

# IoT on Amazon Web Services

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# Agenda

- A simple definition of the Internet of Things
- IoT projects running on AWS
- The AWS IoT platform
  - Devices & SDKs
  - The MQTT protocol
  - Moving IoT data to the cloud
  - Demo on the Arduino Yùn platform
- Q&A

# The Internet of Things



# **RESOURCE-CONSTRAINED COMPUTING DEVICES**

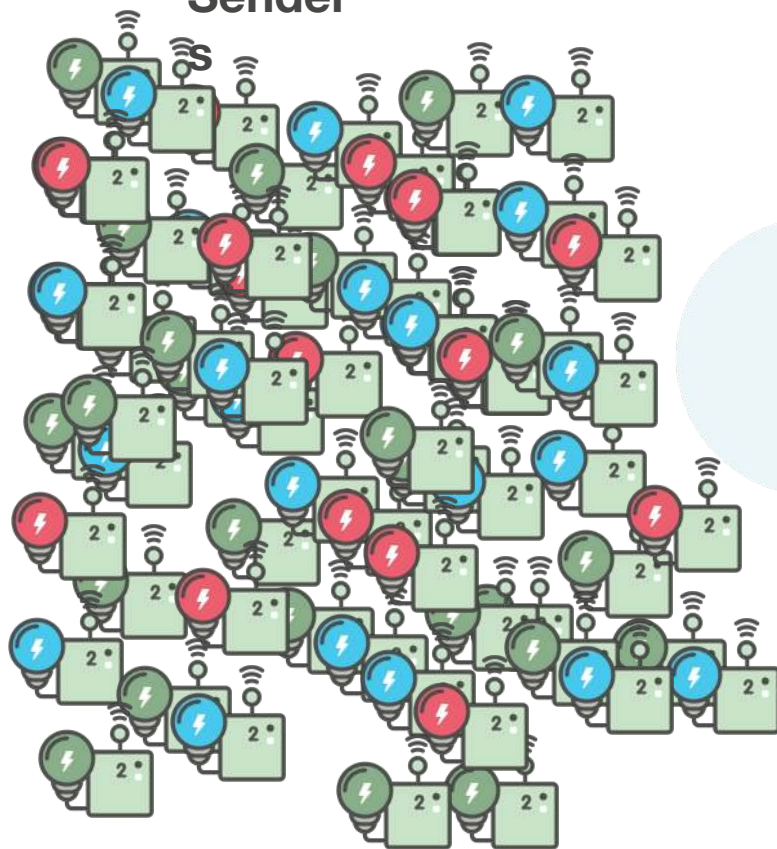
**DEPLOYED IN THE  
THOUSANDS, MAYBE THE  
MILLIONS**

**ABLE TO RUN FOR YEARS**  
**WITHOUT HUMAN**  
**INTERVENTION**

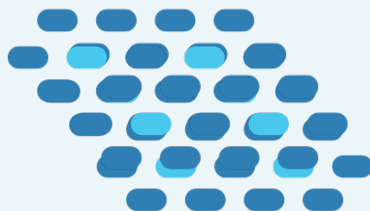
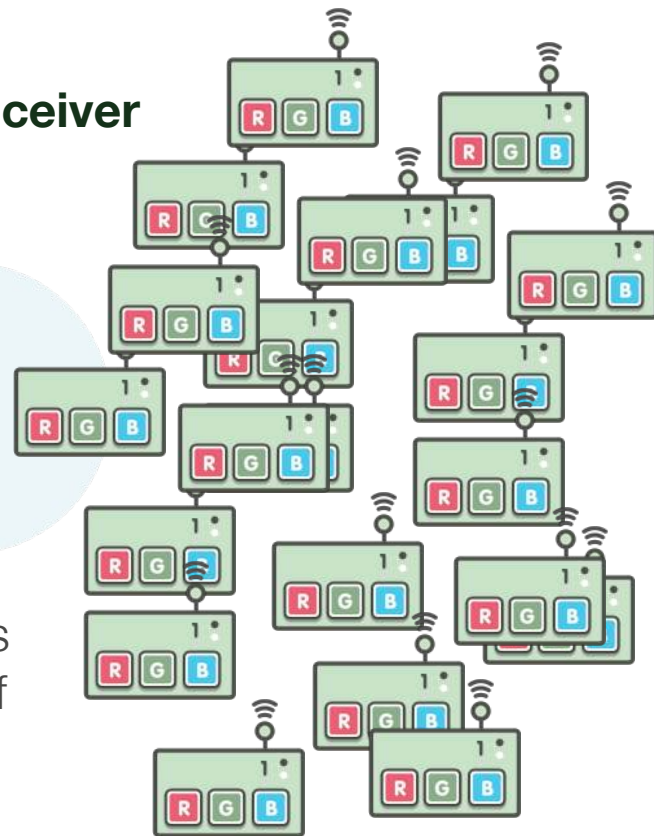
# **COLLECTING AND SENDING STREAMS OF DATA 24/7/365**

