EMBEDDED ONLINE CONFERENCE 2023

FreeRTOS and AWS IoT ExpressLink: Simplify and fast-track your embedded designs

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Agenda

What are customers doing with IoT

Market challenges

Introduction to AWS IoT ExpressLink

Key value proposition and capabilities

Customer impact and references

Top Use cases

Getting started with partner modules

AWS IoT customers solve problems in all sectors

What customers are doing with AWS IoT

Improve the performance and productivity of industrial processes

Remotely monitor patient health and wellness applications

Track inventory levels and manage warehouse operations

Build smarter products and user experiences in homes, buildings, and cities

Grow healthier crops with greater efficiencies

Manage energy resources more efficiently

Transform transportation with connected and autonomous vehicles

Enhance safety in the home, the office, and the factory floor

What are the fundamentals of **AWS IoT?**

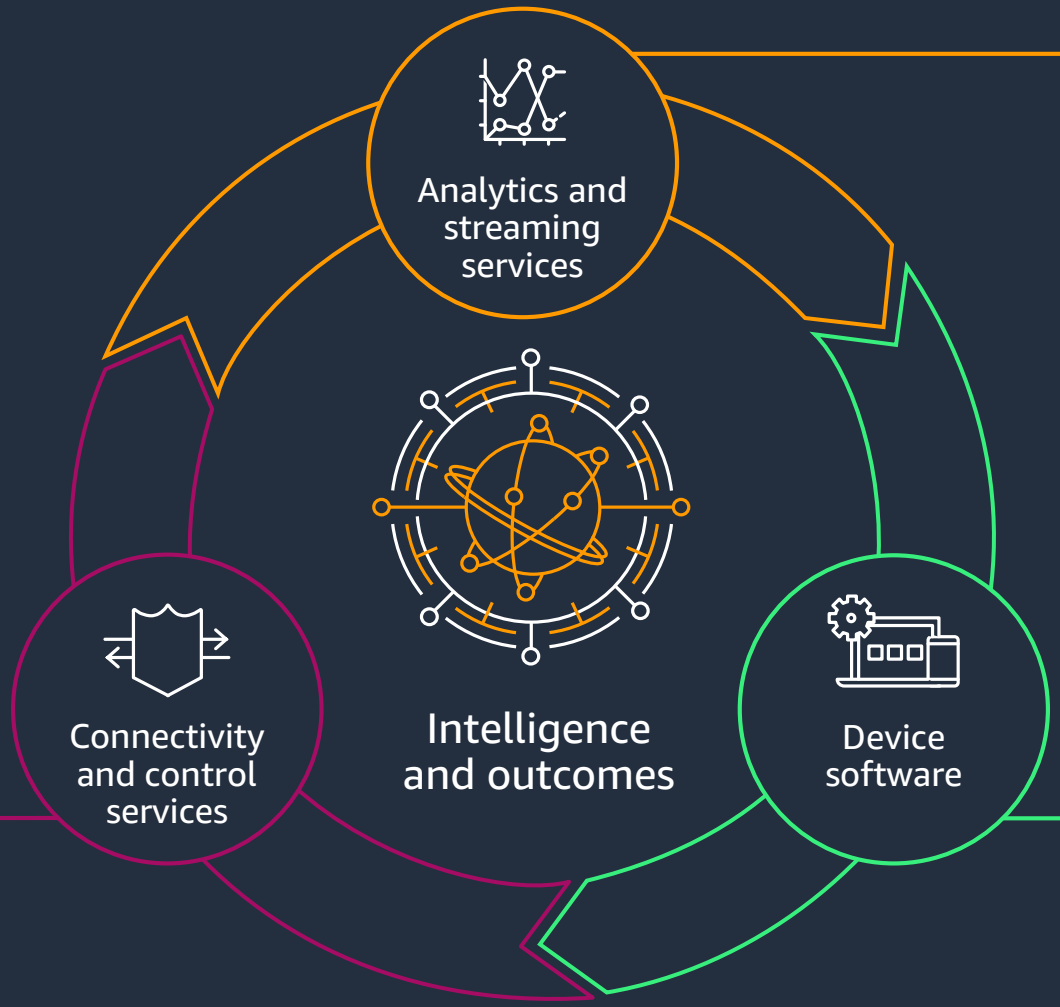
AWS IoT architecture

How can I make sense of my IoT data and take appropriate actions?

How can I control, manage, and secure my devices at scale?

How can I build devices that operate at the edge?

