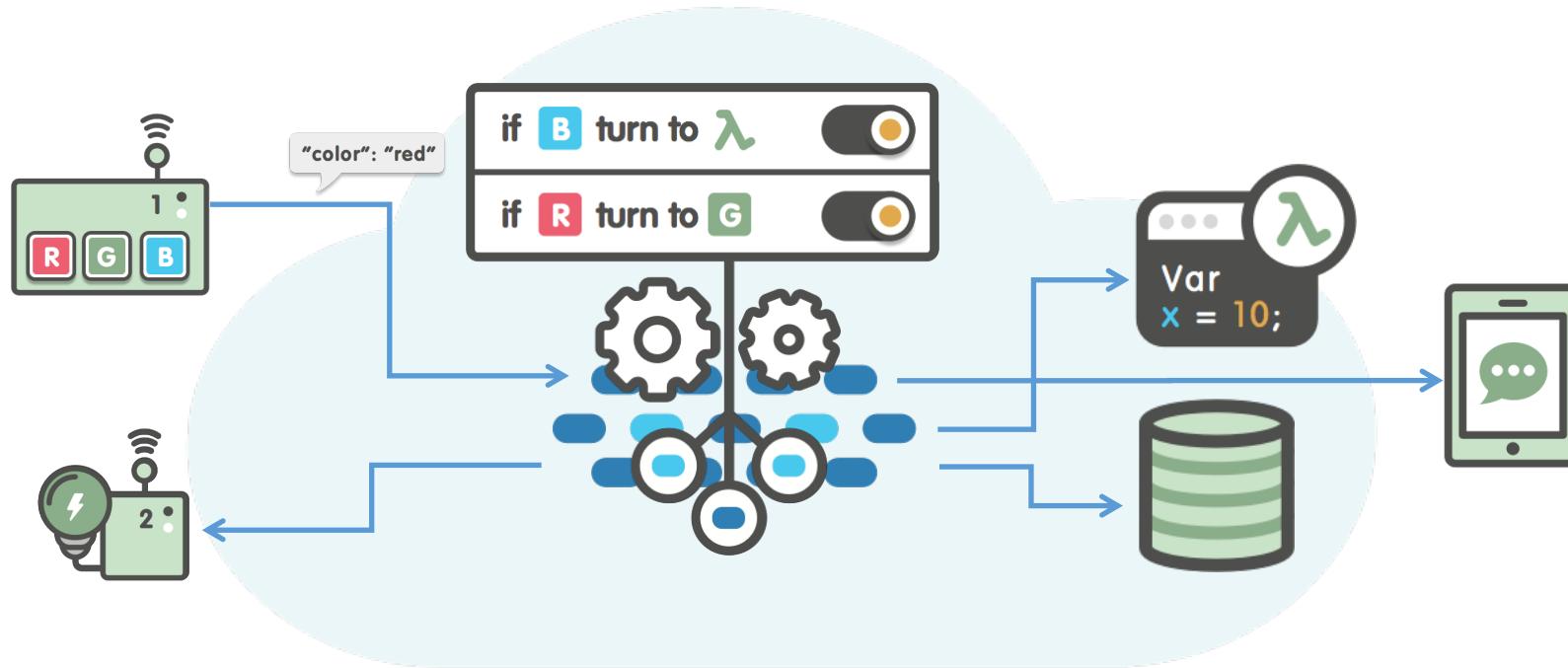
- String manipulation (regex support)
- Mathematical operations
- Context based helper functions
- Crypto support
- UUID, Timestamp, rand, etc.

