NXP MICROCONTROLLER INNOVATION

CLOUD CONNECTIVITY WITH AWS & LPC54018

JUNE 2018

PUBLIC

SECURE CONNECTIONS
FOR A SMARTER WORLD

AGENDA

- MCU Introduction
- AWS IoT Core
  - Identity service
  - Message Broker
  - Shadow Interface
  - Rules Engine
- Demo with LPC54018 module and IoT mini prototype board
- Where to go, resources, get started!

LPC54000 MCU Series | Addressing IoT End Nodes

- **High-efficiency MCU** 180MHz Cortex-M4 to perform complex tasks in little time
- **Low-cost memory expansion** 360KB SRAM and unlimited expansion via Quad SPI flash (SPIFI)
- **Most advanced security with LPC54S0xx (launching 2H 2018)**
  - Secure boot authentication from encrypted images (256-bit symmetric)
  - RSA based signature verification (2048-bit public keys)
  - Root of Trust (RoT) with secure anti-rollback through revocation of image key certificates
  - Physical Unclonable Function (PUF) root key using an SRAM based silicon fingerprint
  - Supports Device Identifier Composition Engine (DICE) from Trusted Computing Group
  - AES-256 engine, random number generator, secure hash algorithm (SHA2)
- **BOM cost savings** highly integrated, from HMI to comms. interfaces, flexible package options, including LQFP100/208, a wide operating voltage and low power consumption
- **Reducing time to market** MCUXpresso software development kit (SDK), tools and technical support to reduce development cycles

AMAZON FREERTOS

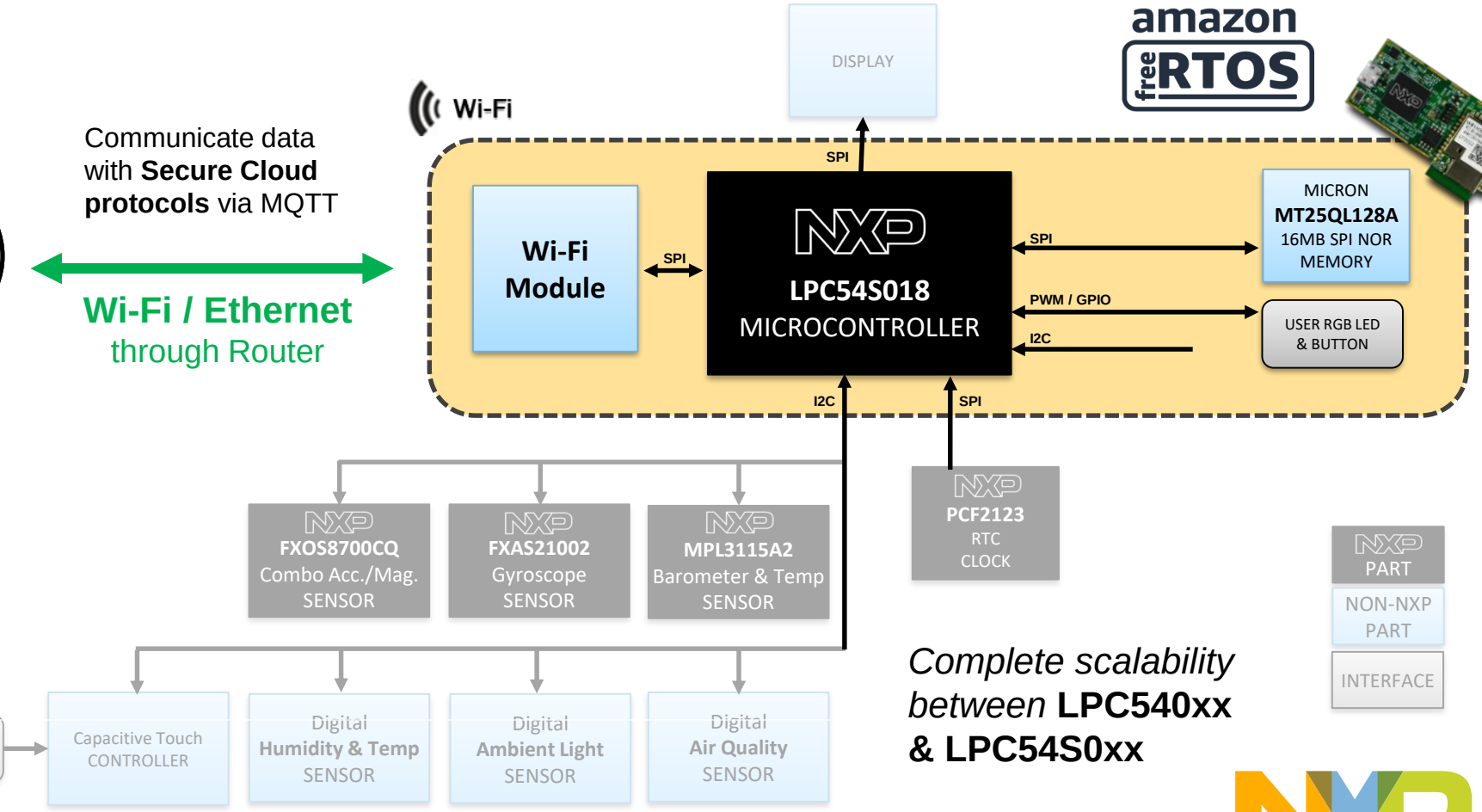
LPC54S018 IOT MODULE

SMART HOME CONTROL & AUTOMATION

Cloud services, including real-time data access & analytics, device management, OTA

Communicate data with **Secure Cloud protocols** via MQTT

Wi-Fi / Ethernet through Router



Complete scalability between **LPC540xx & LPC54S0xx**

Block diagram has been simplified to illustrate an example use case; end product images selected to serve only as an illustration.