**and this is the real challenge in IoT !**

**Sender**



**Receiver**  
**s**



Millions of devices  
sending billions of  
messages









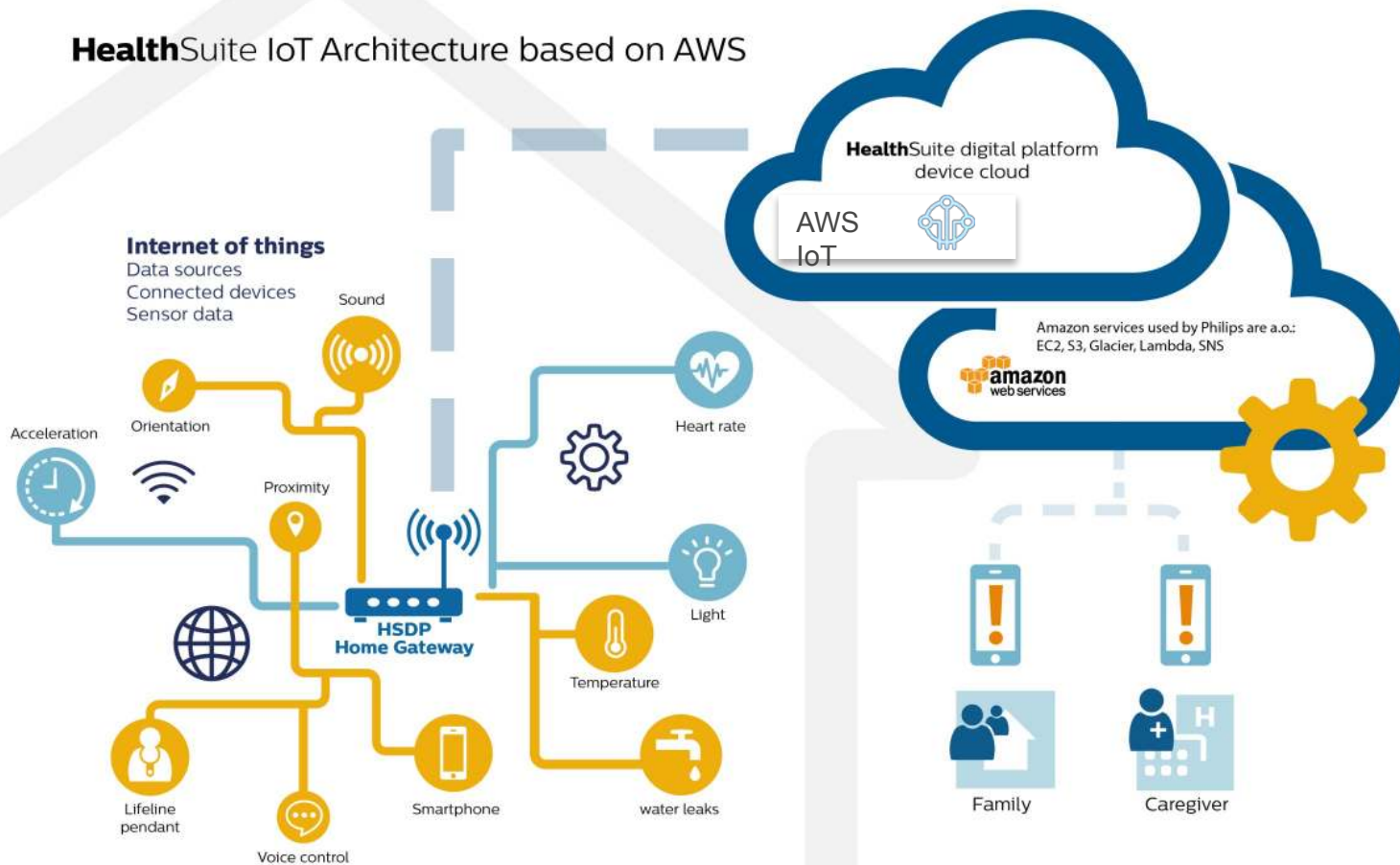


More on this later ☺

# IoT projects running on AWS



## HealthSuite IoT Architecture based on AWS





# JOHN DEERE

Streaming, analysis, storage  
and visualization of data  
coming from 200,000  
farming machines

Precision agriculture and  
yield optimization for  
farmers

New business model for  
John Deere







## “Car as a Sensor”

Collect sensor data  
from BMW 7 Series cars  
to give drivers **dynamically  
updated map information**