IoT virtuous cycle

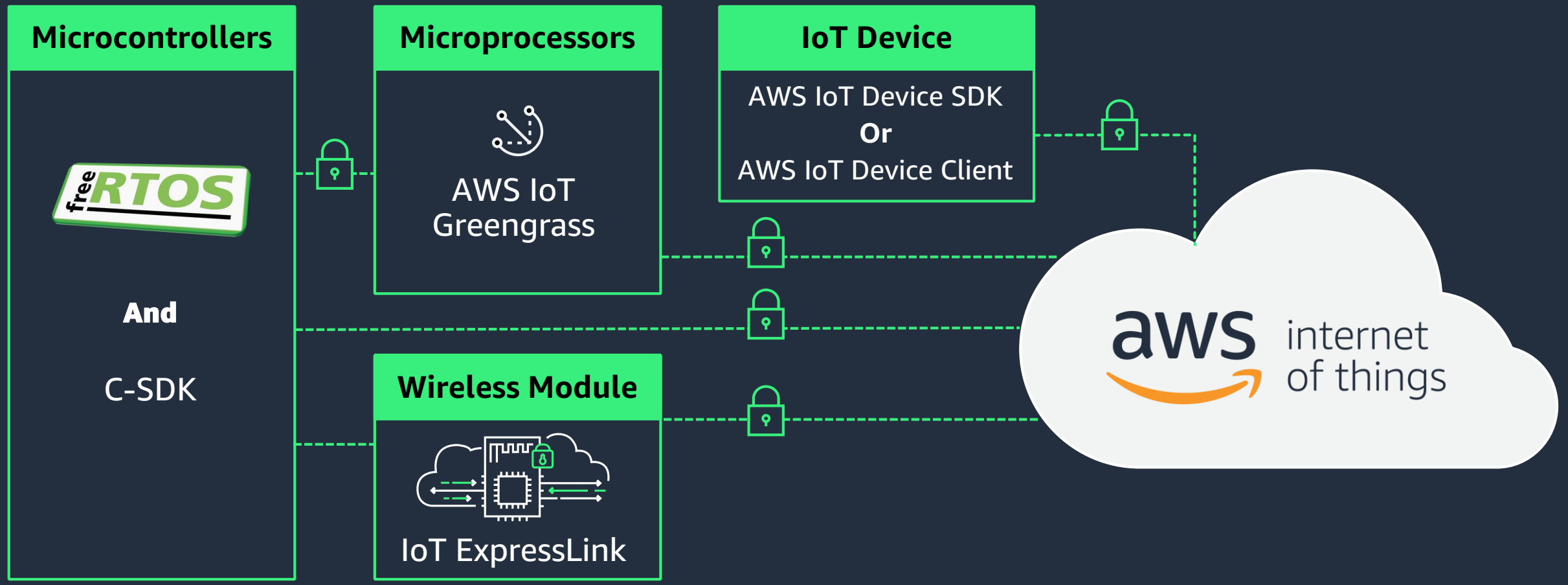


- AWS IoT Events
- AWS IoT Analytics
- AWS IoT SiteWise
- AWS IoT TwinMaker
- Amazon Kinesis Video Streams

- AWS IoT Core
- AWS IoT Device Management
- AWS IoT Device Defender
- AWS IoT FleetWise
- AWS IoT RoboRunner

- FreeRTOS
- AWS IoT ExpressLink
- AWS IoT Greengrass
- AWS IoT Device SDK

Easily build devices that works with AWS IoT



IoT adoption is growing

However, the need to effectively connect devices to the cloud and manage them at scale is not going away…

Total connected device growth by 2030

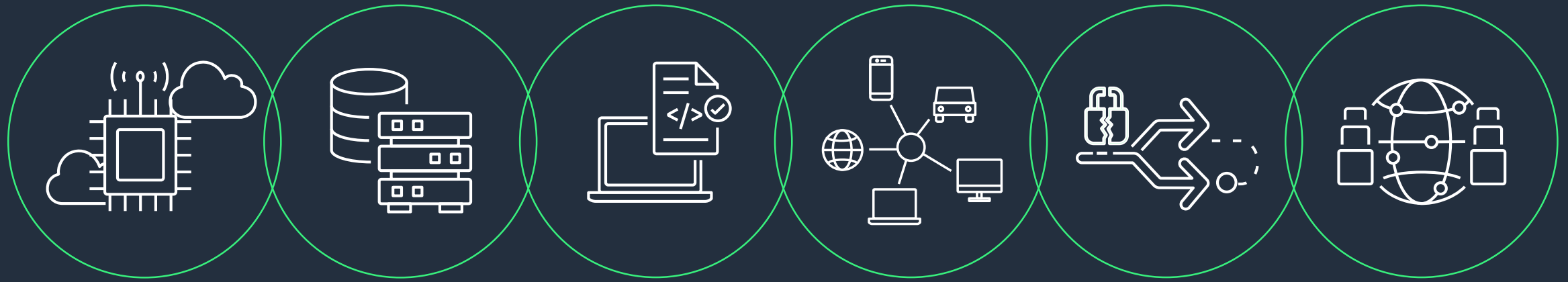
28.5B devices

DEVICES

Source: Transforma Insights, March 2022

How can I quickly build intelligent devices and securely connect them to AWS IoT?

