aws internet of things

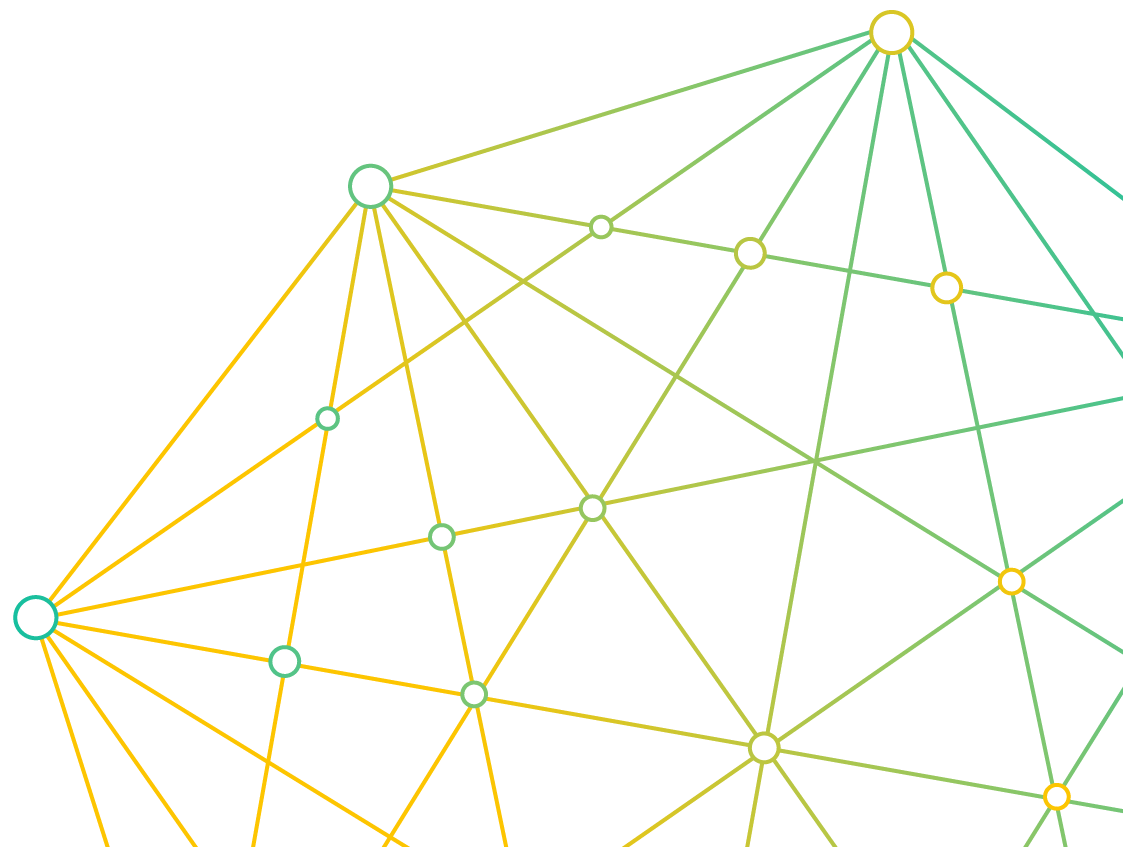# Building next-gen consumer products with AWS IoT edge services

Indraneel Mitra (Neel)
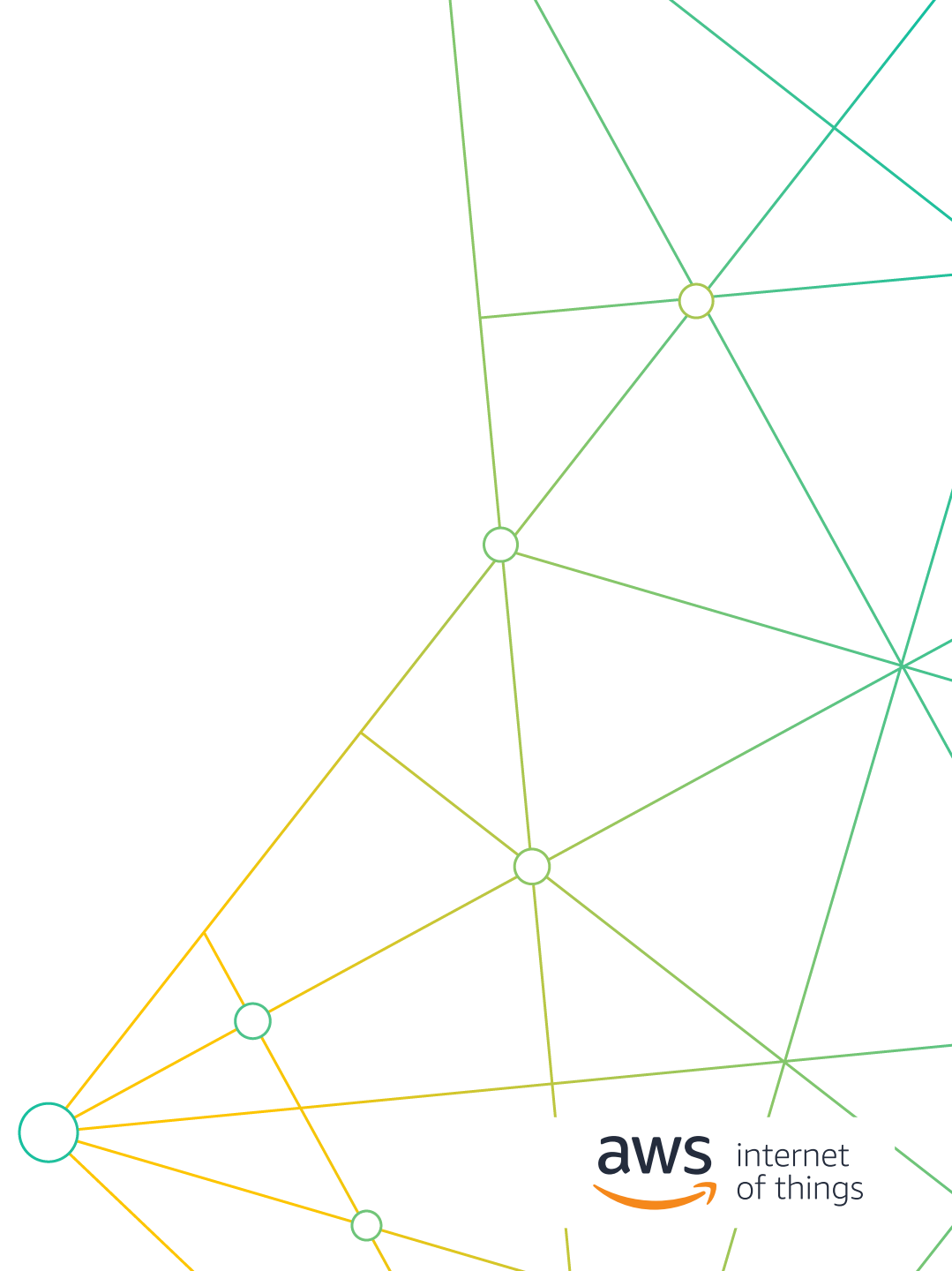Principal SA IoT
AWS

Aaron Schram, Ph.D.
CTO
www.edntech.com

May 5 2021

Agenda

- Use cases , Challenges, Customers
- AWS IoT Edge services Overview
- FreeRTOS
- Greengrass
- Fireside chat with Aaron
- Q & A

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AWS IoT customers are innovating in every part of a consumer's life.