**100,000** vehicles by 2018

Service launched  
in **6 months**







Connected Roomba  
launched in 2015

More than 45 million  
square meters mapped

Discovery and interaction  
with Smart Home devices



# More IoT applications based on AWS



Thermomix  
Consumer equipment



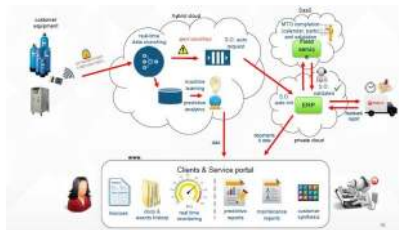
Soitec  
Semiconductors



SPS  
Motors



Siemens Power & Gas  
Energy production



Veolia Water  
Water systems



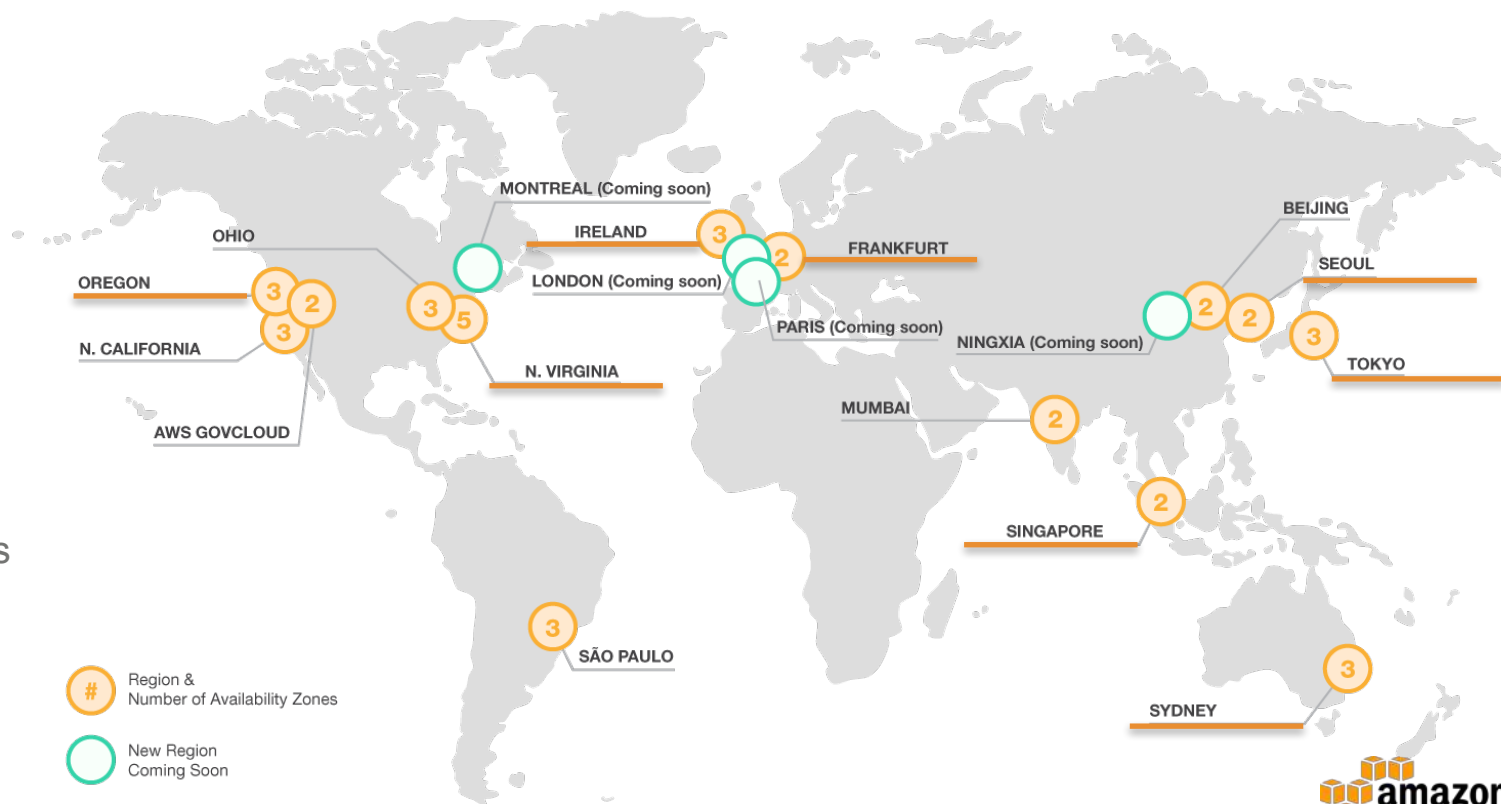
Amazon  
Retail



# The AWS IoT Platform



# AWS Global Infrastructure



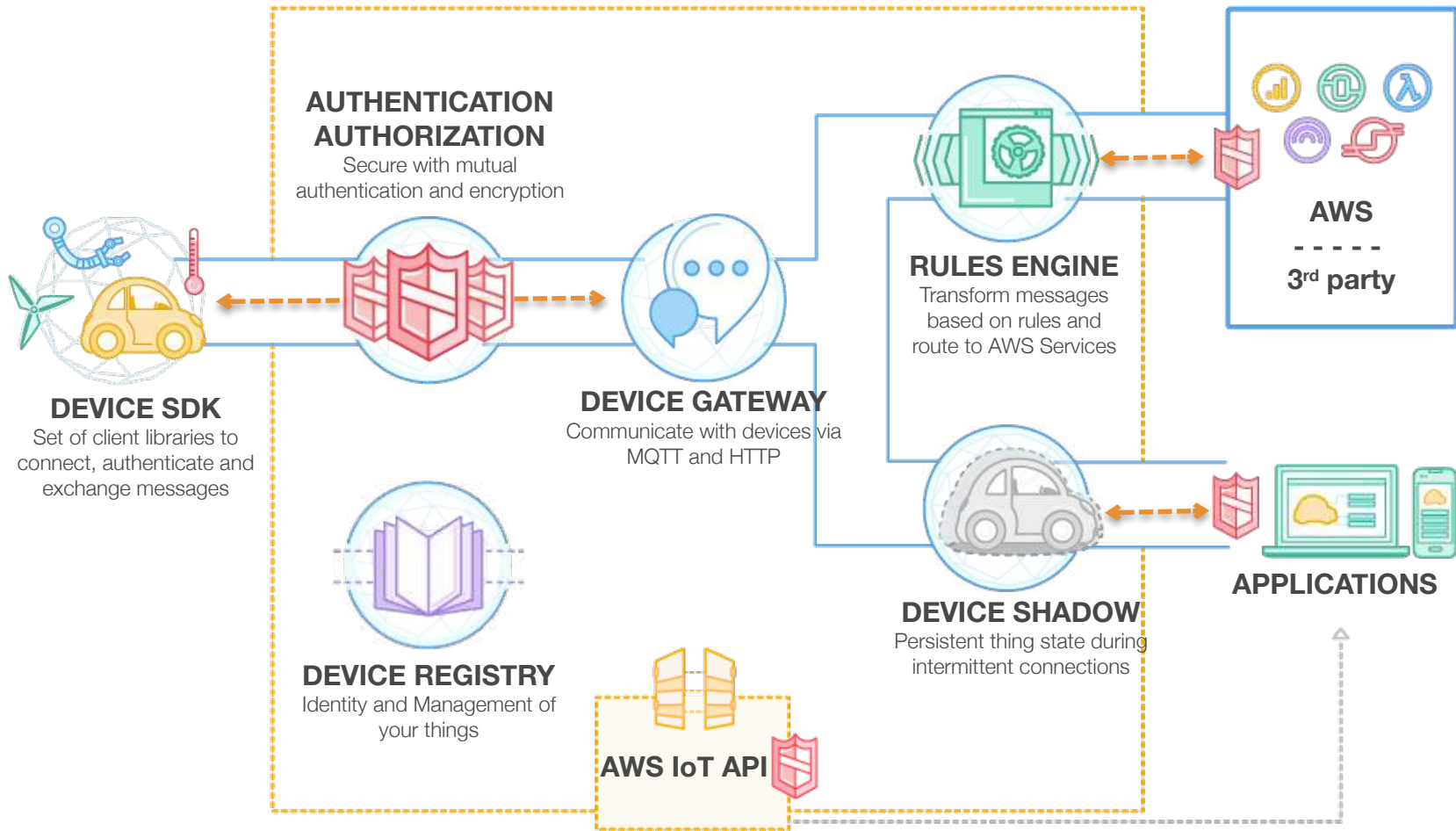
**14** Regions

**38** Availability Zones

**63** Edge Locations

AWS IoT available





# Pricing

Region	Price
US East (N. Virginia)	\$5 per million messages
US West (Oregon)	\$5 per million messages
EU (Ireland)	\$5 per million messages
EU (Frankfurt)	\$5 per million messages
Asia Pacific (Sydney)	\$6 per million messages
Asia Pacific (Seoul)	\$6 per million messages
Asia Pacific (Tokyo)	\$8 per million messages
Asia Pacific (Singapore)	\$8 per million messages

- No minimum fee
- You are only charged on the number of incoming and outgoing messages
- 1 message = 512 bytes maximum
- Free tier: 250K free messages / month for 12 months
- No charge when delivering to Amazon S3, Amazon DynamoDB, AWS Lambda, Amazon Kinesis, Amazon SNS, and Amazon SQS.

# AWS IoT: Devices & SDKs





# Official AWS IoT Starter Kits



# Software platforms supported by AWS IoT

- Arduino Yún <https://github.com/aws/aws-iot-device-sdk-arduino-yun>
- Javascript <https://github.com/aws/aws-iot-device-sdk-js>
- Embedded C <https://github.com/aws/aws-iot-device-sdk-embedded-C>
  
- Android <https://github.com/aws/aws-sdk-android/>
- iOS <https://github.com/aws-labs/aws-sdk-ios-samples>
  
- Java (07/16) <https://github.com/aws/aws-iot-device-sdk-java>
- Python (07/16) <https://github.com/aws/aws-iot-device-sdk-python>

# Managing things

- Thing **Registry**
- Secure **Identity** for Things: one certificate per thing (**mandatory**)
- Secure **Communications** with Things: one keypair per thing (**mandatory**)
- Fine-grained **Authorization** (based on Amazon IAM)
  - Thing Management
  - Access to messages
  - Access to AWS services

<https://aws.amazon.com/security/>

<https://aws.amazon.com/compliance/>

<https://aws.amazon.com/compliance/eu-data-protection/>

# AWS IoT: The MQTT Protocol



# Protocols supported by AWS IoT

- **MQTT over HTTPS:** publish and subscribe (IPv4 and IPv6)
- **MQTT over WebSockets:** publish and subscribe
  - Security is managed with AWS Signatures v4
- **HTTPS** publish only

# MQTT Protocol



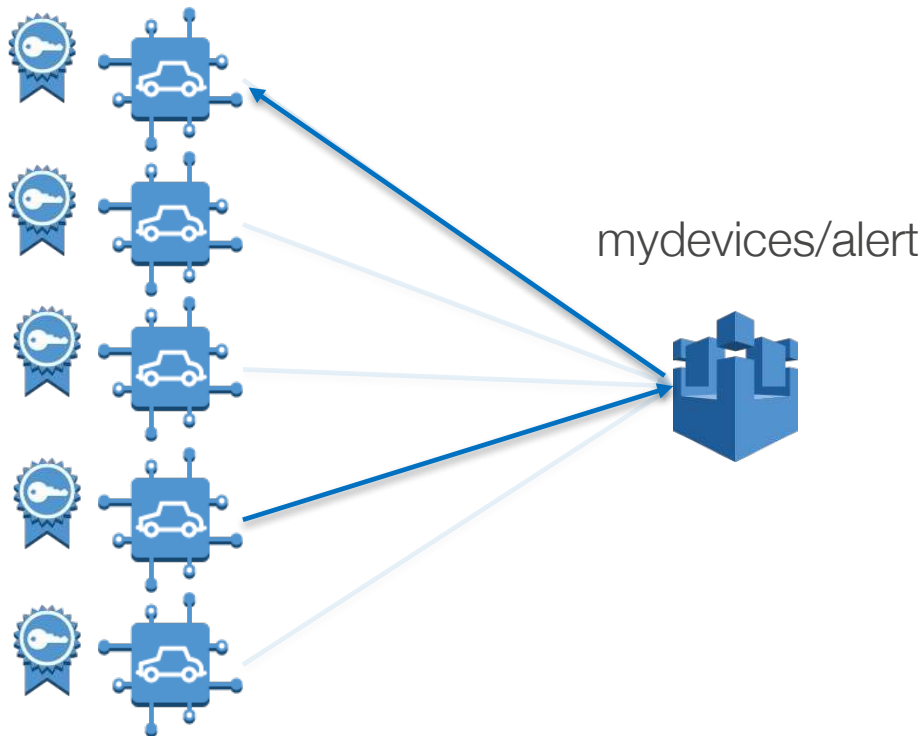
- OASIS **standard** protocol (v3.1.1)
- **Lightweight** transport protocol that is useful for connected devices
- **Publish-subscribe** with topics
- MQTT is used on oil rigs, connected trucks, and many more critical applications
- Until now, customers had to build, maintain and scale a broker to use MQTT with cloud applications