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



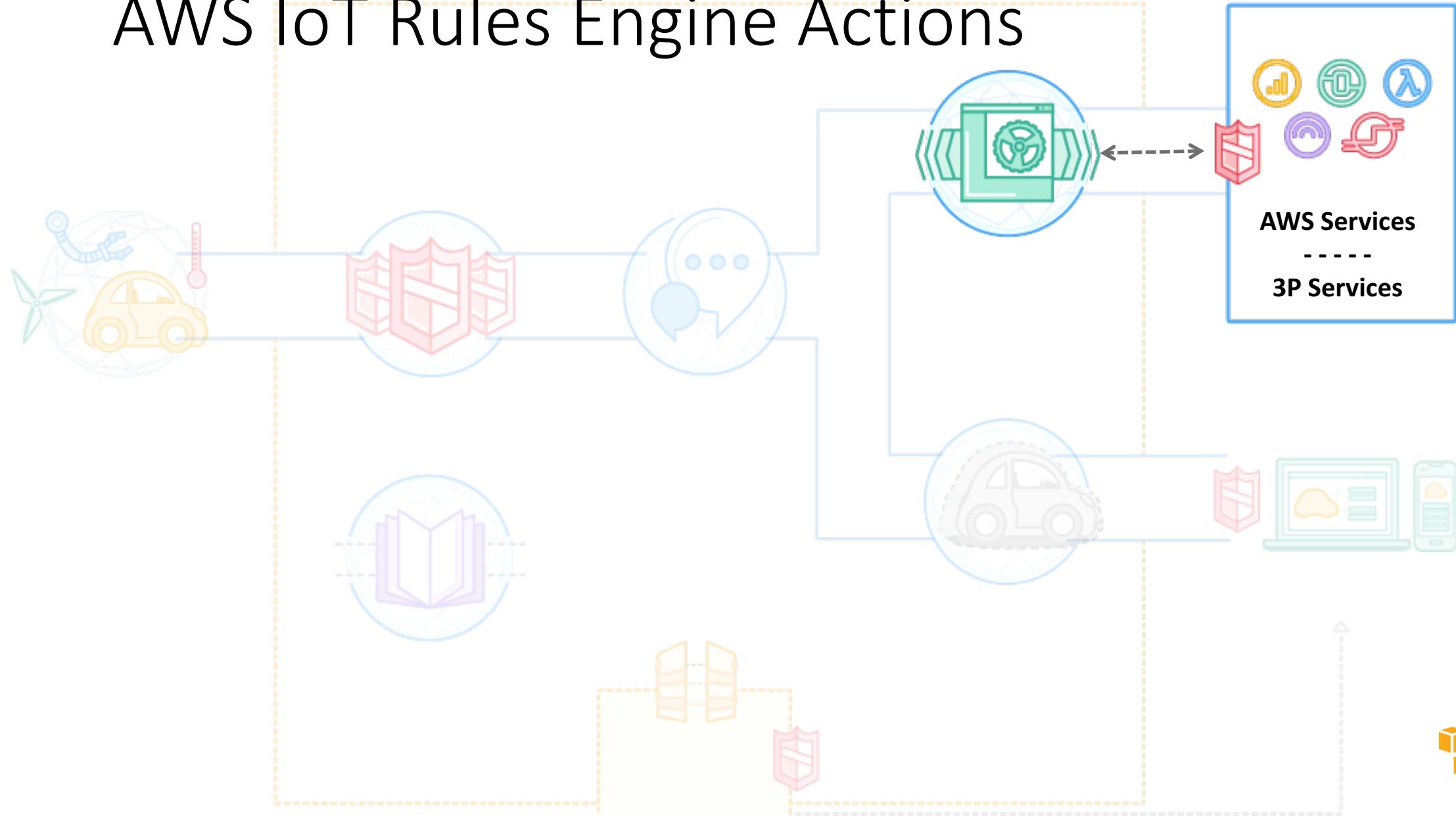
Complex Evaluations

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

Multiple / Simultaneous Actions

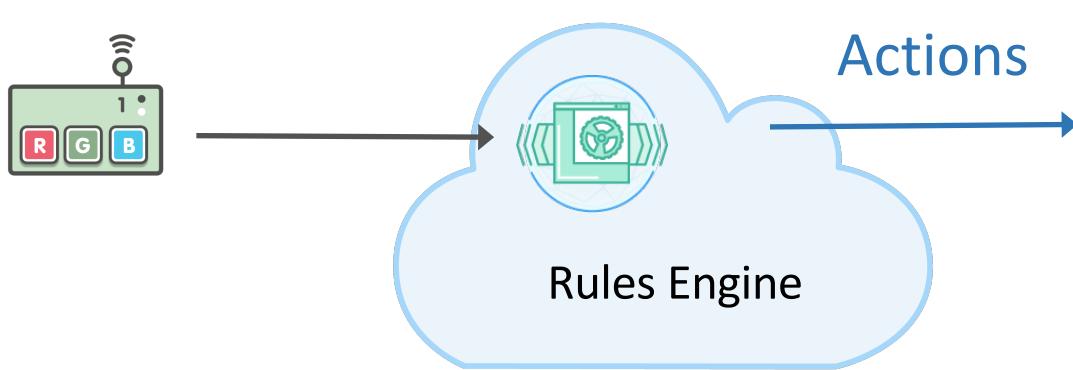
Sometimes a situation requires you to take many actions