Home automation

Alexa, ...

Security & monitoring

Networking
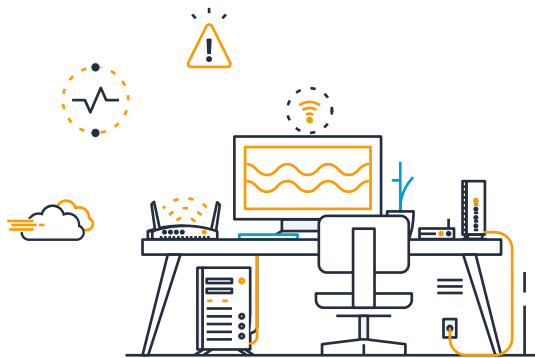
Energy Management

Health & Wellness

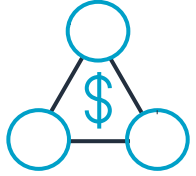aws internet of things
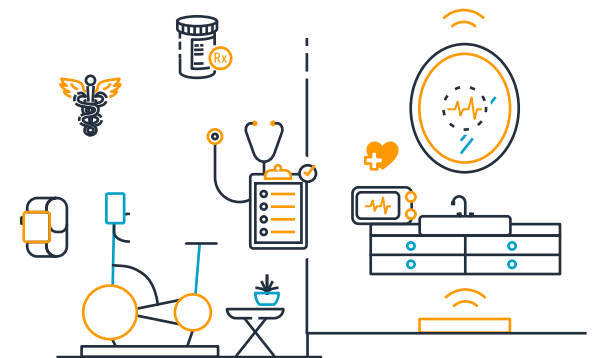
Common challenges of connected products

Turning data into value

Creating new revenue streams with innovative services while managing & reducing IoT operating costs

Managing & scaling large fleets

Ability to scale to millions of devices globally with tools to simplify device management
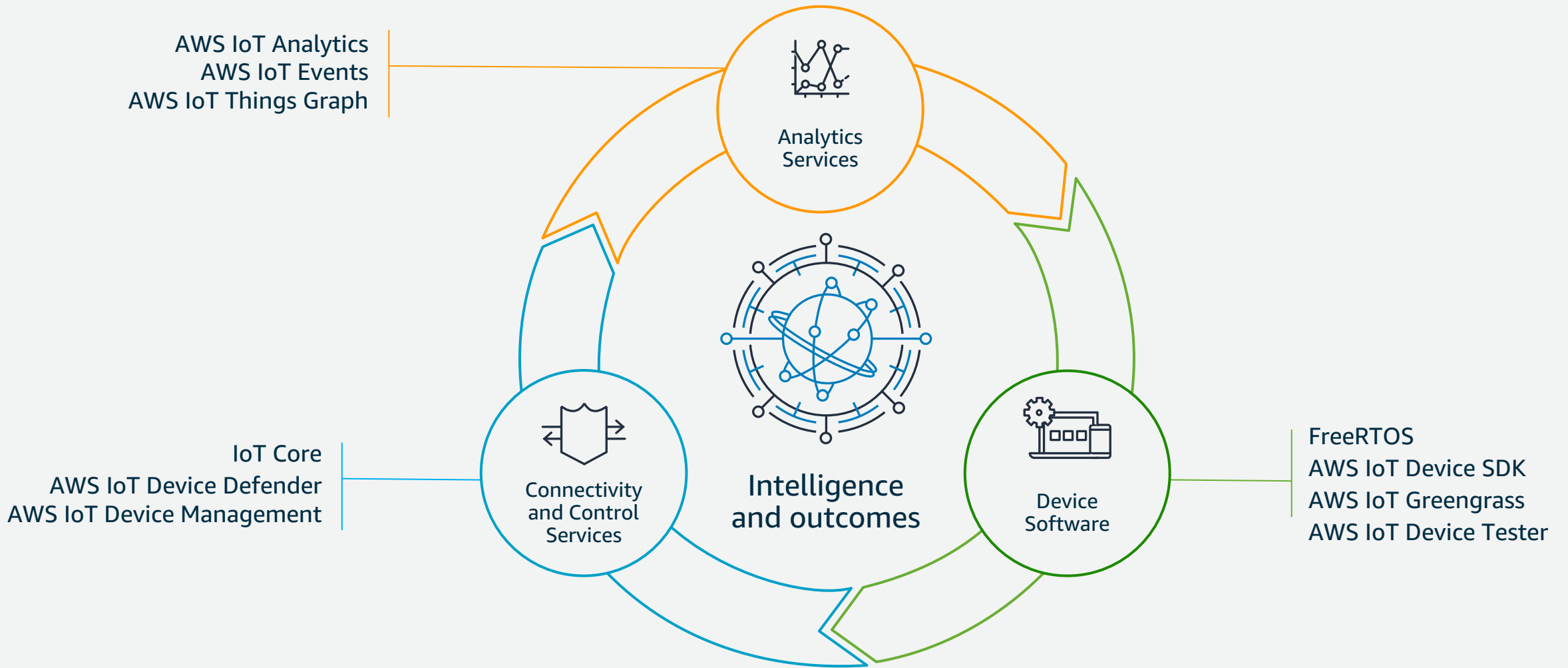
Managing security & privacy

Keeping devices, IoT data and customer information secure and protected from threats to minimize customer issues

Customer experience & support

Create a seamless customer experience across IoT devices and apps, and improve the customer support process

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Easily build secure connected products and solutions at scale with AWS IoT