LPC540xx available globally

LPC54S0xx coming 2H 2018

AWS IoT Services Suite

Things

Sense & Act

Cloud

Storage & Compute & Learn

Secure local triggers, actions, and data sync

Endpoints

Amazon FreeRTOS

Gateway

AWS Greengrass

Secure device connectivity and messaging

AWS IoT Core

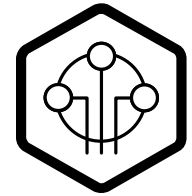
Fleet onboarding, management and SW updates

AWS IoT Device Management

Fleet audit and protection

AWS IoT Device Defender

IoT data analytics and intelligence



AWS IoT Analytics

AWS IoT 1-Click

Amazon FreeRTOS

IoT Operating System for Microcontrollers

Extends the **FreeRTOS Kernel** with libraries for security and cloud & local connectivity

Open source under the MIT license

No requirement to use AWS

AWS IoT Services Suite

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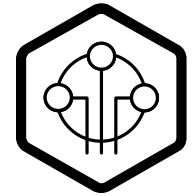


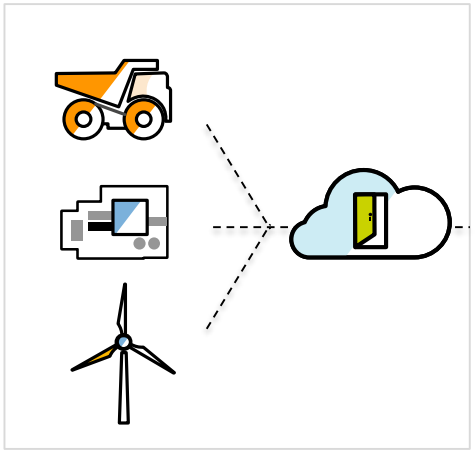
AWS IoT Analytics

AWS IoT 1-Click

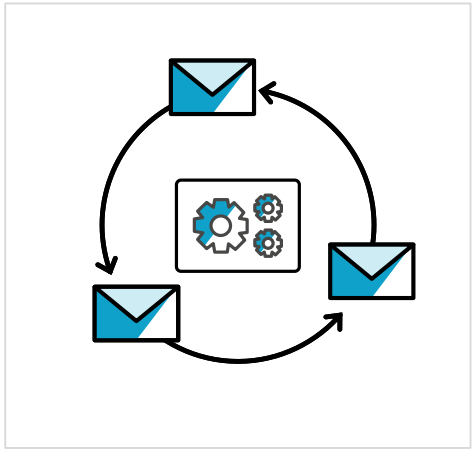
AWS IoT Core

Secure Device Connectivity and Messaging

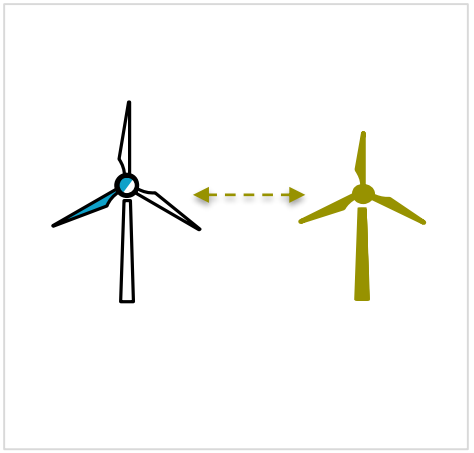
AWS IoT Core is a managed service that lets connected devices easily and securely interact with cloud applications and other devices.



To securely connect devices to the AWS cloud and other devices at scale



To route, process, and act upon data from connected devices

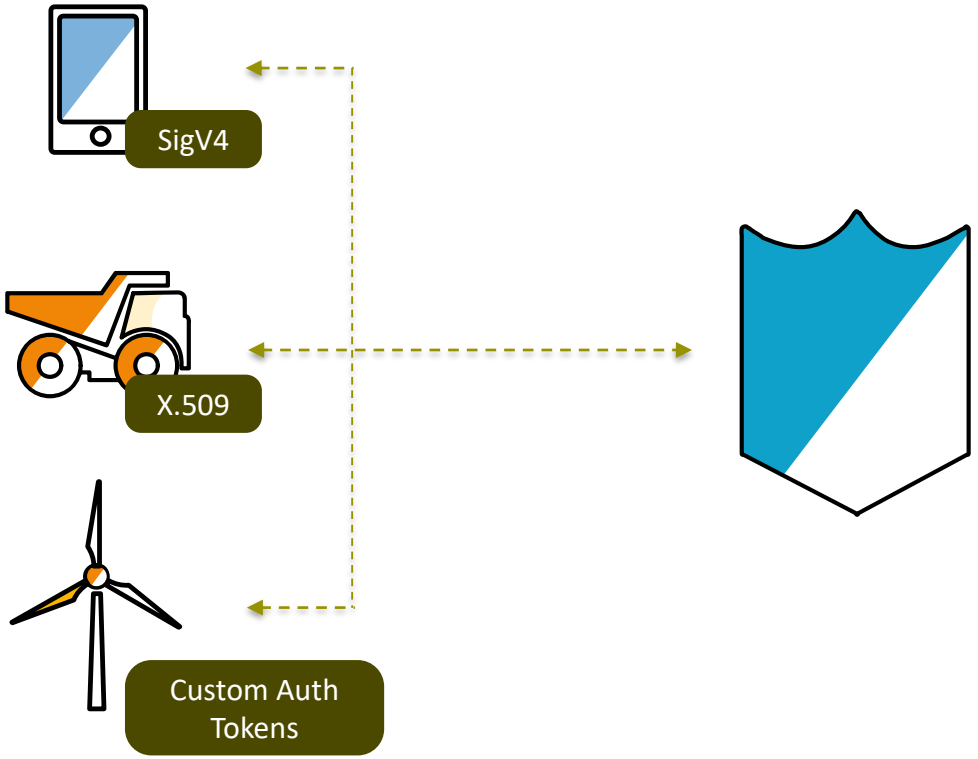


To enable applications to interact with devices even when they are offline

To fully integrate with other AWS service to reason on top of the data (Analytics, Databases, AI, etc.)

