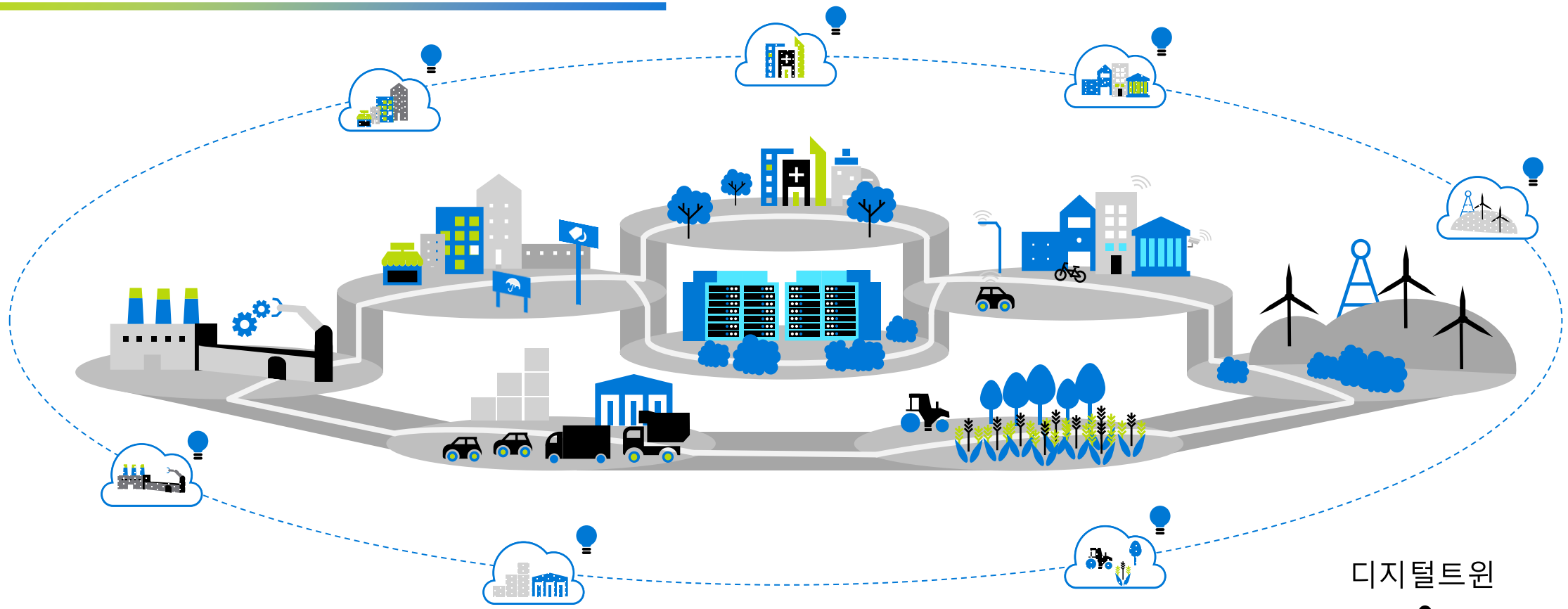
Microsoft Azure

Microsoft IoT Solutions

James Yun
IoT Technical Specialist
WCB IoT Asia

혁신을 통한 새로운 기회의 발견



클라우드

글로벌 가용성 확보, 무제한적 컴퓨팅 자원의 활용

사물인터넷

클라우드를 이용하여 센서와 장치의 신호를 수집 모니터링

Edge

지능형 서비스를 클라우드에서 IoT장치로 분산

인공지능

클라우드와 Edge에서 모두 지능형 서비스가 가능

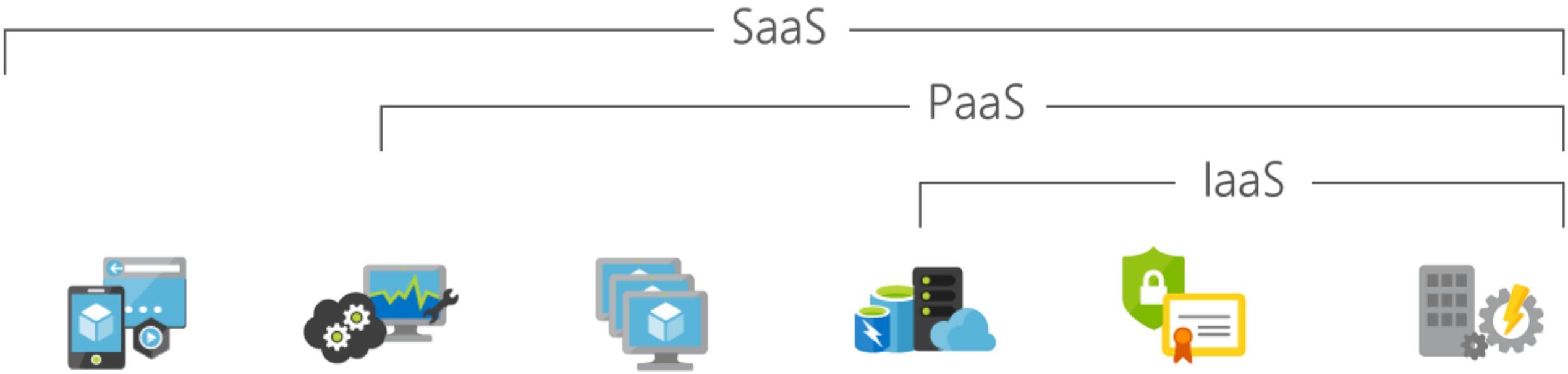
디지털트윈

물리적인 환경에 대한 디지털 복제를 통하여 과거와 미래를 추적하고 예측

Microsoft

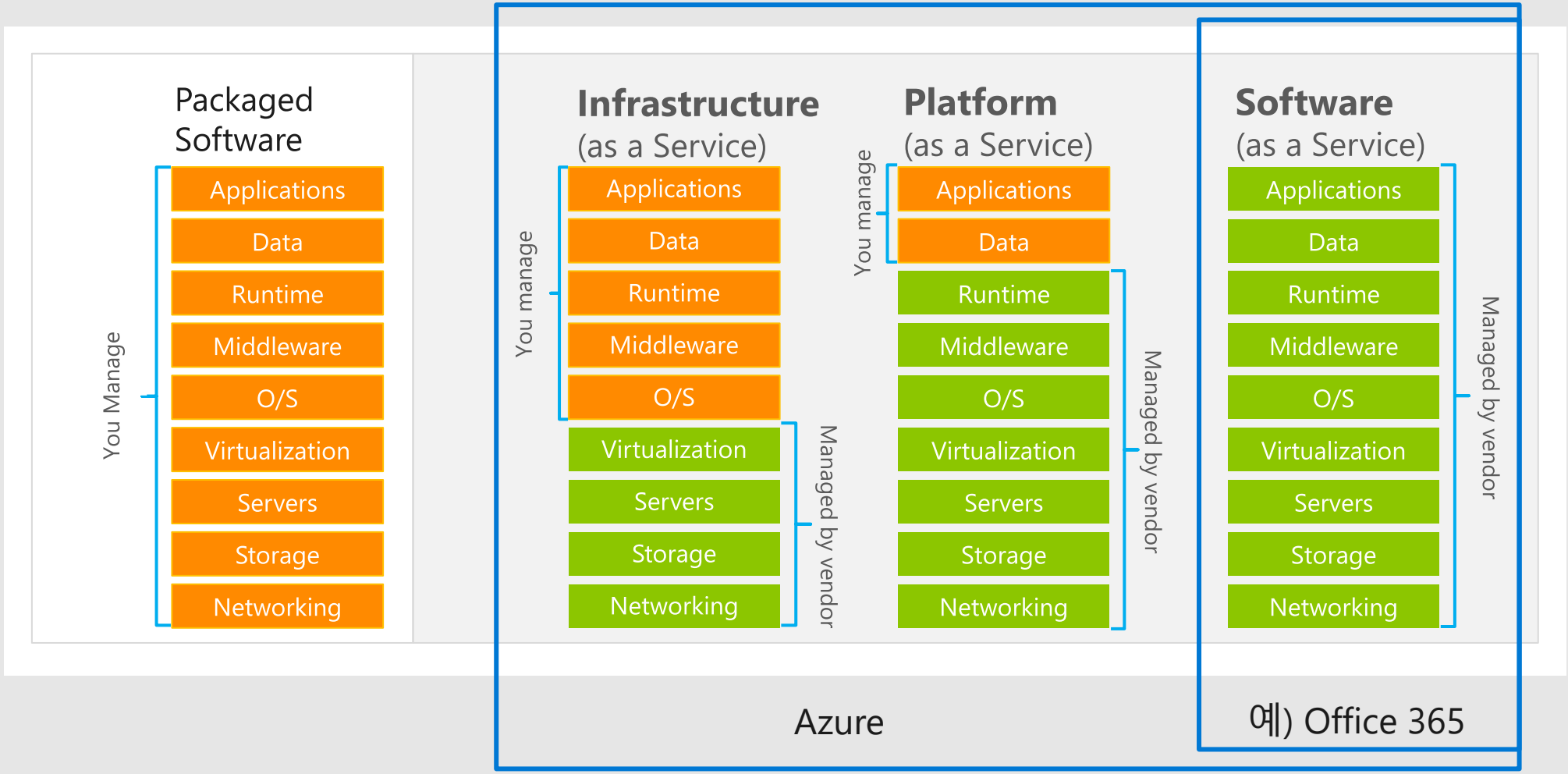
IoT사례 영상 비디오

IaaS , PaaS , SaaS ?



Hosted applications/apps	Development tools, database management, business analytics	Operating systems	Servers and storage	Networking firewalls/security	Data center physical plant/building