## MQTTS vs HTTPS:

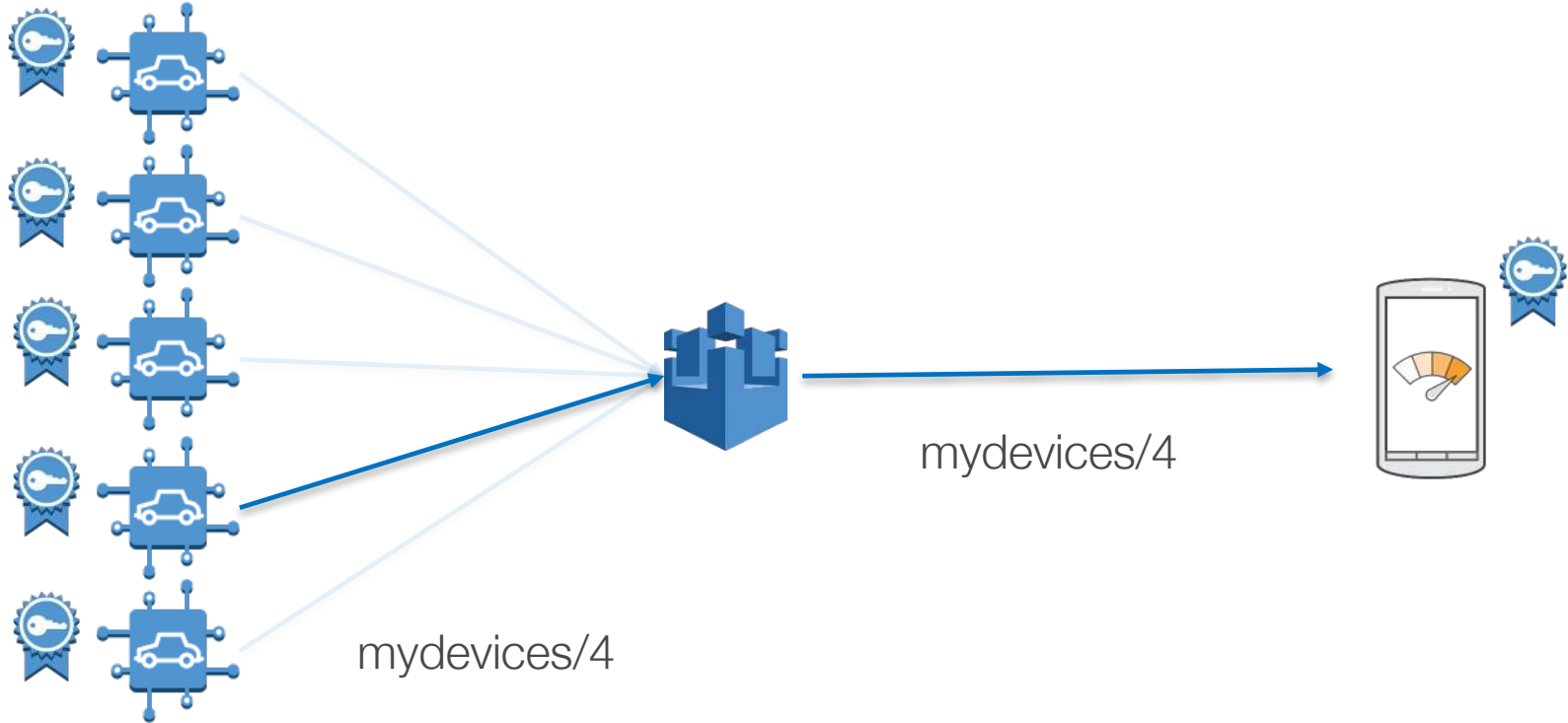
**93x faster** throughput  
**11.89x less battery** to send  
**170.9x less battery** to receive  
**50% less power** to stay connected  
**8x less network** overhead