AWS IoT Analytics
AWS IoT Events
AWS IoT Things Graph

Analytics Services

IoT Core
AWS IoT Device Defender
AWS IoT Device Management

Connectivity and Control Services

Intelligence and outcomes

Device Software

FreeRTOS
AWS IoT Device SDK
AWS IoT Greengrass
AWS IoT Device Tester

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IoT virtuous cycle

AWS IoT SiteWise

AWS IoT Analytics

AWS IoT Events

AWS IoT Things Graph

Analytics
Services

Intelligence
and outcomes

Connectivity
& Control
Services

AWS IoT Core

AWS IoT Device Management

AWS IoT Device Defender

Device
Software

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Software

FreeRTOS

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FreeRTOS

18+ years, trusted, and widely distributed

40+ supported architectures, including RISC-V and Arm v8-M

Broad ecosystem support

Free and open source

MIT Open Source License

Improved Inter-Process Communication (IPC) capabilities with stream and message buffers

Device software

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FreeRTOS Libraries

FreeRTOS Kernel

Real Time Operating System (RTOS)

Local Connectivity

Communicate with AWS IoT Greengrass devices without a cloud connection
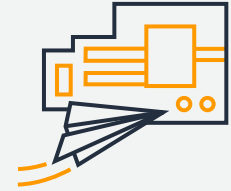
Cloud Connectivity

Easily collect data & take actions on microcontroller -based devices

Security

Secure device data and connections

OTA & Code Signing

Deploy security updates, bug fixes, and firmware updates to devices in the field

FreeRTOS Long Term Support

Device software

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FreeRTOS: New features

- FreeRTOS **Long Term Support** (LTS) release

- FreeRTOS **Cellular LTE-M** library

- **OTA** features:

  - Pause and resume

  - Job configurations (e.g. rollout, abort, execution timeout)

  - Update multiple file types

- **FreeRTOS kernel 1.4.0** with improved memory protection unit support

- **40+ AWS IoT reference integrations** from 20 silicon partners

Device
software

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IoT Reference Integrations

IoT virtuous cycle

AWS IoT SiteWise

AWS IoT Analytics

AWS IoT Events

AWS IoT Things Graph

Analytics
Services

Intelligence
and outcomes

Connectivity
& Control
Services

AWS IoT Core

AWS IoT Device Management

AWS IoT Device Defender

Device
Software

FreeRTOS

AWS IoT Greengrass

AWS IoT Device SDK

AWS IoT Device Tester

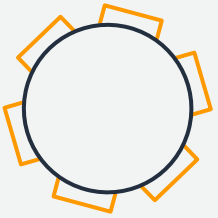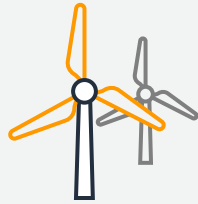aws internet of things

AWS IoT Greengrass Edge Capabilities

Local Messages and Triggers

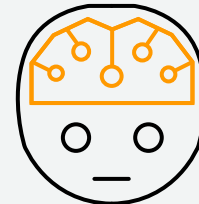Enable device communication without a cloud connection

Data and State Sync

Operate devices offline & synchronize data when reconnected

Choice of Runtime

Use AWS Lambda, Docker, OS native processes, or any edge runtime

ML Inference

Perform ML Inference locally
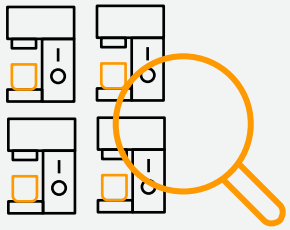
Stream Manager

Collect, process, & export high-volume data streams from edge devices

Secrets Manager

Deploy secrets to edge devices

AWS IoT Greengrass Tools and Cloud Capabilities

Remote Fleet Management

Deploy and manage apps on millions of devices

Components

Software unit that is deployed to and runs on Greengrass Core device

Over the Air Updates

Easily update AWS IoT Greengrass Core

Security

Mutual authentication & authorization, both locally and with the cloud
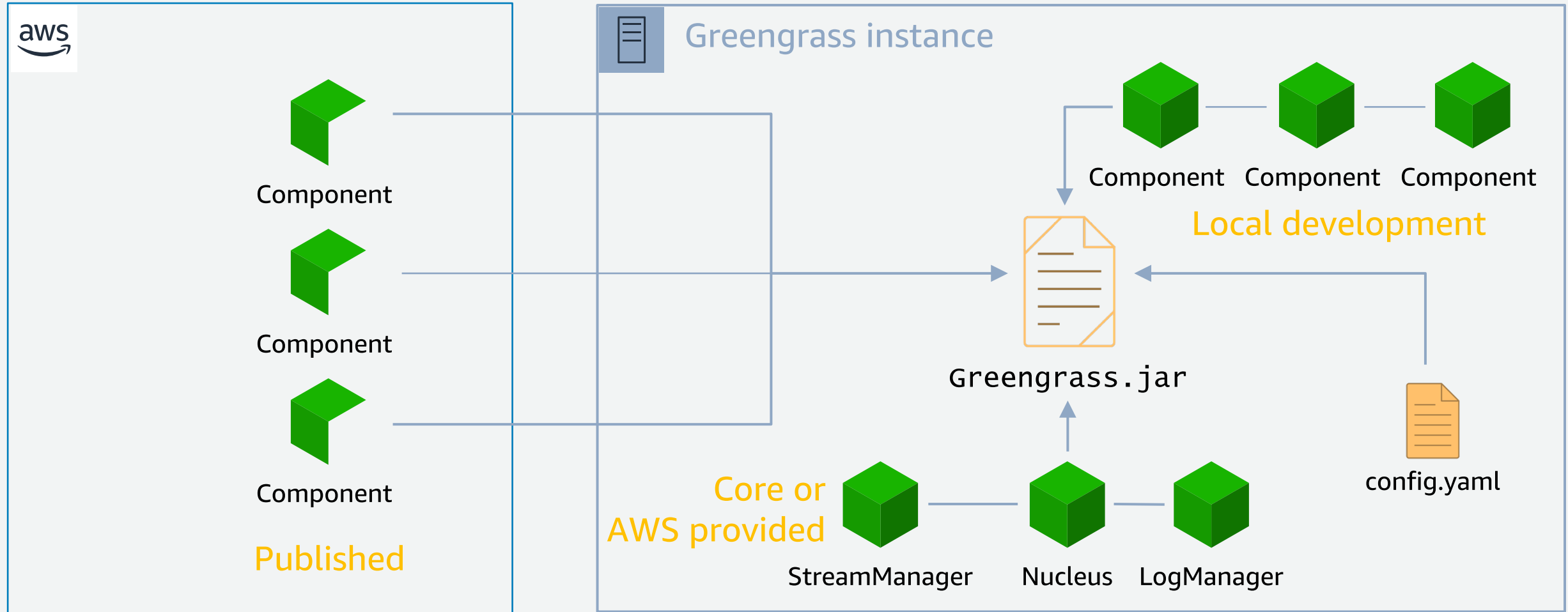
Local Tools

