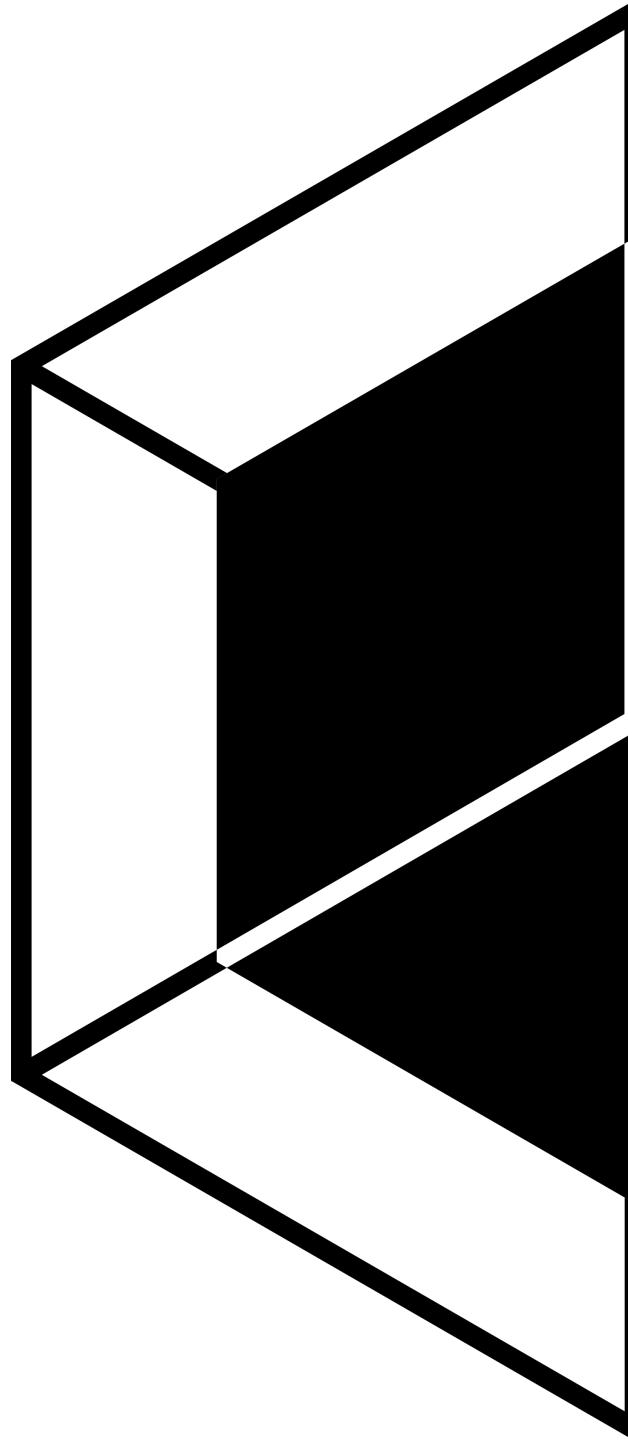


IoT and Cloud

ARTIK Based Product



What is an IoT Product?