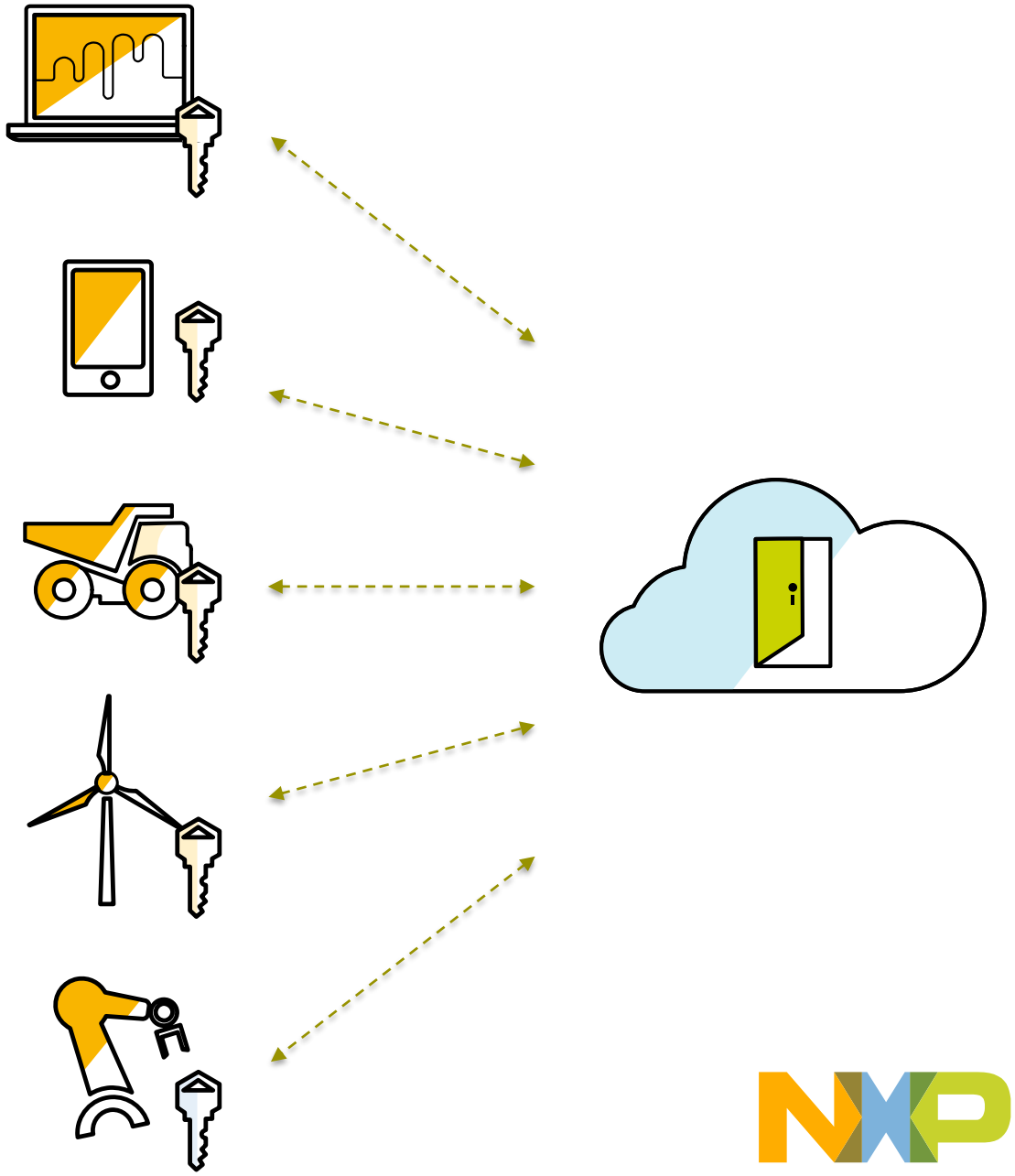
Identity Service

- Certificates
  - AWS or BYOC
- Manual or JITR
- IAM and AWS IoT policies
- Amazon Cognito
- Federated users