Azure 는 Microsoft 의 클라우드 컴퓨팅 플랫폼



마이크로소프트의 IoT솔루션

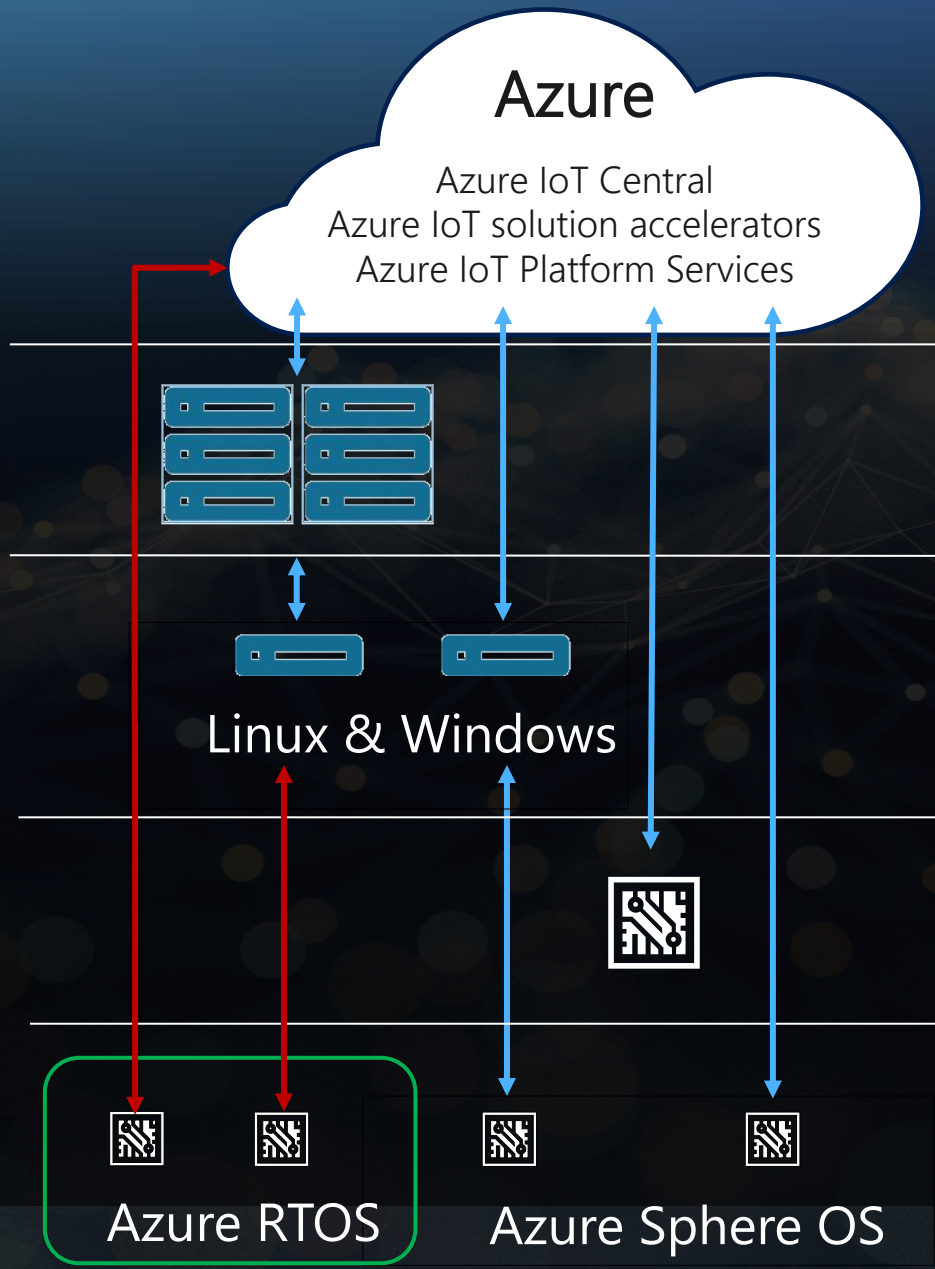
Azure Security Center

Azure IoT 주요 산업영역

제조 | 유통 | 농축산 | 에너지 | 스마트시티 | 의료 | 운송

Azure IoT 솔루션	Azure IoT Central (SaaS)	Azure IoT Reference Architecture & Accelerators (PaaS)	Dynamics Connected Field Service (SaaS)
Azure IoT 서비스	Azure IoT Hub Azure IoT Hub Device Provisioning Service Azure Digital Twins Azure Time Series Insights Azure Maps	Azure Stream Analytics Azure Cosmos DB Azure AI Azure Cognitive Services Azure ML Azure Logic Apps	Azure Active Directory Azure Monitor Azure DevOps Power BI Azure Data Share Azure Spatial Anchors
IoT & Edge 장치지원	Azure RTOS Azure Sphere Azure IoT Device SDK Azure IoT Edge Data Box Edge	Windows IoT Azure Certified for IoT—Device Catalog Azure Stream Analytics Azure Storage	Azure ML Azure SQL Azure Functions Azure Cognitive Services

Microsoft IoT Offerings



Azure
- Available in Azure Regions
- Full functionality

Azure Stack
- Azure Services & Management on-prem
- Azure IoT Hub

Azure IoT Edge
- Deploy and manage cloud services
- Managed by Azure or Azure Stack

Windows IoT, Linux
- Azure IoT Edge runs on Windows and Linux

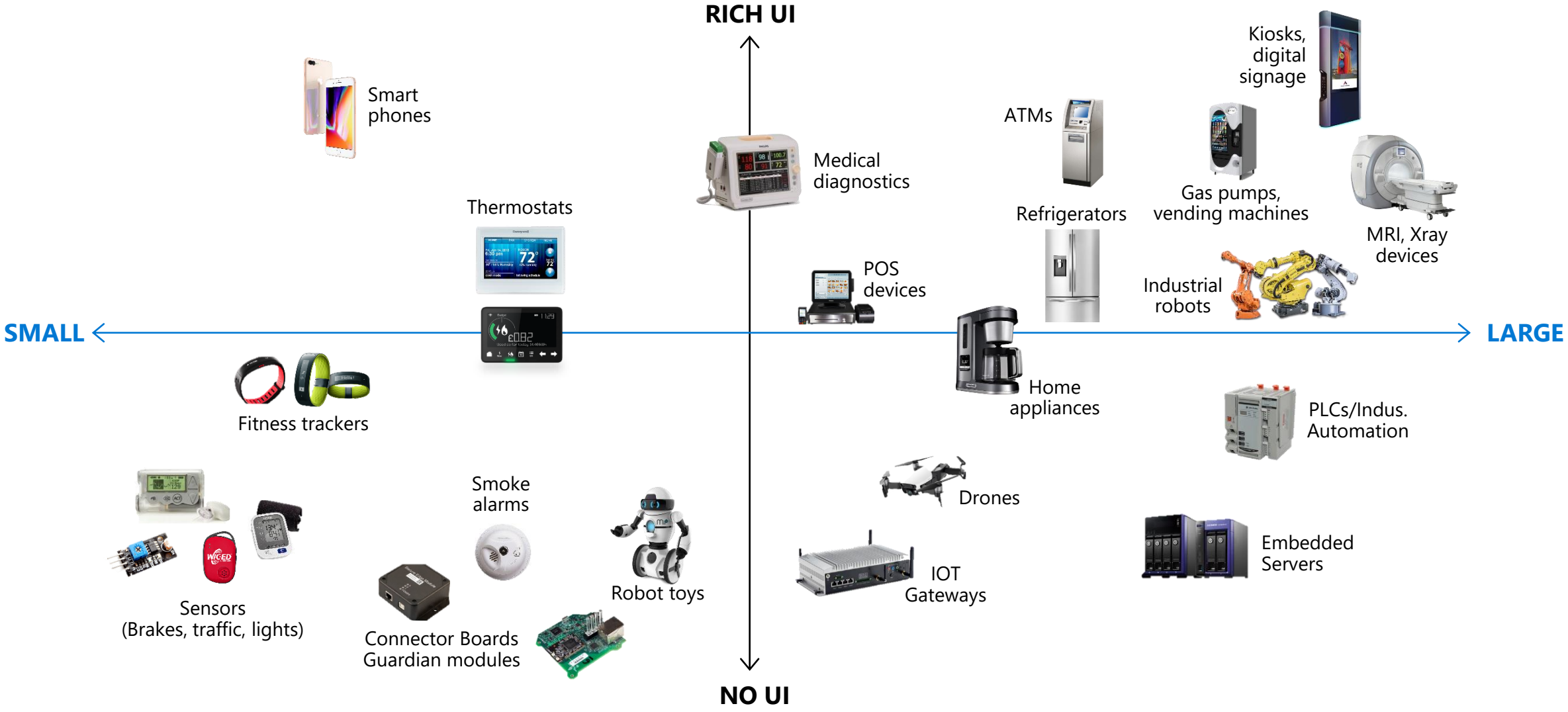
Azure IoT Device SDK
- Multi-device, multi-language, multi-OS
- Linux, iOS, Android, Windows, RTOS

Azure Sphere
- Peerless security for MCU devices
- Connect directly to Azure or via Azure IoT Edge

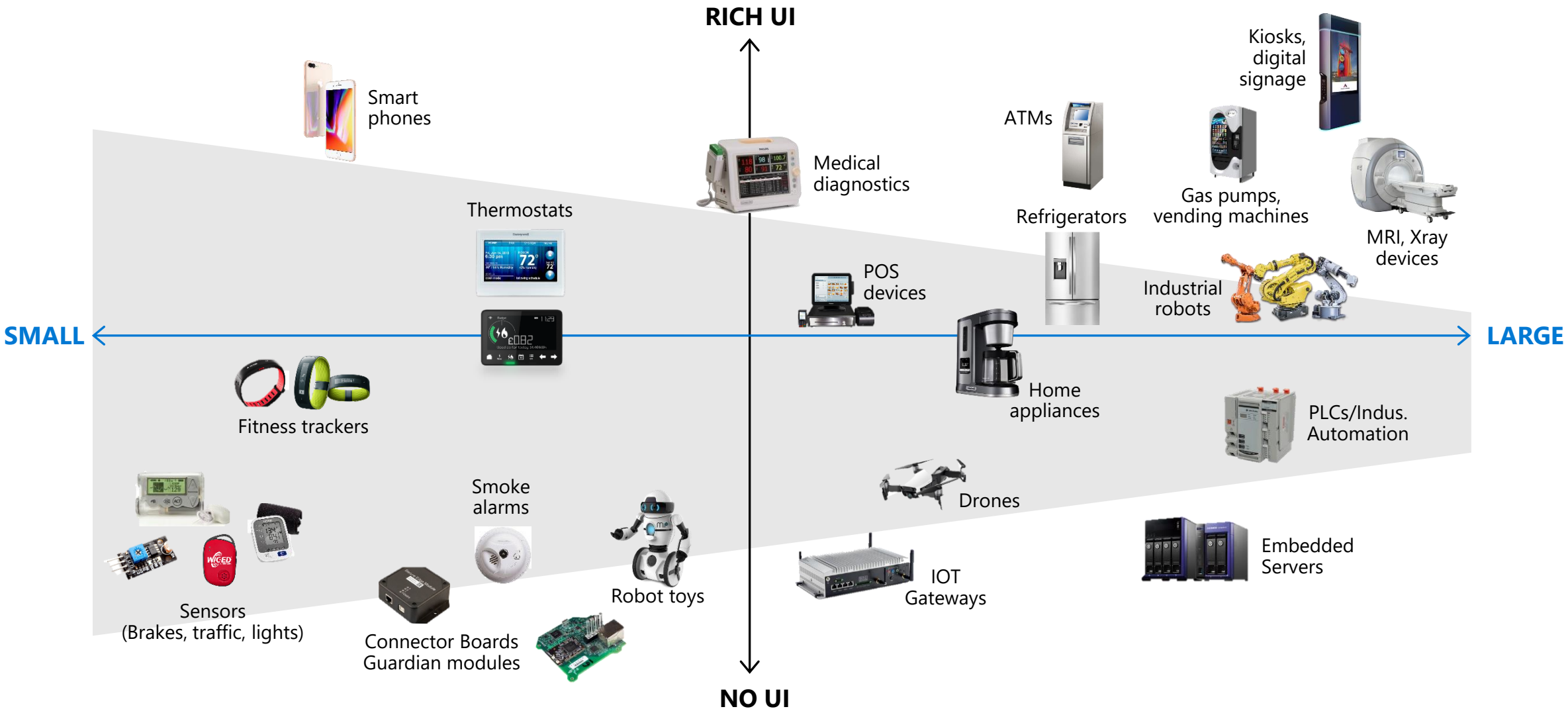
Azure Sphere OS
- Linux Kernel that modernizes MCU devices

Azure RTOS
- Comprehensive suite featuring high performance small, fast and reliable RTOS, middleware and tools

