Using AWS IoT & Alexa Skills Kit to Voice-Control Connected Home Devices

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What you will learn

- How AWS IoT can support an endpoint backend for Alexa Smart Home
- How to build an Alexa Smart Home skill using AWS IoT
- Tips, tricks, and troubleshooting callouts for integrating an Alexa Smart Home skill with AWS IoT

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Connected Home Use Cases

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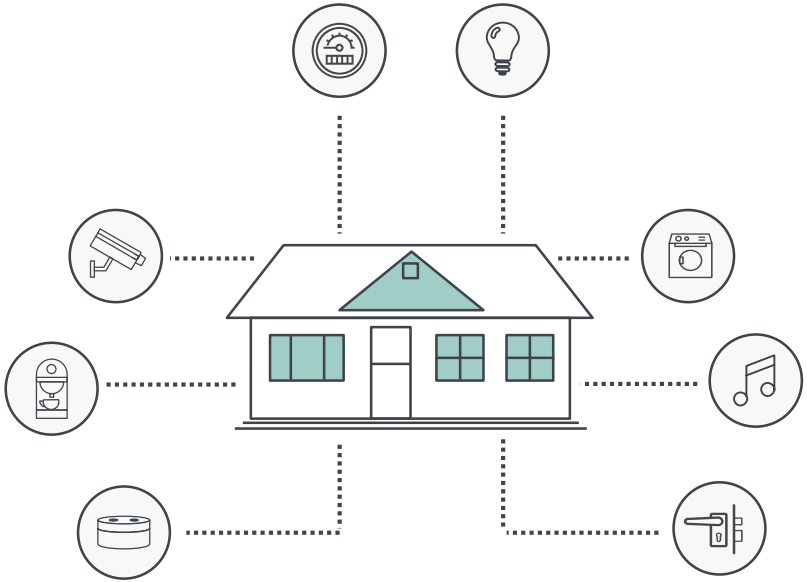
Connected Home Market – Use Cases

Home automation

- Lighting systems
- White goods
- Media & entertainment
- Small appliances
- Home assistants



Home networking

- Wi Fi routers & modems
- Cable Set top boxes

Home security & monitoring

- Security cameras
- Door locks
- Thermostat
- Water leak detectors
- Smart meters

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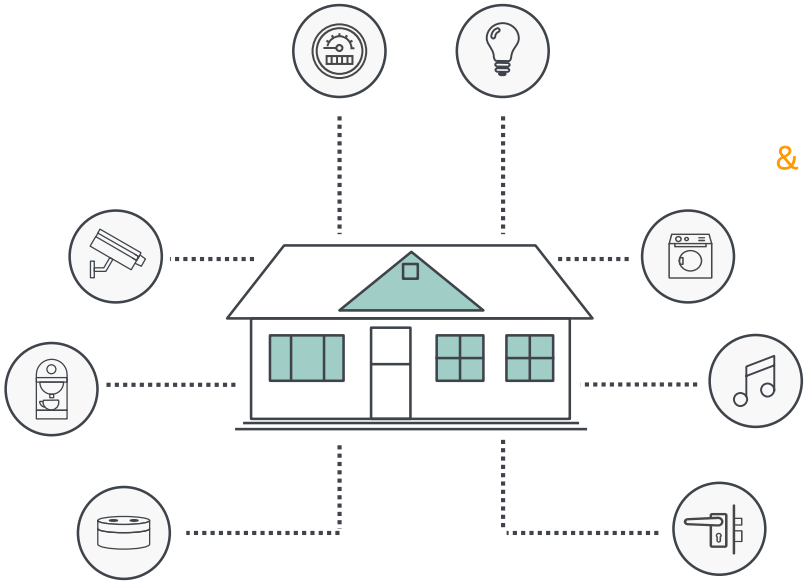
Connected Home Market - Challenges

Hard to differentiate in a crowded market

Hard to improve customer experiences while keeping costs low

Hard to maintain interoperability between multi-vendor devices



Lack of a reliable & scalable cloud infrastructure platform

Need to ensure secure connections

Need for local intelligence

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Why AWS IoT for Connected Home—Summary

Deep edge services

Scalable, responsive, and reliable

Device management & data-driven insights

Built-in security and anomaly detection

Pay as you go pricing

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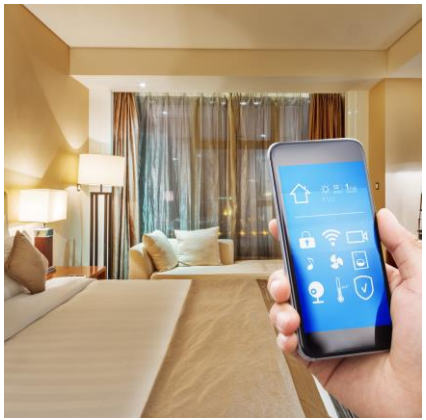
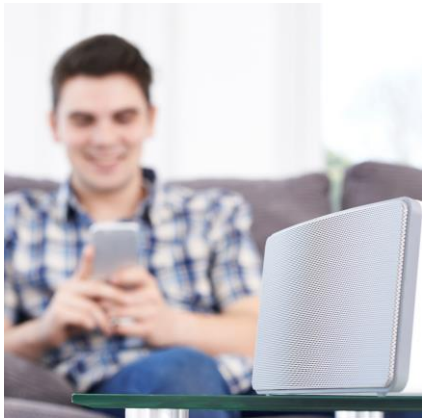
Home Automation

Integration with
voice control



Interoperability
between devices

Enriching
customer experience



Customer
ease of use

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AWS IoT for Smart Home

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AWS IoT Services Suite

Things

Sense & Act

Secure local triggers, actions, and data sync

Endpoints

Amazon FreeRTOS

Gateway

AWS Greengrass

Cloud

Storage & Compute & Learn

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

Intelligence

Insights & Logic → Action

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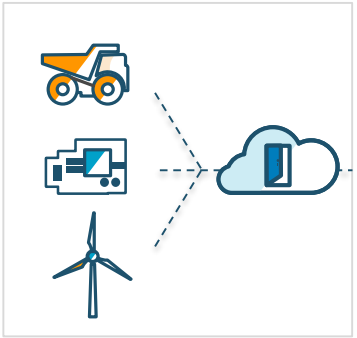
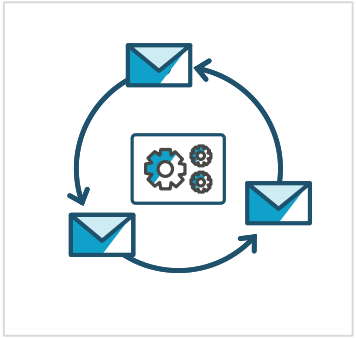
AWS IoT Core

Secure Device Connectivity and Messaging

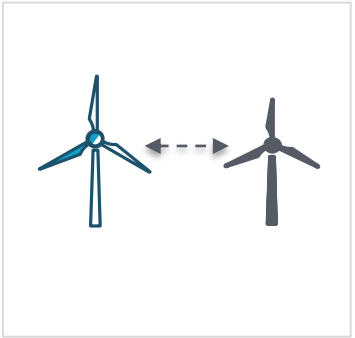
AWS IoT Core is a managed service that lets connected devices easily and securely interact with cloud applications and other devices.



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.)