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

# MQTT: device-to-device communication

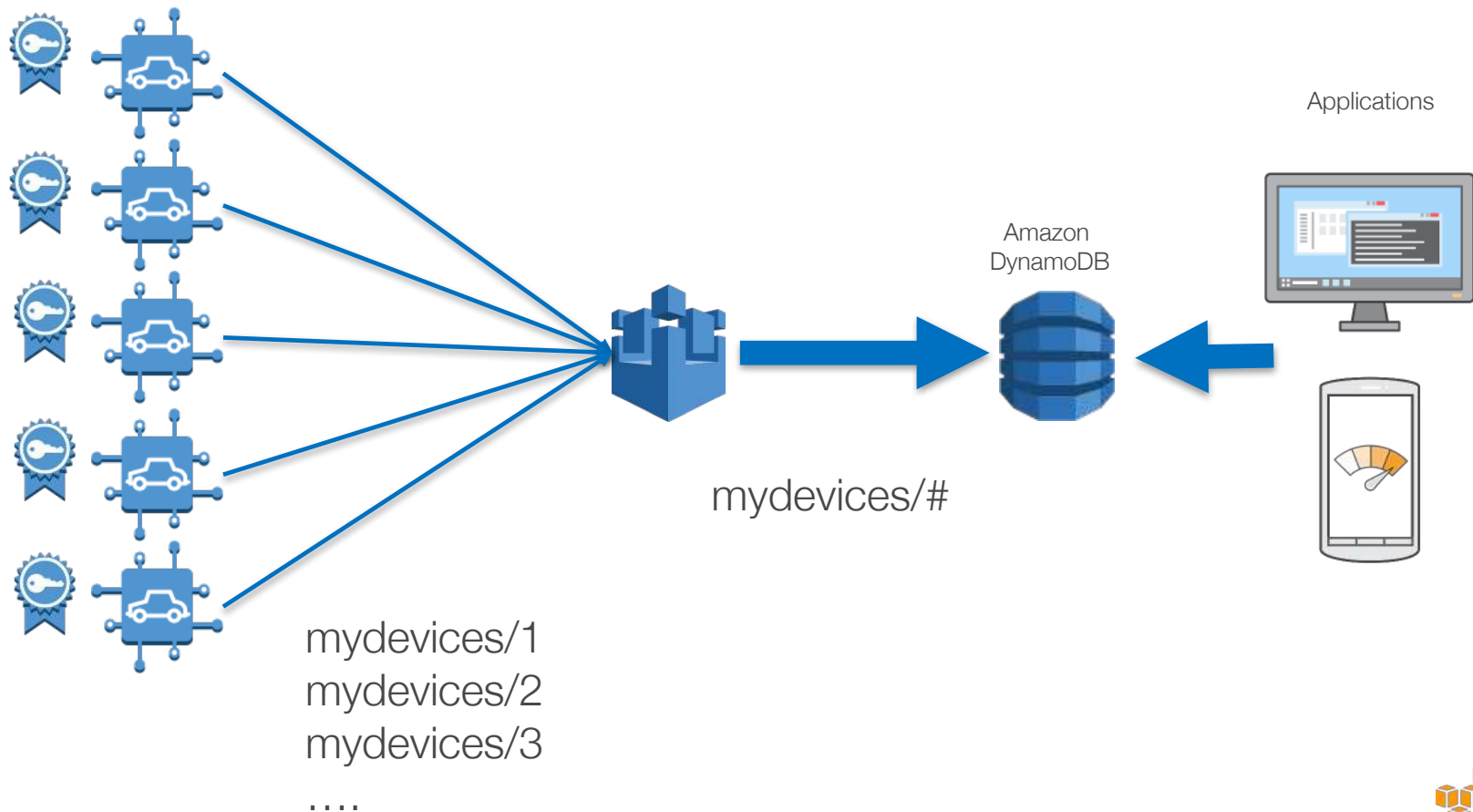


# MQTT: collect data from a device

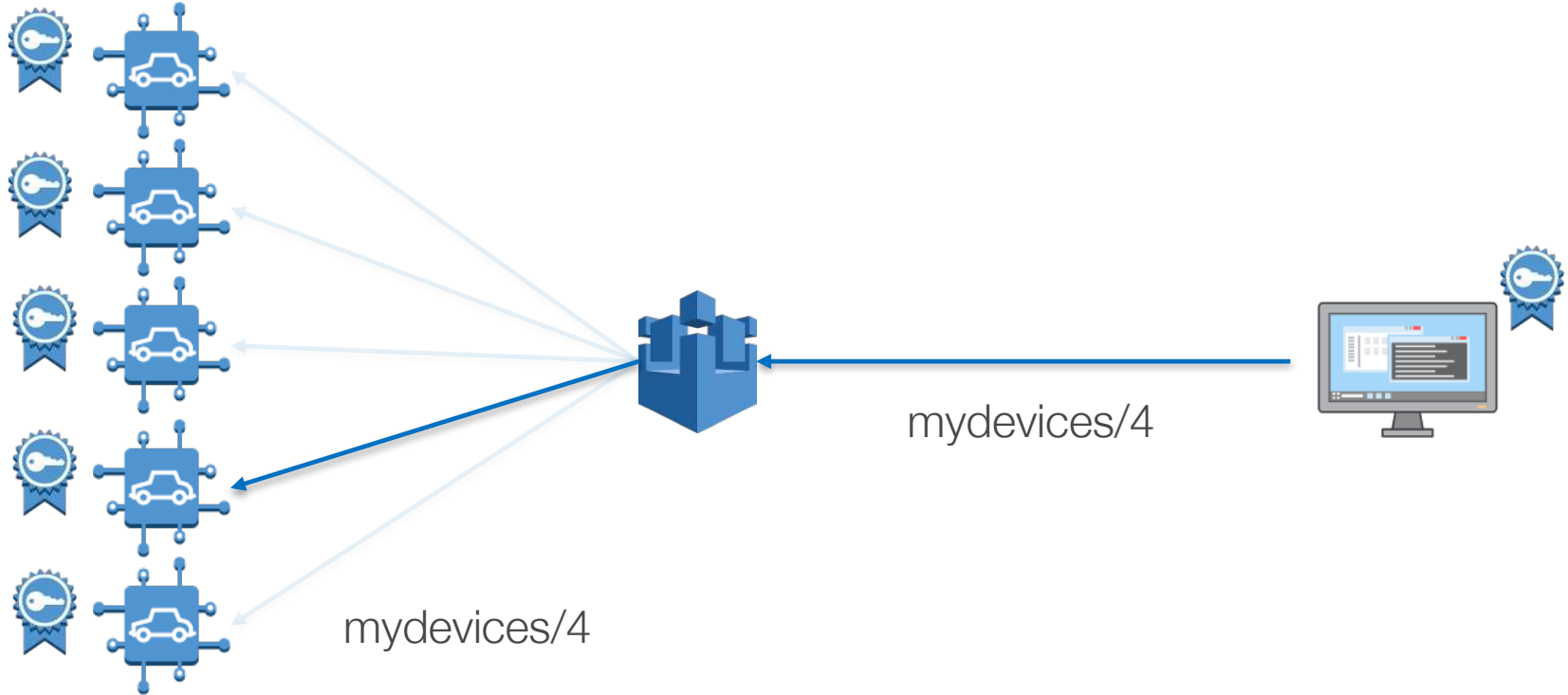




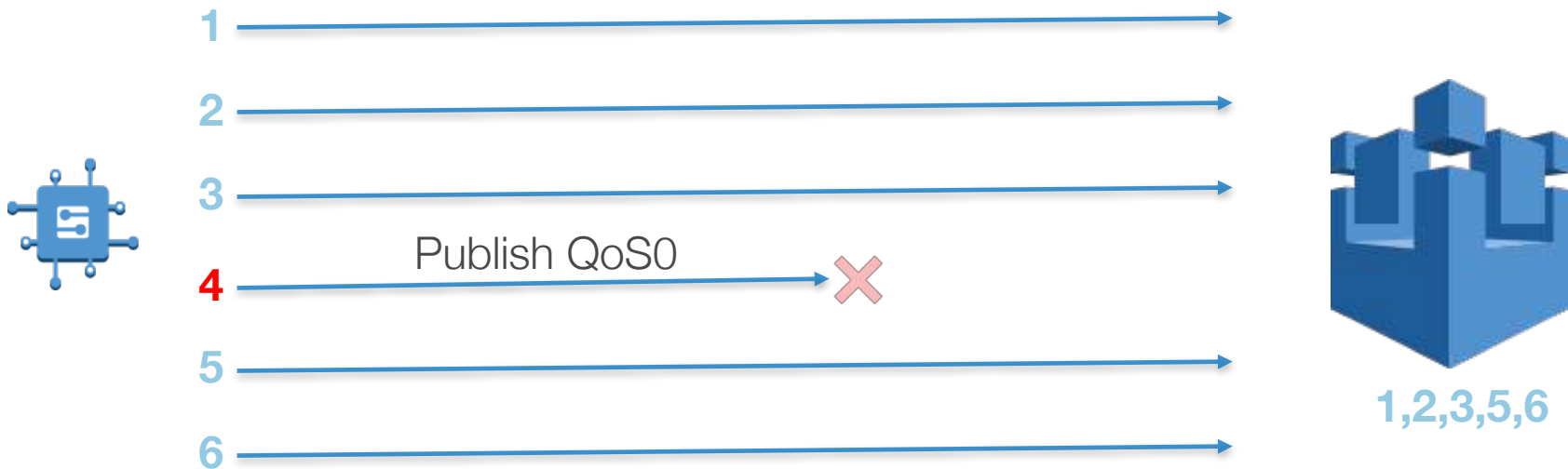
# MQTT: aggregate data from many devices