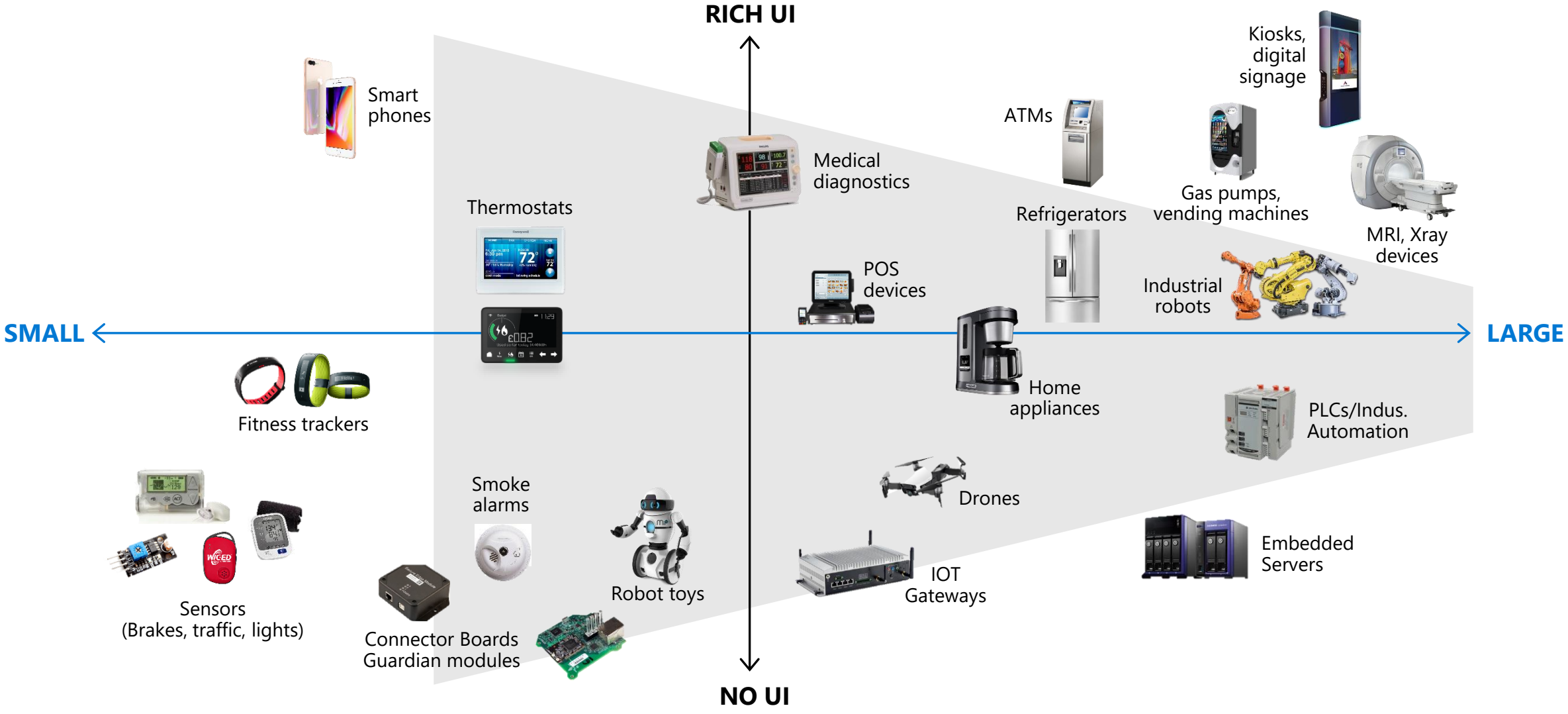
Understanding the device landscape



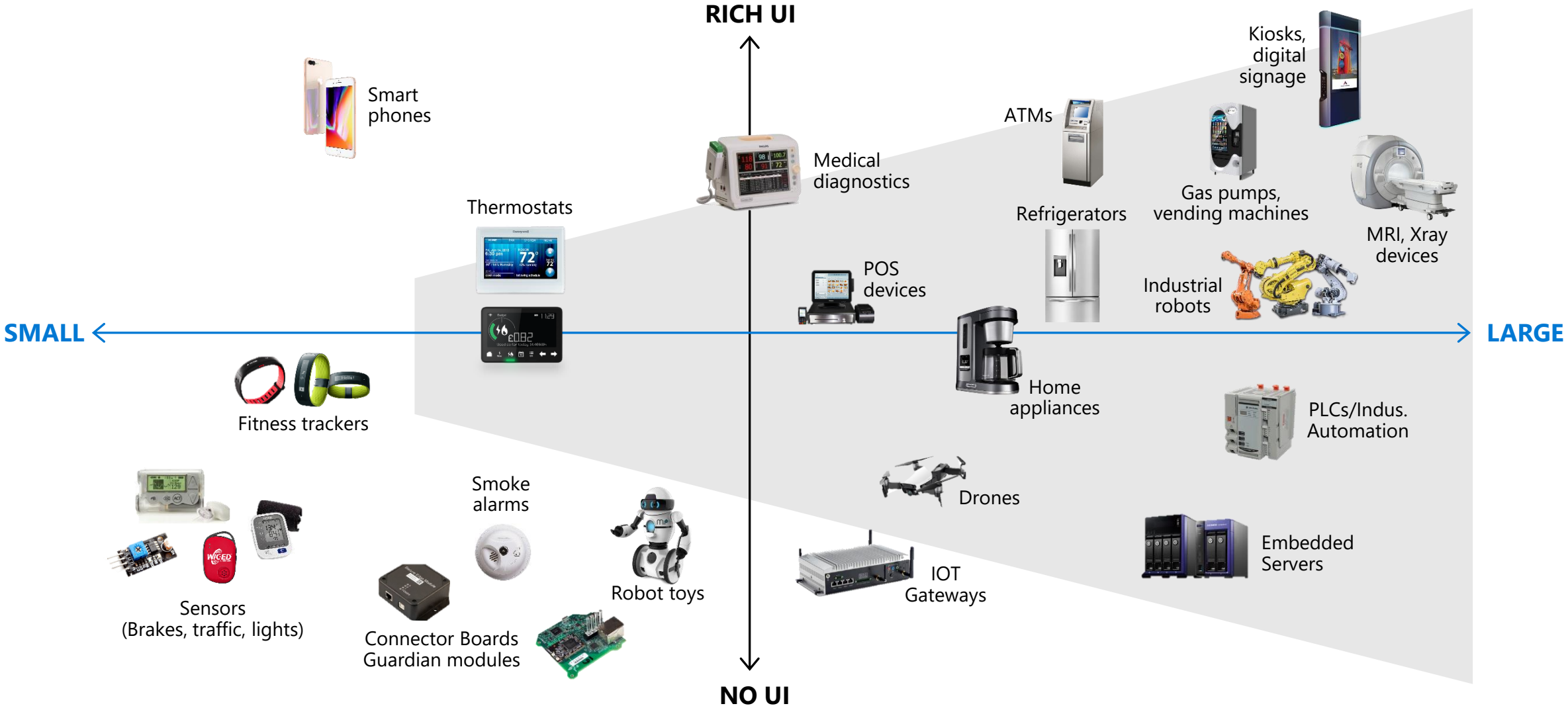
Operating system “neighborhoods” | Azure RTOS



Operating system “neighborhoods” | Azure Sphere



Operating system “neighborhoods” | Windows 10 IoT



Microsoft Azure

Azure IoT

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Azure IoT solution accelerators

- End-to-end implementation
- Completely customizable
- Open-source microservices based architecture
- Device connectivity and management
- Dashboards, visualization, and insights
- Workflow automation and integration
- Command and control
- Preconfigured solutions

- Remote Monitoring
- Connected Factory
- Predictive Maintenance
- Device Simulation

Accelerate time to value

Start quickly for common IoT scenarios

Get started in minutes

Modify existing rules and alerts

Add your devices and begin tailor to your needs

Finish with your IoT application

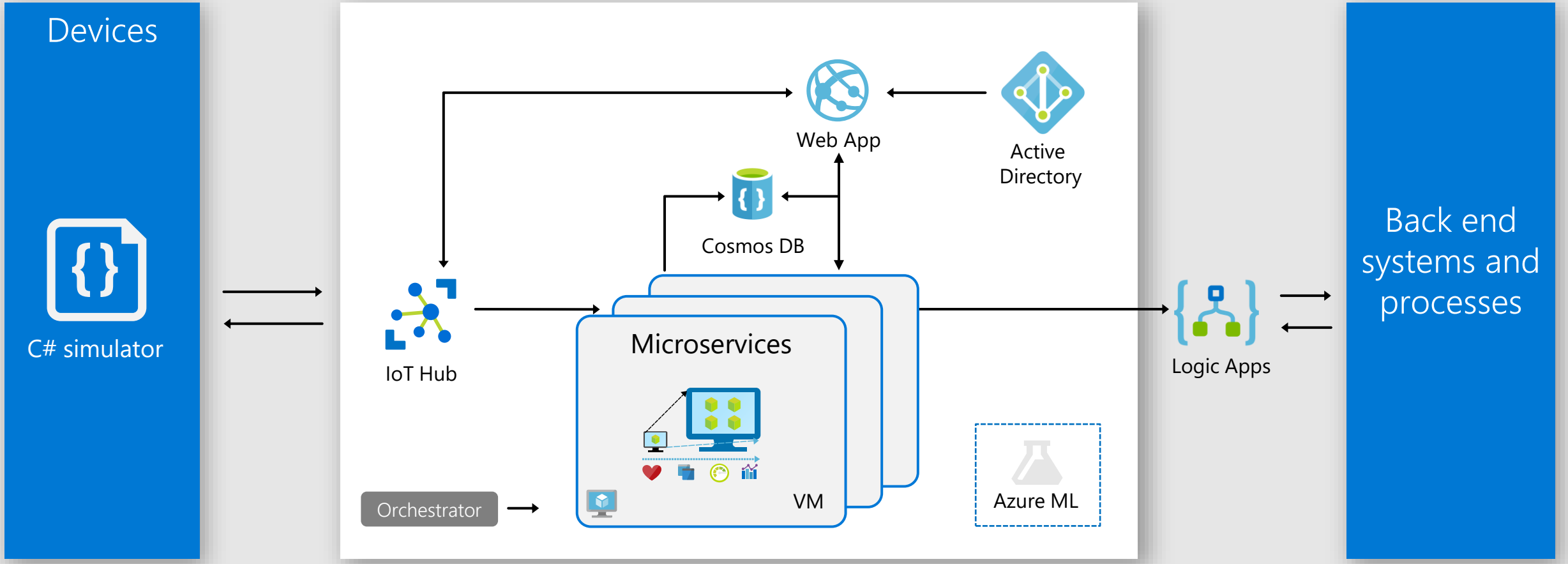
Fine-tuned to specific assets and processes

Highly visual for your real-time operational data

Integrate with back-end systems

Components of a pre-configured solution

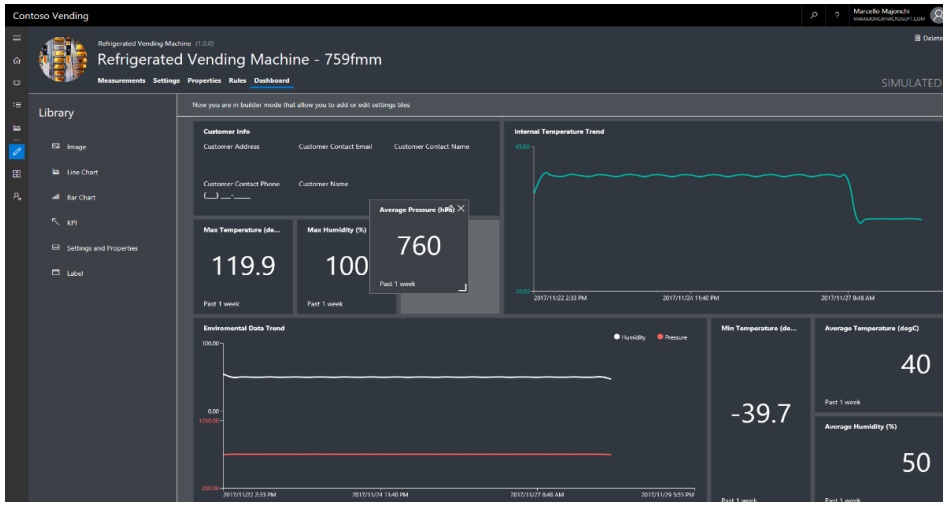
Remote monitoring | Predictive maintenance | Connected factory | Device simulation



Azure IoT Central

- Fully hosted and managed by Microsoft
- No cloud development expertise required
- Device connectivity and management
- Monitoring rules and triggered actions
- User roles and permissions
- Analytics, dashboards and visualization
- Risk-free trial with simplified pricing

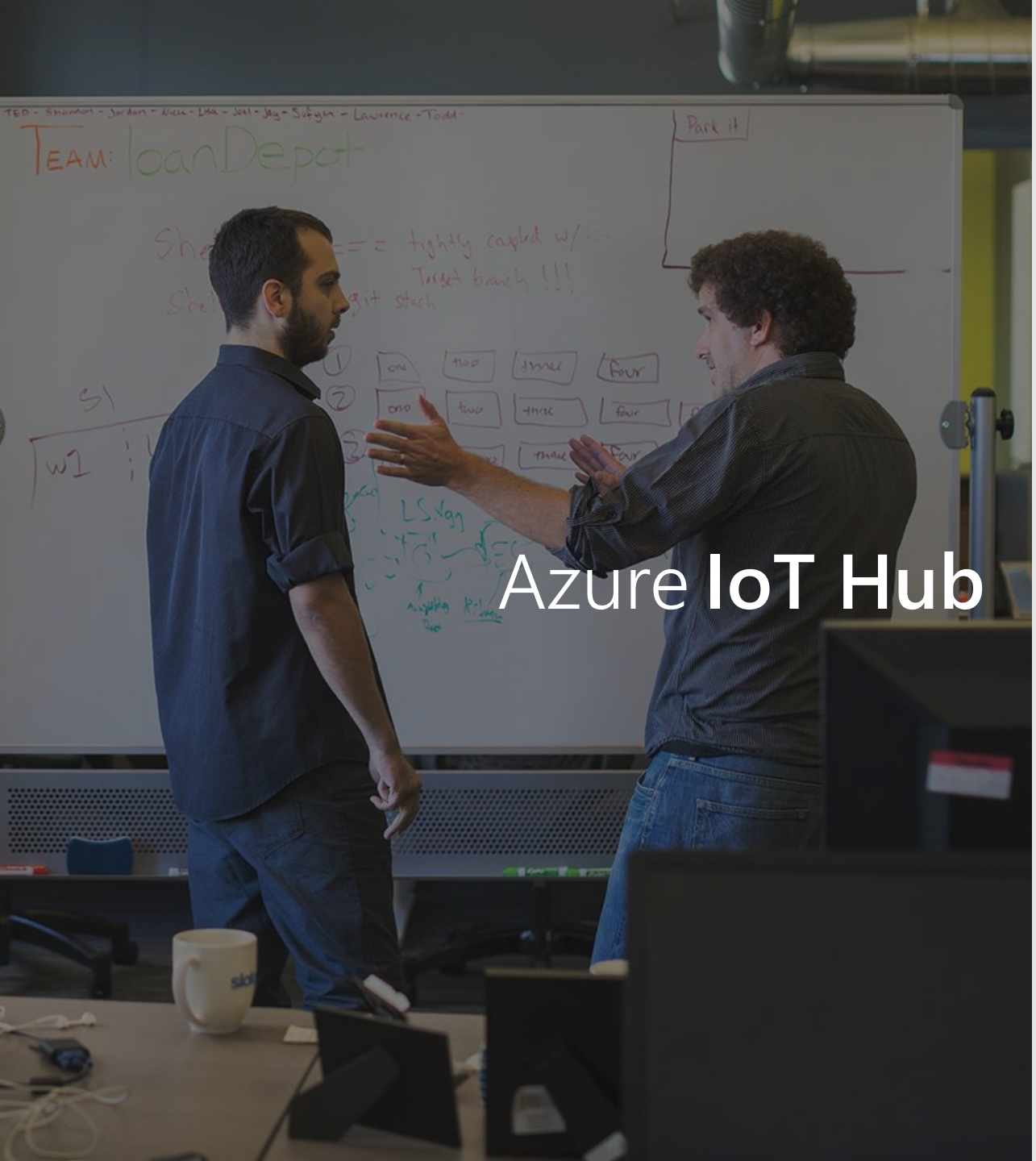
Builder



- Product modeler
- Device settings
- Template management
- Rules workflows
- User and identity management