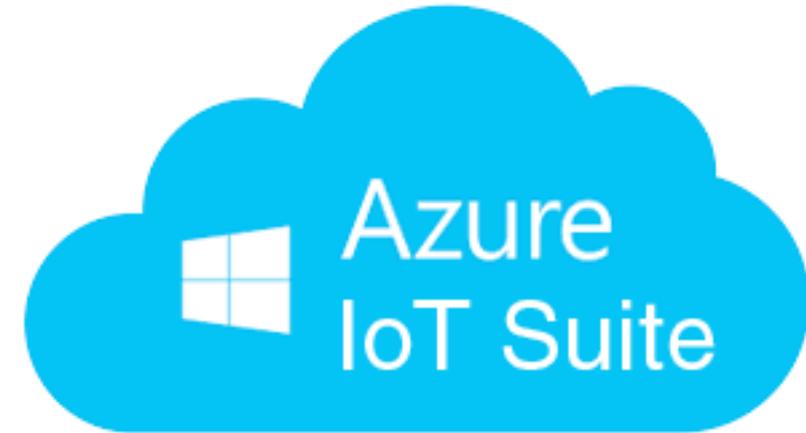
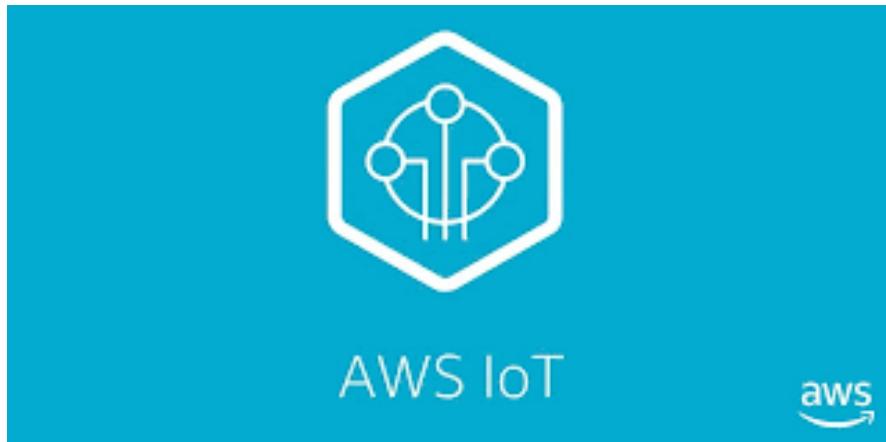
The interconnection via the **Internet**, of computing devices embedded in everyday objects, enabling them to send and receive **data**.