Customer challenges



Securely connecting embedded devices to the cloud is hard

Requires specialized competencies often not available in-house

Need to add 50,000 lines (or more) of embedded C code

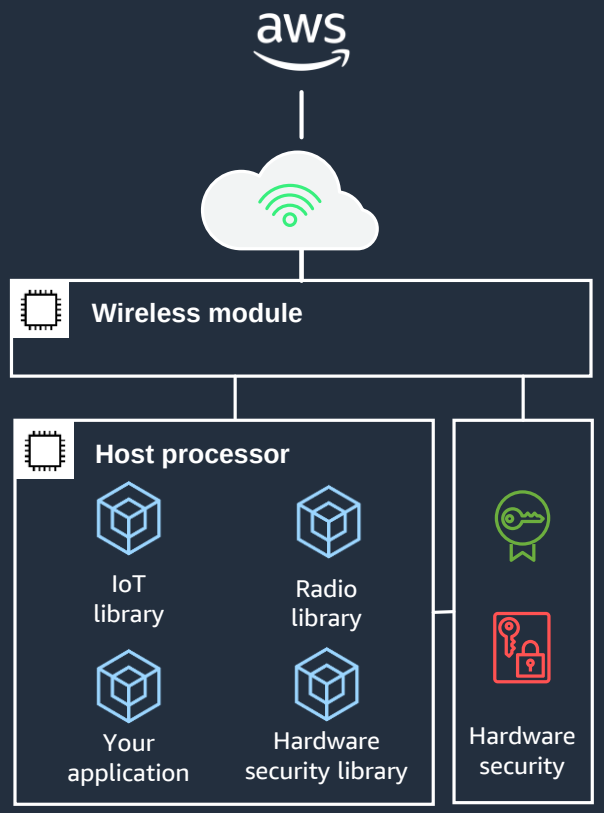
Undifferentiated work is required to integrate networking and security libraries and achieve a secure connection

A lot of room for mistakes and security vulnerabilities

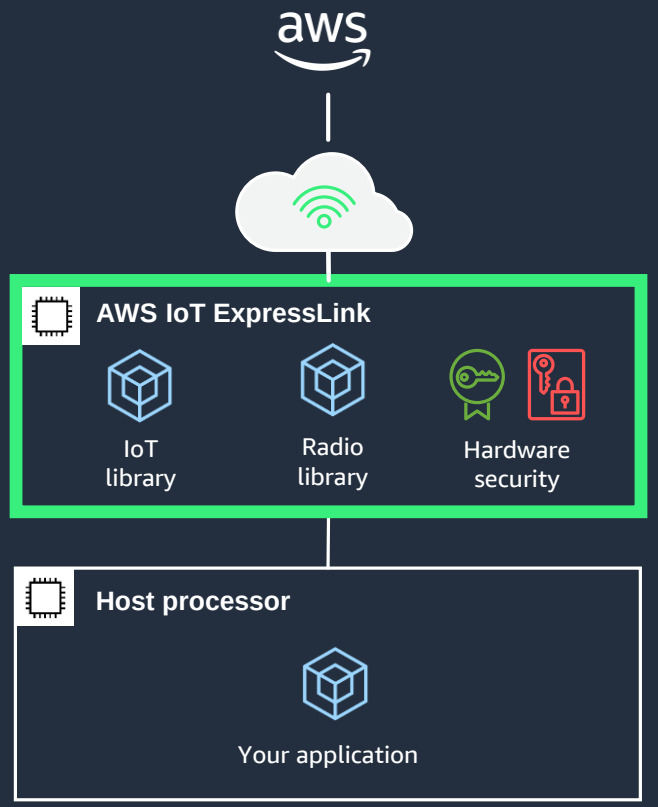
Difficult to maintain the health and security of device fleets at scale