Operator

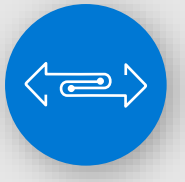
- Device management
- Analytics & dashboards
- Time-series Insights
- Alerts and actions



Azure IoT Hub

- Establish bi-directional communication with billions of IoT devices
- Enhance security with per device authentication
- Provision devices at scale w/IoT Hub Device Provisioning Service
- Manage devices at scale with device management
- Multi-language and open source SDKs

Azure IoT Hub



Bi-directional communication

Millions of Devices
Multi-language, open source SDKs
HTTPS/AMQPS/MQTTS
Send Telemetry
Receive Commands
Device Management
Device Twins
Queries & Jobs

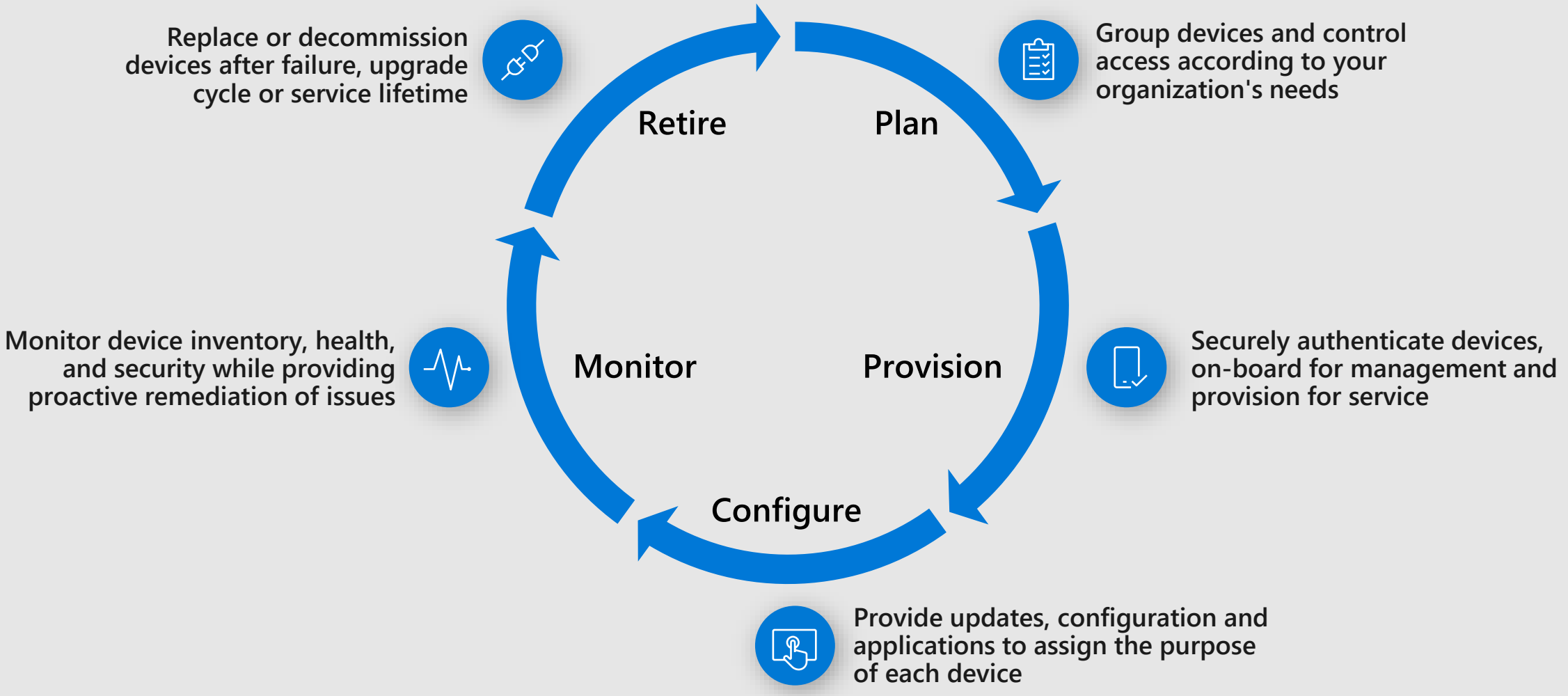
Enterprise scale & integration

Billions of messages
Scale up and down
Declarative Message Routes
File Upload
WebSockets & Multiplexing
Azure Monitor
Azure Resource Health
Configuration Management

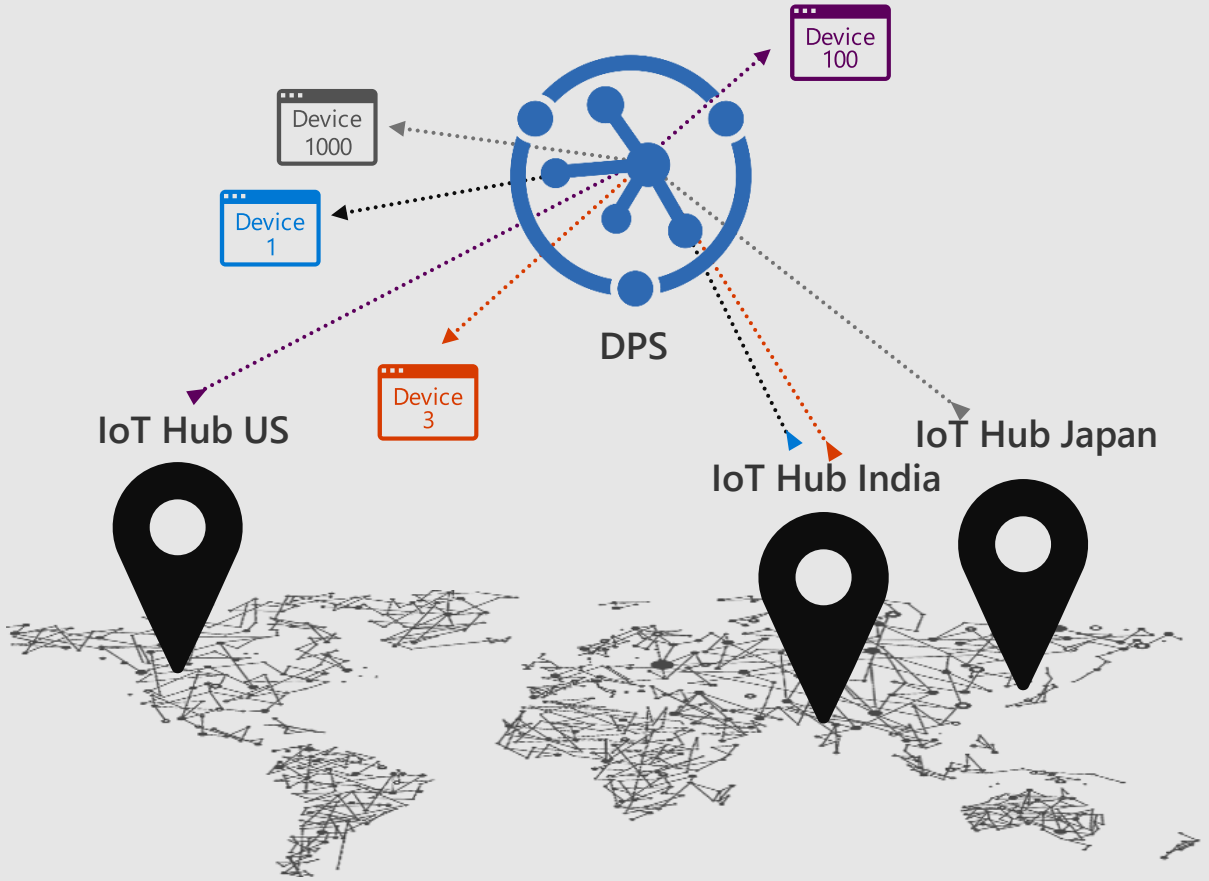
End-to-end security

Per Device Certificates
Per Device Enable/Disable
TLS Security
X.509 Support
IP Whitelisting/Blacklisting
Shared Access Polices
Firmware/Software Updates