CLI and Local Debug Console support device-first development

Local Resource Access

AWS Lambda functions can access & use local resources of a given device

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AWS IoT Greengrass 2.0 – New features

aws

Component

Component

Component

Published

Greengrass instance

Component   Component   Component

Local development

Greengrass.jar

config.yaml

Core or
AWS provided

StreamManager   Nucleus   LogManager

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of things

Components

Component = Recipe file + Artifacts

Component categories

- Core

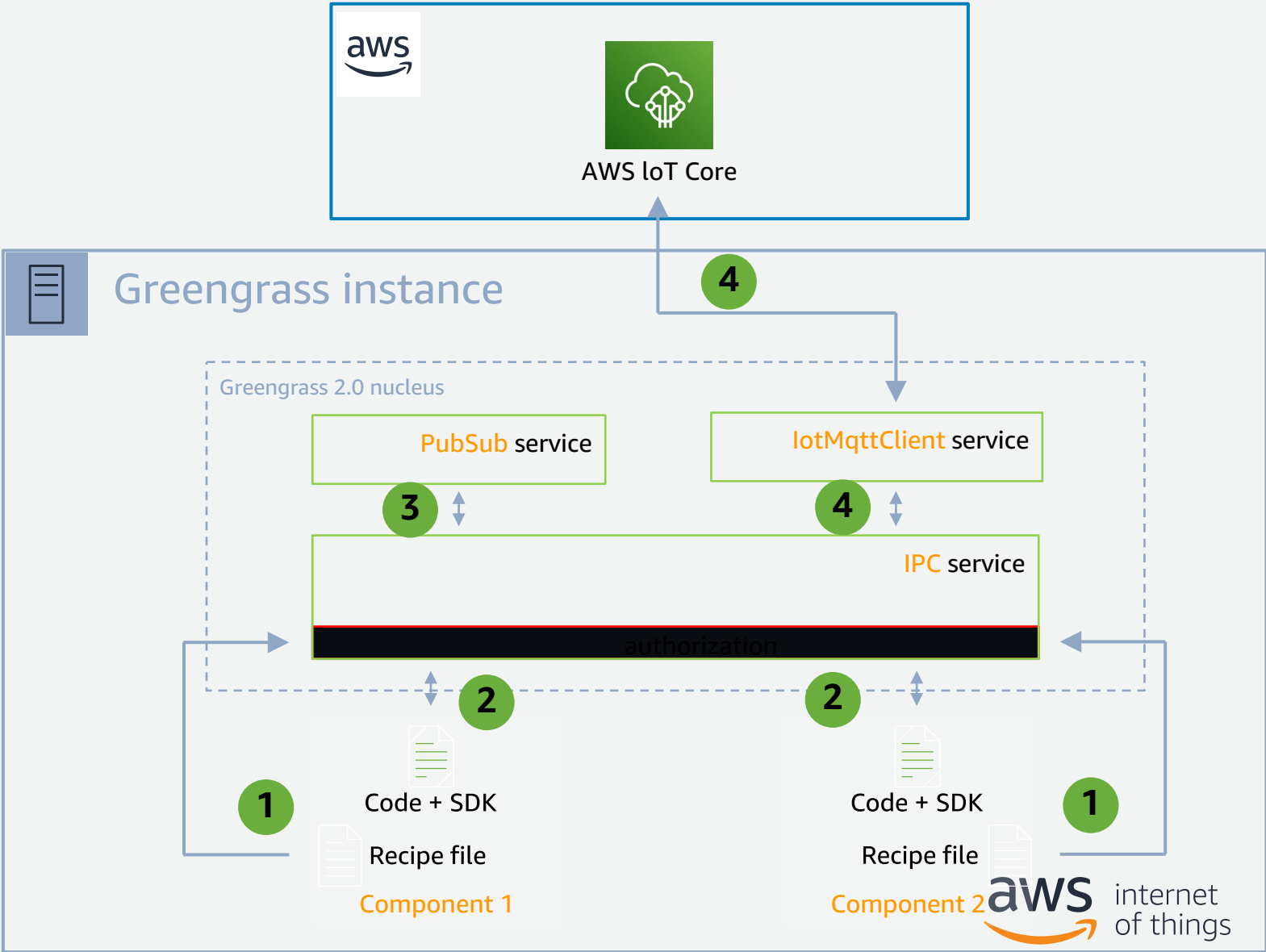- Public (AWS)

- Private (customer)

Dependency mapping

```
---
RecipeFormatVersion: 2020-01-25
ComponentName: demo.example.hello_world
ComponentVersion: '1.0.0'
ComponentDescription: My first AWS IoT Greengrass component.
ComponentPublisher: Amazon
ComponentDependencies:
  aws.greengrass.TokenExchangeService:
    VersionRequirement: '>=0.0.0'
    DependencyType: HARD
ComponentConfiguration:
  DefaultConfiguration:
    Message: world
Manifests:
  - Platform:
      os: linux
    Lifecycle:
      Run: |
        while true; do
          python3 {artifacts:path}/hello_world.py \
            '{configuration:/Message}'
          sleep 5
        done
    Artifacts:
      - URI: s3://BUCKET/artifacts/demo.example.hello_world/...
```
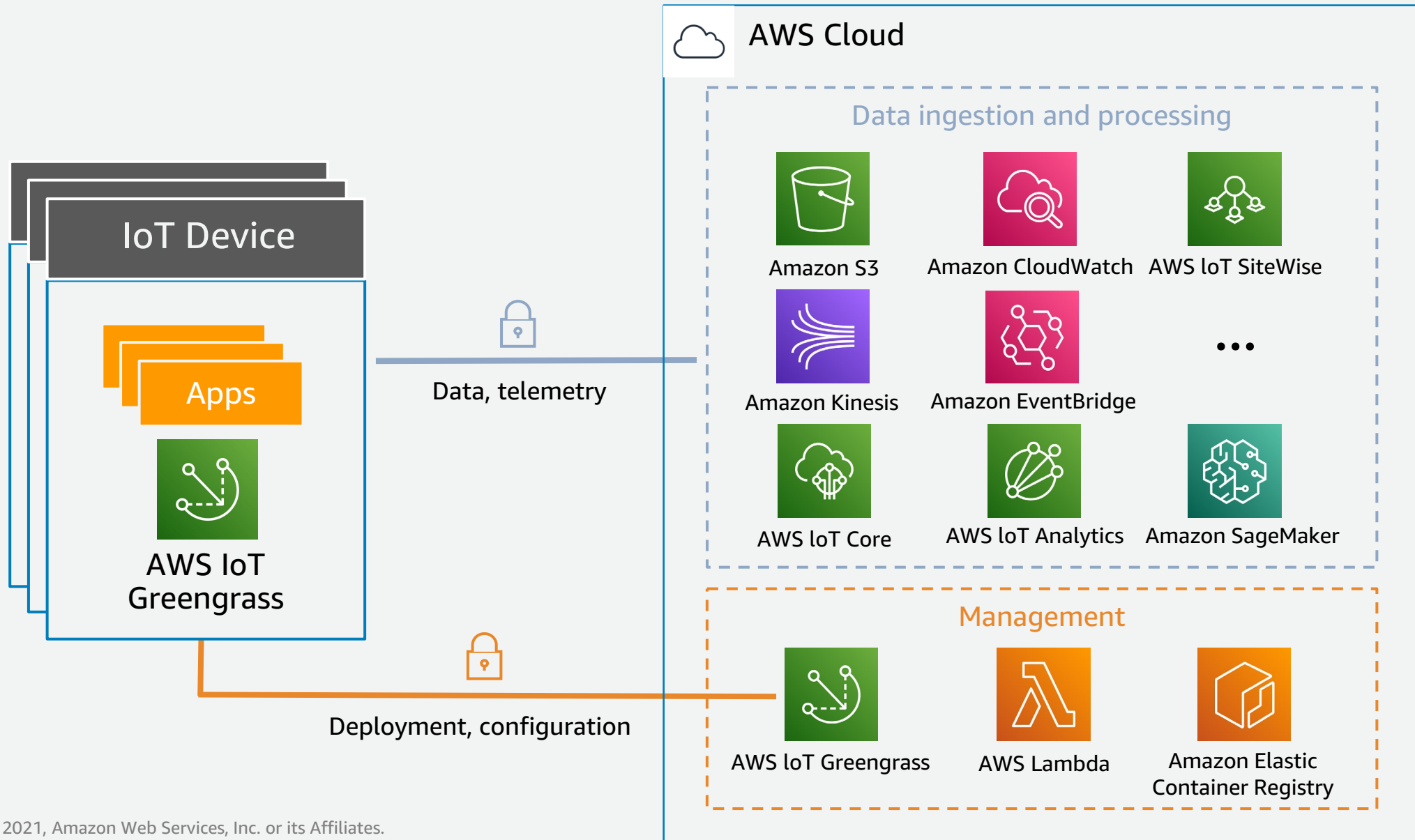
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Inter-process communication