AWS IoT Rules Engine Actions

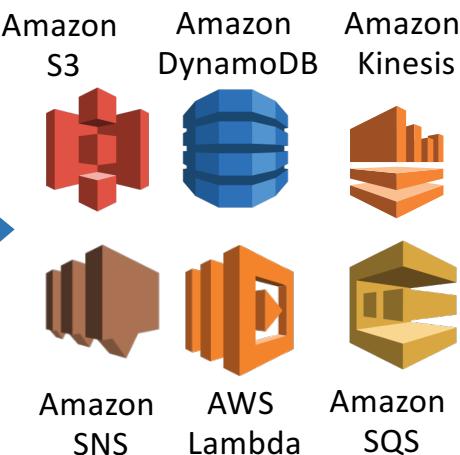


AWS IoT Rules Engine

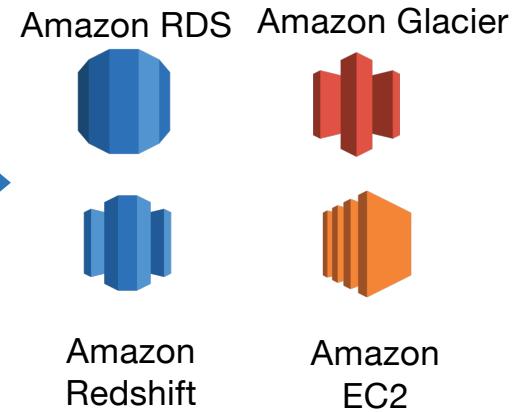
Rules Engine connects AWS IoT to
External Endpoints and AWS
Services.



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.