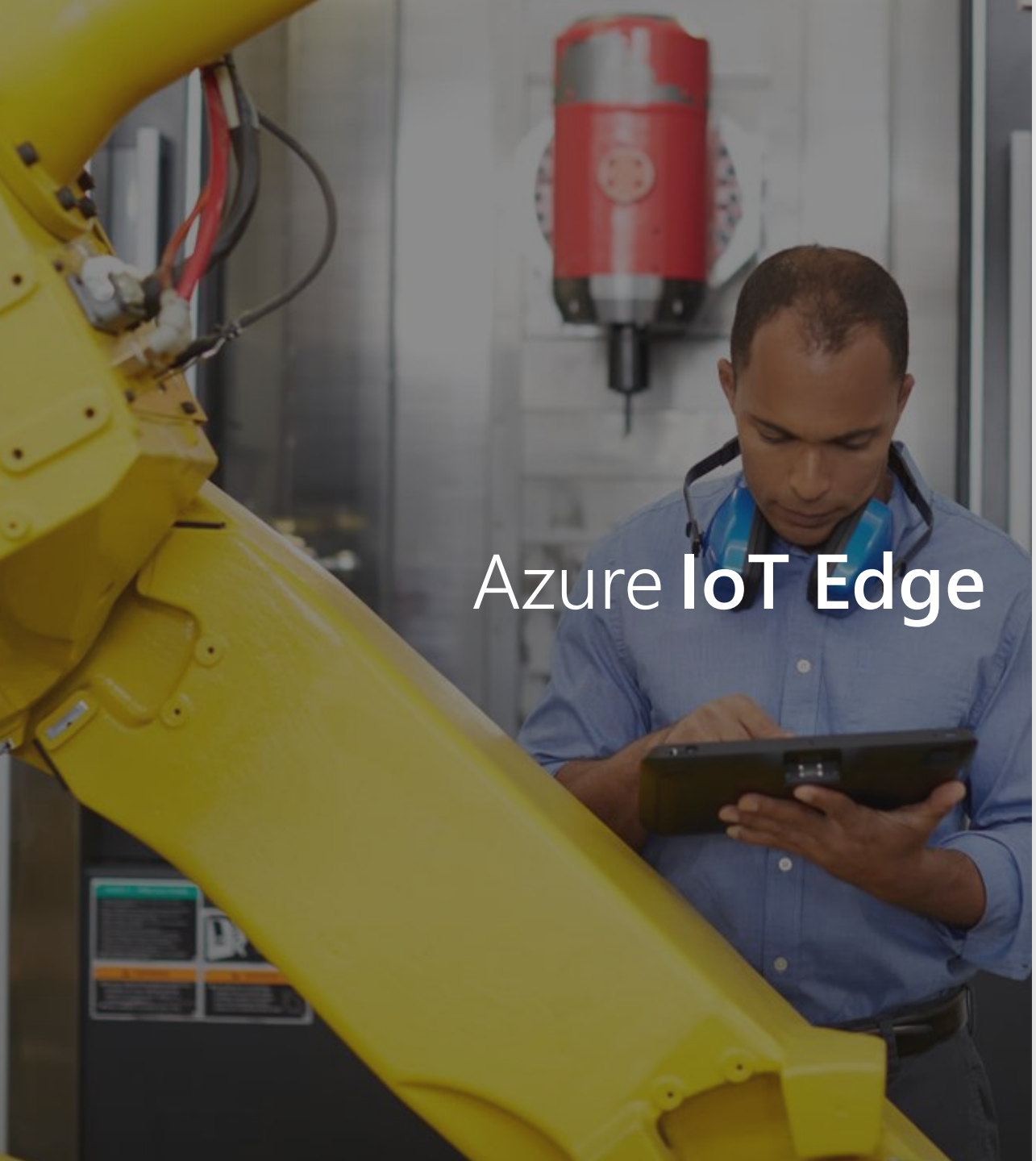
IoT device management lifecycle



Azure IoT Hub
Device Provisioning Service



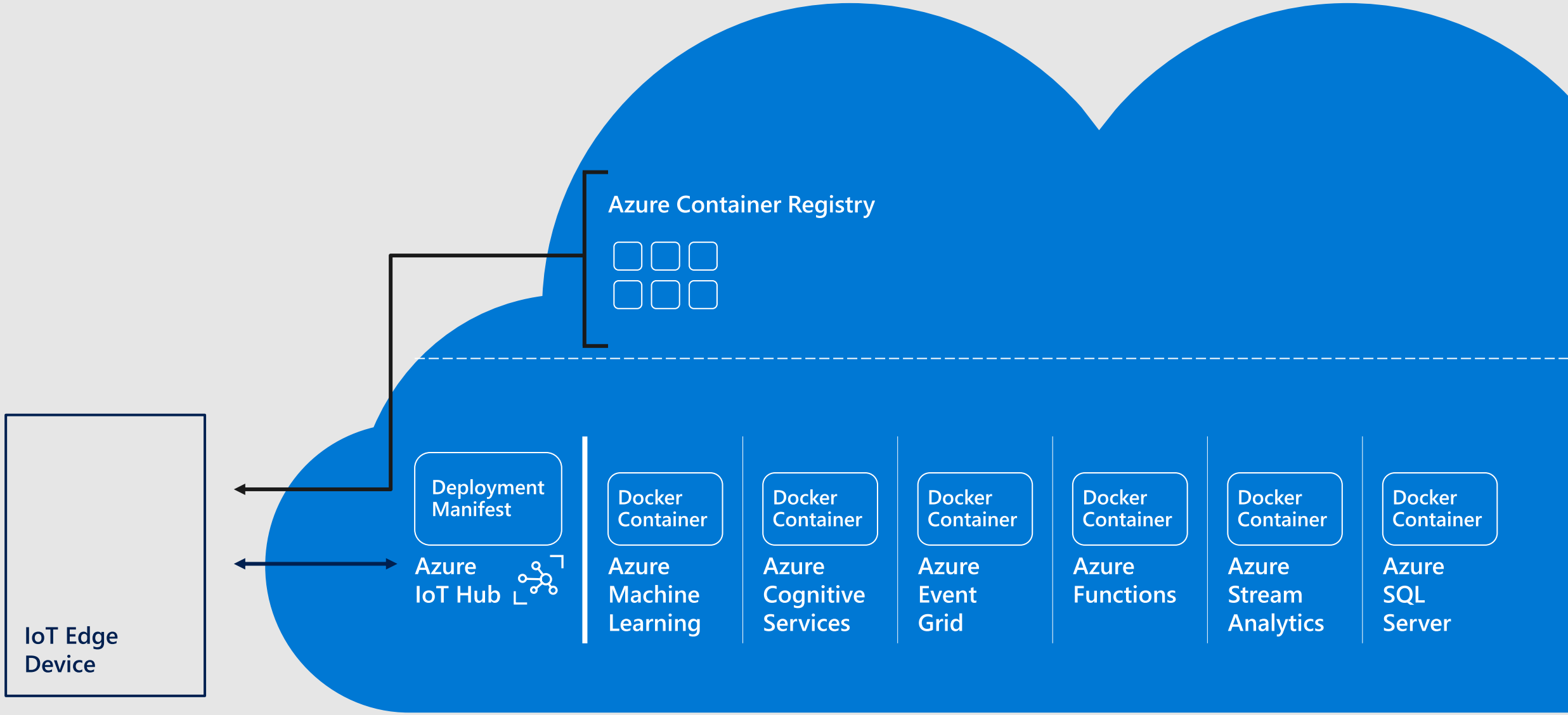
- Zero touch Provisioning
- TPM / X.509 Certificate / Symmetric key
- Multi Region / Multi tenancy
- Minimize manual job to remove human error



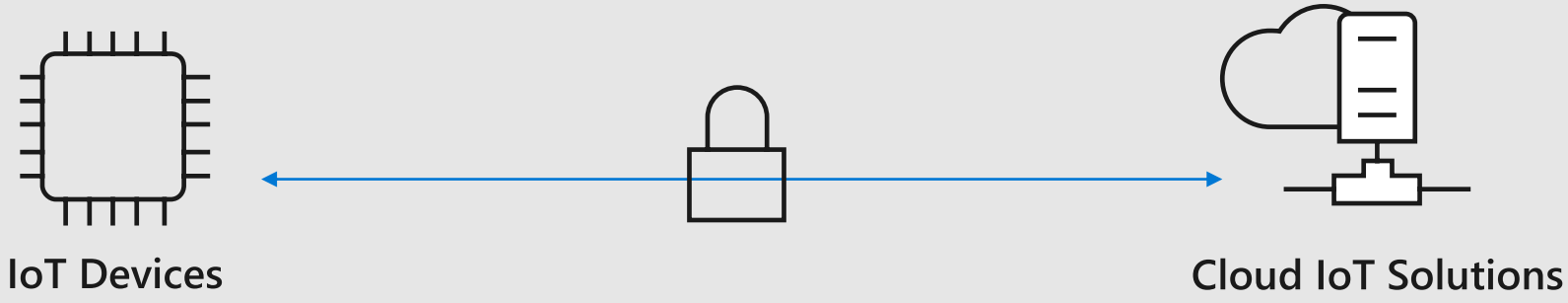
Azure **IoT Edge**

- Move cloud and custom workloads to the edge, securely
- Seamless deployment of AI and advanced analytics
- Configure, update and monitor from the cloud
- Compatible with popular operating systems
- Code symmetry between cloud and edge for easy development and testing
- Secure solution from chipset to cloud

Azure IoT Edge Deployment

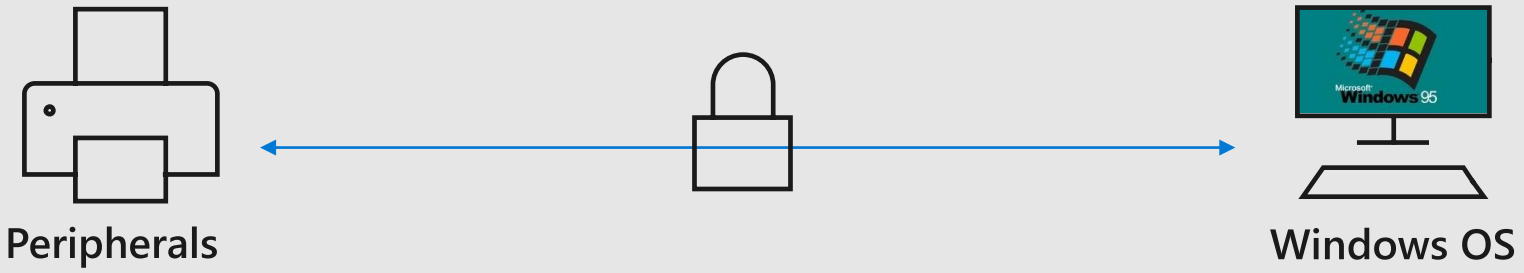


IoT Today

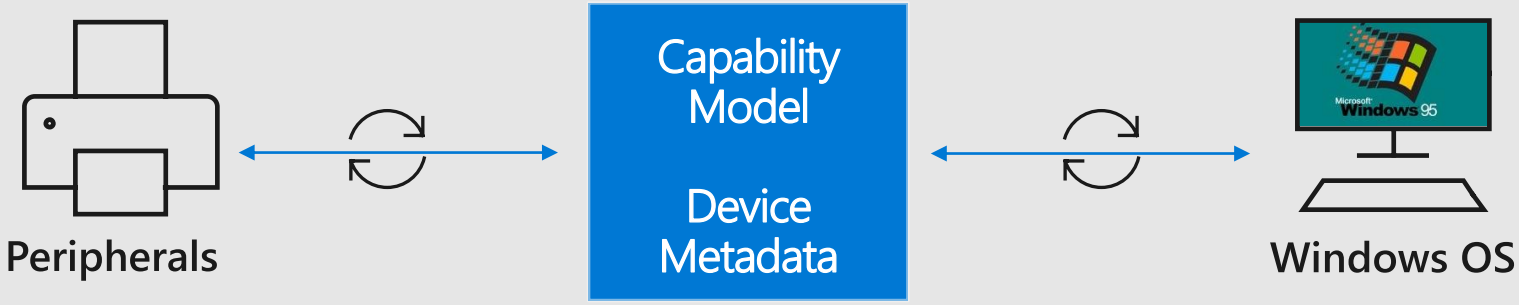


Tight coupling between software on device and IoT solution in the cloud

We had a similar challenge in the past…



That was solved with Windows “Plug and Play”



Devices published their capability models and adhered to them
Windows used the capability model to know how to interact with them