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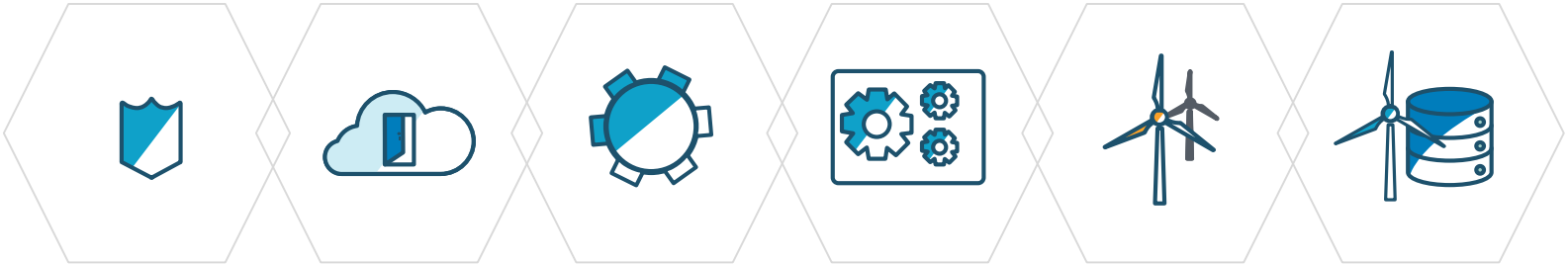
AWS IoT Core

Secure Device Connectivity and Messaging



Identity Service

Device Gateway

Message Broker

Rules Engine

Device Shadow

Registry

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MQTT Topics

Ephemeral

Publish/Subscribe

- Publish to individual topics
- Subscribe to one or topics and hierarchies
- Published messages and subscribed responses are metered

Wildcards

- Single level (+)
  - myhome/groudfloor/+/temperature
  - Returns **temperature** messages for all **groundfloor** things
- Multi-level (#)
  - myhome/groundfloor/#
  - Returns **all** messages for all **groundfloor** things