The solution

Without AWS IoT ExpressLink

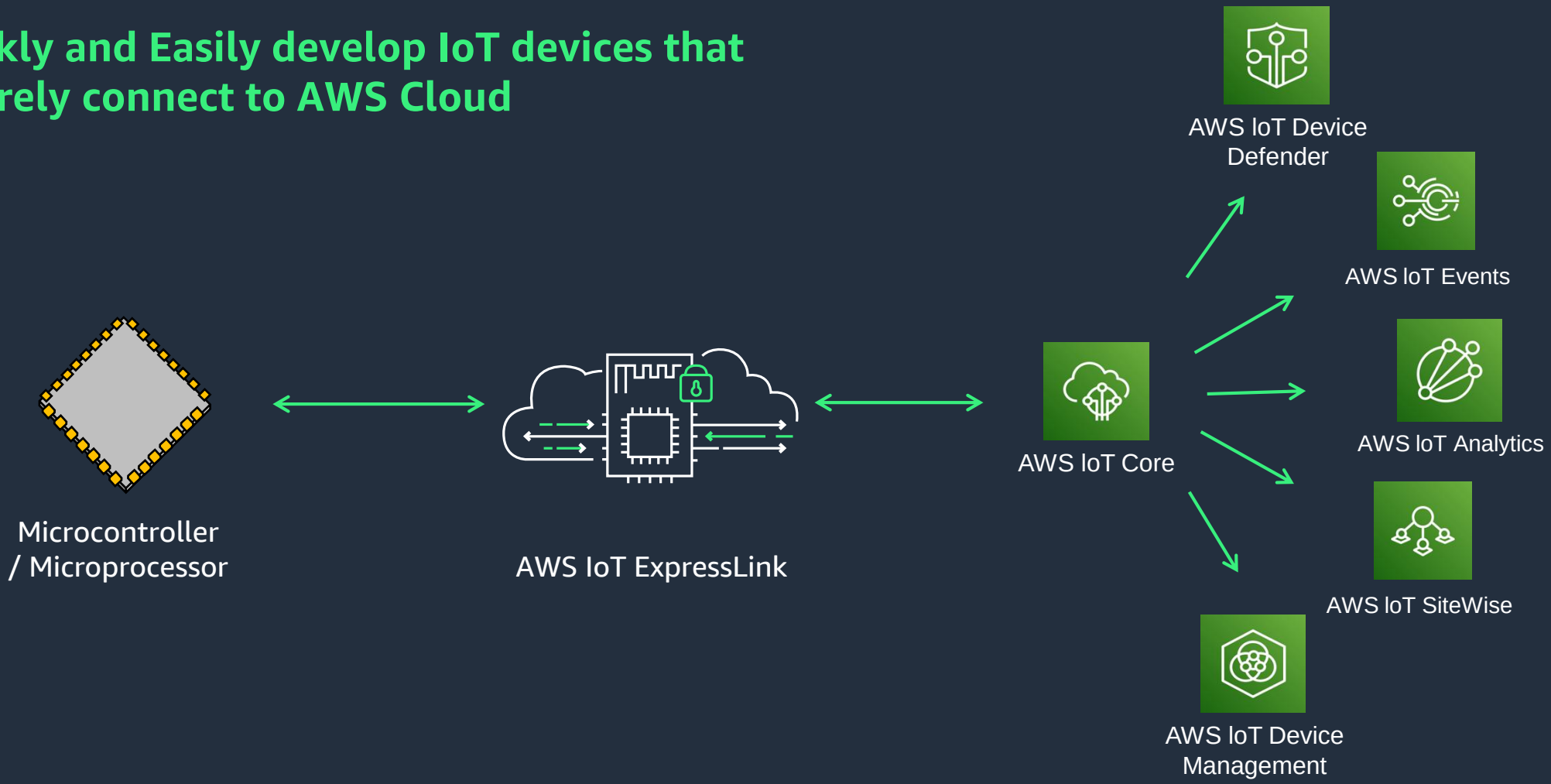


With AWS IoT ExpressLink



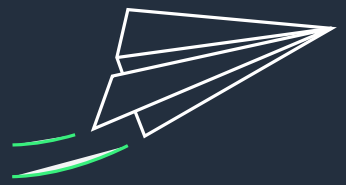
AWS IoT ExpressLink

Quickly and Easily develop IoT devices that Securely connect to AWS Cloud



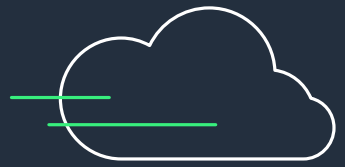
AWS IoT ExpressLink benefits

AWS IoT ExpressLink connectivity modules include software implementing AWS mandated security requirements, making it faster and easier for you to securely connect devices to the cloud.



Quick

Off-load the complex networking and cryptography tasks to the module



Easy

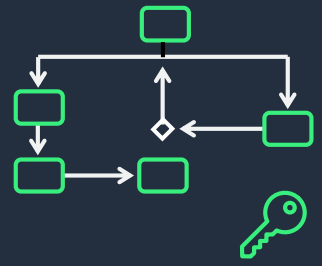
Modules are preprogrammed to seamlessly integrate with over 200 AWS services

Secure

Features leading security software to help protect devices from remote attacks.