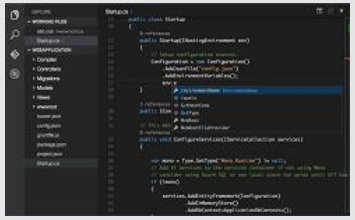
IoT Plug and Play

Devices that just work out of the box with no code required

Partner Solutions & Azure IoT Central

Azure IoT Device Simulation

VS Code



Easy to model device capabilities, easy to generate device software skeleton

Device Capability Model

JSON-LD Schema

Azure IoT Device Catalog IoT Plug & Play Certified

Easy to certify plug and play devices

Easy for customers and partners to find plug and play devices that just work

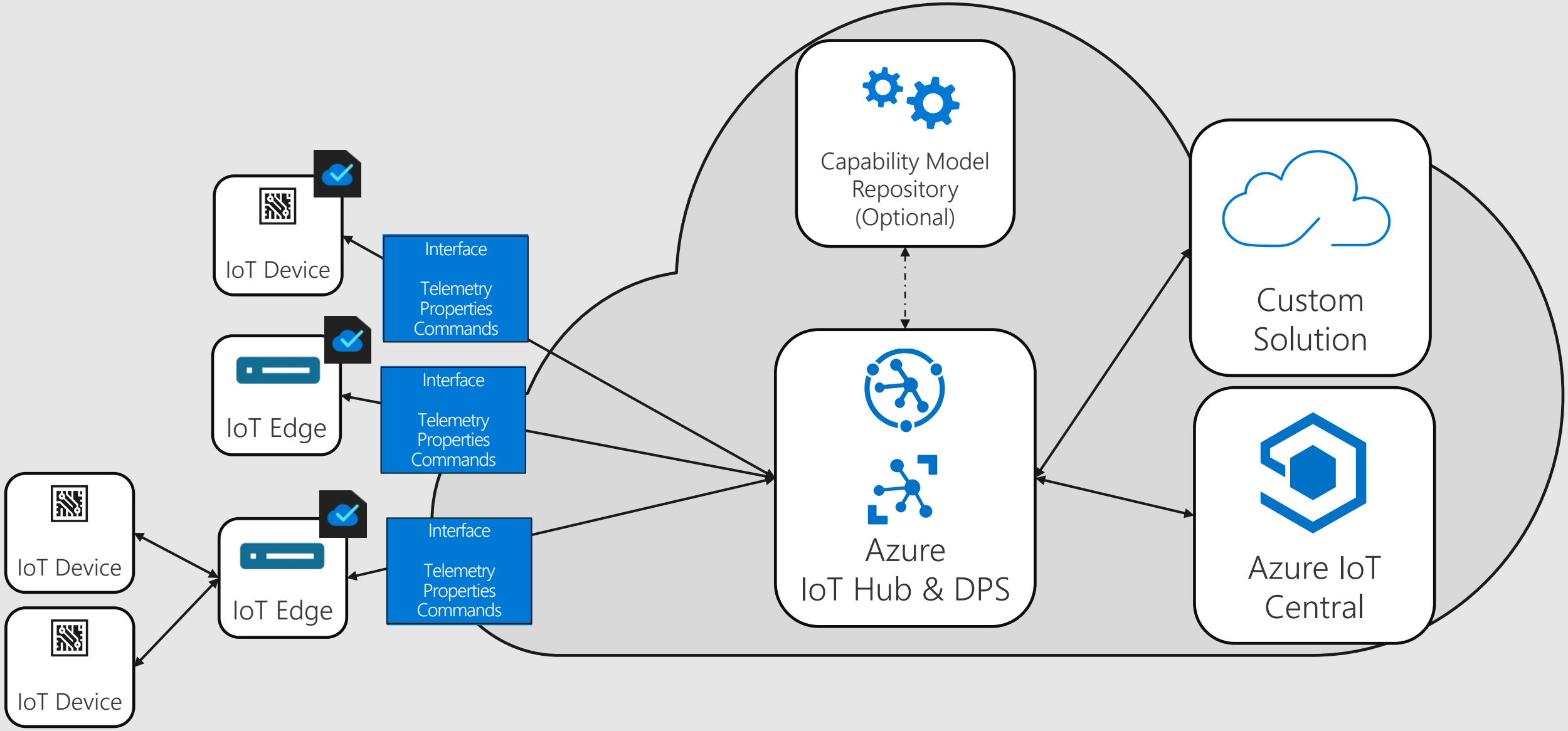
IoT Plug and Play Device Software

Generated Device Agent

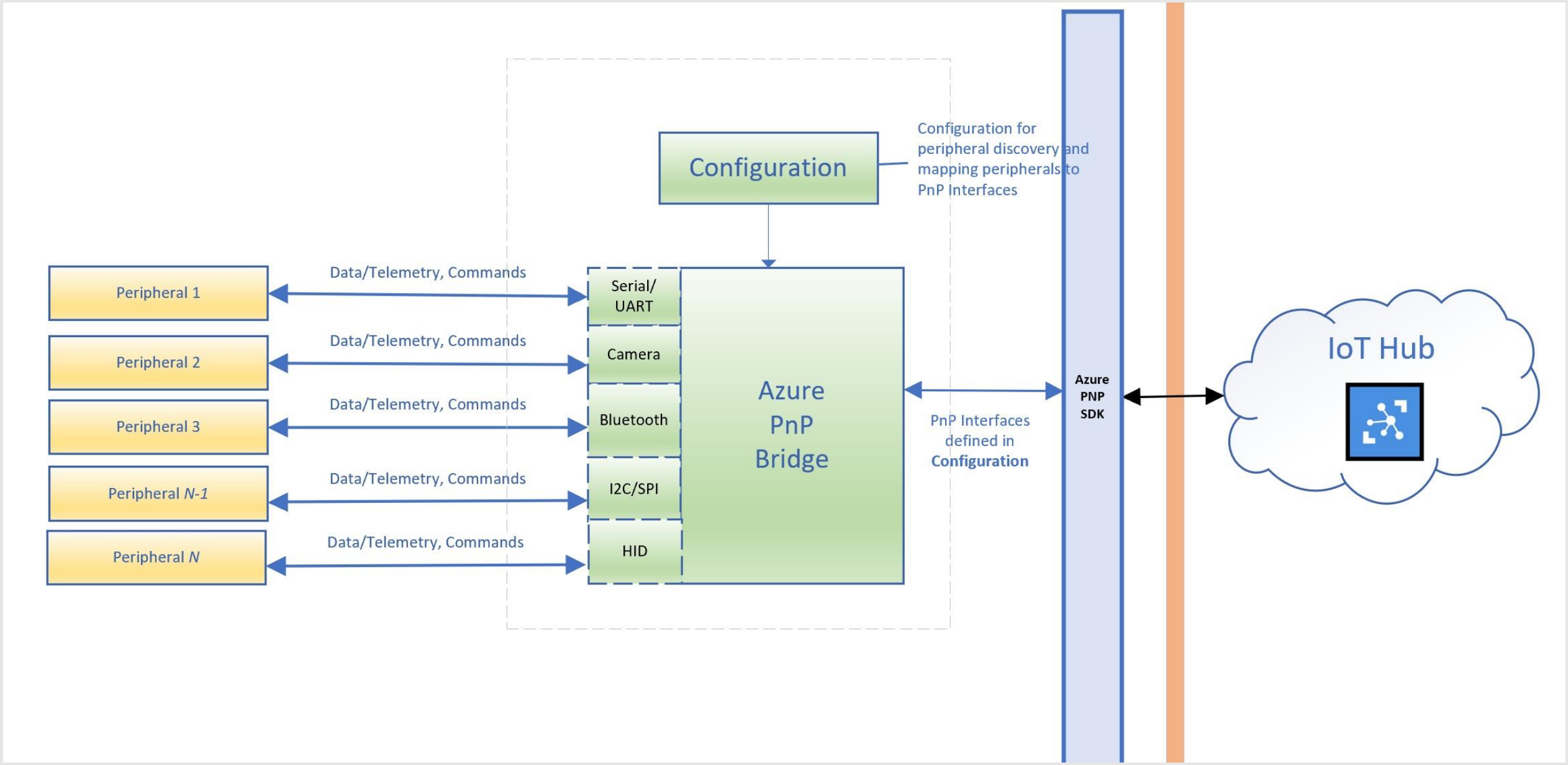
Azure IoT Device SDK

Easy to develop device software and ensure it just works with IoT solutions

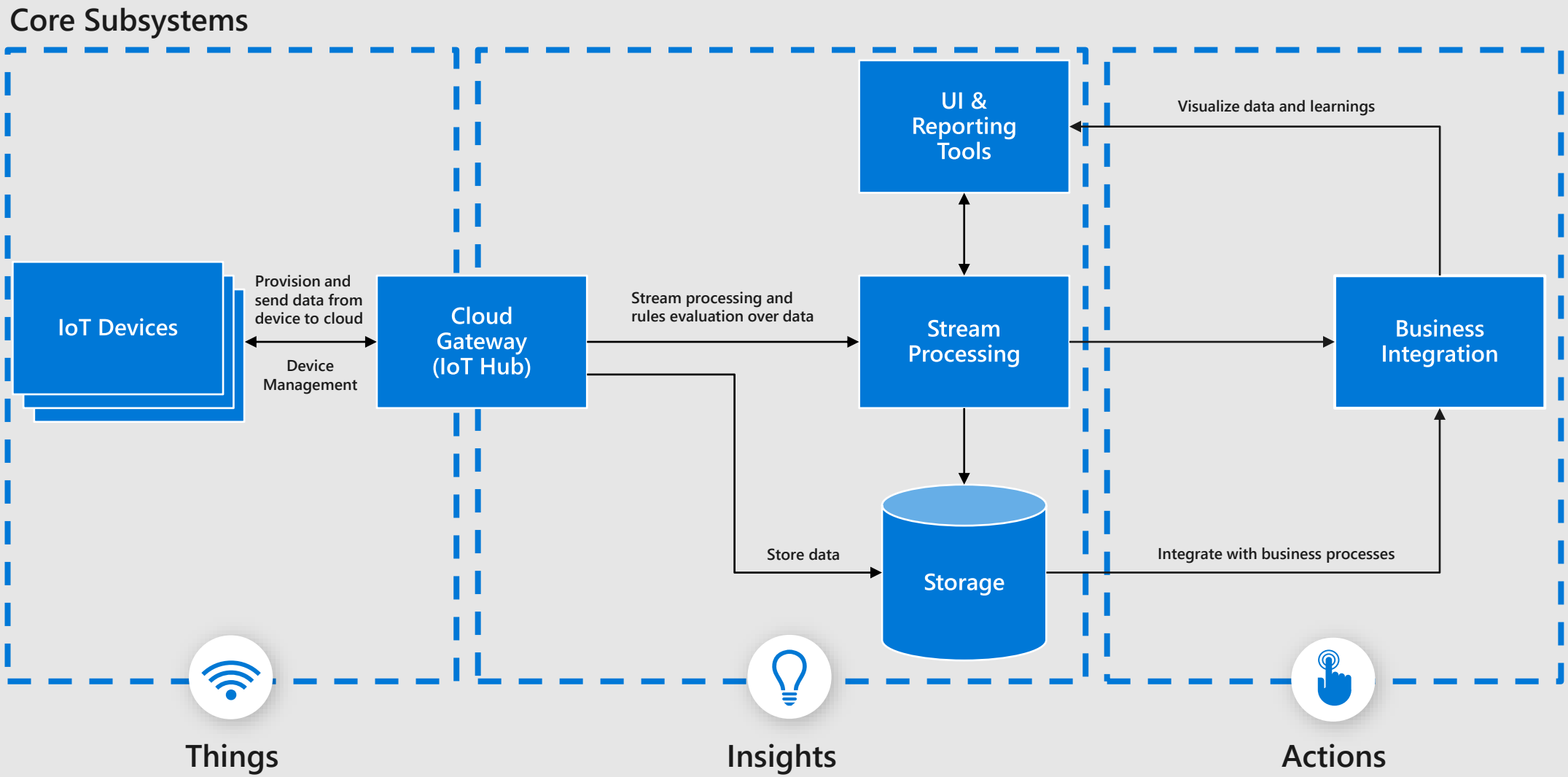
IoT Plug and Play In Platform Context



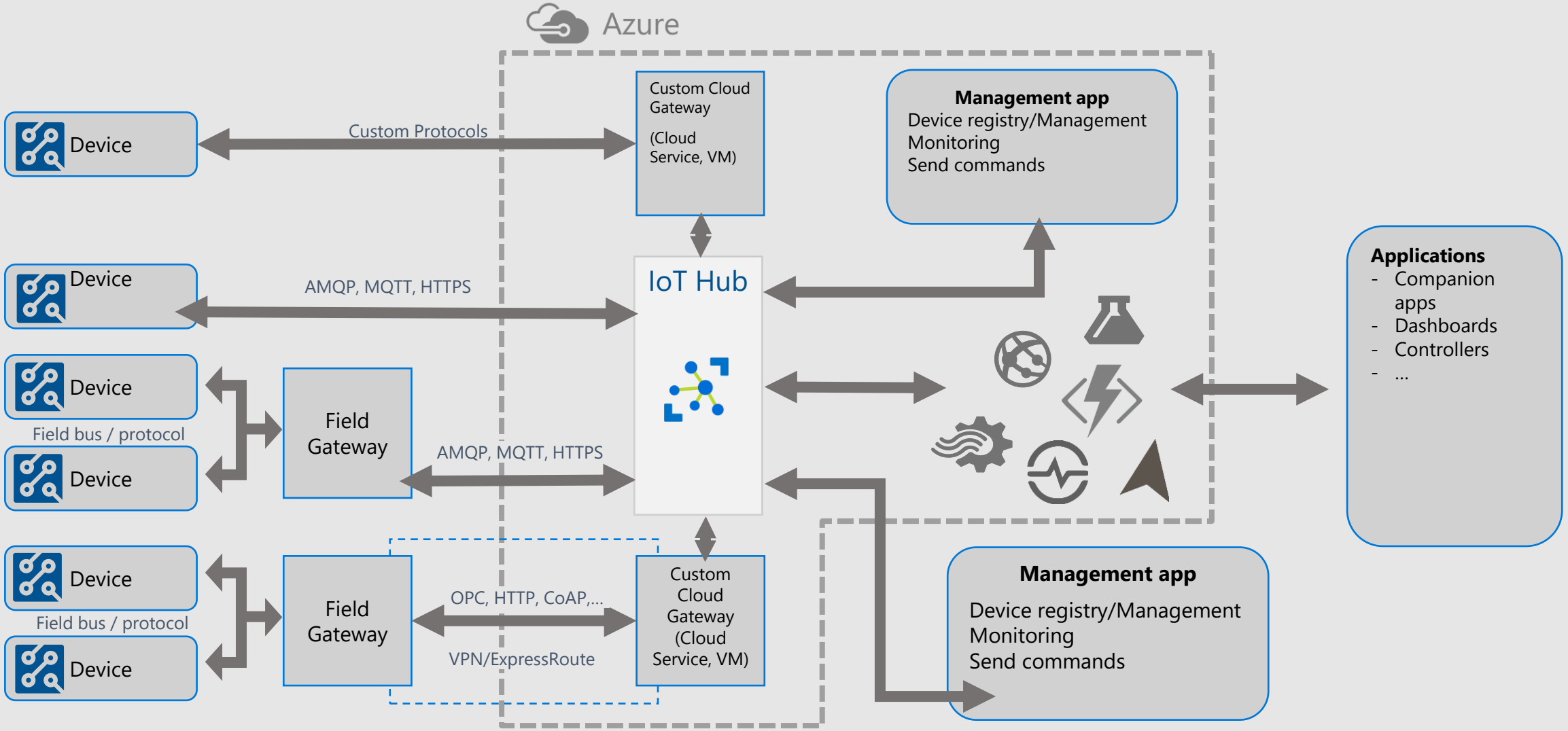
IoT Plug and Play Bridge Architecture



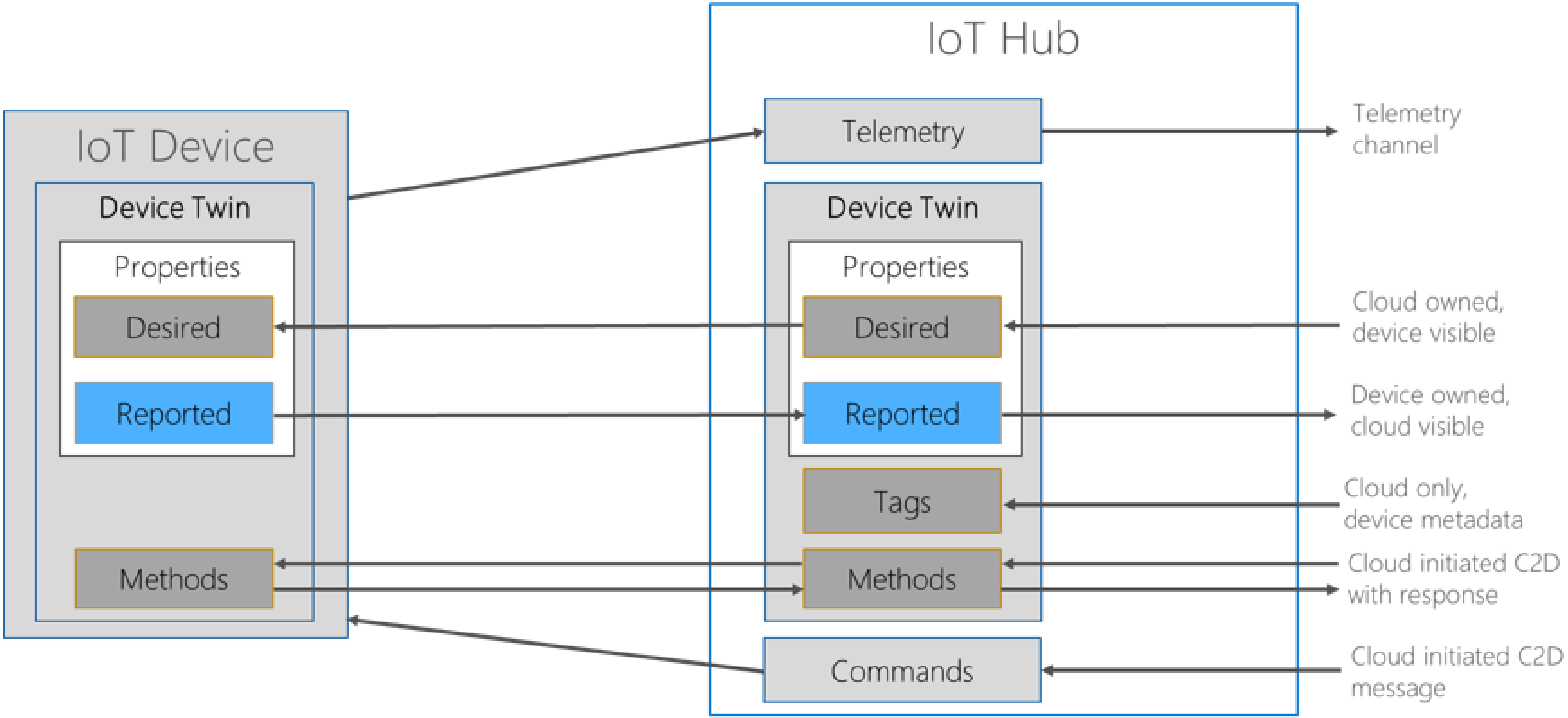
Azure IoT 기본 아키텍쳐



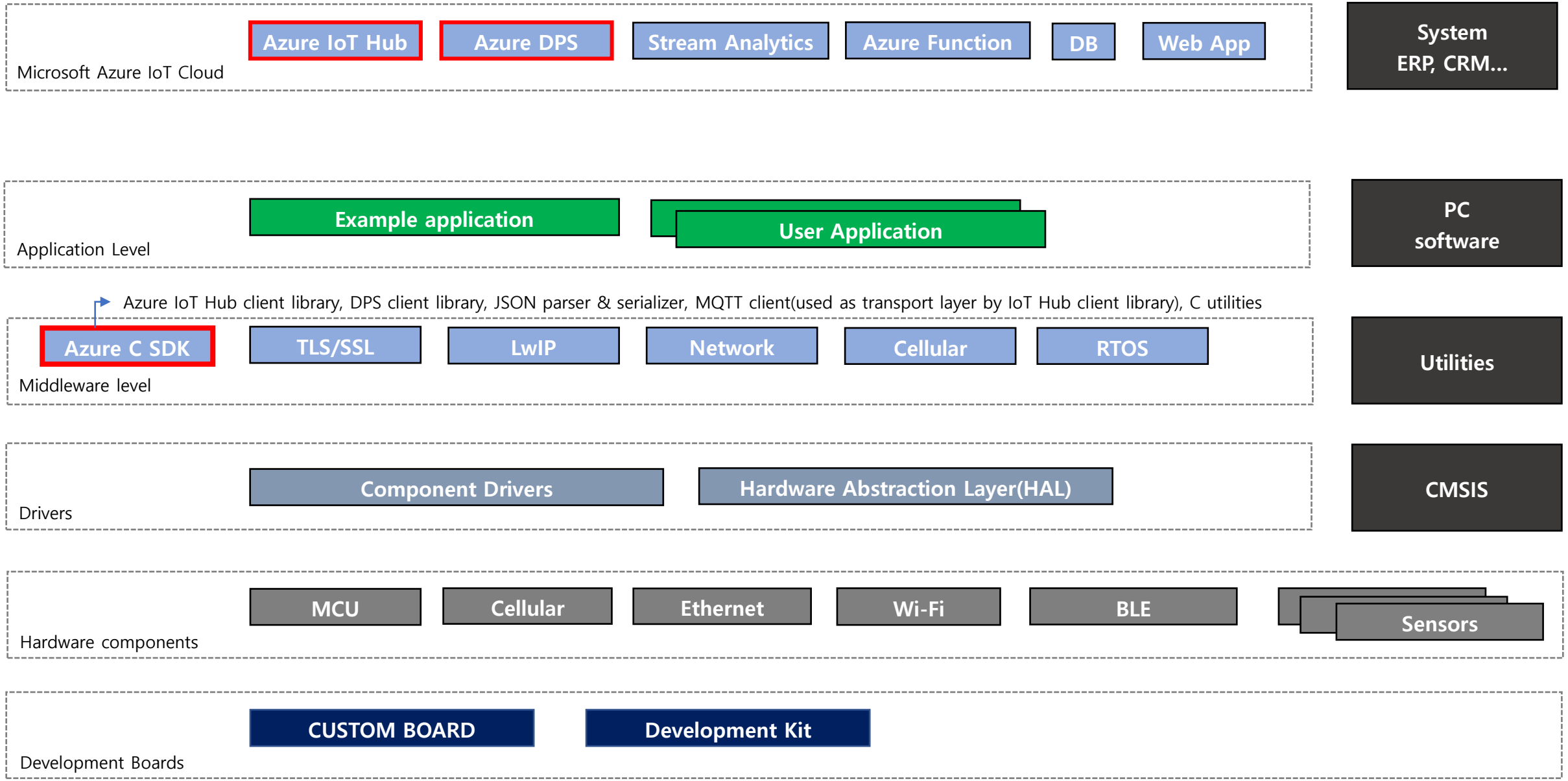