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



Amazon Elasticsearch



Amazon Machine Learning



Publish to an Amazon Kinesis stream

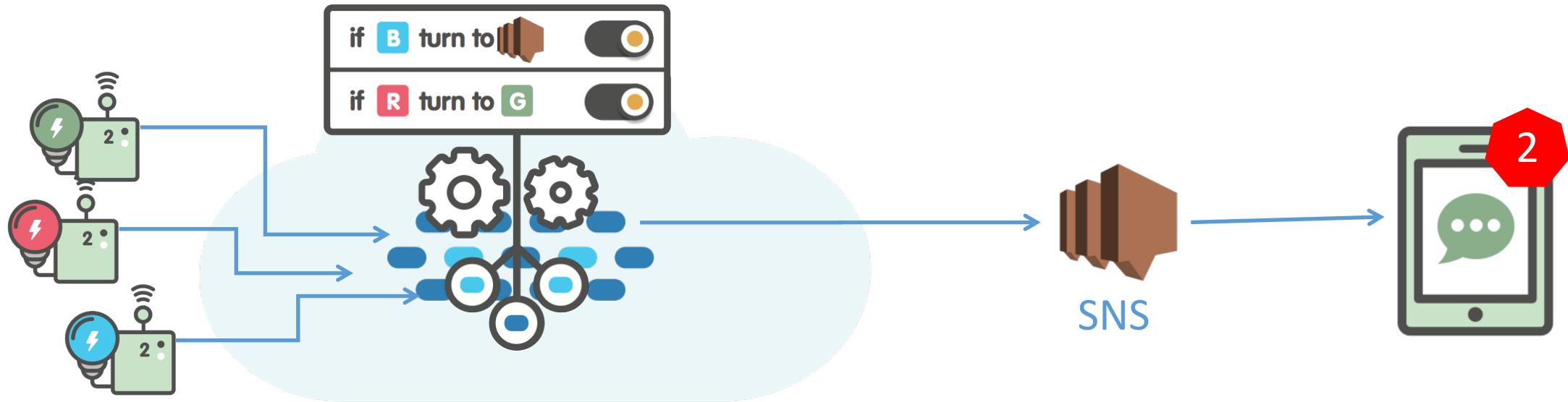


Amazon Kinesis Firehose



Republish to AWS IoT