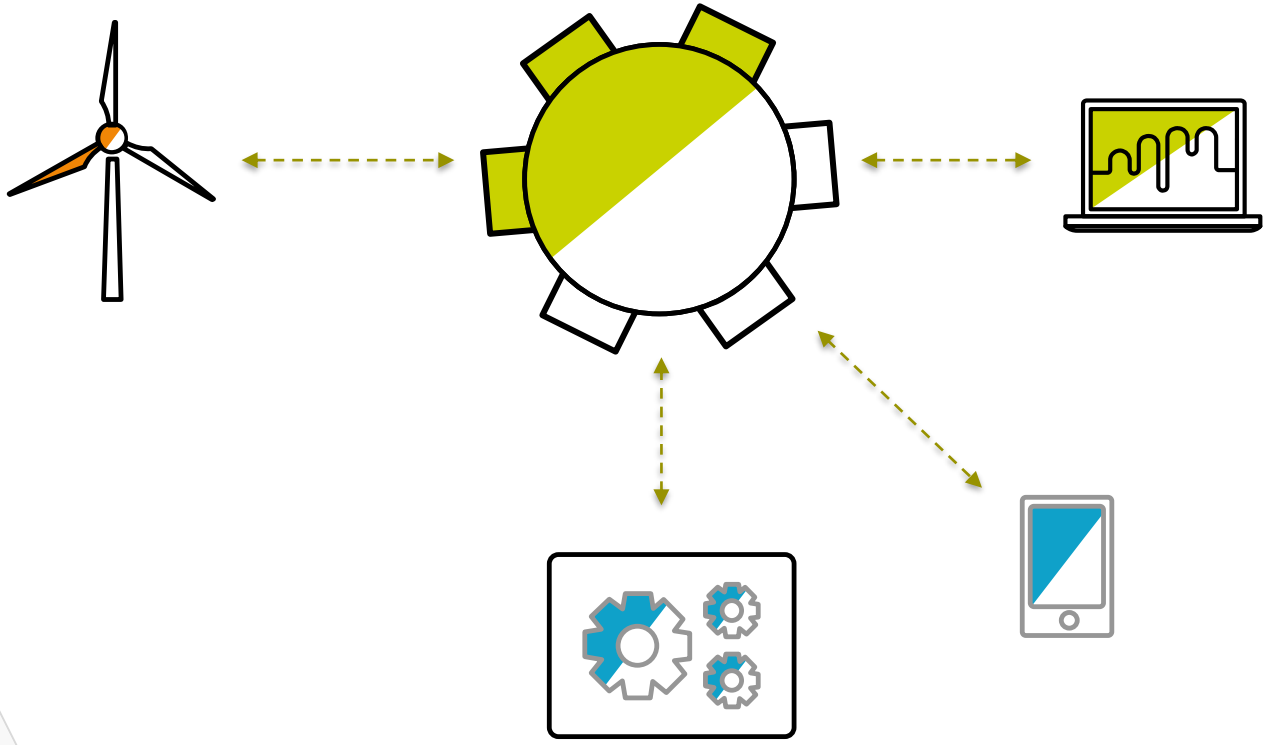
Device Gateway

- Long-lived connections
- MQTT, WebSockets, HTTP
- SigV4, X.509, and token-based authentication
- TLS 1.2

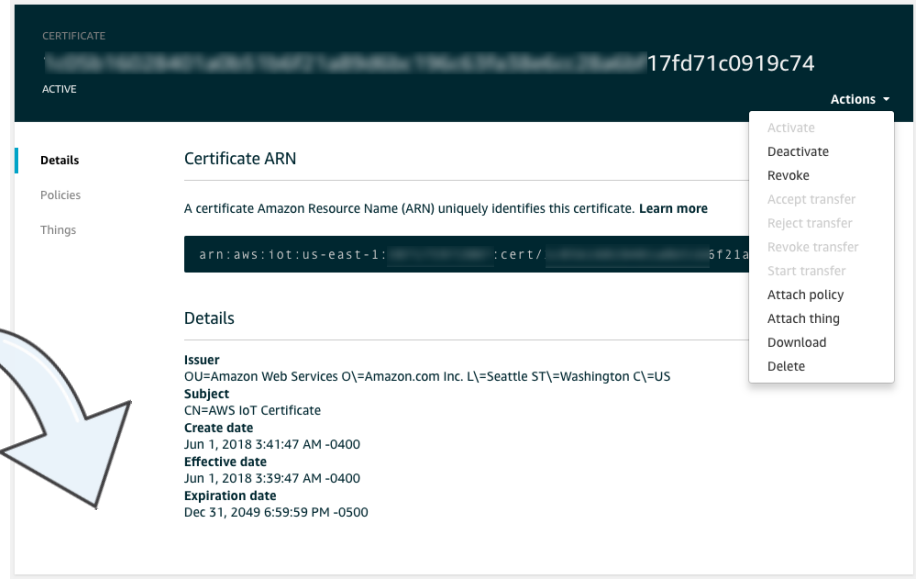


Message Broker

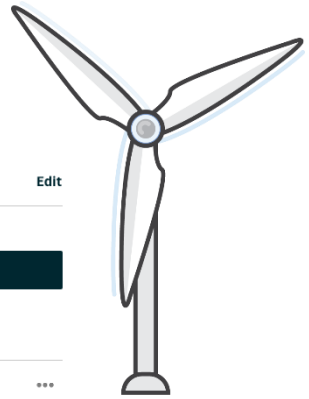
- MQTT-based routing
- Publish/Subscribe
- QoS 0/1
- Topics
  - Reserved ($aws/#)
  - Wildcards



Things management



Certificate



Thing

Policy


```
{
 "Version": "2012-10-17",
 "Statement": [
  {
   "Effect": "Allow",
   "Action": "iot:Connect",
   "Resource": "arn:aws:iot:us-east-1:123456789012:*"
  },
  {
   "Effect": "Allow",
   "Action": "iot:Publish",
   "Resource": "arn:aws:iot:us-east-1:123456789012:client/${iot:ClientId}"
  },
  {
   "Effect": "Allow",
   "Action": "iot:Subscribe",
   "Resource": "arn:aws:iot:us-east-1:123456789012:*"
  },
  {
   "Effect": "Allow",
   "Action": "iot:Receive",
   "Resource": "arn:aws:iot:us-east-1:123456789012:*"
  }
 ]
}
```