Manage fleet security and health at scale

Remotely deploy security updates, bug fixes, and new firmware updates



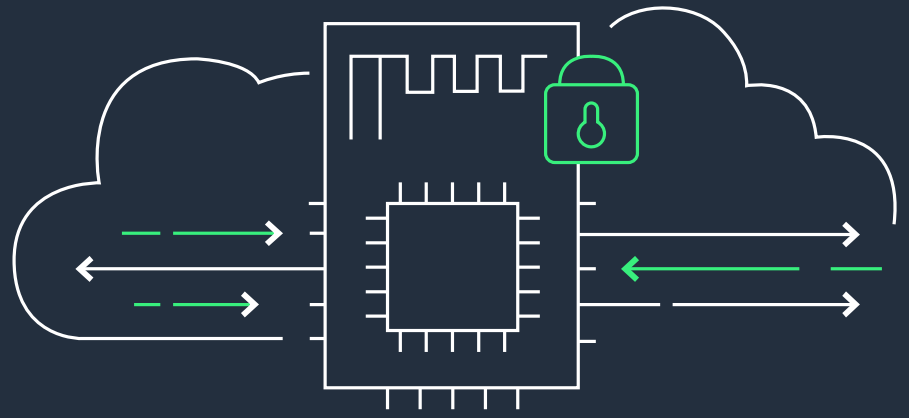
IP protection, manufacturing flexibility and savings

Pre-provisioned security certificates limits IP exchanges with contract manufacturers and reduces complexities

AWS IoT ExpressLink is quick

AWS IoT ExpressLink take care of all the complex and security-critical code and packs it into **a single hardware component.**

A 3-wire serial interface is all you need to connect **ANY embedded device** to the cloud.



AWS IoT ExpressLink is easy

Express your application in less than 10 simple lines of code.

A dozen AT commands to rule them all

Media independent:
CONNECT, SEND, SUBSCRIBE, GET
“Write to the application NOT to the media!”

- Wi-Fi
- Cellular LTE-M, CAT-M1
- Cellular NB-IoT (future)
- LoRa (future)

In less than 10 lines of code

```
void main()
{
    puts("AT+CONNECT\n");
    while (1)
    {
        printf("AT+SEND1 {\"A\"=%d}\n", getSensorA());
        sleep(10);
    }
}
```

AWS IoT ExpressLink is secure

AWS IoT ExpressLink
connects securely out of the box

Implements AWS mandated security requirements and security best practices:

- Hardware root of trust
- Secure secrets storage
- Mutually authenticated
- Encrypt all communication to and from the cloud
- Updated Over the Air using AWS IoT OTA service
- Secure Boot
- Support Host processor OTA updates
- Built in support for AWS IoT Device Defender

Deploy and manage at scale

Modules ready to connect to the cloud out of the box.

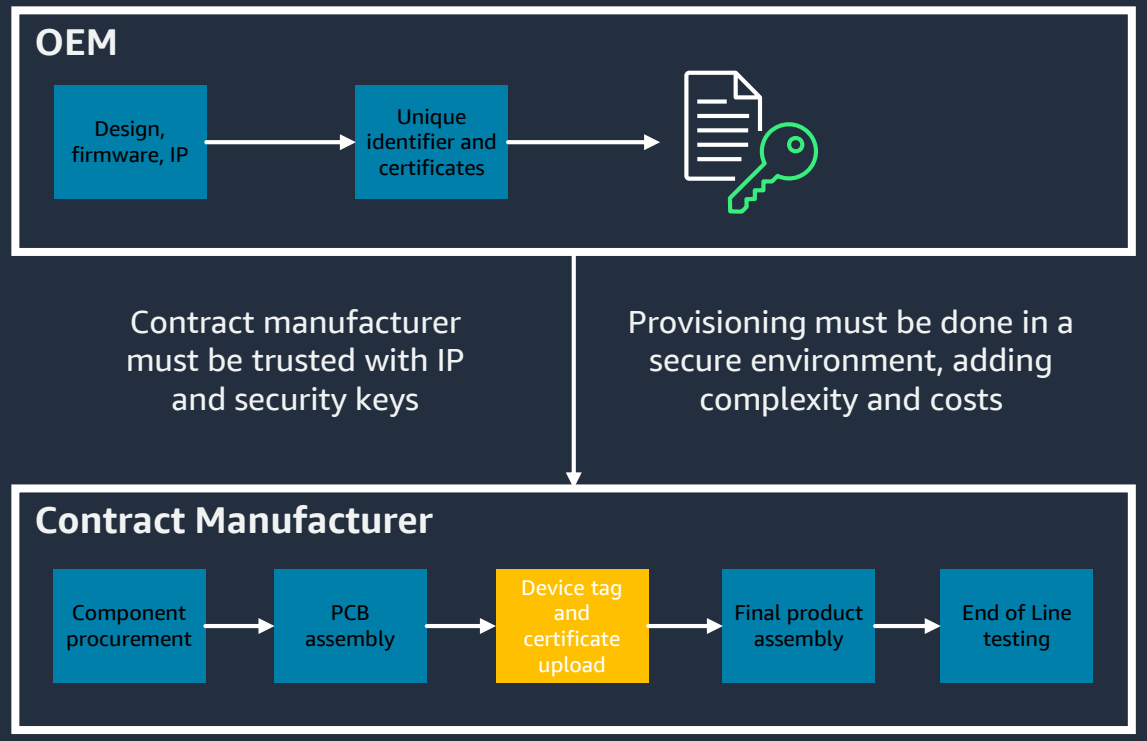
Modules come preprovisioned with a unique identifier and a birth certificate to simplify deployment at scale.