AWS IoT Rules Engine & Amazon SNS



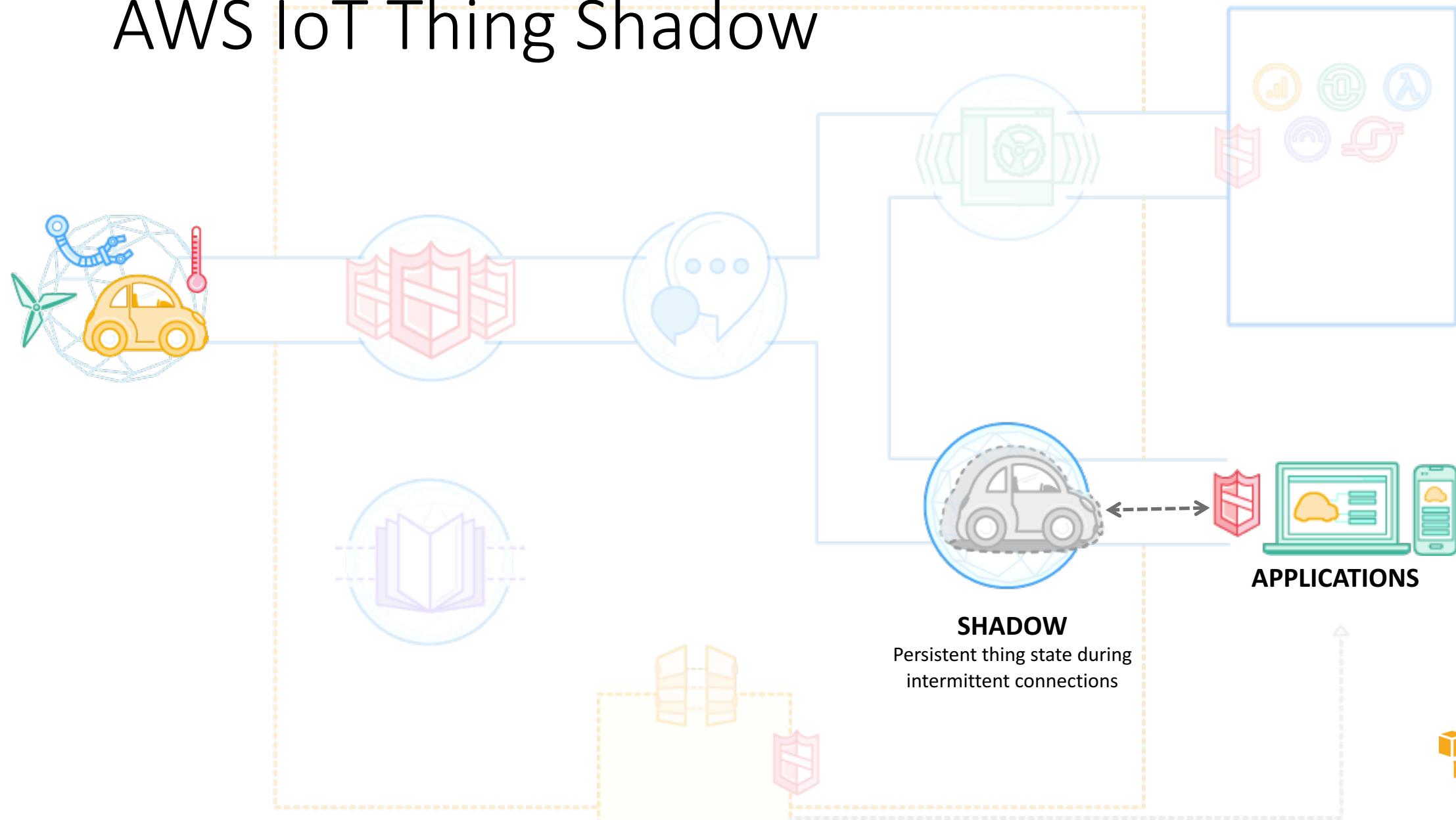
Push Notifications

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

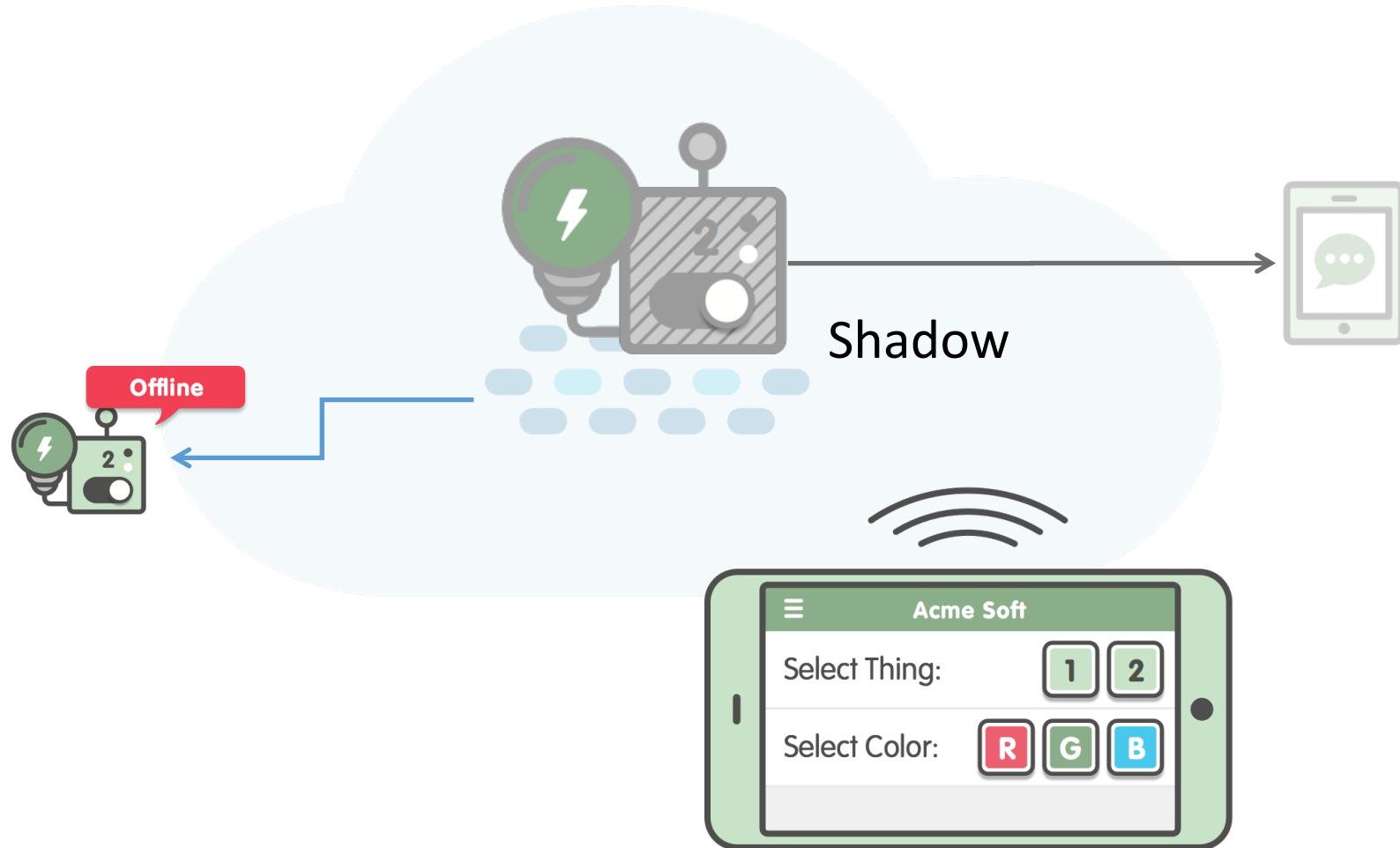
Amazon SNS -> HTTP Endpoint (Or SMS or Email)