Authorization policies
Events
Interactions
  PubSub
  IotMqttClient

Component 1

PUB local: topicA

Component 2

SUB local: topicA

PUB cloud: topicB

AWS IoT Core

Greengrass instance

Greengrass 2.0 nucleus

PubSub service   IotMqttClient service

3   4

IPC service

authorization

2   2

Code + SDK   Code + SDK

1   1

Recipe file   Recipe file

Component 1   Component 2

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Pre-integrated with AWS cloud services

AWS Cloud

Data ingestion and processing

Amazon S3

Amazon CloudWatch

AWS IoT SiteWise

Amazon Kinesis

Amazon EventBridge

• • •

AWS IoT Core

AWS IoT Analytics

Amazon SageMaker

IoT Device

Apps

AWS IoT Greengrass

Data, telemetry

Deployment, configuration

Management

AWS IoT Greengrass

AWS Lambda

Amazon Elastic Container Registry

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HIVE

CHALLENGE

Centrica Hive, a leading UK Smart Home company, creates a family of smart products and services that connect customers' homes to make daily living easier. Hive products work best when they work together and can be managed remotely using the Hive Hub and app. With a cloud platform already leveraging Amazon EC2, Hive wanted to lower their operational complexity and cost per customer by moving from bespoke EC2 deployments to utilizing AWS IoT services.

SOLUTION

Hive used AWS IoT to move data to the edge, closer to the home and customer. With AWS IoT Core and AWS IoT Greengrass, Hive brought local security, automatic management, and machine learning capabilities to their Hive Hubs, migrating 879,000 live hubs to their new IoT platform without end customers noticing.
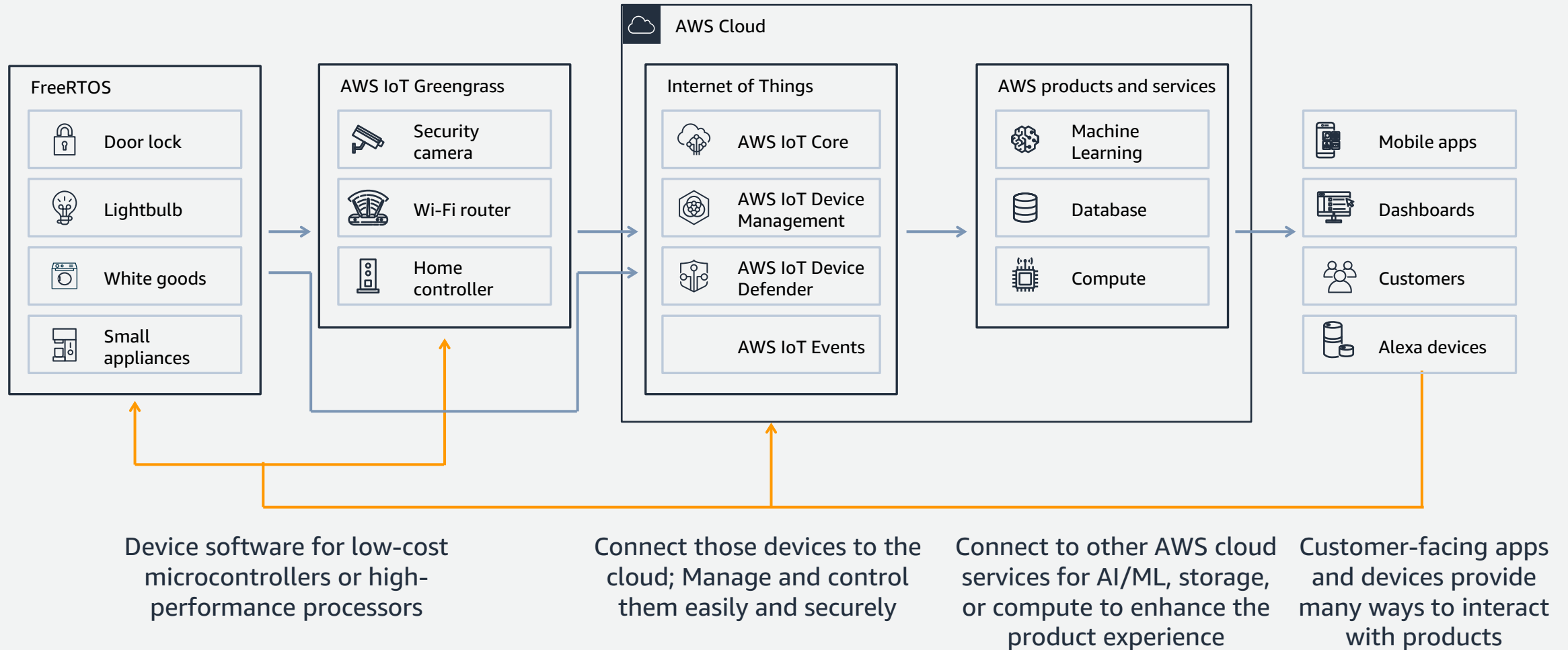
IMPACT