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AWS IoT Device Shadow

Device

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

Applications

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,
  "timestamp" : 28034023492,
  "clientToken": "UniqueClientToken"
}
```

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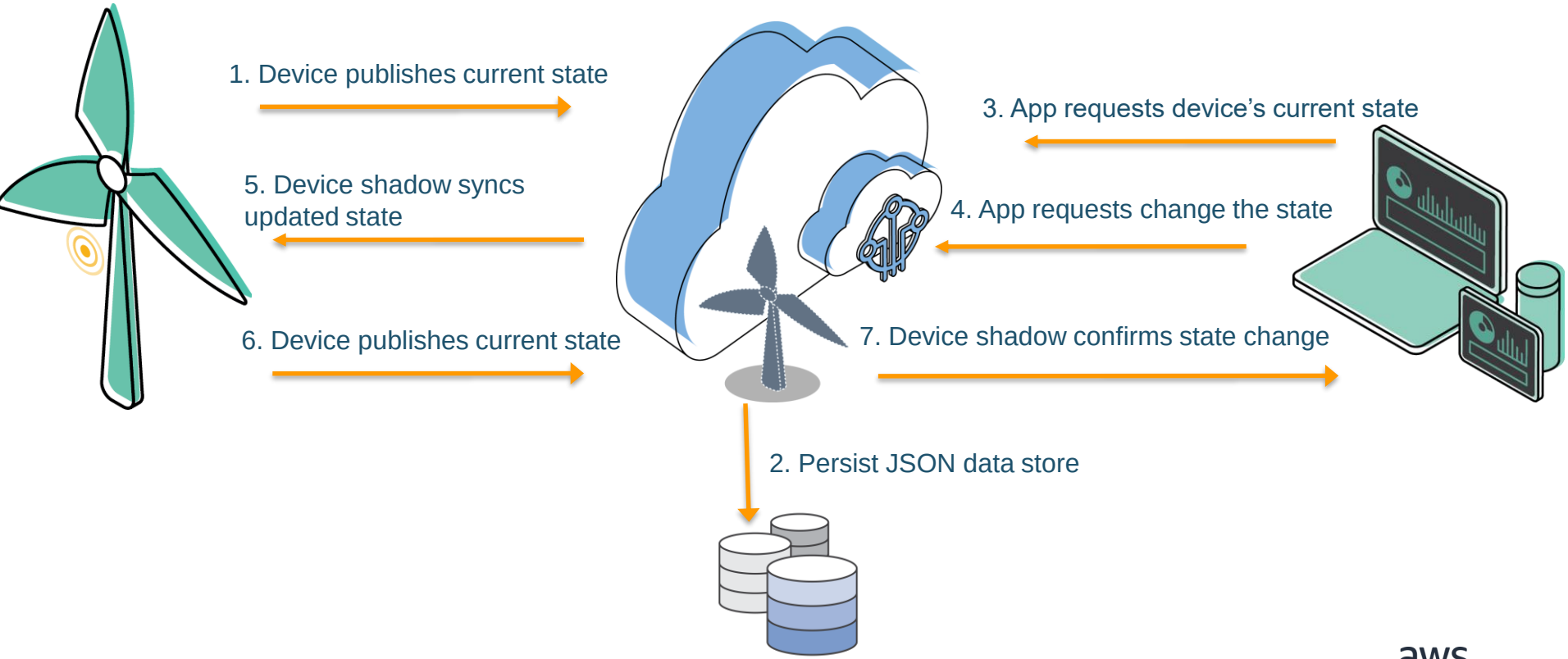
AWS IoT Device Shadow flow



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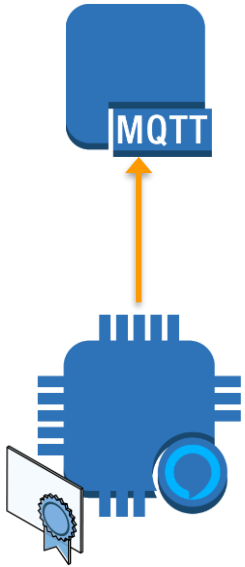
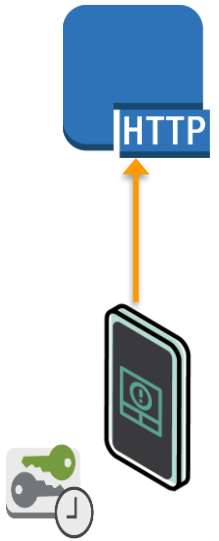
AWS IoT Device Shadow Protocol Support

IoT Permissions:
iot:Publish
Iot:Subscribe



IoT Permissions:
iot:GetThingShadow
iot:UpdateThingShadow
iot:DeleteThingShadow



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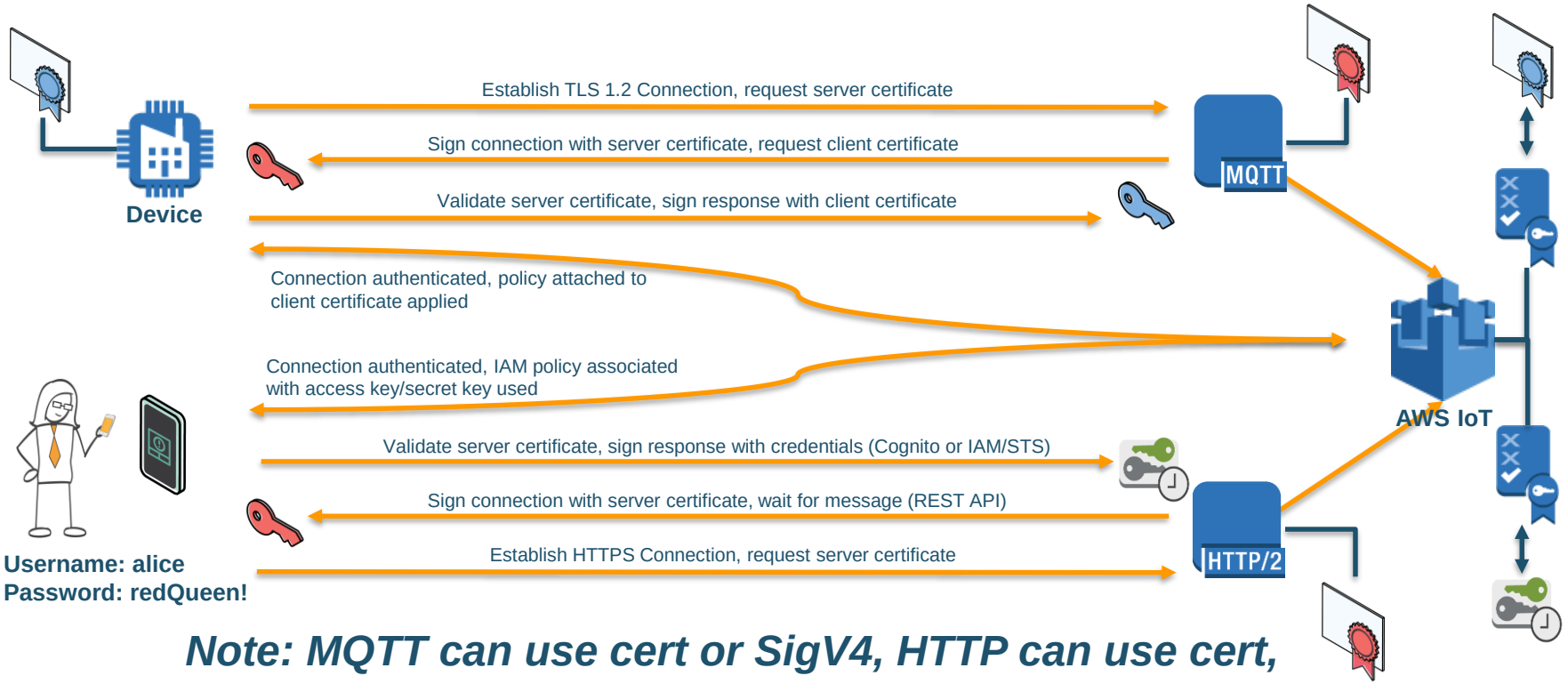
Authentication/Authorization in AWS IoT



Note: MQTT can use cert or SigV4, HTTP can use cert, SigV4, or Custom Authorizer

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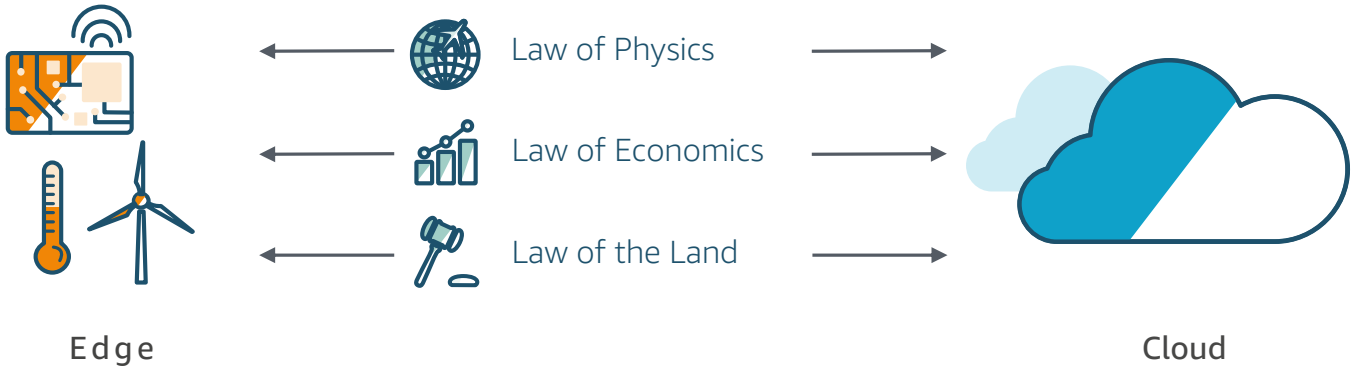
AWS Greengrass

Extend AWS IoT to the Edge

AWS Greengrass extends AWS IoT onto your devices, so that they can act locally on the data they generate, while still taking advantage of the cloud.



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AWS Greengrass

Extend AWS IoT to the Edge