Rules Engine

Data transformation and actions

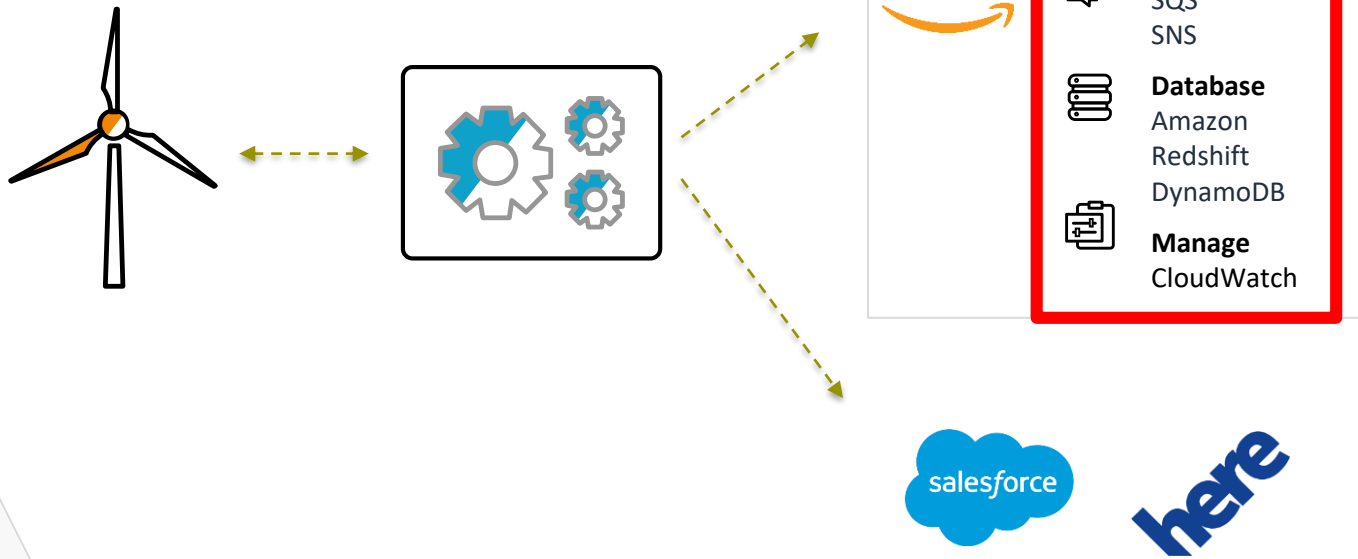
- Query language

SELECT * from 'topic/structure'

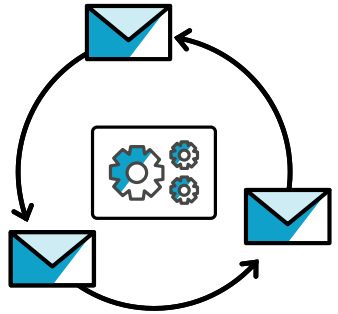
WHERE temperature > 35

- Topics

- Republish
- ML



Rules Engine



Overview

Description

Edit

No description

Rule query statement

Edit

The source of the messages you want to process with this rule.

```
SELECT hallsensor FROM 'lpc54018/demo' WHERE hallsensor > 4096
```

Using SQL version 2016-03-23

Actions

Actions are what happens when a rule is triggered. **Learn more**

Store messages in an Amazon S3 bucket
acmelambdas
Remove Edit

Add action

Error action

Optionally set an action that will be executed when something goes wrong with processing your rule.

Add action

Select an action.

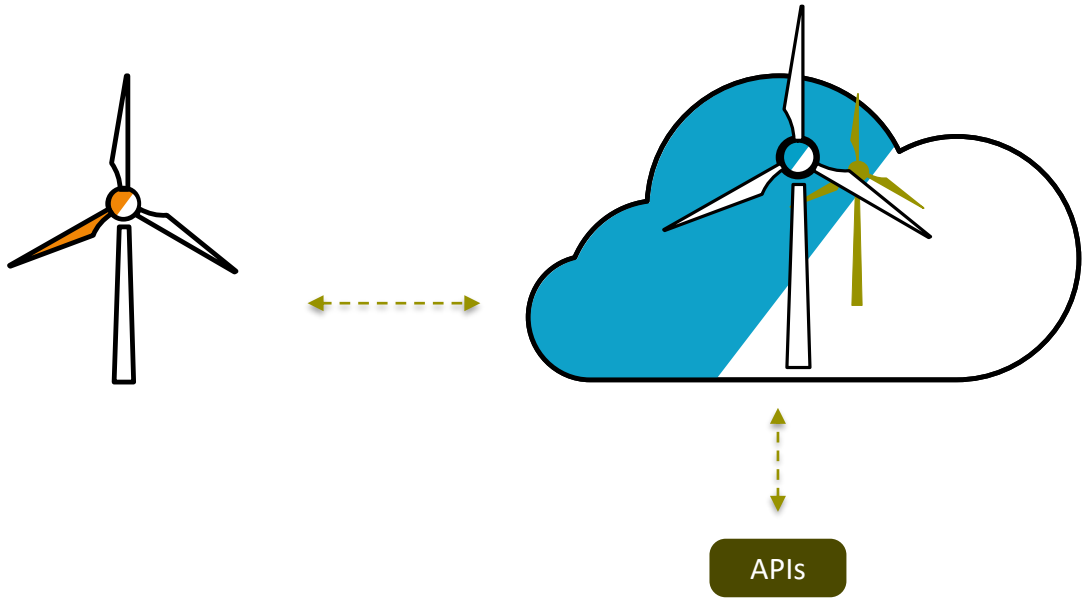
- Insert a message into a DynamoDB table — DYNAMODB
- Split message into multiple columns of a database table (DynamoDBv2) — DYNAMODBV2
- Invoke a Lambda function passing the message data — LAMBDA
- Send a message as an SNS push notification — SNS
- Send a message to an SQS queue — SQS
- Sends messages to an Amazon Kinesis Stream — AMAZON KINESIS
- Republish messages to an AWS IoT topic — AWS IOT REPUBLISH
- Store messages in an Amazon S3 bucket — S3
- Send messages to an Amazon Kinesis Firehose stream — AMAZON KINESIS FIREHOSE
- Sends message data to CloudWatch — CLOUDWATCH METRICS
- Change the state of a CloudWatch alarm — CLOUDWATCH ALARMS
- Send messages to the Amazon Elasticsearch Service — AMAZON ELASTICSEARCH
- Send message to a Salesforce IoT Input Stream — SALESFORCE IOT
- Send message to an IoT Analytics Channel — IOT ANALYTICS