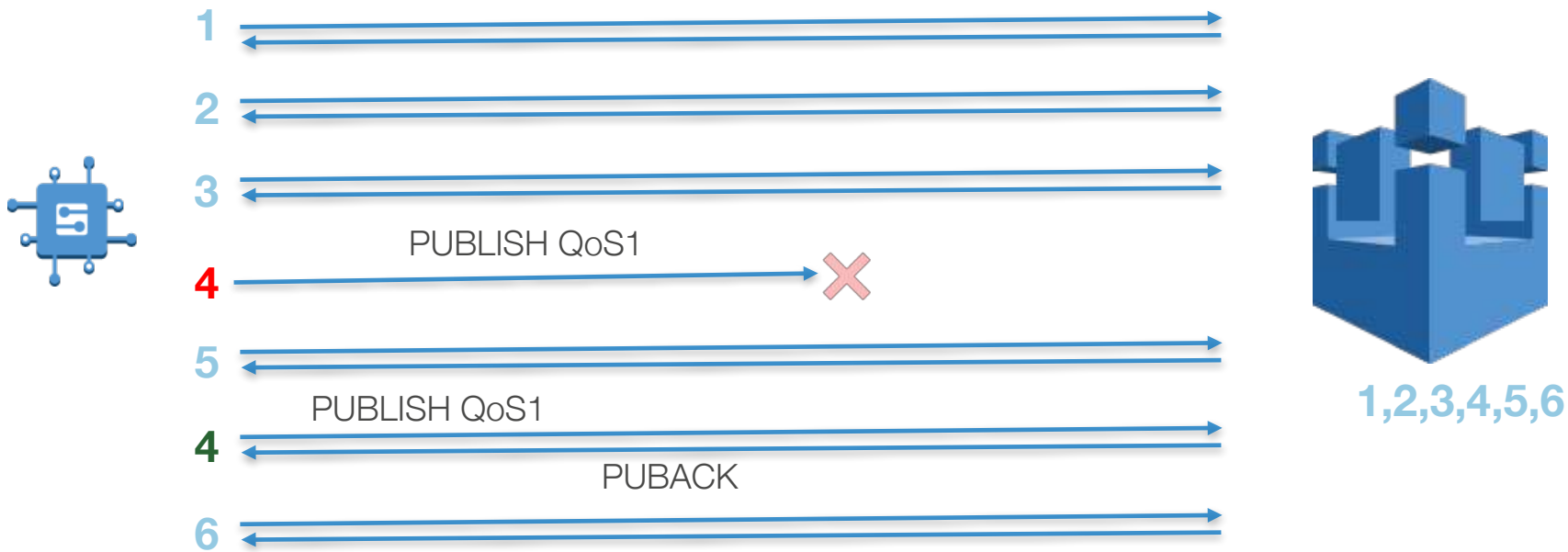
# MQTT: update a device



# MQTT: QoS 0 (at most once)



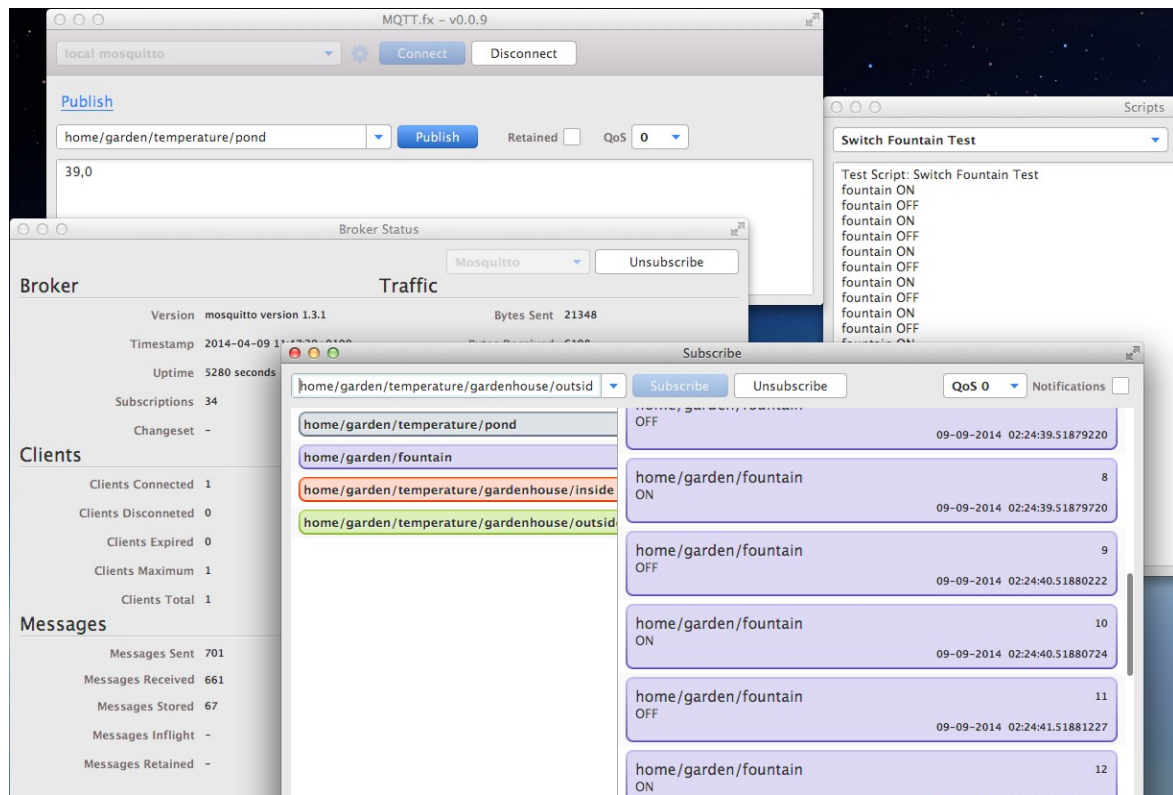
## MQTT: QoS 1 (at least once)