Local Messages and Triggers

Local Message Broker

Local Actions

Lambda Functions

Data and State Sync

Local Device Shadows

Security

AWS-grade security

Local Resource Access

Lambdas Interact With Peripherals

Machine Learning Inference

Local Execution of ML Models

Protocol Adapters

Easy Integrations With Local Protocols

Over the Air Updates

Easily Update Greengrass Core

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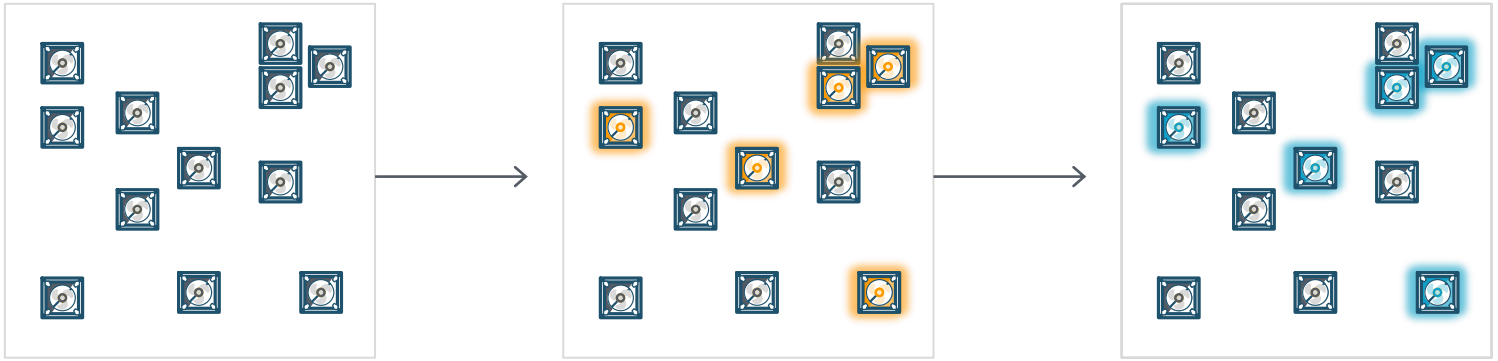
AWS IoT Device Management

Device Management Service

AWS IoT Device Management helps you onboard, organize, monitor, and remotely manage your growing number of connected devices.



Fast device onboarding at scale

Real-time fleet indexing and search

Monitoring and updating devices

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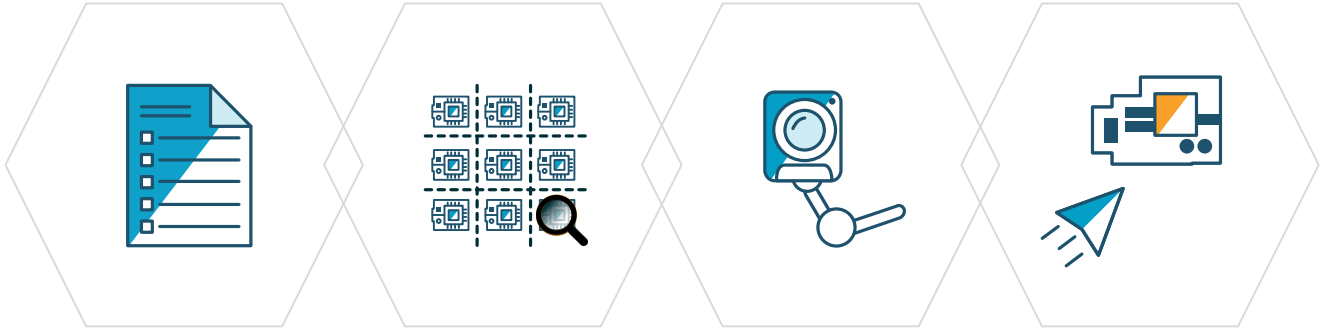
AWS IoT Device Management

Maintain Fleet Health



Batch Fleet Provisioning

Real-time Fleet Index & Search

Fine Grained Device Logging & Monitoring

Over the Air Updates

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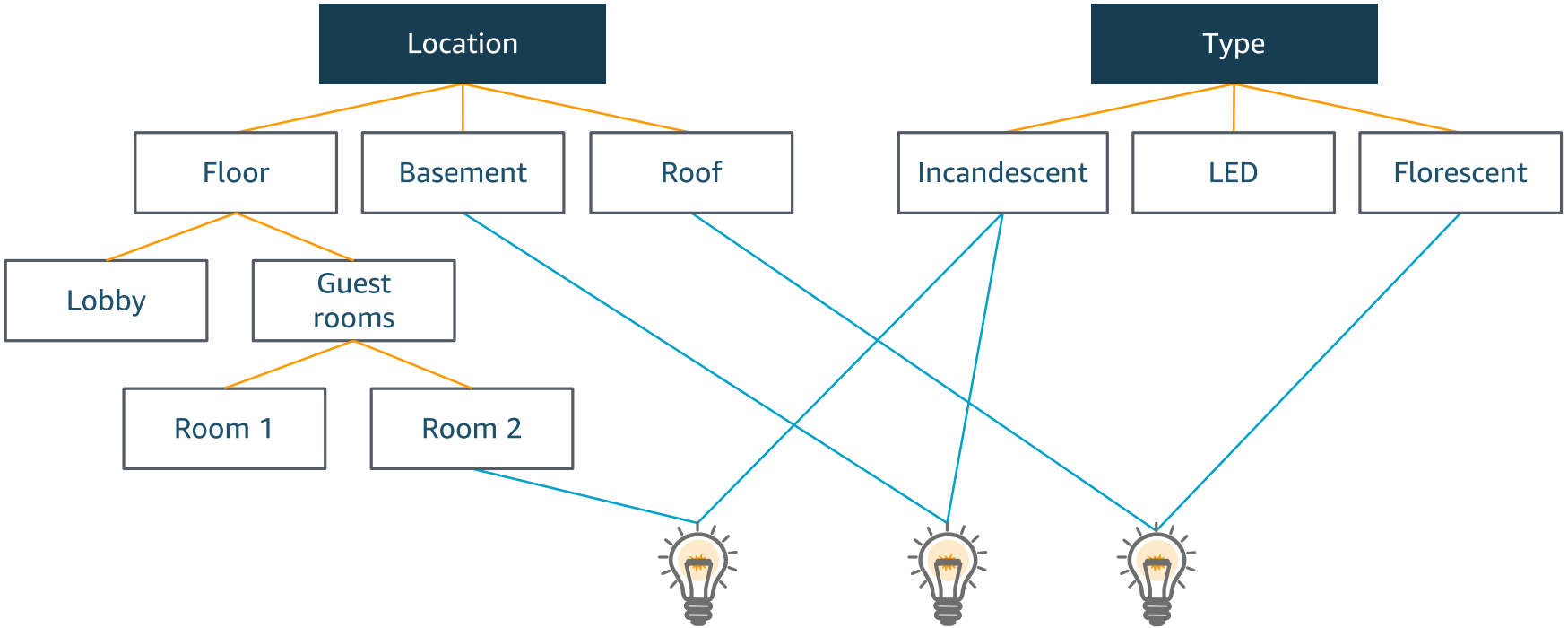
Thing Groups in AWS IoT Device Management



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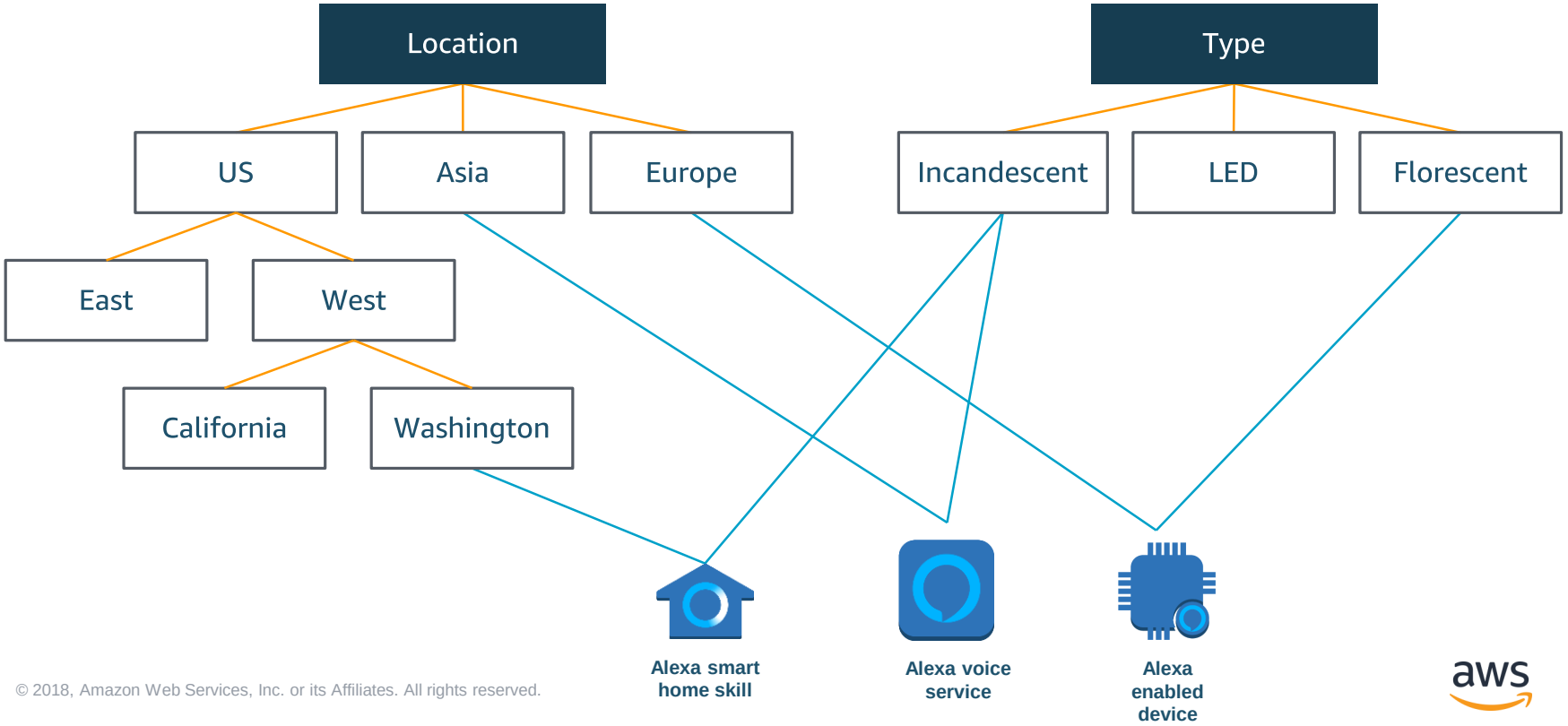
Thing Groups for Smart Home