Migrating from AWS EC2 to AWS IoT Core and AWS IoT Greengrass, Hive significantly lowered operational costs. By moving data to the edge, Hive reduced its AWS cloud costs to create a more distributed architecture that provided the foundation for Hive to deploy new features quicker, while still being able to service millions of customers.
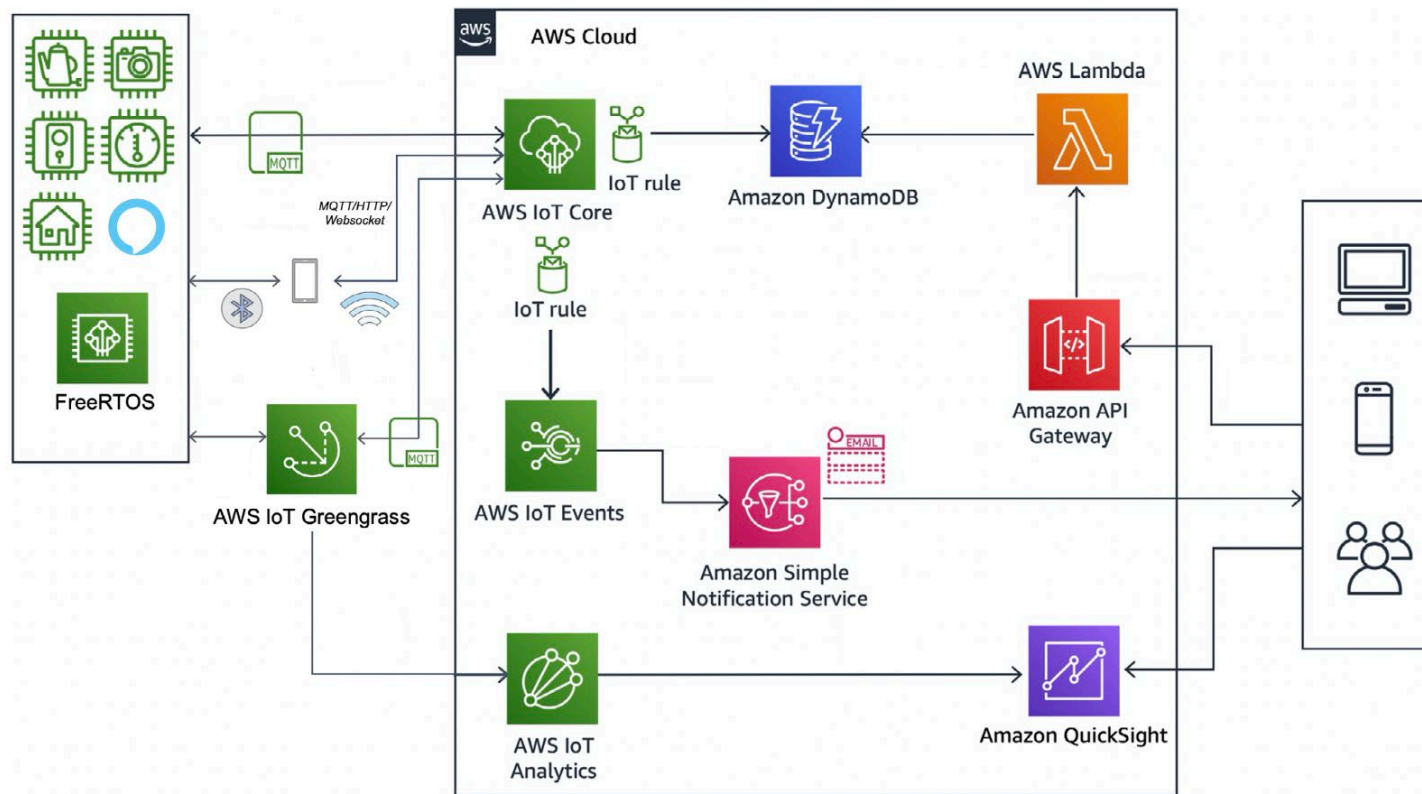
Bringing everything together

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How it works

FreeRTOS
- 🔒 Door lock
- 💡 Lightbulb
- White goods
- Small appliances

AWS IoT Greengrass
- Security camera
- Wi-Fi router
- Home controller

AWS Cloud

Internet of Things
- AWS IoT Core
- AWS IoT Device Management
- AWS IoT Device Defender
- AWS IoT Events

AWS products and services
- Machine Learning
- Database
- Compute

- Mobile apps
- Dashboards
- Customers
- Alexa devices

Device software for low-cost microcontrollers or high-performance processors

Connect those devices to the cloud; Manage and control them easily and securely

Connect to other AWS cloud services for AI/ML, storage, or compute to enhance the product experience

Customer-facing apps and devices provide many ways to interact with products

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How it works

Connect FreeRTOS devices to AWS IoT services

Summary

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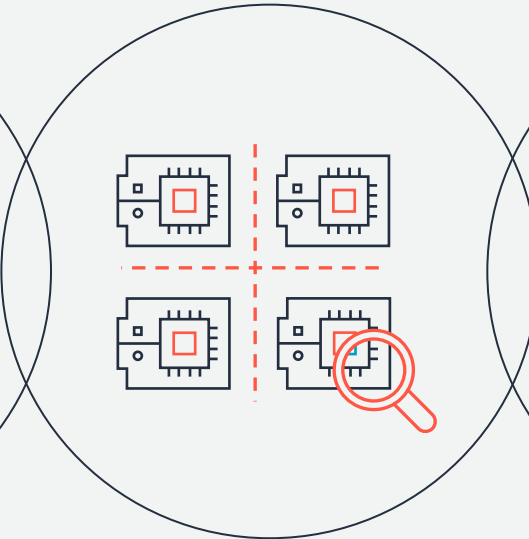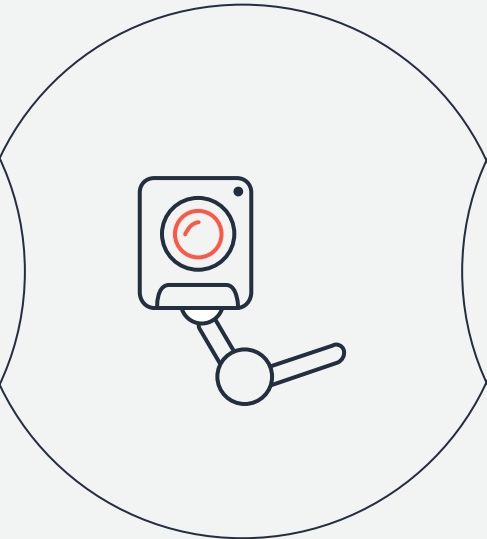# Device lifecycle management with AWS IoT