Source: Google



The IoT Technology Stack

IoT Clouds



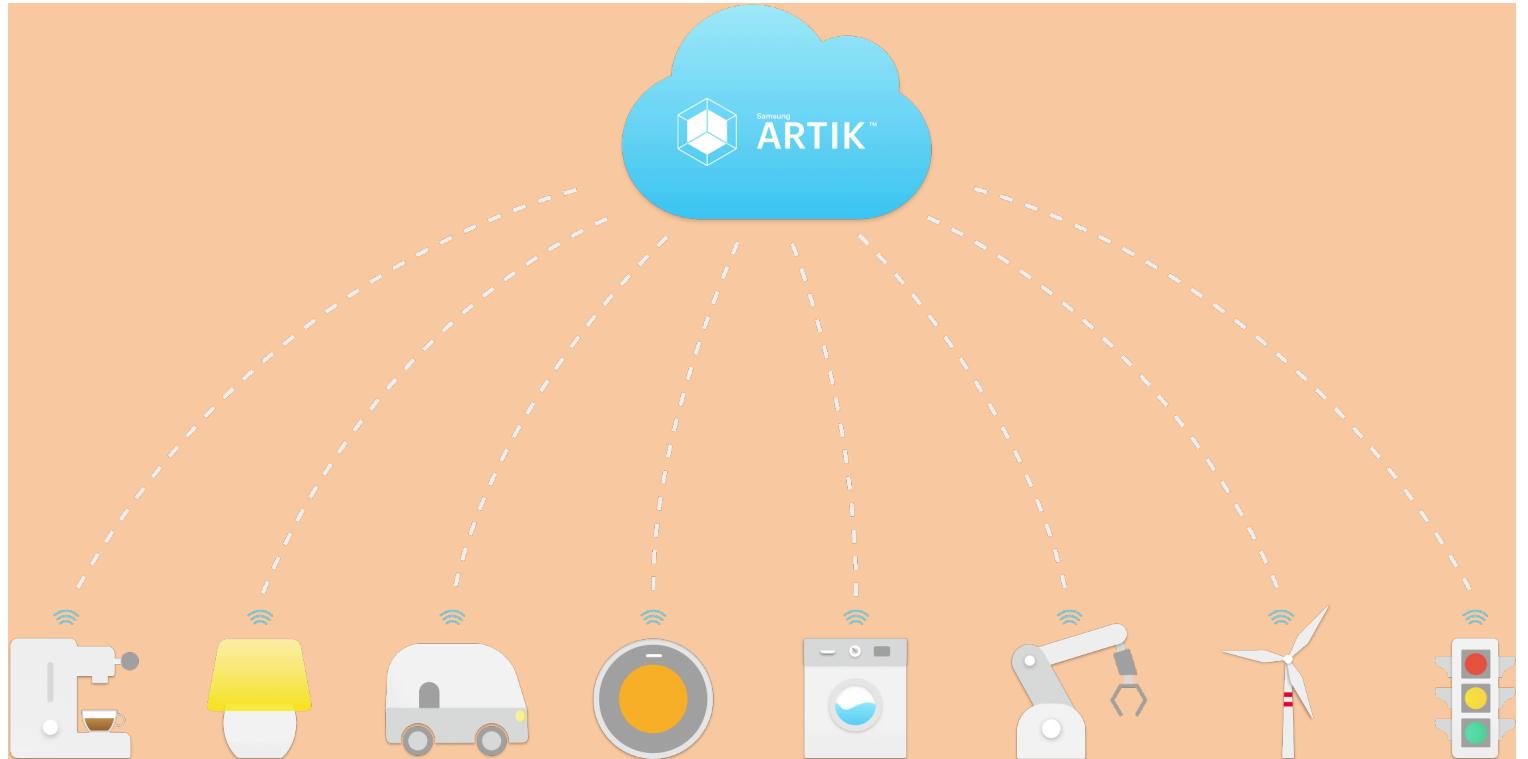
Cloud Digital Twin/Shadow

- Digital Representation of Device in the Cloud
 - Device reports State to the Cloud
 - Application updates Desired State in the Cloud
- State is synched in real-time or asynchronously (if offline)



Device – Cloud Interactions

- Onboarding
- Messaging
- Device Management
- OTA Updates
- Decommissioning/Transfer