Call HTTP based 3rd party endpoints through SNS with subscription and retry support

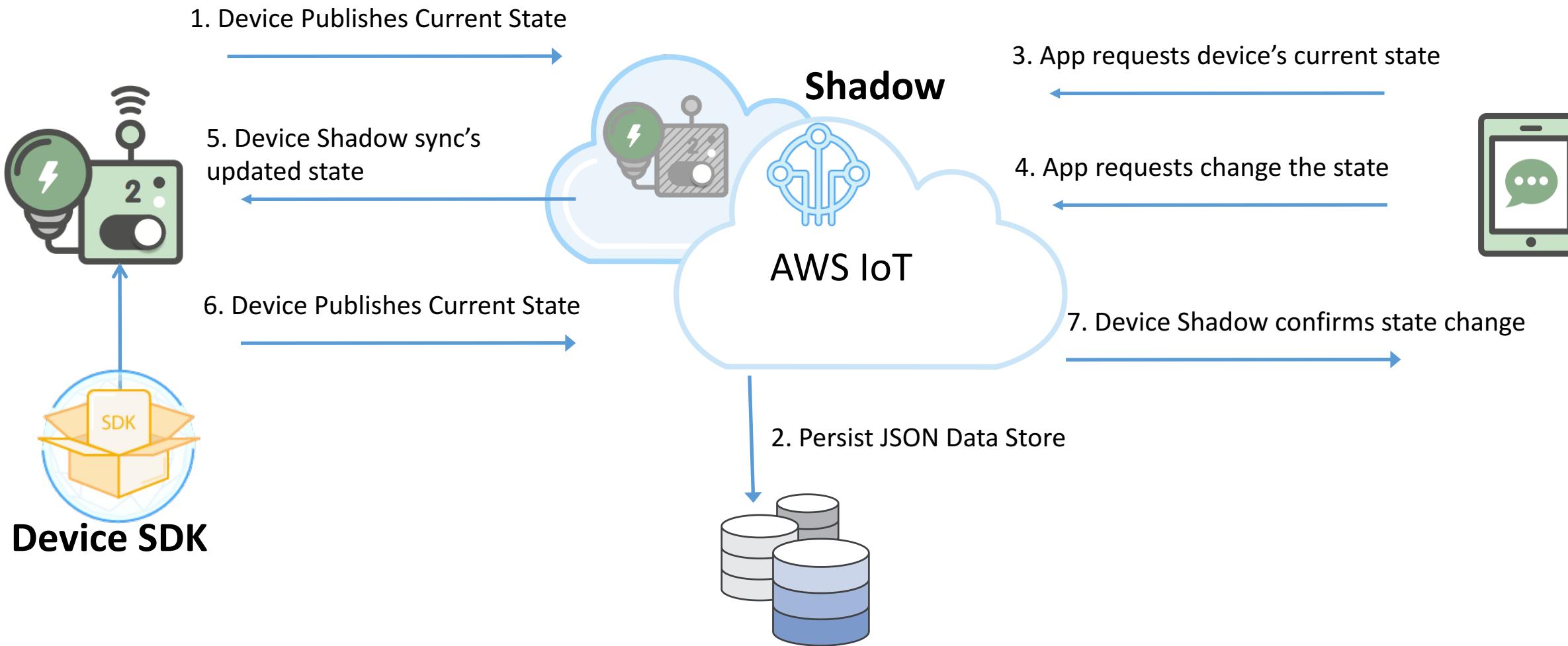
AWS IoT Thing Shadow



AWS IoT Thing Shadow



AWS IoT Shadow Flow

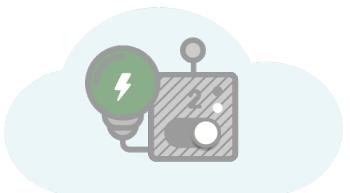


AWS IoT Device Shadow - Simple Yet Powerful



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  
}
```

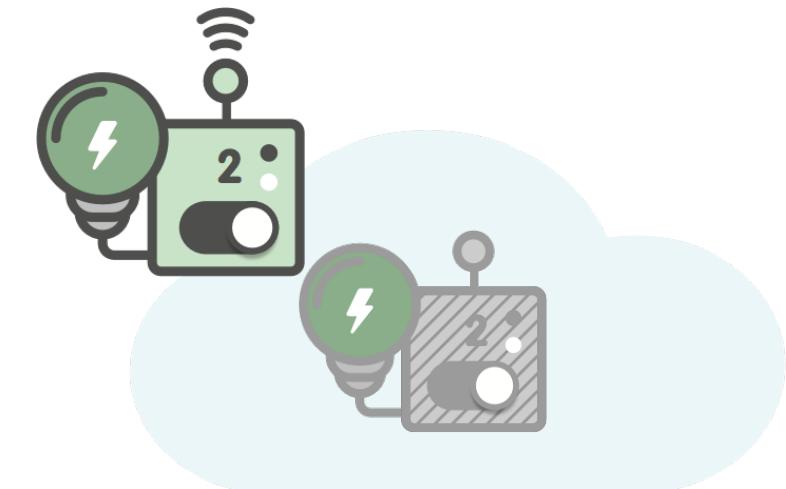
AWS IoT Device Shadow Topics (MQTT)



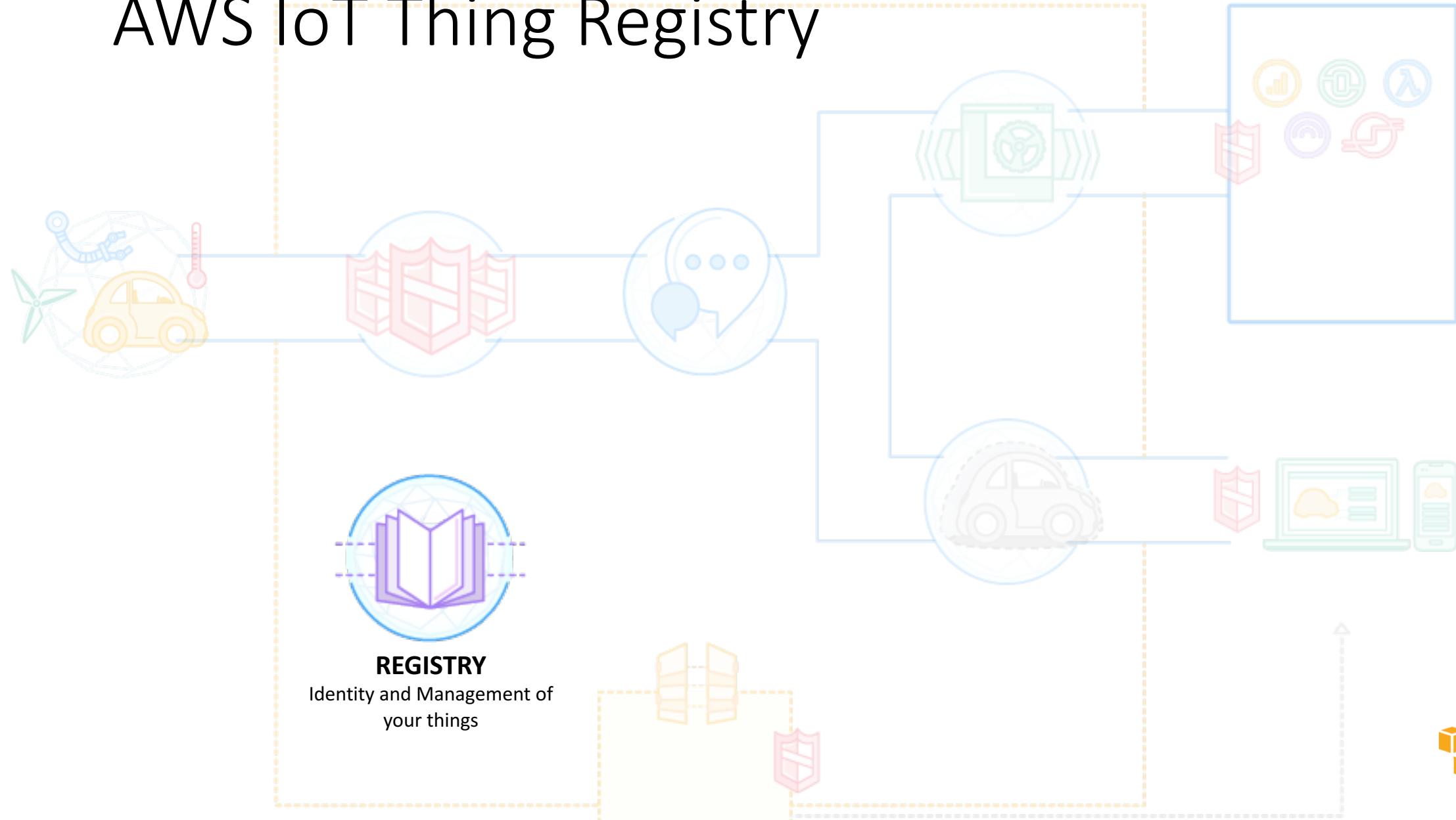
Thing SDK (C-SDK, JS-SDK)
makes it easy for you build shadow