Onboard
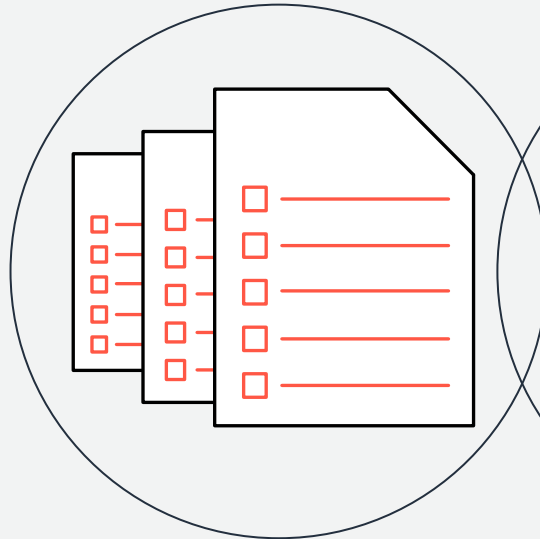
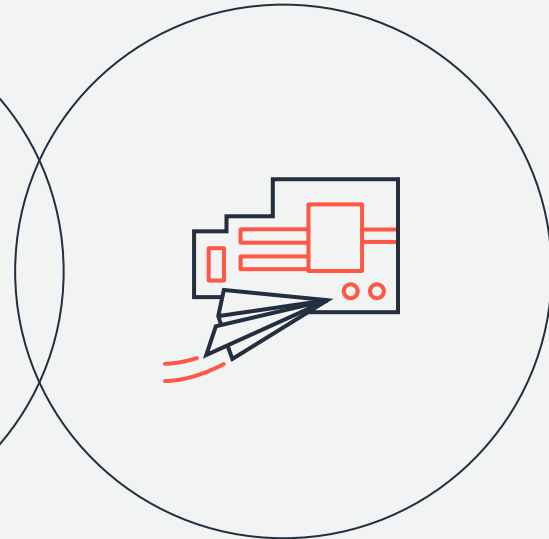Register and configure devices with a few clicks

Organize

Understand the health and status of your device fleet

Monitor

Collect device logs to quickly identify and remediate problems

Update

Organize and trigger actions on devices

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Unlocking the value of connected data

Data for internal insights

Usage patterns

Customer support

Engineering & quality

Design optimization

Warranty

Data for ecosystem

Add-on services

Accessories

Upsell opportunities

3rd party apps

Distribution network

Data for customers

Predictive maintenance

Energy optimization

Customer satisfaction

Part replacement

Maintenance optimization

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Fireside chat with Aaron Schram

CTO
www.edntech.com

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Bringing Nature Indoors

Aaron Schram, CTO, ēdn

People ~~want~~ *need* nature.

Yet we spend 90% of our lives inside
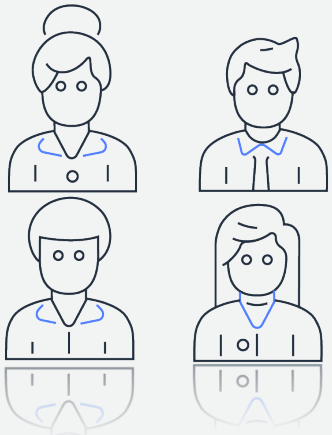
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"I speak for the trees for the trees have no tongues."
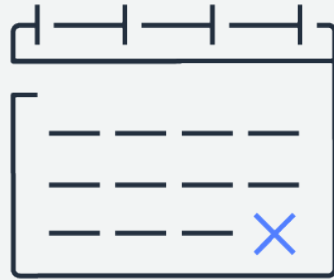
— Dr. Seuss, The Lorax

aws

We build **technology** that **speaks** for nature.
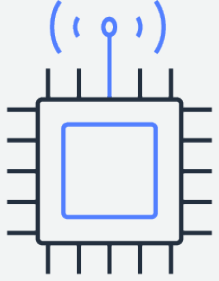
Design Constraints

Small Team

Limited Timeline

Cost

Managed Services

Core Architecture Design Goals

Provisioning

State Management

Security

Jobs and OTA

Extensible Clients

CX Support

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AWS IoT Core-Based Architecture