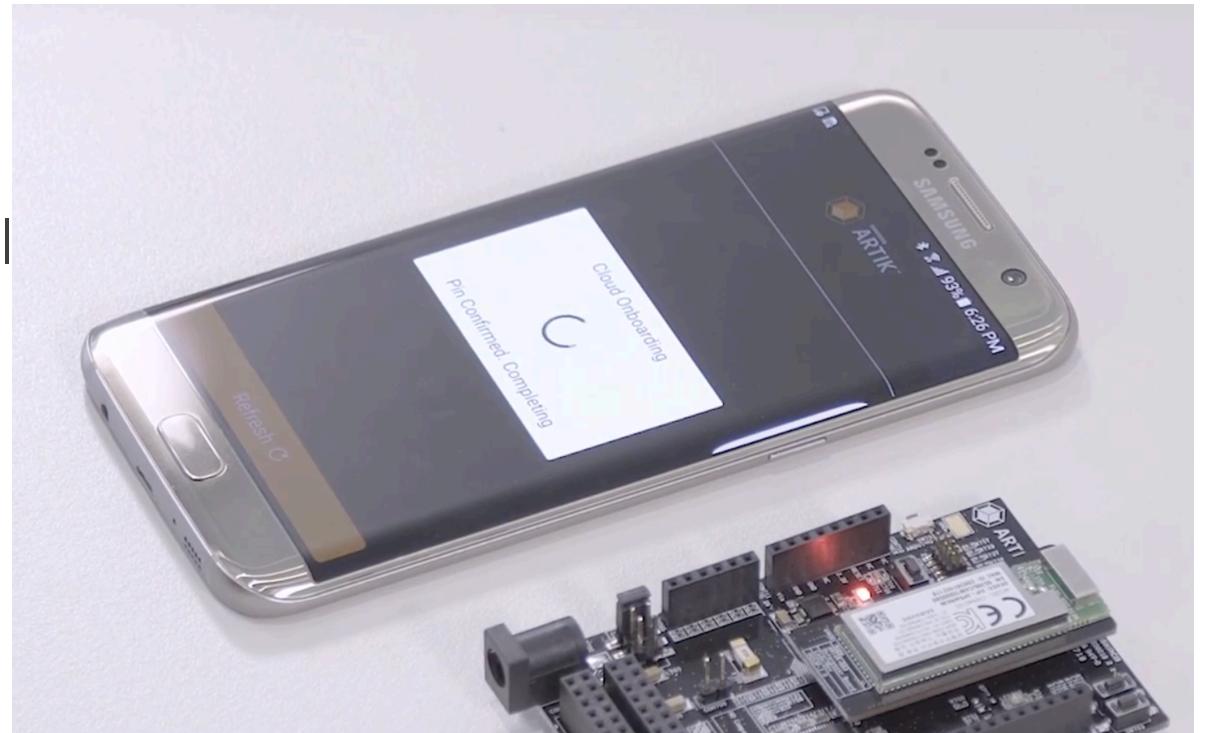
Onboarding – Getting Devices Connected

- Provision Wi-Fi on Device
- Authenticate with Cloud
- Create Digital Twin/Shadow
- Create Access Control Policies
- Store Device Information (App, Device)