Device Shadow

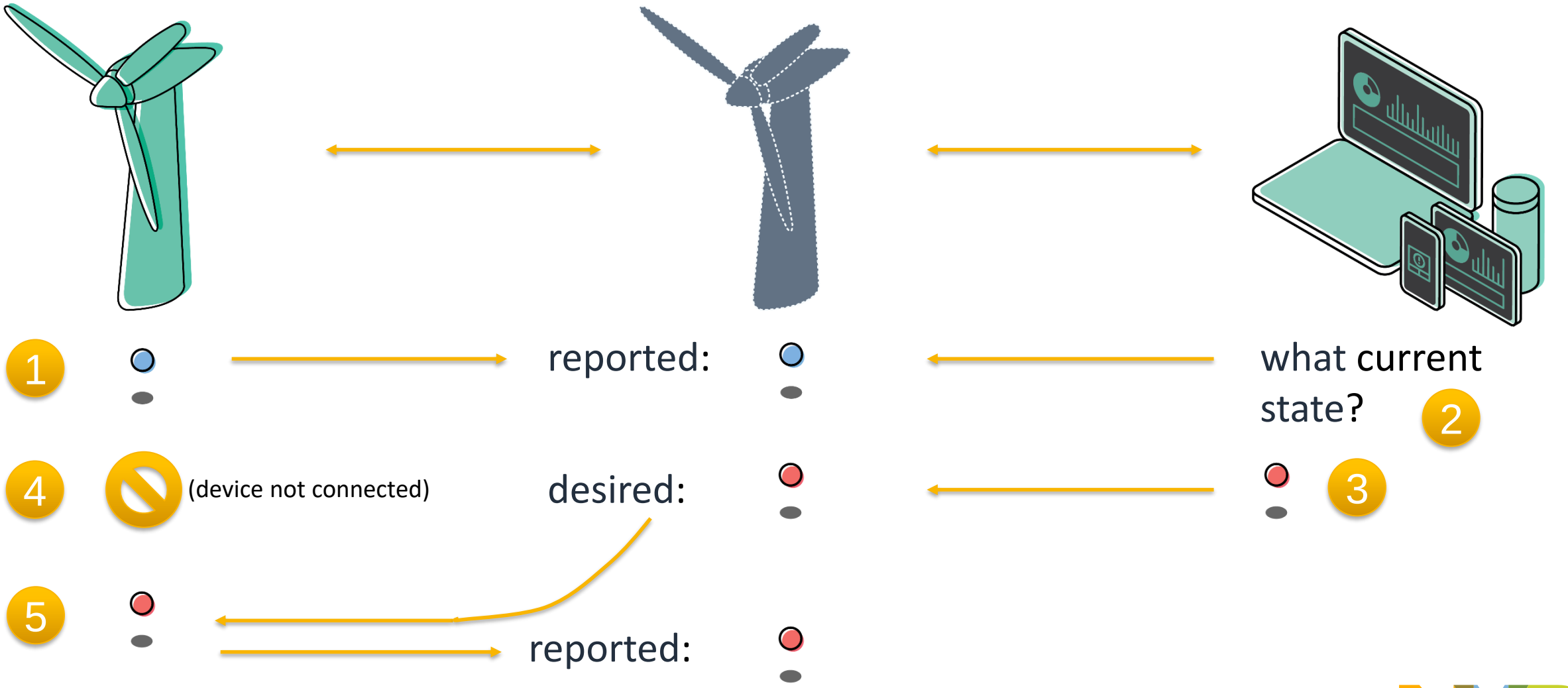
- Representation of state
  - Reported
  - Desired

```
{
  "desired": {
    "welcome": "aws-iot"
  },
  "reported": {
    "welcome": "aws-iot",
    "latitude": "38.10",
    "longitude": "98.17",
    "counter": "3",
    "button": "1"
  }
}
```