Supports a late-binding onboarding mechanism to reduce manufacturing time and cost, and increase flexibility.

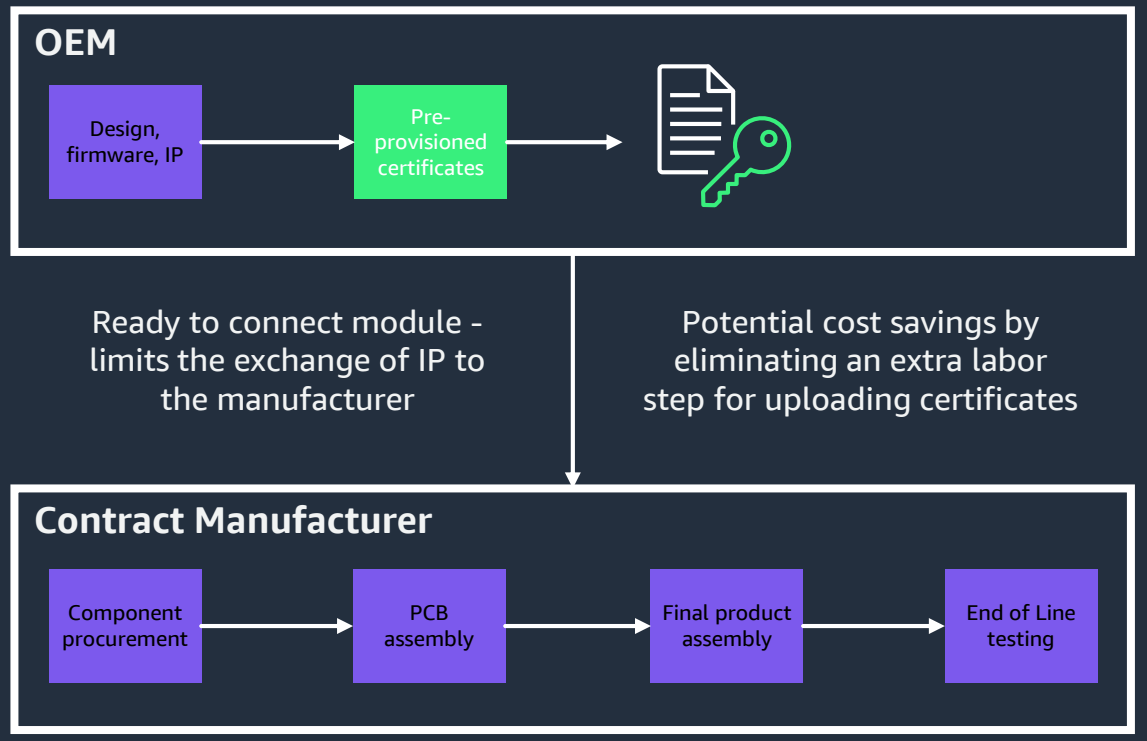
Monitor and manage device fleet health and security at scale with AWS IoT Device Management and AWS IoT Device Defender.

IP Protection, Manufacturing Flexibility and Savings

Without AWS IoT ExpressLink



With AWS IoT ExpressLink



Customer impact

Develop secure IoT devices in days or weeks, instead of months or years

Provide unparalleled peace of mind; security is part of the product from day one

Connect **any** embedded device to the cloud, even if it's resource constrained, such as small processors

Off-load the undifferentiated tasks and free up resources to focus on innovative capabilities that define your brand and product

Write to the application, not the connectivity media

Deploy and maintain your application securely using AWS IoT Core services

CONSUMER

CHALLENGE

ēdn's mission is to make growing plants indoors easy, year-round. Their SmallGarden product is a smart hydroponic garden that uses a series of sensors to determine what plants need, then communicates those needs to gardeners via an app. Connecting the device required ēdn to either outsource the development to a third party or allocate internal engineering resources, which would have delayed differentiated and innovative features.

SOLUTION

ēdn used u-blox's hardware module with AWS IoT ExpressLink to easily enable secure and reliable cloud connectivity for their devices.

The u-blox connectivity module included AWS-validated software, making it faster and easier to securely connect devices to the cloud and seamlessly integrate with a range of AWS services.