Onboarding – ARTIK Mobile Reference Sample

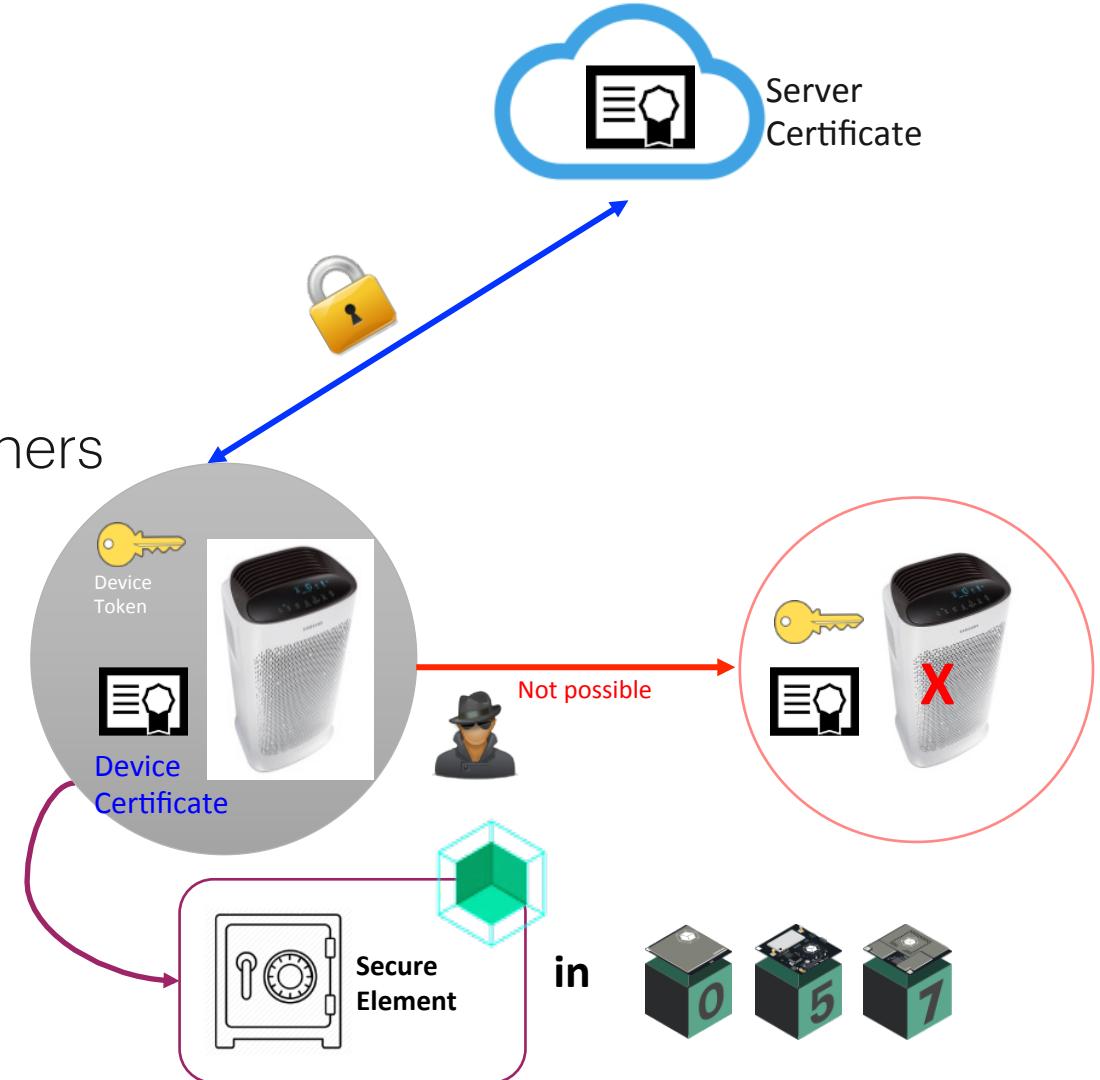


- QR Code Scanner to Identify Module
- BLE Onboarding for ARTIK 5, 7 Modules
- Soft AP Onboarding for ARTIK 05x Modules
- Reference Mobile Application source:
 - Android
 - iOS
- Extensible to support any Cloud

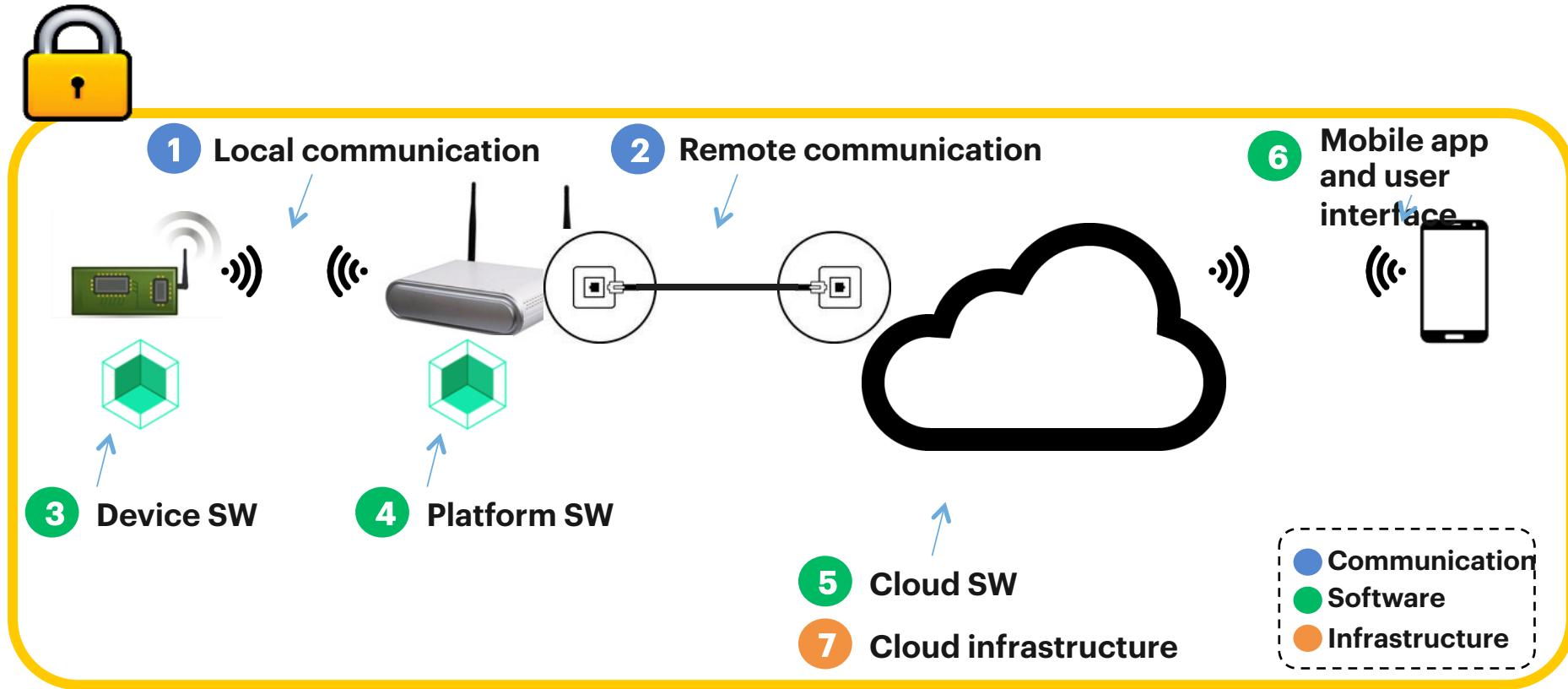


Authenticate with Cloud

- Secure communication (TLS)
 - Mutual authentication
 - Server & Clients can authenticate each others
- Root of Trust
 - The Secure Element (SE) hardens security