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Benefits of Using Thing Groups for Smart Home

- Set up Thing Group Security Policies for Home Appliances
- Create Individual Log Groups
- Create Deployment Groups Based on Environment

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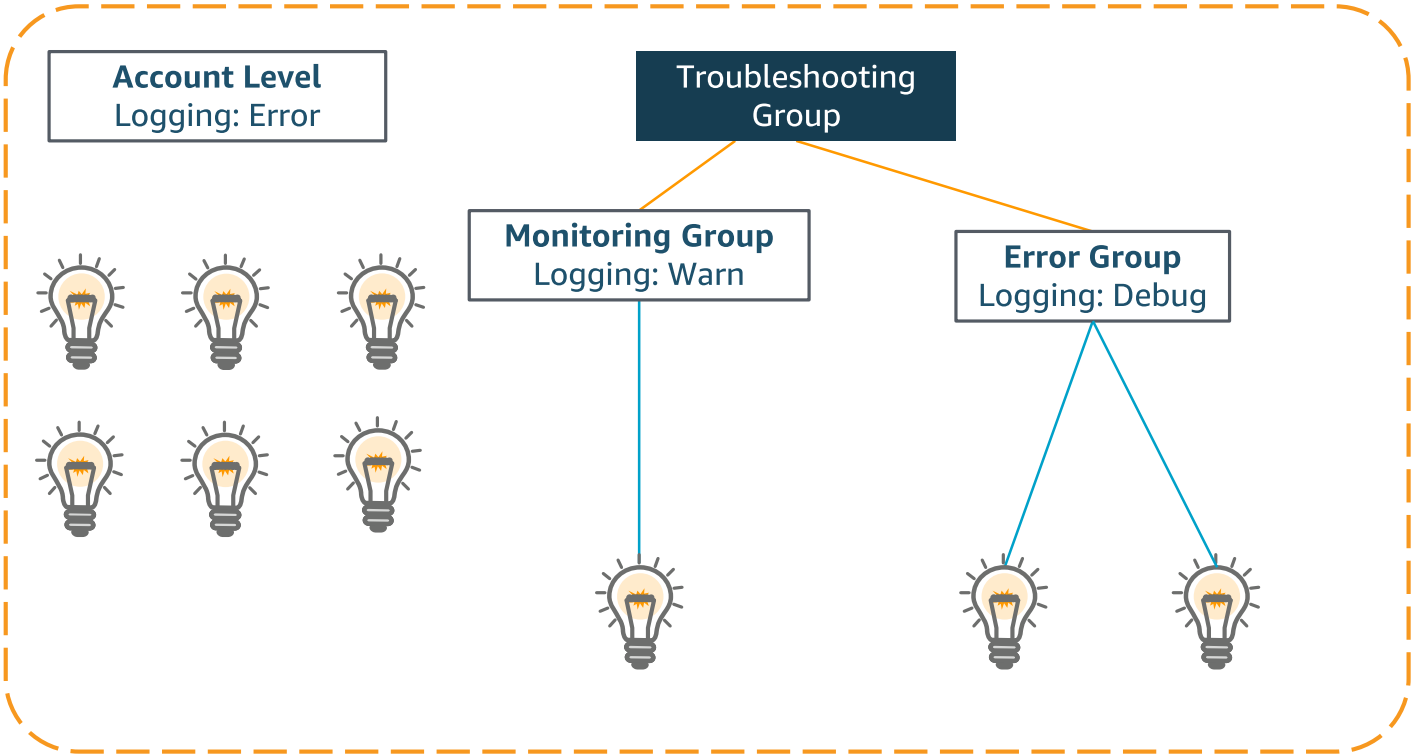
Fine-grained Logging



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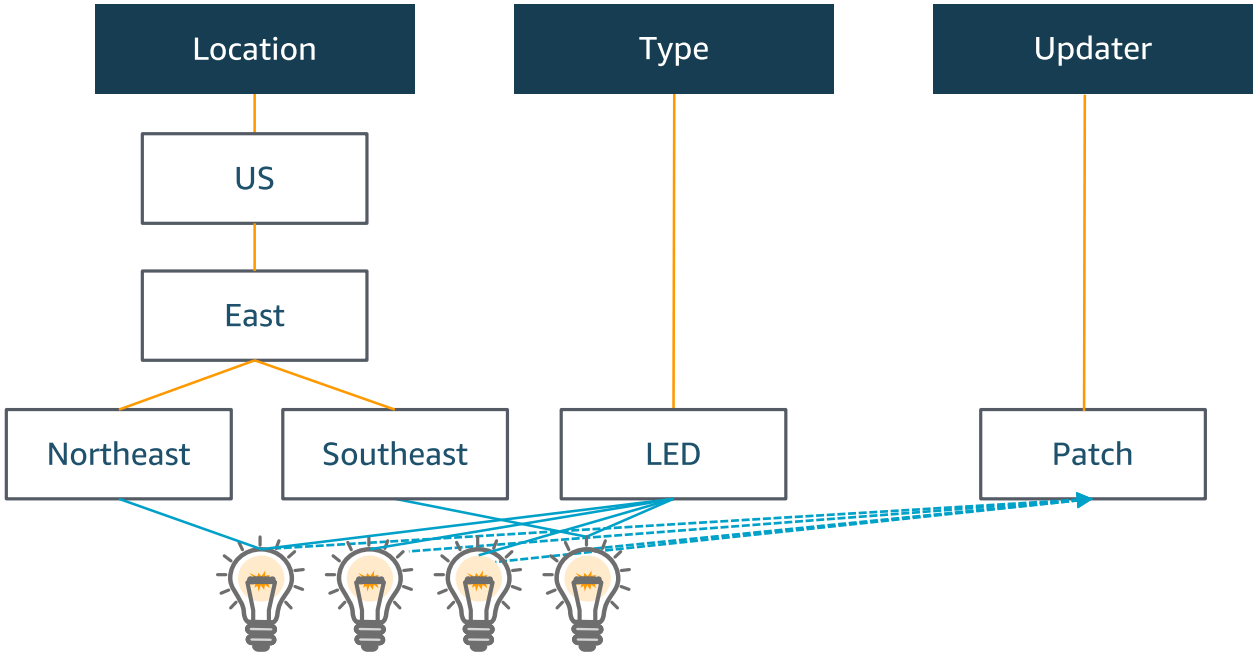
Device Jobs using Groups



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Best Practices of Thing Groups

Thing Groups Hierarchies are immutable so use groups that align with long-term use cases:

- Location (Countries, Buildings, Consumer Account, etc)
- Hardware
- Firmware versions
- Environments (dev, test, beta, production)

Create a Diagnostics Group for auditing in production with more verbose CloudWatch Logging

Leverage Thing Group Policies to reduce duplicate policy creation

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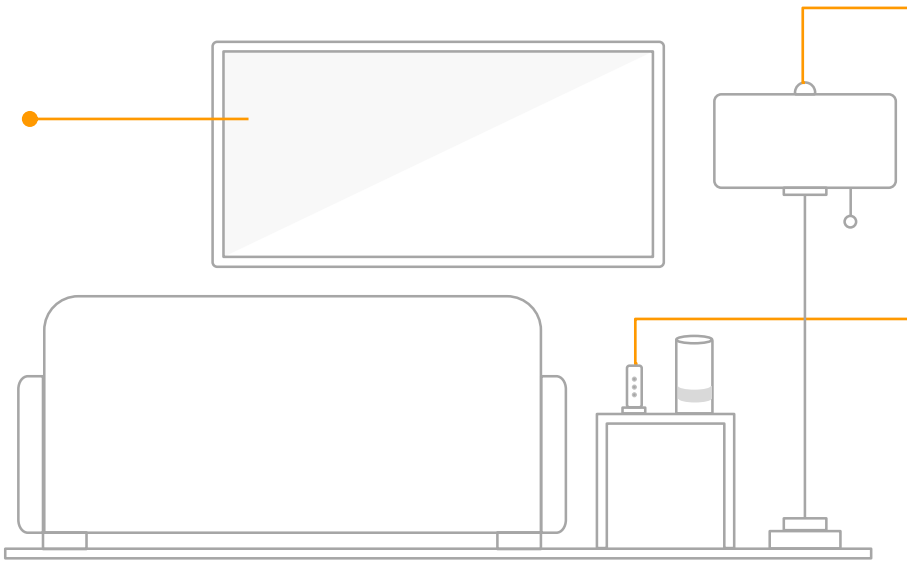
AWS IoT Services for Home Automation

Smart TVs can connect to **AWS IoT Core** to take advantage of a fully scalable cloud backend that provides easy integration with **Alexa.**

AWS IoT Device Management, AWS IoT Device Defender, and **AWS IoT Analytics** provide added benefits once devices are connected.