- Application interaction

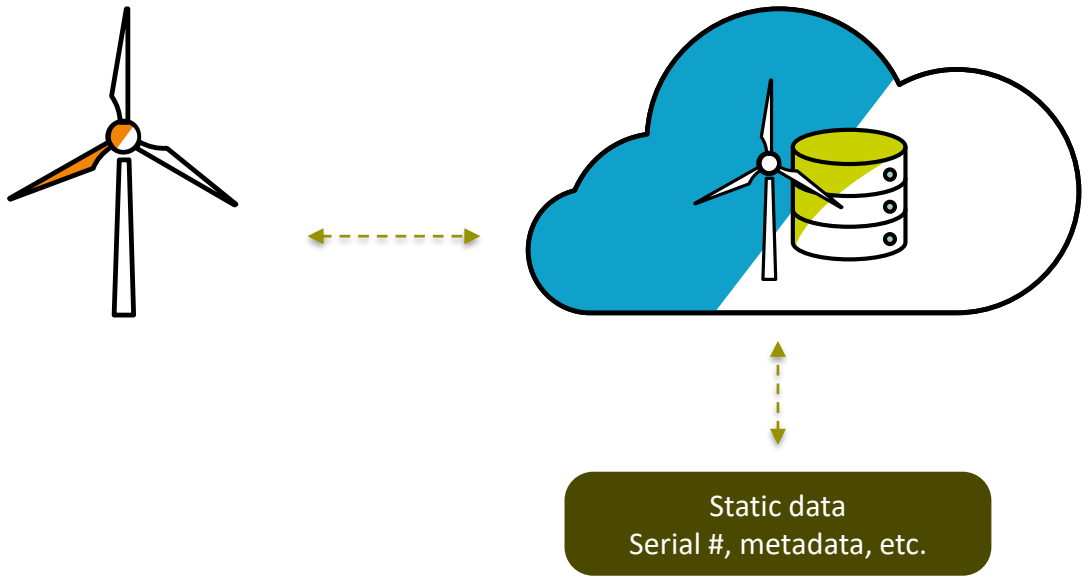


Device Shadows



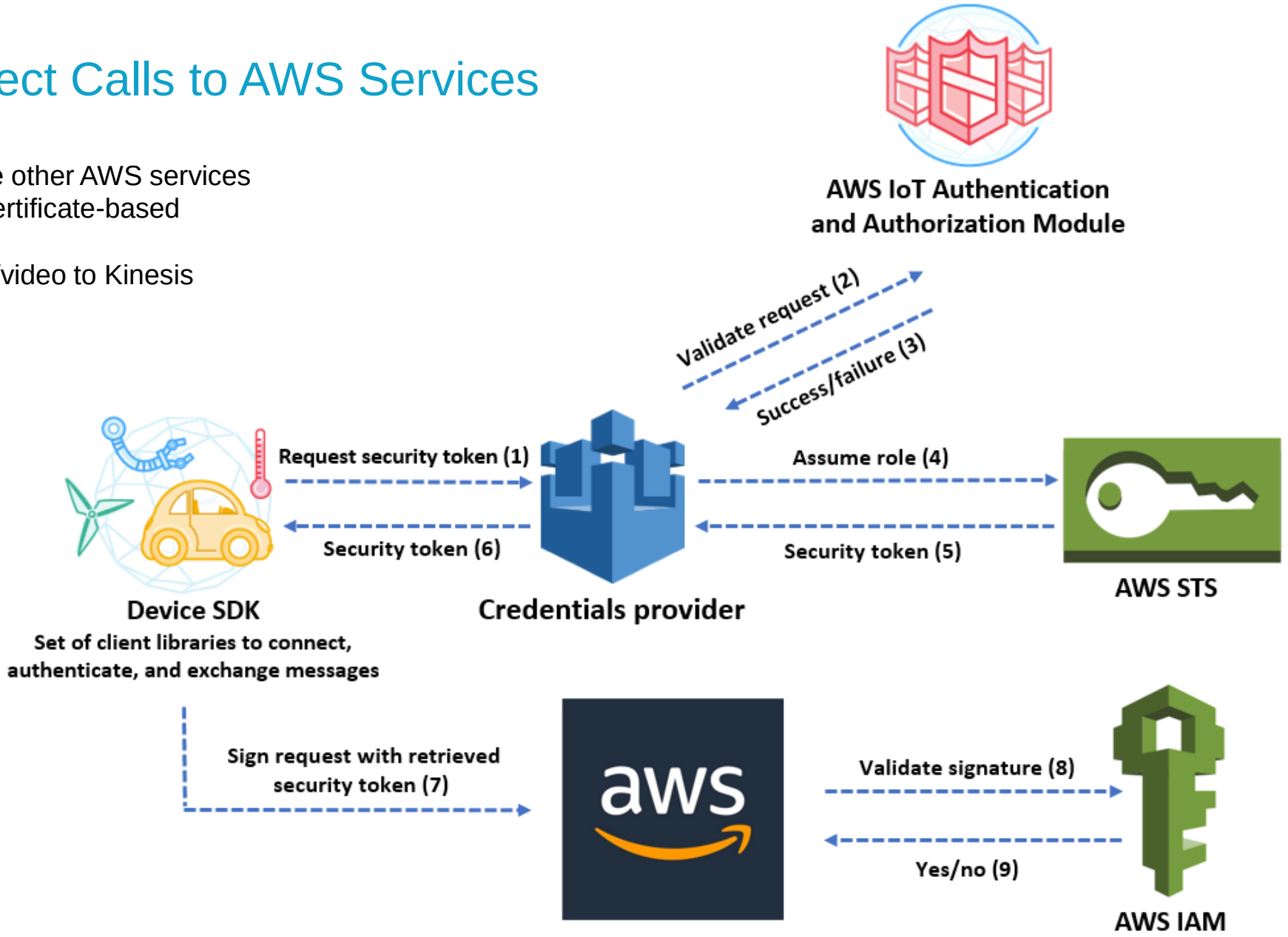
Registry

- Static device metadata
- ThingTypes
- Groups
- Jobs



Authorizing Direct Calls to AWS Services

Allows devices to use other AWS services that do not support certificate-based authentication
e.g. publishing audio/video to Kinesis stream