End to End Security



Create Access Control Rules

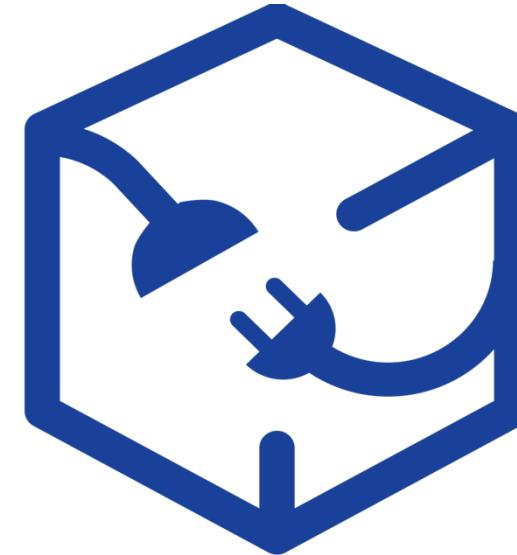
- ARTIK Cloud has default Access Control Policies (User + Device)
- Specify which Entities can perform Operations on Device Shadow/Twin
 - Read Properties
 - Write Properties
 - Update Device Shadow
 - Delete Device Shadow

Messaging

- Cloud Exchange
 - Messages capture Actual Device State
 - Actions to set Device to Desired State
- Protocols supported Out-of-the-Box:
 - REST
 - CoAP
 - MQTT
 - WebSocket

REST API

- Simple, scalable, light weight APIs for POST and GET messages
- Request-Response Messaging Pattern
- Latency determined by poll rate
- Less Impact on power
- Apps and Periodic postings



REST – Operations

VERB	OBJECTIVE	IoT Usage
GET	Retrieve information from resource	Get Device State
POST	Create new item in resource	Create Device, Create Device State
PUT	Replace existing item in resource	Update Device Information
DELETE	Delete existing item in resource	Delete Device
PATCH	Update existing item in resource	Update name/description of Device

Web Socket

- Advanced pipes for communication across devices
- Power hungry, as the socket needs to be open and listen always
- Lower Latency
- Sends Binary information
- Bi-Directional Communication
 - Real-time
 - Full Duplex