Amazon FreeRTOS provides security, connectivity, and updateability for devices running on microcontrollers, like a light bulb so it can respond to voice commands.

AWS Greengrass can run on a home gateway so that the lighting system, TV, and Echo continue to operate even if connection to the cloud is lost.

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AWS Ecosystem for Smart Home Skills

AWS IoT

Amazon API Gateway

AWS Lambda

Amazon DynamoDB

Amazon Cognito

AWS CloudFormation

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Alexa Skills Kit

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Alexa Skills Kit

The Alexa Skills Kit (ASK) lets you teach Alexa new skills.

It contains the documentation, tools, and sample code needed to build Alexa skills.

https://developer.amazon.com/ask

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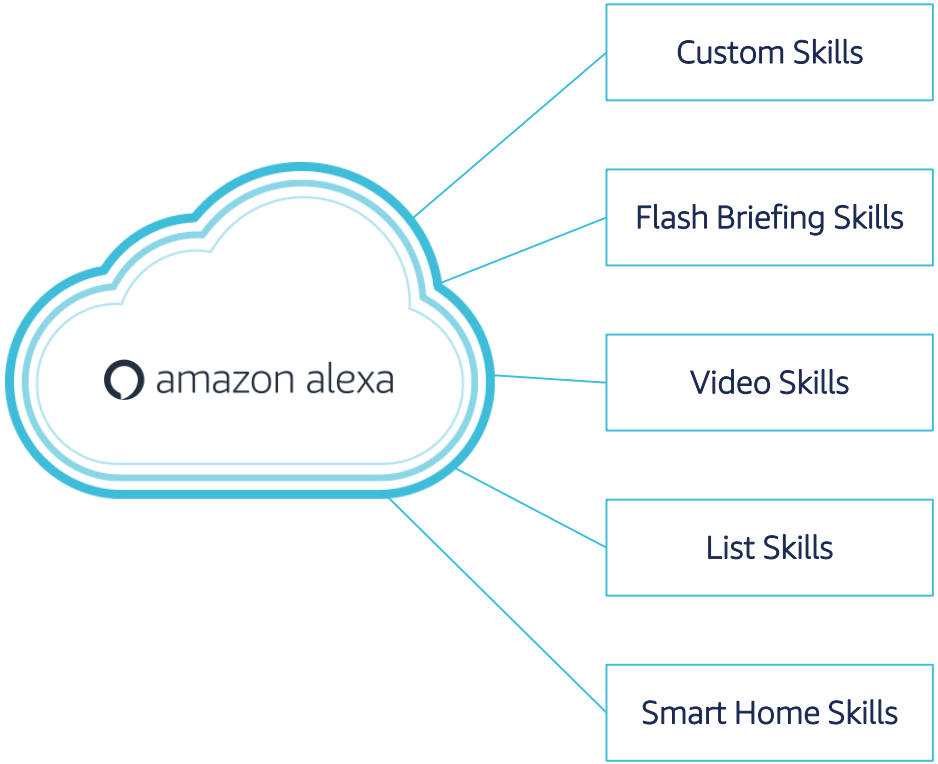
Types of Alexa Skills



For crafting unique game or app experiences

For providing flash briefing content

For providing video playback of content

For using and maintaining lists

For controlling a smart home and devices

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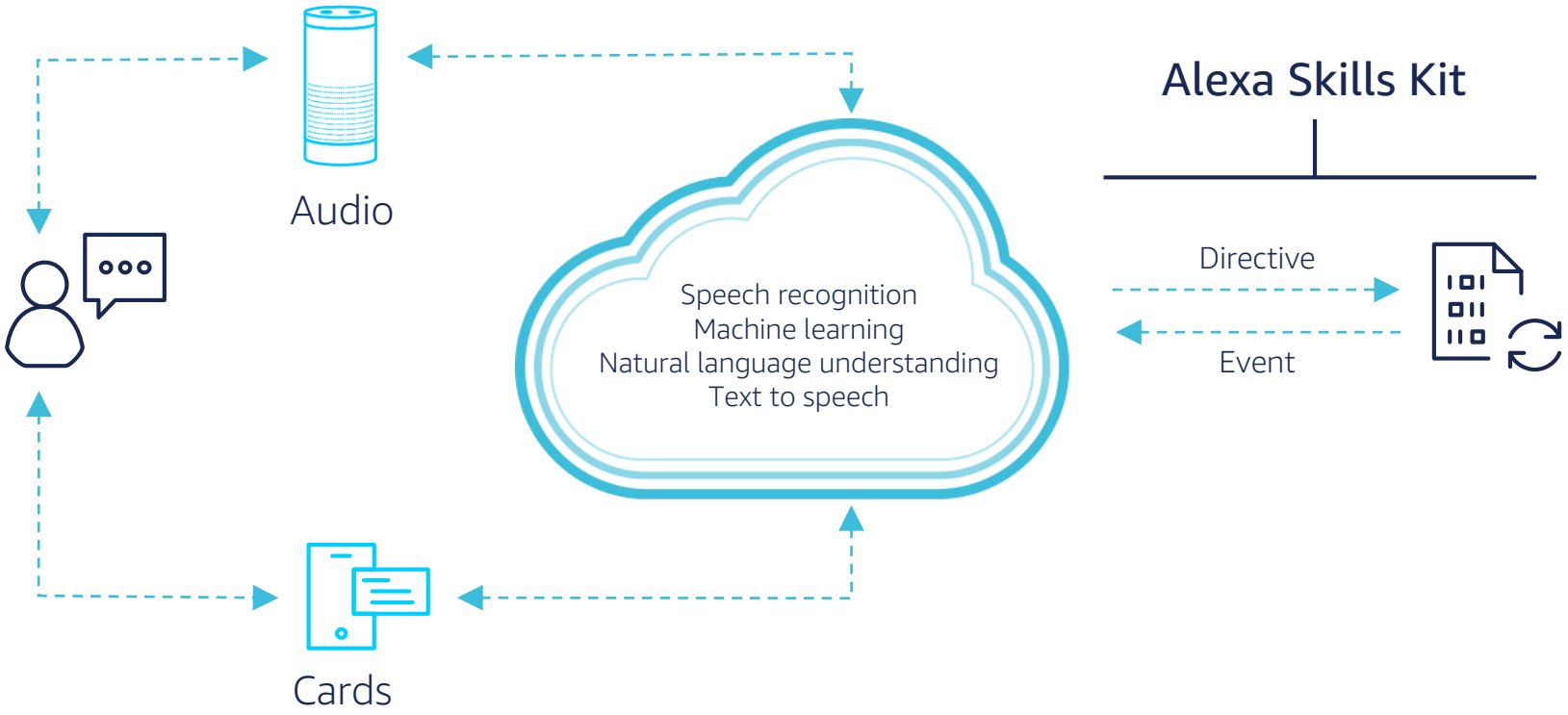
Alexa Skills Kit