IMPACT

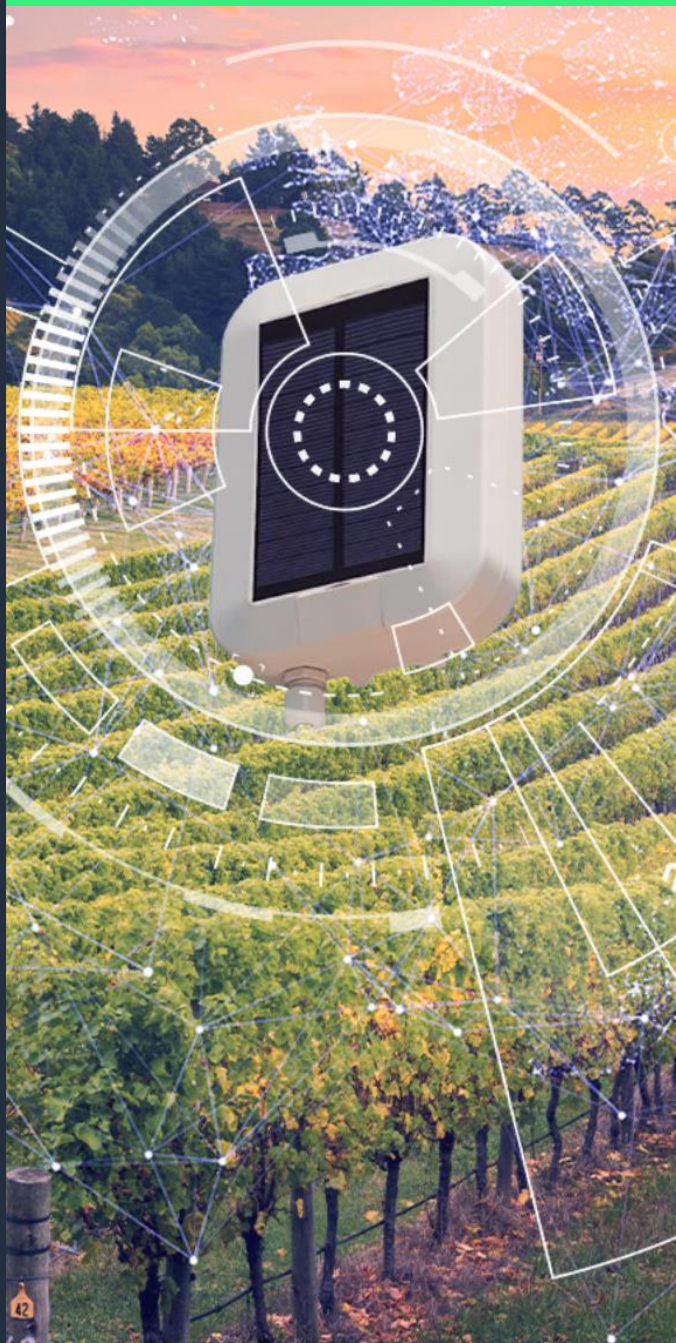
Accelerated product development time from months to days.

Offloaded complex IoT connectivity and security tasks and ensured engineering team remains focused on shipping leading-edge technologies.

"Our team has gone all in with AWS. We're leveraging them from the small business perspective for anything that we can. We have an internal mantra in engineering that is, 'If Amazon can do it for us, we don't do it.'"

Ryan Woltz, Founder & CEO, ēdn

INDUSTRIAL



CHALLENGE

SPHERAG delivers IoT enabled solutions for agricultural environments with 5G connectivity, allowing the control and monitoring of fertigation installations in real time. To extend their offering into remote rural properties across the globe, SPHERAG needed a secure cellular solution with reliable real-time connectivity and communication.

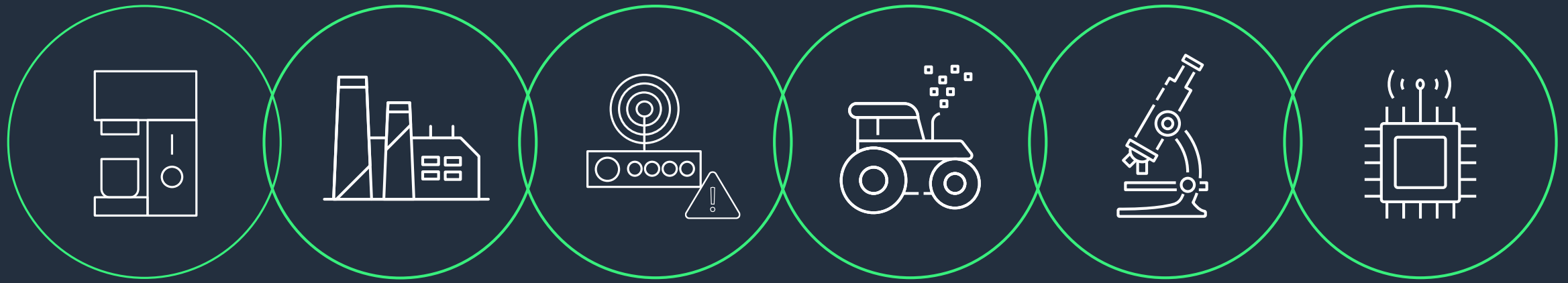
SOLUTION

SPHERAG integrated an AWS IoT ExpressLink connectivity module to their cellular-based encrypted device, allowing them to easily address their connectivity challenges. They further integrated their solution to AWS IoT Device Defender to effectively manage device fleet health and security at scale using over-the-air updates.