Provision - **IoT & FreeRTOS**

State - **Device Shadow**

Sec. - **Device Defender**
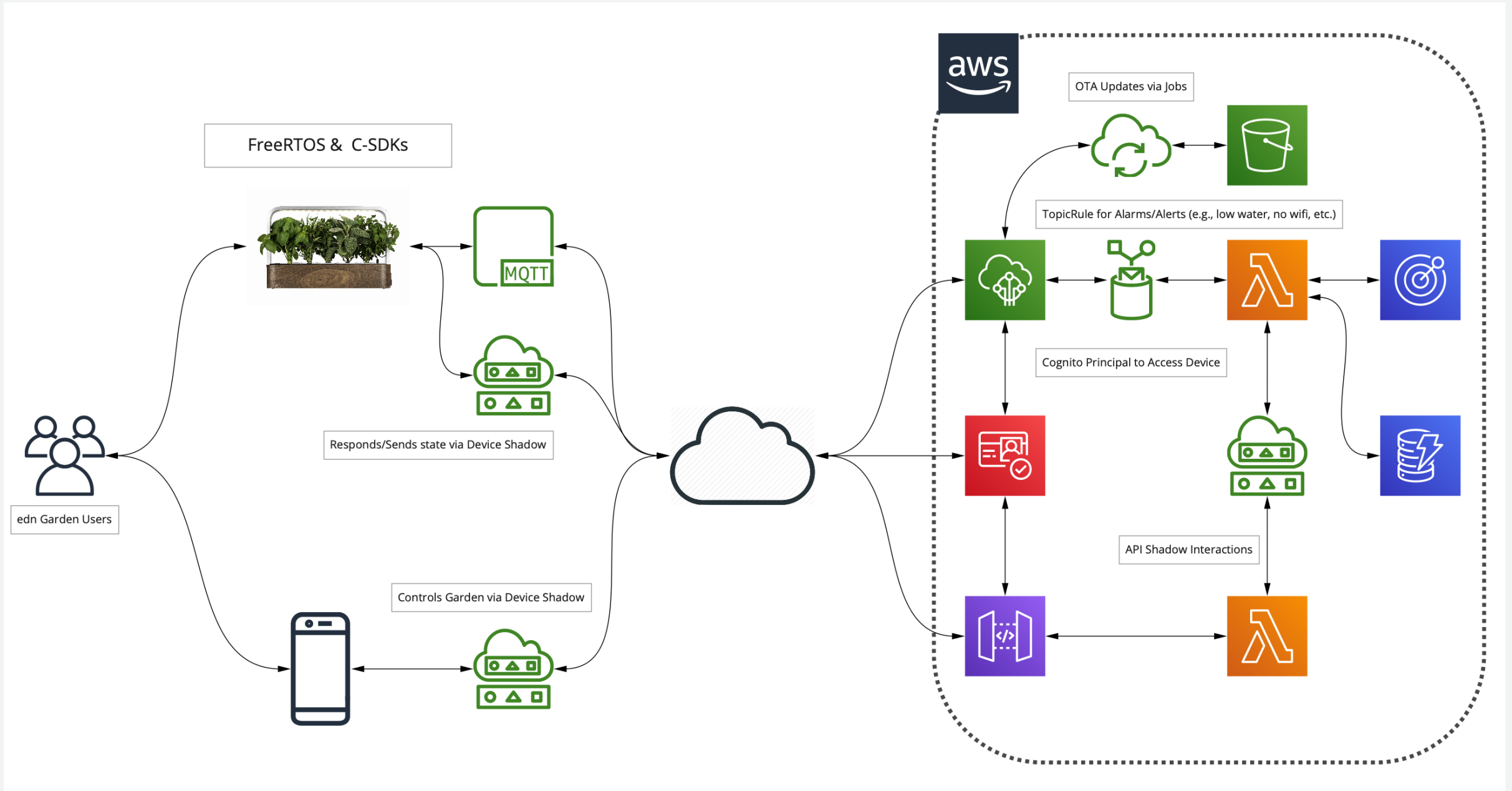
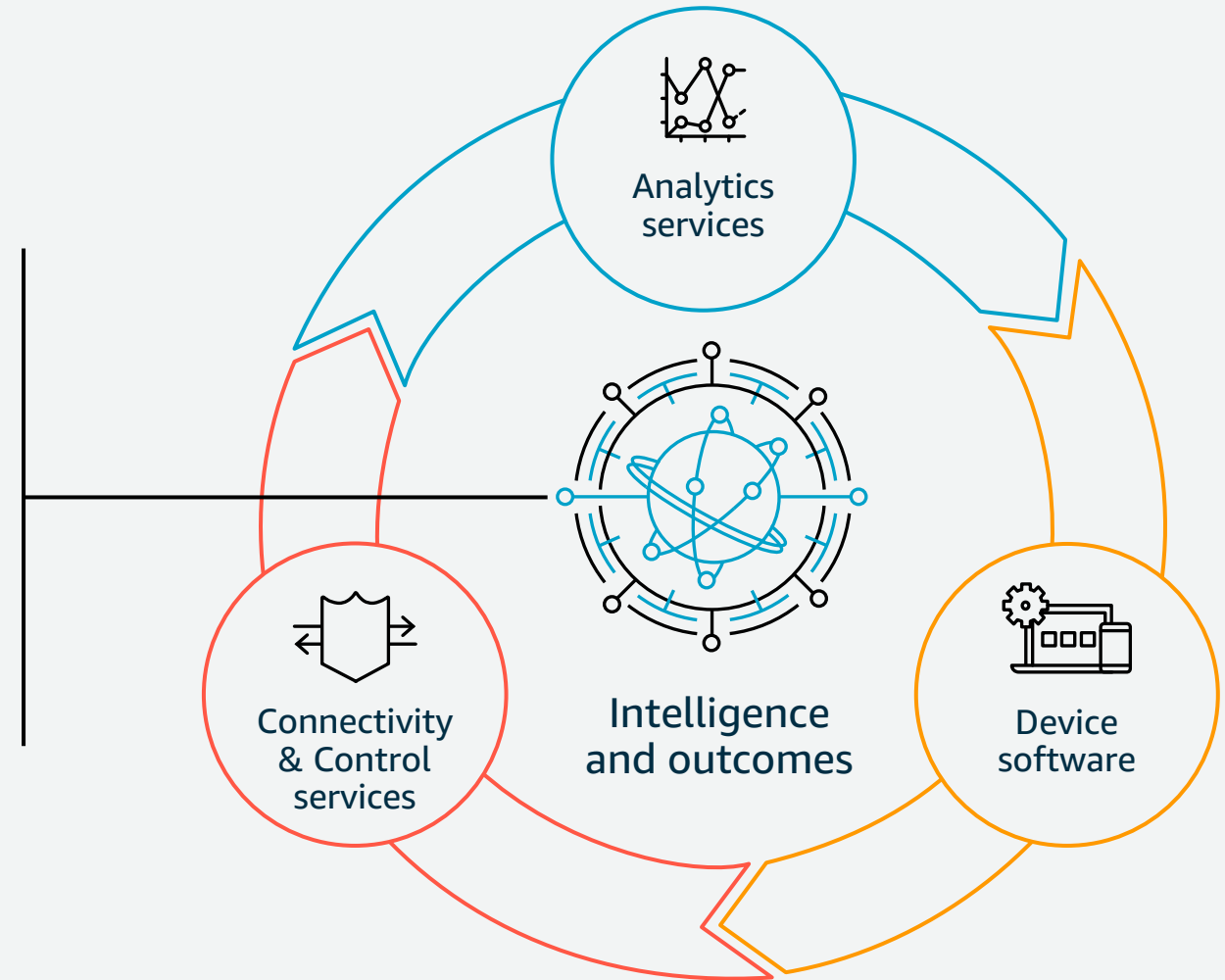OTA - **Jobs Framework**

Clients - **MQTT**

CX - **FleetHub**

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AWS IoT Enabled a Focus on Business Logic

- Pairing
- Water Level
- Grow Lighting
- Additional Sensors
- Fleet Metadata
- Integrations

FreeRTOS & C-SDKs

MQTT

OTA Updates via Jobs

TopicRule for Alarms/Alerts (e.g., low water, no wifi, etc.)

Responds/Sends state via Device Shadow

Cognito Principal to Access Device

Controls Garden via Device Shadow

API Shadow Interactions

edn Garden Users

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Now that you **know** the state of every thing, and **can** reason on top of that data, what problems would you solve?

aws.amazon.com/IoT

Q&A

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Thank you!

Any questions?

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