functionality into your device so it can
automatically synchronize the state
with the device.

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 Thing Registry

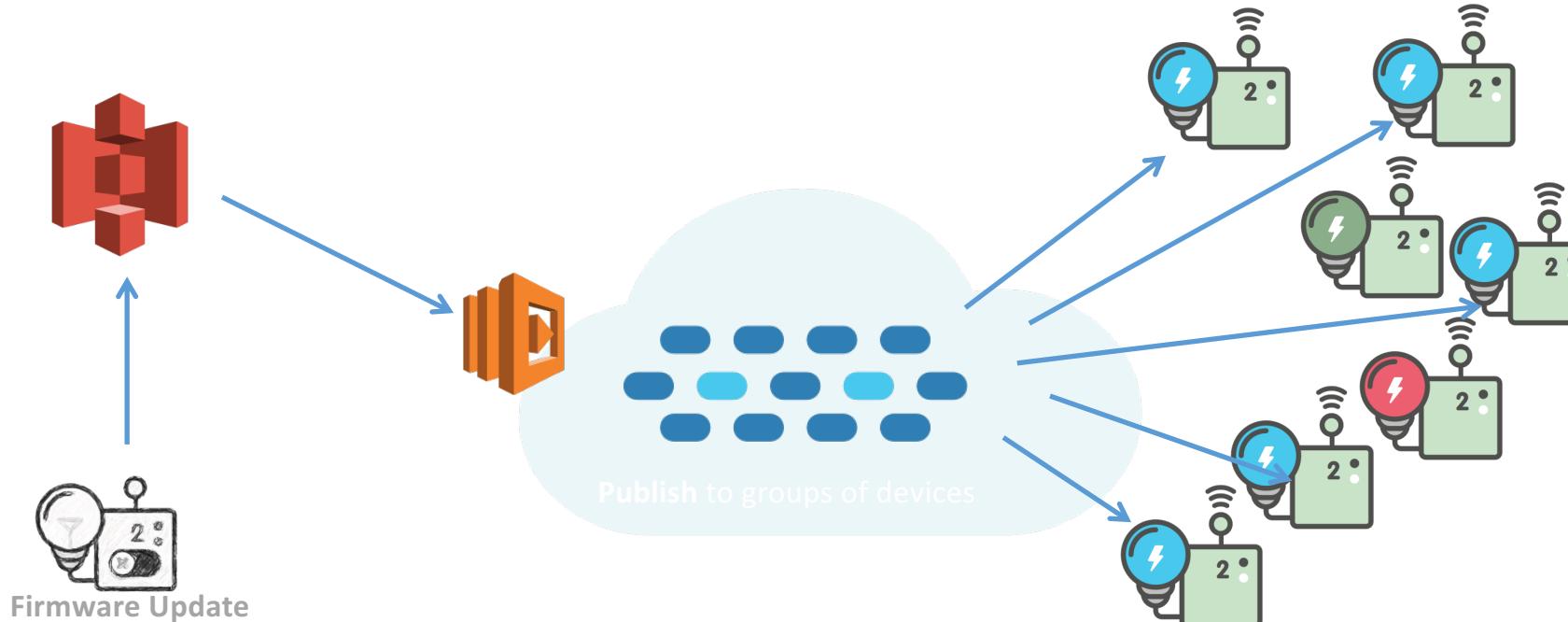




AWS IoT Thing Registry

- 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

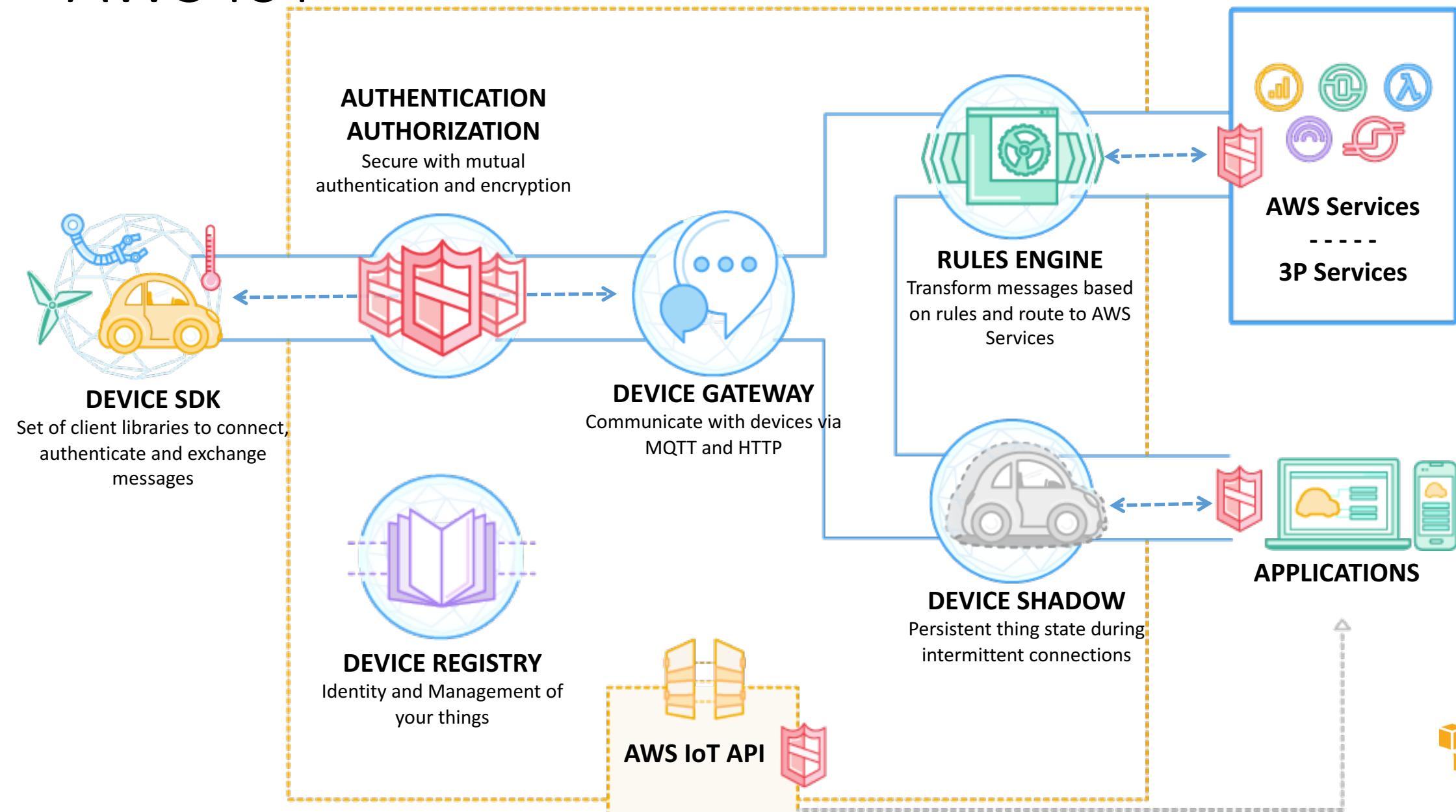
S3 Holds Versioned Firmware Distributions

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

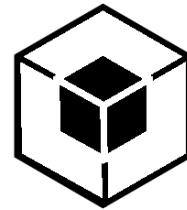
Get Started with AWS IoT Device SDK



C-SDK
(Ideal for embedded
OS)



JS-SDK
(Ideal for Embedded
Linux Platforms)



Arduino Library
(Arduino Yun)



Mobile SDK
(Android and iOS)



Official IoT Starter Kits, Powered by AWS



Official IoT Starter Kits on Variety of Platforms

Broadcom WICED
BCM4343W
On Threadx/Netx



Intel Edison
on Yocto Linux



Mediatek
LinkOne
on Linkit OS



Marvell EZConnect

MW302
On FreeRTOS

Renesas RX63N
On Micrium OS

TI CC3200
On TI-RTOS

Microchip WCM
PIC32 Platform



Dragonboard
410c on
Ubuntu



Seeeduino
Arduino on
openWRT



Beaglebone
Green on
Debian