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Smart Home Capability interface examples

Interface	Capability
Alexa.Discovery	Discover and describe endpoints
Alexa.PowerController	Turning on or off
Alexa.PercentageController	Sets a percentage (Percentage, intensity, speed, etc.)
Alexa.ColorController	Change and report the color (Hue, saturation, brightness)
Alexa.PlaybackController	Control playback (Play, pause, rewind, etc.)
Alexa.ThermostatController	Set a temperature or point or range

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Endpoint cloud architecture

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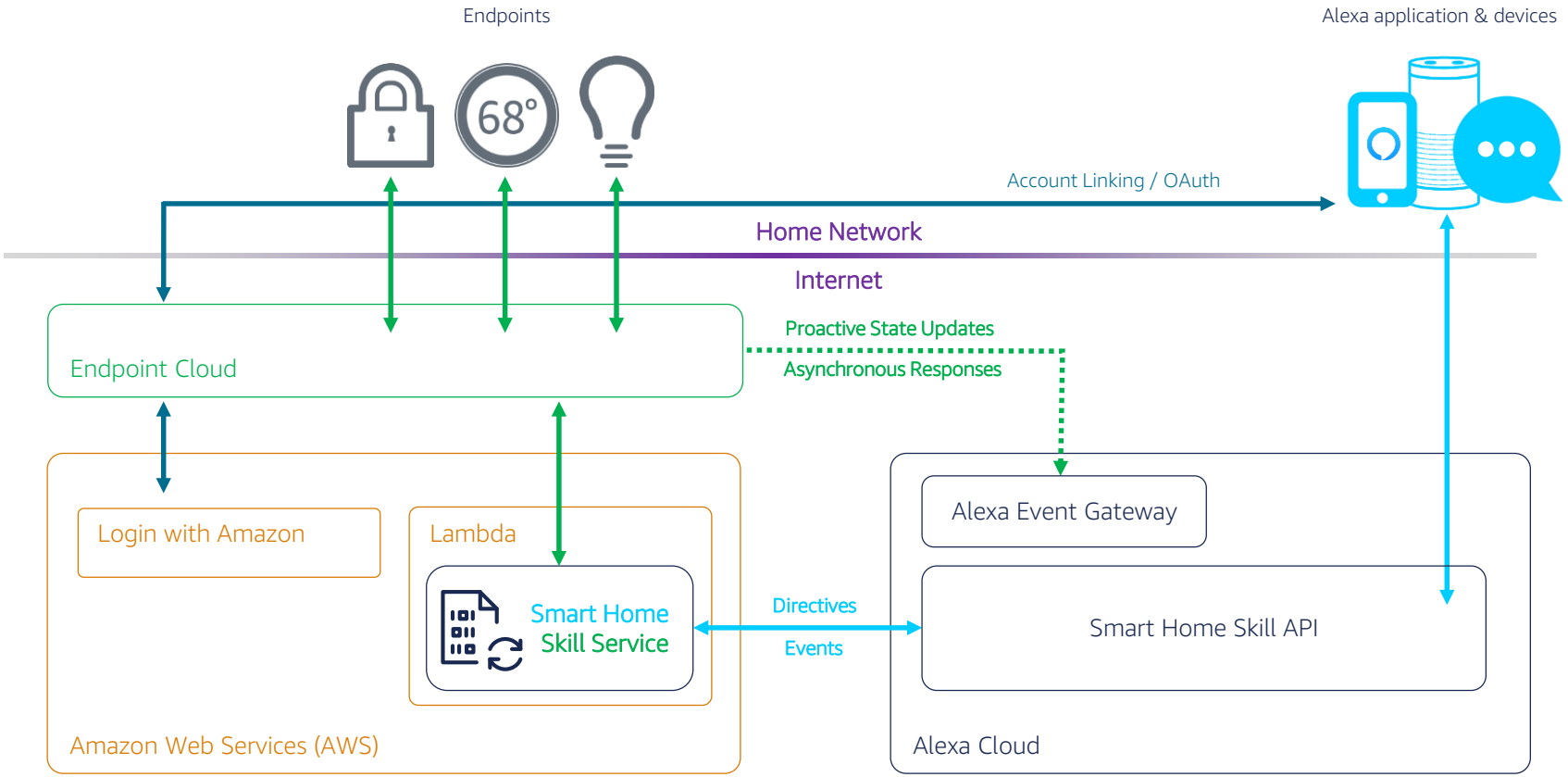

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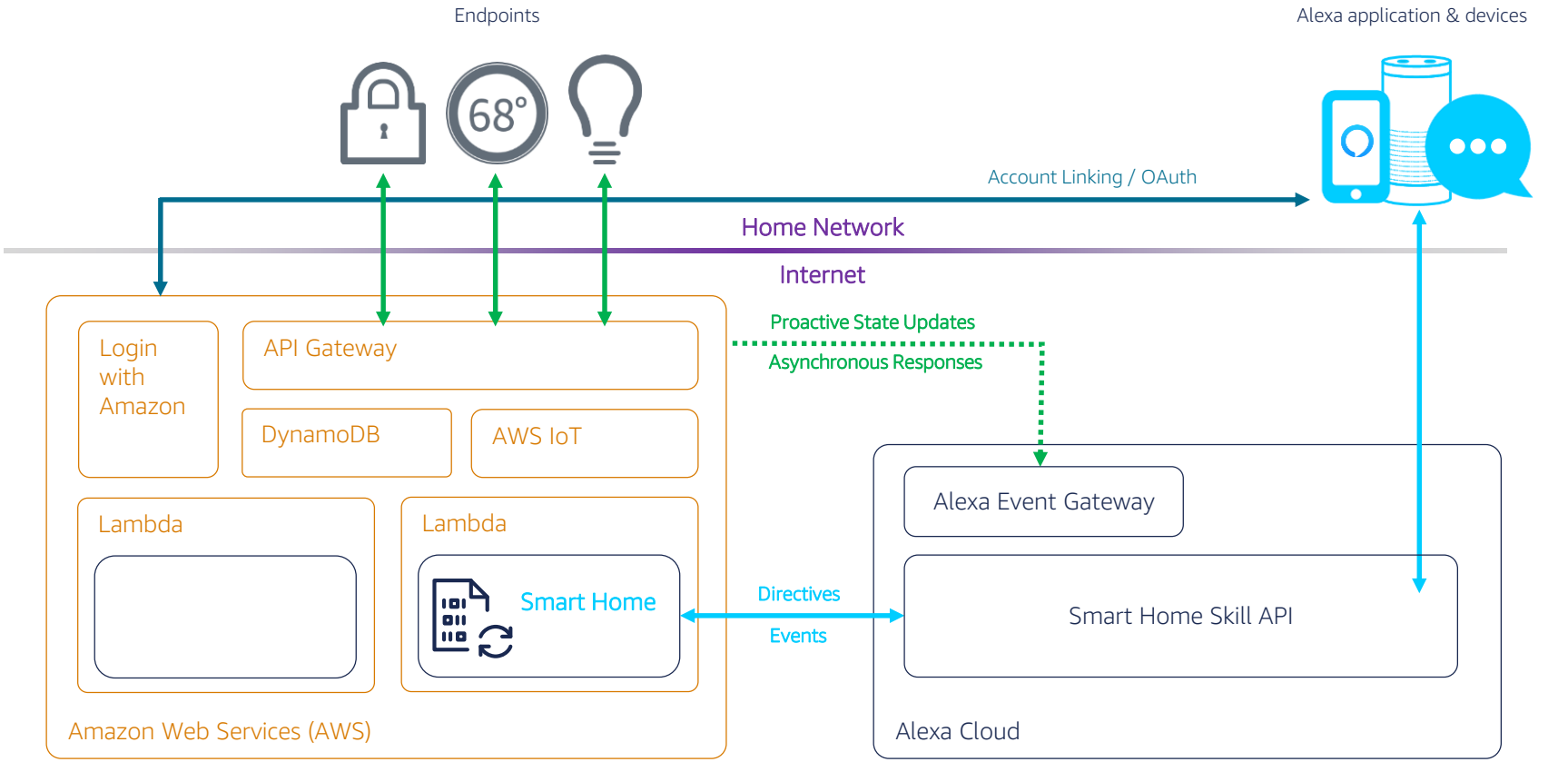

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Sample architecture

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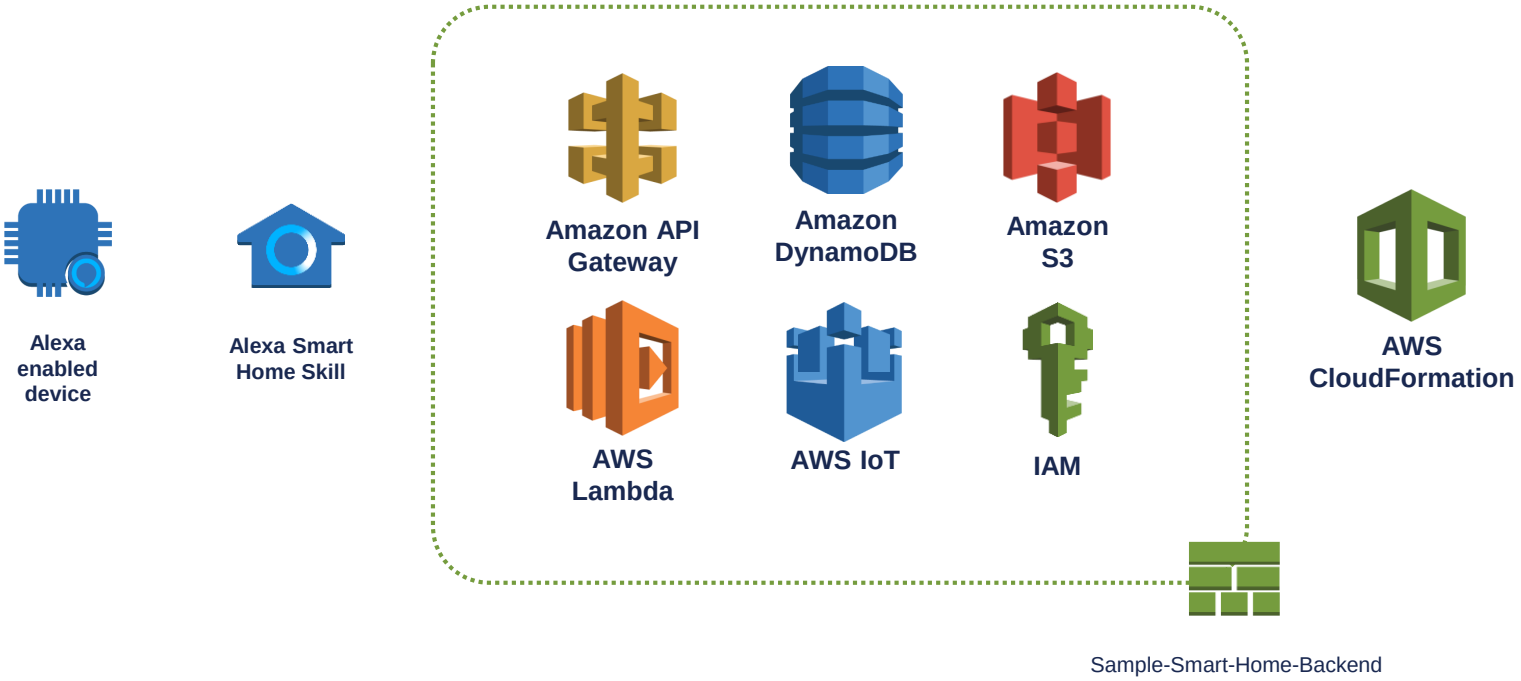
Alexa Service infrastructure



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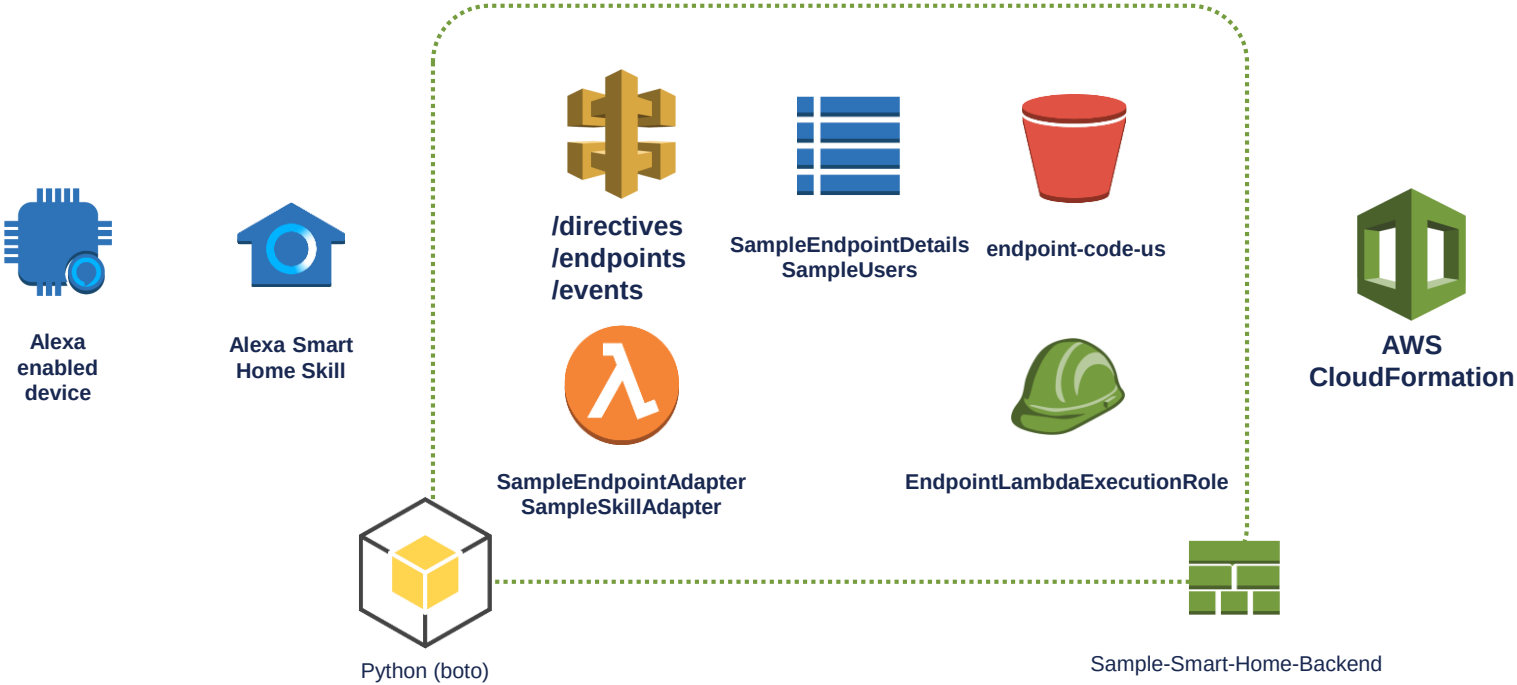
Alexa Service infrastructure instances



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Sample demonstration

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Key points

Amazon API Gateway

Message Router

- Inbound: Directive and endpoint abstraction with JSON Messaging Data
- Outbound: Helps handle proactive state updates

AWS Lambda

Logical Router

- Handles compute / processing for API and Skill services

AWS IoT

State Arbiter

- From Alexa (directives)
- From the device cloud (device state changes)

Amazon DynamoDB

Data Provider

- Referential information that may not change (SKUs, descriptions, etc.)

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Summary

- Solving IoT challenges with AWS IoT and Alexa
- Overview of common AWS services for Smart Home
- Examples of home automation and home security implementations

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Resources

Smart Home Portal

https://alexa.design/smarthome

https://aws.amazon.com/iot/solutions/connected-home/

Smart Home Code

https://github.com/alexa/alexa-smarthome

Developer Slack Channel

https://alexasmarthome.slack.com

Invite Link: https://alexa.design/smarthome-invite-slack

Sample Backend

https://github.com/alexa/alexa-smarthome/tree/master/sample_backend

Getting Started with AWS IoT Core

https://docs.aws.amazon.com/iot/latest/developerguide/what-is-aws-iot.html

AWS IoT Services

https://aws.amazon.com/iot-device-management/

https://aws.amazon.com/greengrass/

https://aws.amazon.com/iot-analytics/

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