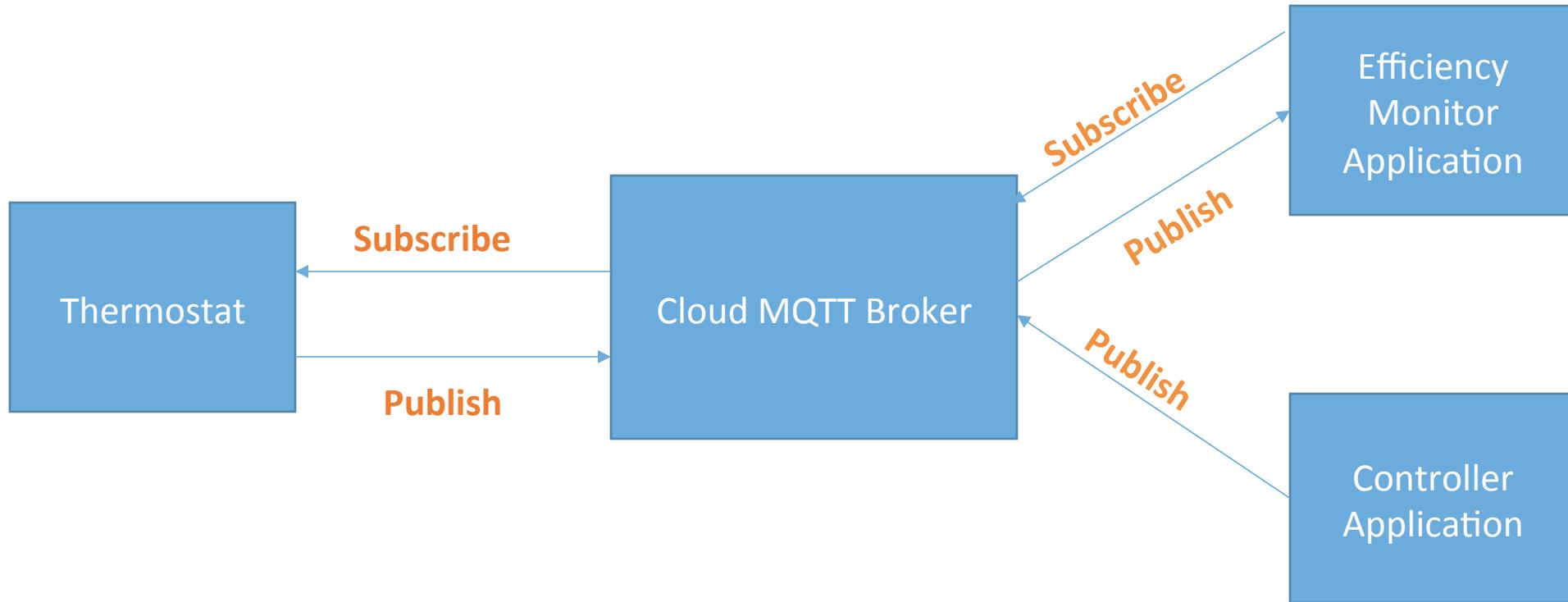


MQTT

- Message Queuing Telemetry Transport
- Publish-Subscribe Messaging Pattern
- MQTT is a many-to-many protocol for passing messages between multiple clients through a central broker
- Extremely Light weight:
 - Messages with 2B header, sent Asynchronous with SSL/TLS
 - Suitable for Low power sensor



MQTT



CoAP

- CoAP is a one-to-one protocol for transferring state information between client and server.
- Support observing resources, best suited to a state transfer model, not purely event based
- Request-Response, or Publish-Subscribe communication model
- Support RESTful API with 4B header
- Supports Dynamic discovery

Messaging Protocol Considerations

	Characteristics	Communication style	So what ?	For whom
REST	Simple, scalable, light weight APIs for POST and GET messages	Client/server message postage communication	Latency determined by poll rate Less Impact on power	Apps and Periodic postings
Web Socket	Advanced APIs for event driven real time responses	Interactive communication	Very less latency, Power hungry, as the socket needs to be open always	Devices that need to react in real-time
MQTT	Extremely Light weight messaging protocol	Publish-Subscribe	Consumes least power. Not suitable for data stream	Extremely Low power sensor
CoAP	UDP based light weight protocol	Client/Server messaging over UDP and DTLS	Small packet size,	Sensor streams

Device Management

- Securely Manage a Fleet of Devices
 - Read Properties (Serial Number, Firmware Version, Battery Level, Error Information,...)
 - Update Properties (Current Time, Timezone, UTC offset)
 - Execute (Reboot, Factory Reset, Reset Error Code, Update Firmware)
- LWM2M / MQTT

Over-the-Air Updates

- Update any application/system component:
 - Firmware
 - Linux Packages
 - Machine Learning Models
- Signed Package sent to Device as a URI
- Verify Task success/failure

References

- <https://developer.artik.io/documentation/artik/cloud-services/>

Cloud Services		
Cloud Services		
SERVICE	TUTORIAL DESCRIPTION	RELATED PROJECT
ARTIK Cloud	Blinking an LED and retrieving sensor data	MQTT series
AWS S3	File "bucket"	Object detection
AWS Rekognition	Object detection	Smart trash can
AWS Greengrass	Deployment of encapsulated compute modules (AWS Lambda functions)	OPC-UA
FRED	Node-RED in the cloud	
Google Assistant	Speech recognition	
Kairos	Facial recognition	Identity detection
ThingWorx	Industrial control and monitoring	ThingWorx agent (A05X)