IMPACT

Accelerated time to market as SPHERAG's team can now completely focus on building innovative agricultural products and services without having to spend expensive engineering resources on implementing fundamental IoT connectivity and security concepts.

Top use cases



Connected appliances

Industrial equipment monitoring, sensing, actuating

Asset tracking & monitoring

Agricultural equipment

Medical equipment

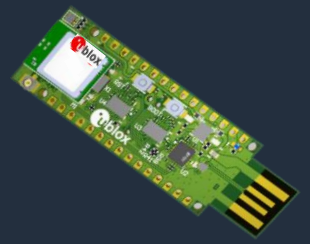
Other applications using resourced constrained devices

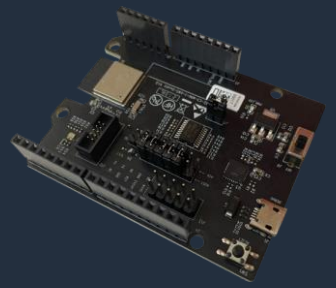
Four partners – five modules

Wi-Fi	ESP32-C3-Mini AWS IoT ExpressLink
Wi-Fi	CCM AWS IoT ExpressLink
Cellular Wi-Fi	SARA-R5 AWS IoT ExpressLink NORA-W2 AWS IoT ExpressLink
Wi-Fi BLE	Ameba Z2 AWS IoT ExpressLink module

Get started choosing from 5 evaluation kits

Vendor	Evaluation Kit	Technology	Form Factor	Buy
Espressif	ESP32-C3-DevKitM1	Wi-Fi/BLE 2.4GHz	Arduino Zero	AVAILABLE NOW
Infineon	CCM Eval Kit	Wi-Fi/BLE 2.4GHz	USB Stick	AVAILABLE NOW
Relatek	RTL8720CM-EVB AWS IoT ExpressLink Devkit	WiFi+BLE4.2	Arduino	AVAILABLE NOW
u-blox	USB-NORA-W2 Mini Eval kit	Wi-Fi/BLE 2.4GHz	USB Stick	AVAILABLE NOW
u-blox	SARA – R5 AWS Eval kit	Cellular LTE-M	MircoMod Carrier Board	AVAILABLE NOW





AWS IoT ExpressLink comparison

Vendor	Module P/N	Radio	Eval Kit	Dimensions	Highlights
Espressif	ESP32-C3-MINI-1-N4-A	Wi-Fi 4 2.4GHz	ESP32-C3-AWS-ExpressLink-DevKit (Arduino shield)	13.2 mm x 16.6 mm	Small form factor
Infineon	IFW 56810	Wi-Fi 4 2.4GHz	IFW56810 Evaluation Kit (USB stick)	36.0 mm x 18 mm x 2.8 mm(H)	Cloud-ID provisioning technology
Realtek	Ameba Z2 RTL8720CM	Wi-Fi 4 2.4GHz BLE4.2	AMB31 AWS IoT ExpressLink Devkit	76mm x56mm X12mm (H)	4MB RAM memory to minimize IoT end-product size
u-blox	NORA – W251 NORA – W256	Wi-Fi 4 2.4GHz	USB NORA-W2 Evaluation kit (USB stick)	14.3 mm x 10.4 mm x 1.8 mm(H)	High performance on chip antenna (W251)
u-blox	SARA – R5	Cellular LTE-M	Sparkfun IoT ExpressLink SARA – R5 Starter Kit	16.0 mm x 26.0 mm x 2.2 mm(H)	Low Power Cellular technology Evaluation SIM included

Simple FreeRTOS Example

```c
#include <stdio.h>
#include "FreeRTOS.h"
#include "task.h"

void vTaskExpressLink()
{
    puts("AT+CONNECT!\n");
    for (;;)
    {
        printf("AT+SEND1 {\"data\"=%d}\n", getSensorData());
        vTaskDelay(10000);
    }
}

void main()
{
    xTaskCreate(vTaskExpressLink, "ExpressLink Task", 256, NULL, 1, NULL);
    vTaskStartScheduler();
}
```

AWS IoT ExpressLink Resources

LEARN MORE

Check out the AWS IoT ExpressLink webpage and FAQs

Access the programmer's manual and learn the simple AT commands

CONNECT, SEND, SUBSCRIBE, GET, CONF, …

Choose an evaluation kit, clone one of the example projects, and start prototyping today!

Dive into this workshop and this blog for deeper implementation examples

Thank you!

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