# MQTT.fx

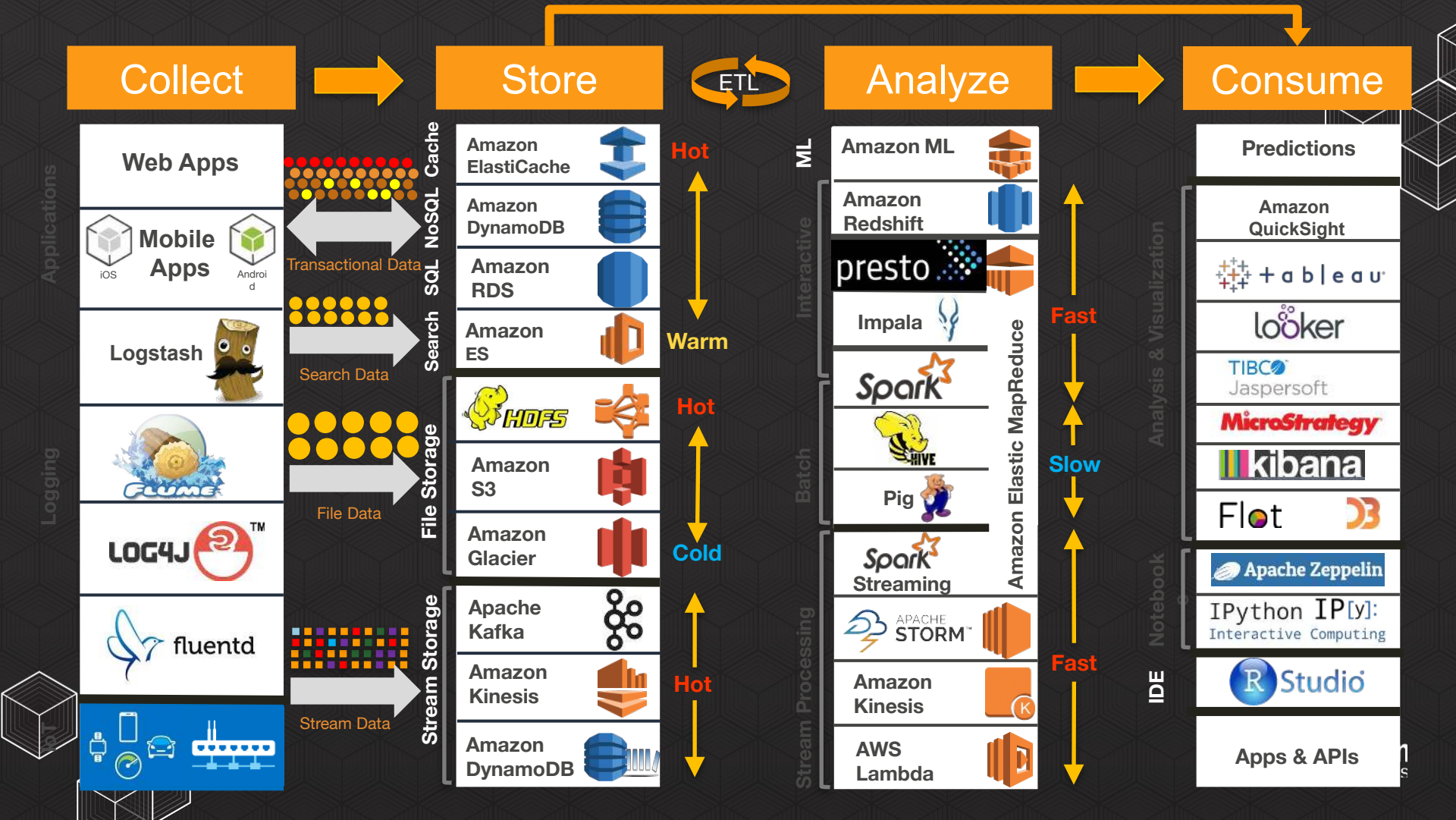


<http://mqttfx.jfx4ee.org/>

The image shows the MQTT.fx v0.0.9 application interface. It features several overlapping windows. The top window is the main control panel with a 'Connect' button, a 'Publish' button, and a text input field containing 'home/garden/temperature/pond'. Below this is a 'Broker Status' window showing 'mosquitto version 1.3.1' and 'Uptime 5280 seconds'. A 'Clients' window lists 'Clients Connected 1'. A 'Messages' window shows 'Messages Sent 701' and 'Messages Received 661'. A 'Subscribe' window is open, showing a list of topics: 'home/garden/temperature/pond', 'home/garden/fountain', 'home/garden/temperature/gardenhouse/inside', and 'home/garden/temperature/gardenhouse/outside'. A 'Traffic' window shows a list of messages, including 'home/garden/fountain ON' and 'home/garden/fountain OFF'.