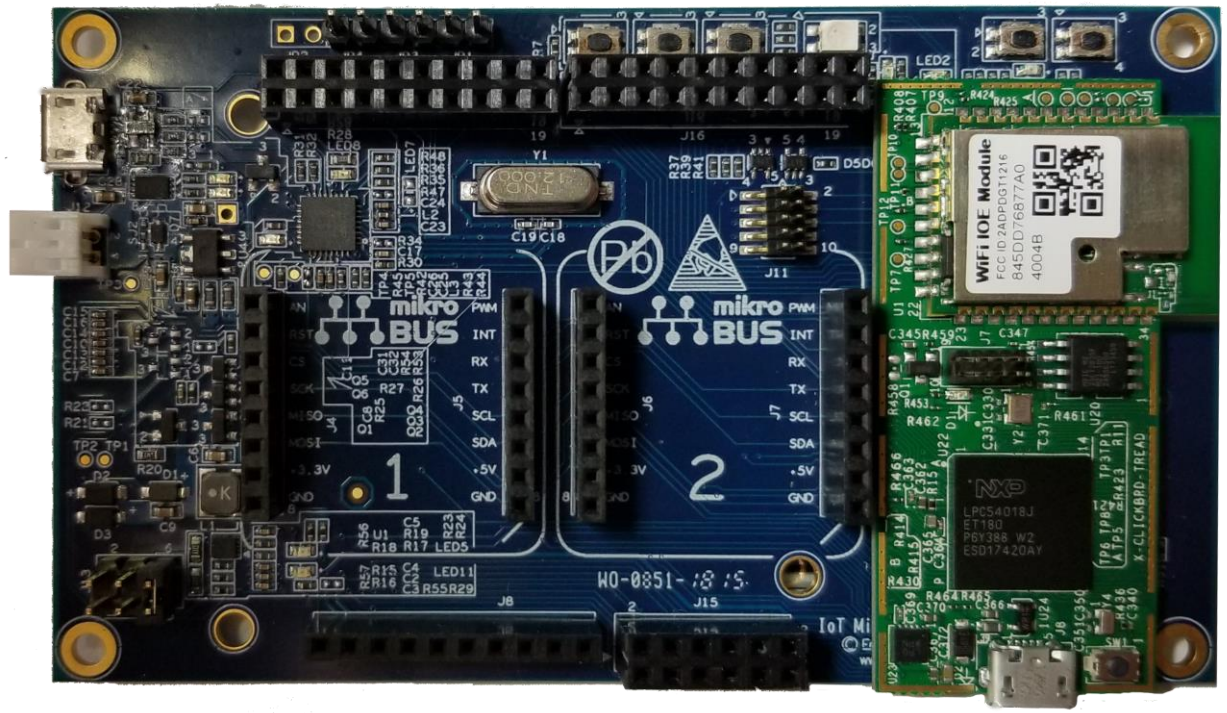


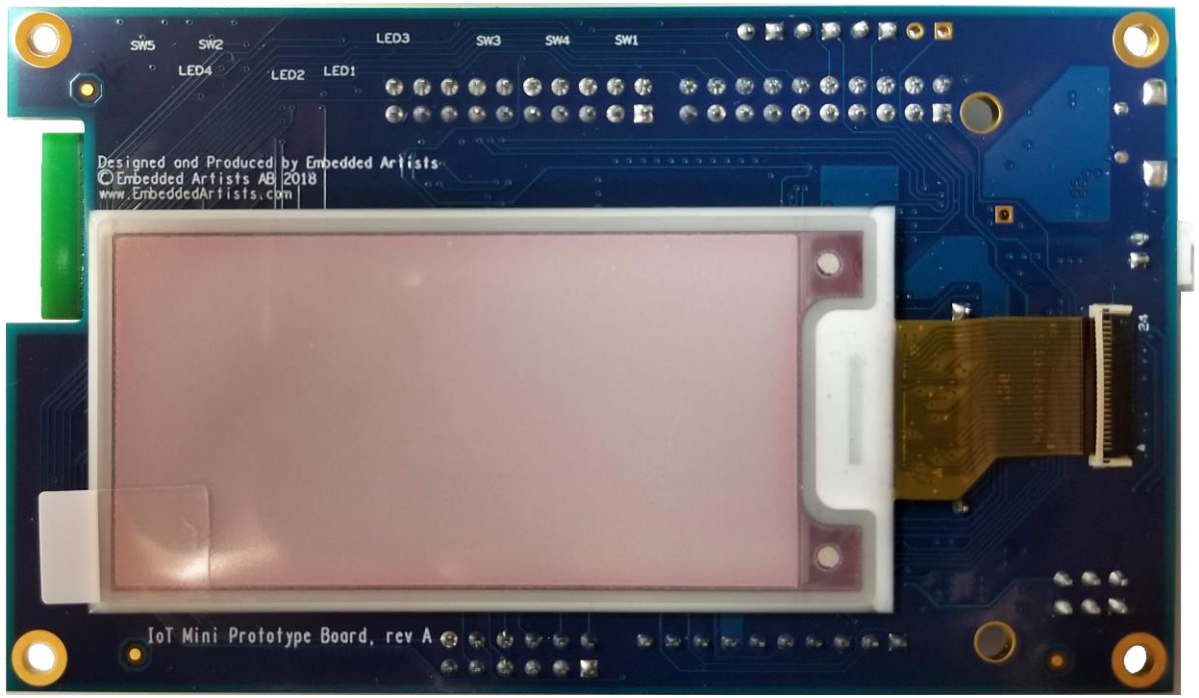
https://docs.aws.amazon.com/iot/latest/developerguide/authorizing-direct-aws.html

DEMO

DEMO

LPC54018
IoT Mini Prototyping board
3-color e-Ink display





DEMO

http://gs.aws.lc

RESOURCES

AWS Resources

- **Getting Started with the LPC54018 IoT Module**
  - https://docs.aws.amazon.com/freertos/latest/userguide/getting_started_nxp.html
- **Amazon FreeRTOS Github**
  - https://github.com/aws/amazon-freertos
- **Today's demo:**
  - https://github.com/embeddedartists/54018_iot

- **Commercial support:** aws-iot-commercial-nxp@amazon.com
- **Technical support:** aws-iot-technical-nxp@amazon.com

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