# AWS IoT: Moving data to the cloud





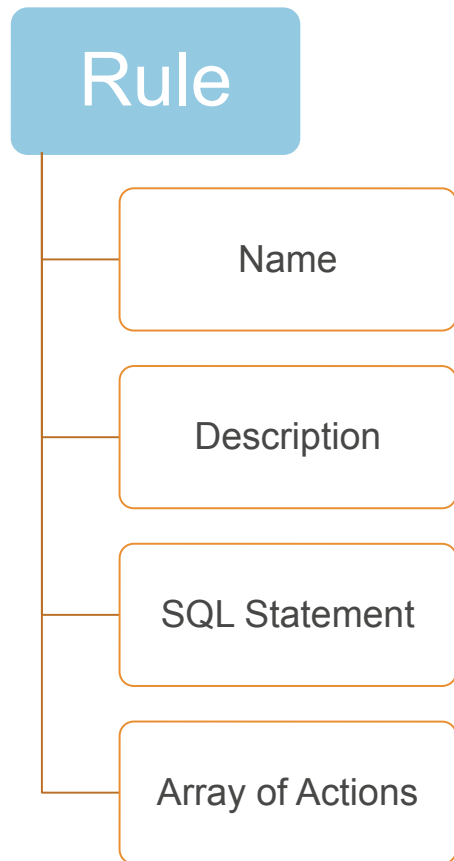
# AWS IoT Rules

Rules connect AWS IoT to  
**External Endpoints**  
and **AWS Services**





# AWS IoT Rules Engine



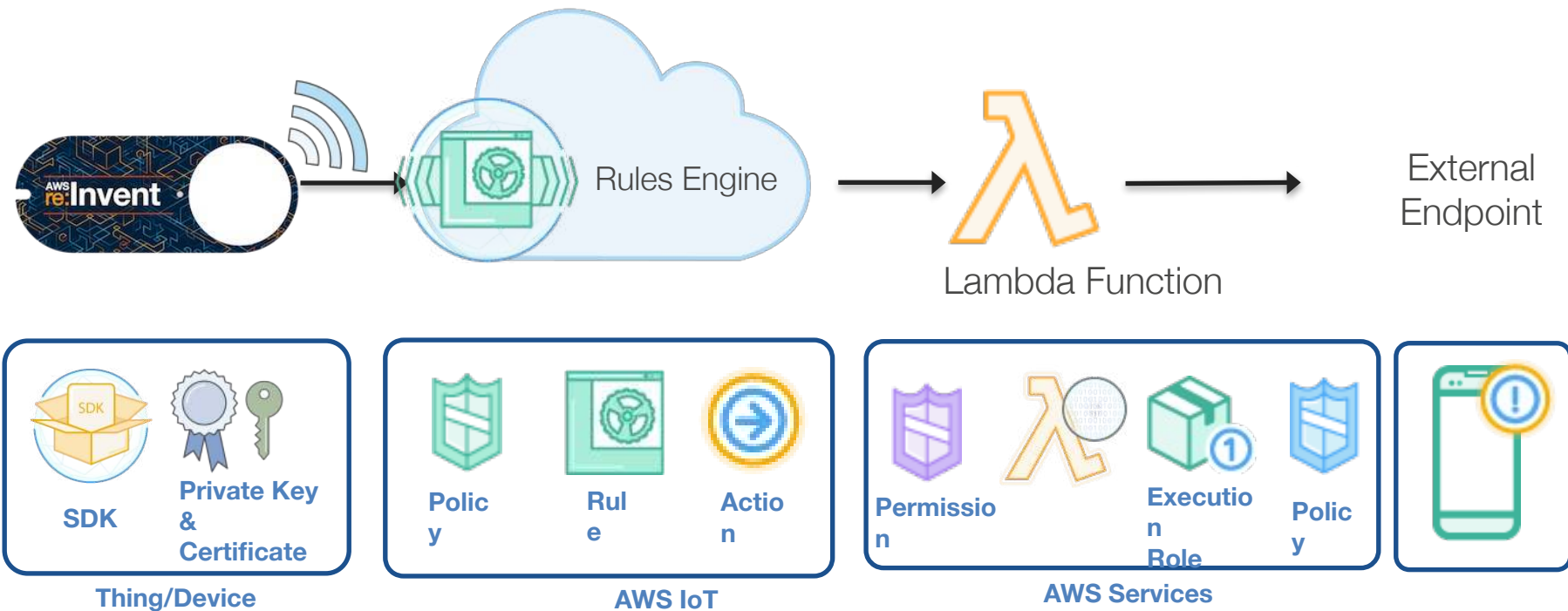
## Simple & Familiar Syntax

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

## Many functions available

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

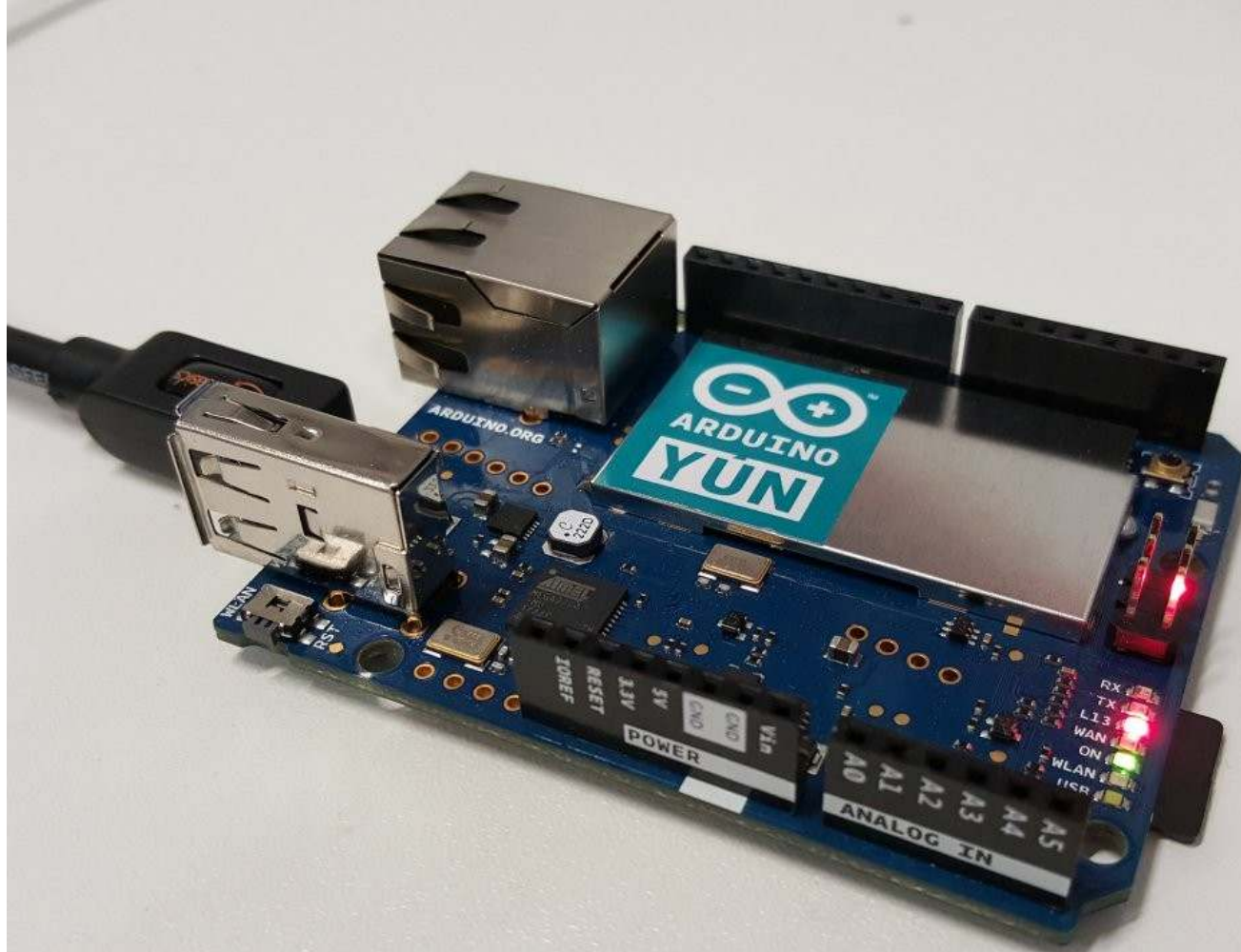
# From AWS IoT to an External Endpoint



Select \* from  
'iotbutton/+'

# AWS IoT Demo





Personal picture

# Hardware Shopping List



## Arduino Yun ATmega32u4 Microcontroller Board A000008

by Arduino Org

**\$65.66** ~~\$74.95~~  **Prime**

Get it by **Monday, Mar 21**

## More Buying Choices

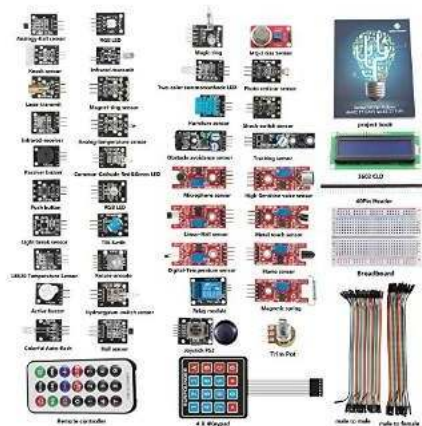
**\$65.00** new (17 offers)

**\$59.99** used (1 offer)

★★★★☆ 68

**FREE Shipping** on eligible orders

**Electronics:** See all 153 items



SunFounder 37 modules Arduino Sensor Kit for Arduino UNO R3  
Mega2560 Mega328 Nano (without controller)

by SunFounder

**\$68.99**  **Prime**

Get it by **Monday, Mar 21**

## More Buying Choices

**\$68.99** new (64 offers)

★★★★★ 92

FREE Shipping on eligible orders

**Electronics:** See all 76 items



# Software Shopping List



Arduino IDE and libraries  
<http://arduino.org/software>

Arduino Web Editor & Cloud Platform  
<https://aws.amazon.com/blogs/aws/arduino-web-editor-and-cloud-platform-powered-by-aws/>

Tip: ArduinoJson, a JSON library for embedded systems  
<https://github.com/bblanchon/ArduinoJson>

# Arduino: connecting to AWS IoT

```
aws_iot_mqtt_client myClient;

if((rc = myClient.setup(AWS_IOT_CLIENT_ID)) == 0) {
    // Load user configuration
    if((rc = myClient.config(AWS_IOT_MQTT_HOST,
        AWS_IOT_MQTT_PORT, AWS_IOT_ROOT_CA_PATH,
        AWS_IOT_PRIVATE_KEY_PATH, AWS_IOT_CERTIFICATE_PATH)) == 0) {
        if((rc = myClient.connect()) == 0) {
            // We are connected
            doSomethingUseful();
        }
    }
}
```

# Arduino: subscribing and publishing to a topic

```
if ((rc=myClient.subscribe("myTopic", 1, msg_callback)) != 0)
{
    Serial.println("Subscribe failed!");
    Serial.println(rc);
}
```

```
if((rc = myClient.publish("myTopic", msg, strlen(msg),
    1, false)) != 0)
{
    Serial.println("Publish failed!");
    Serial.println(rc);
}
```



**Now what?**



# Now it's your turn!

Whitepaper: "Core Tenets of IoT"

<https://d0.awsstatic.com/whitepapers/core-tenets-of-iot1.pdf>

Whitepaper: "Big Data Analytics Options on AWS" [http://d0.awsstatic.com/whitepapers/Big\\_Data\\_Analytics\\_Options\\_on\\_AWS.pdf](http://d0.awsstatic.com/whitepapers/Big_Data_Analytics_Options_on_AWS.pdf)

Learn more about AWS IoT <https://aws.amazon.com/iot/>

Learn about the AWS Free Tier <https://aws.amazon.com/free/>

Get started! <https://aws.amazon.com/getting-started/>

Next AWS events in France <https://aws.amazon.com/fr/events/>

- **AWSome Day in Lille** 22/11 <https://aws.amazon.com/fr/awssomeday/lille/>
- **Security Week**: 10 webinars (19-23/12) <https://aws.amazon.com/fr/events/security-week/>

# Thank You !

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