Azure IoT Hub 상세 아키텍쳐

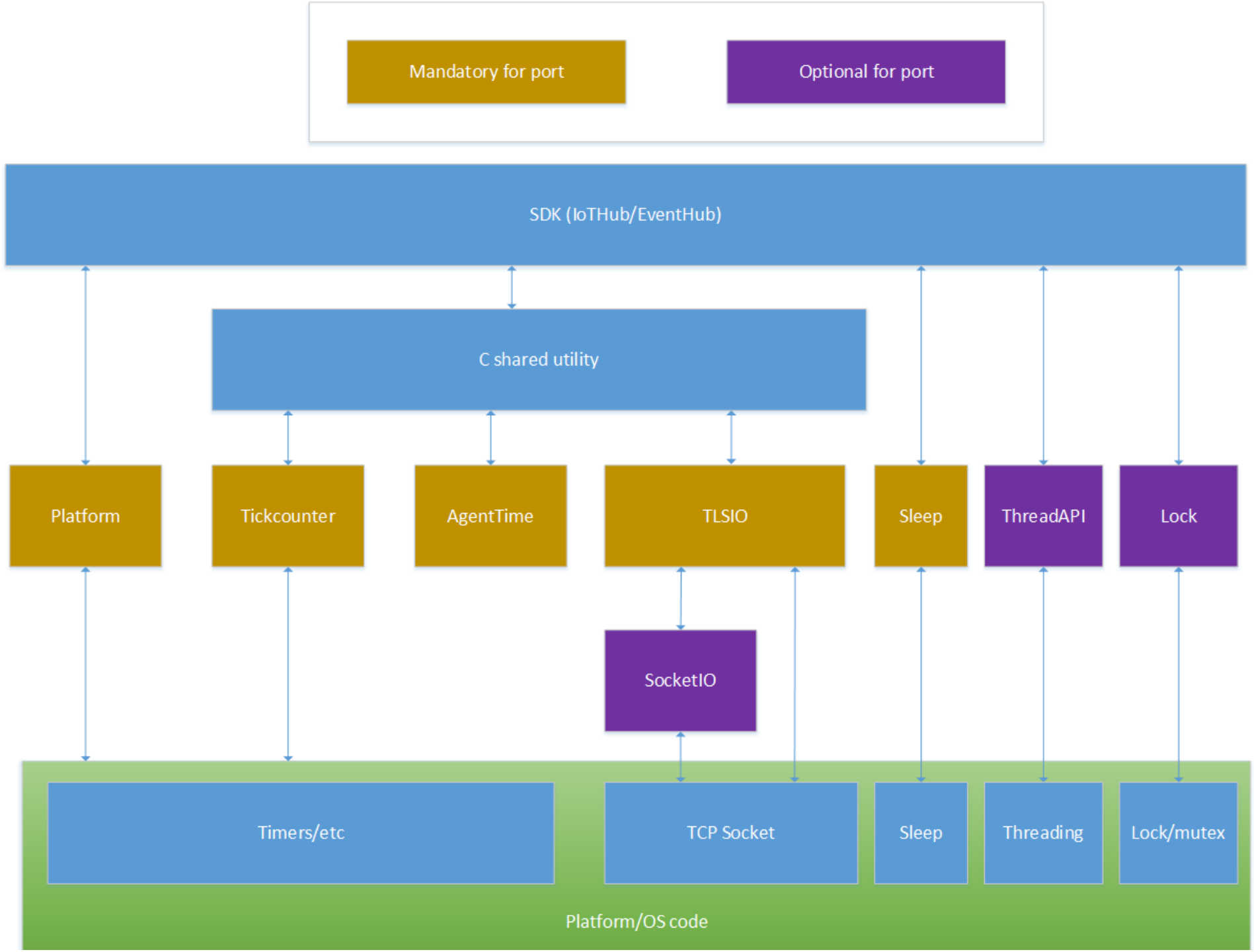


IoT Hub – Device 통신 종류

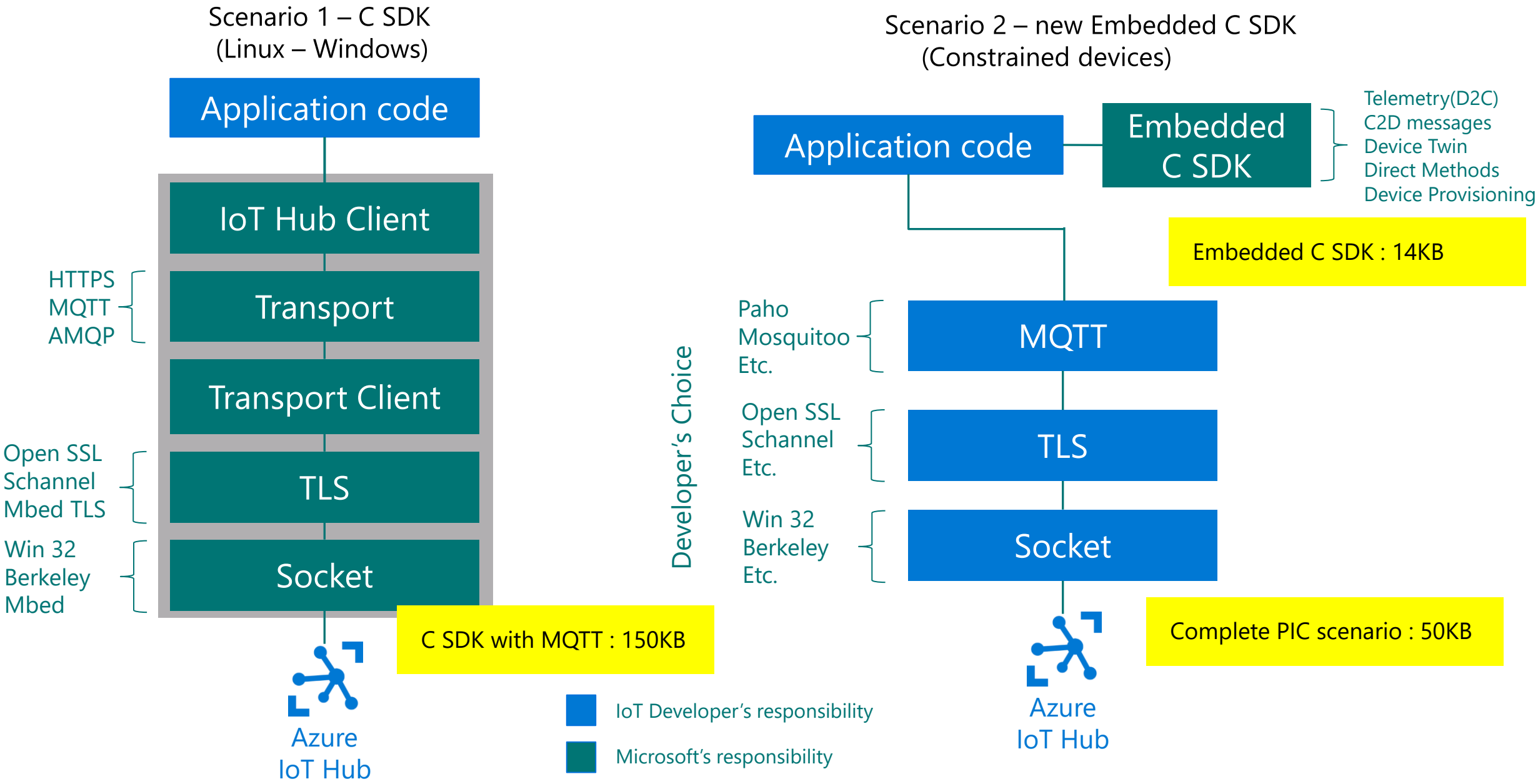


MCU Device to Cloud E2E Architecture



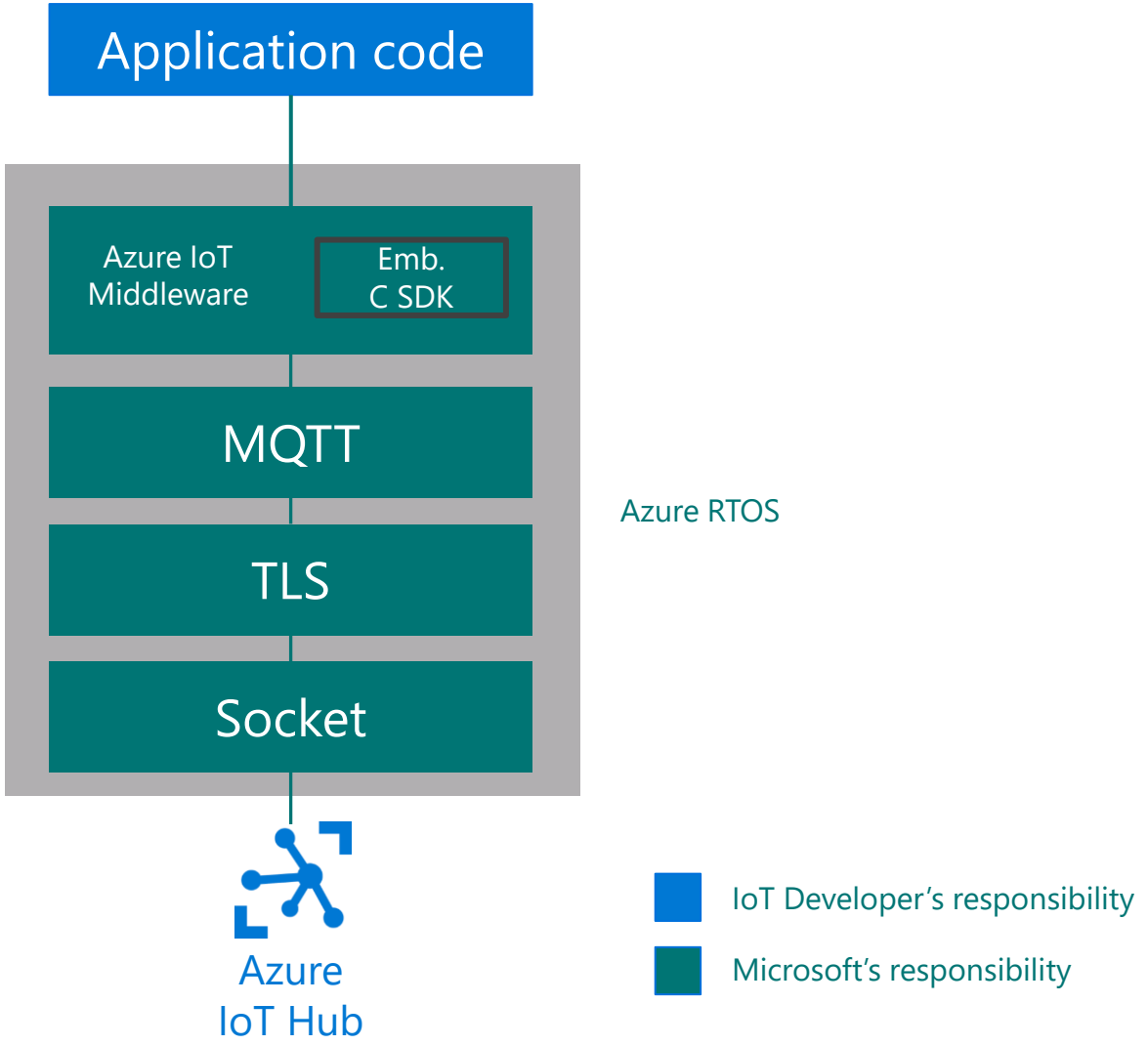

Mandatory for port
Optional for port
SDK (IoTHub/EventHub)
C shared utility
Platform
Tickcounter
AgentTime
TLSIO
Sleep
ThreadAPI
Lock
SocketIO
Timers/etc
TCP Socket
Sleep
Threading
Lock/mutex
Platform/OS code

Azure C SDK scenarios



Azure C SDK scenarios

Scenario 3 – Azure RTOS + new Embedded C SDK + Azure IoT Middleware (Constrained devices)



Microsoft Azure

Azure RTOS

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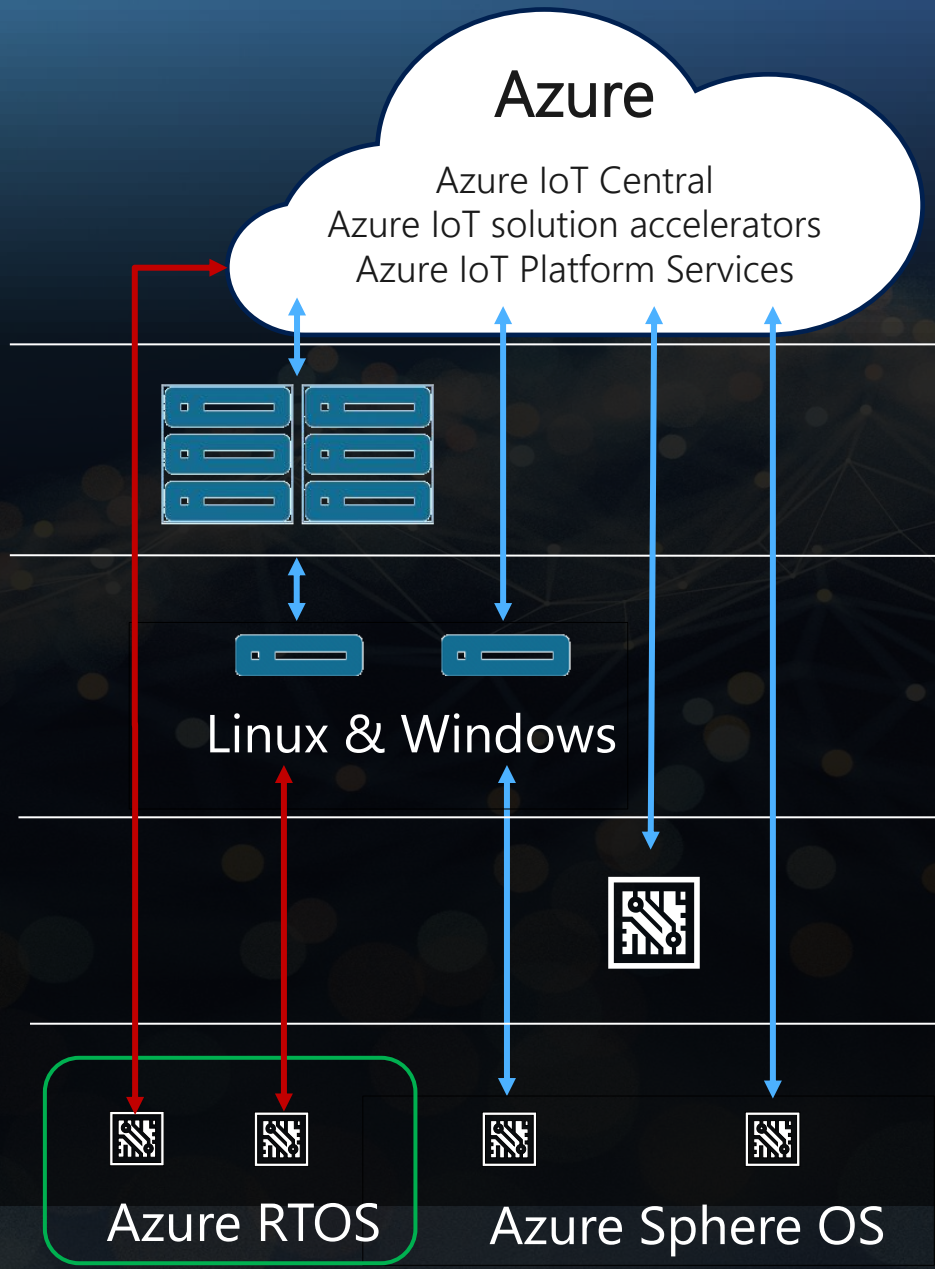
Microsoft IoT Offerings



Azure
- Available in Azure Regions
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Azure Stack
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- Azure IoT Hub

Azure IoT Edge
- Deploy and manage cloud services
- Managed by Azure or Azure Stack

Windows IoT, Linux
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- Linux, iOS, Android, Windows, RTOS

Azure Sphere
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- Connect directly to Azure or via Azure IoT Edge

Azure Sphere OS
- Linux Kernel that modernizes MCU devices

Azure RTOS
- Comprehensive suite featuring high performance small, fast and reliable RTOS, middleware and tools

HLOS vs RTOS
Mission Critical? Time Sensitive?

	General Purpose OS (Linux / Windows)	RTOS
Type of usage	Non-time critical system / application	Time or mission critical system / task.
Real-timeness	Not near real time; at most soft real-time	Highly deterministic behavior and timely response events and interrupts
Scheduling	Non-preemptive. Optimized for throughput. Fair Scheduling	pre-emptive priority based scheduling
Interrupt Latency	Delayed. Mainly due to premption latency (ISR x Process)	Fast and Deterministic
Context Switch	~100 usec ~ msec range	< 10 usec range
CPU Resources	CPU intensive	Lightweight
MMU	Required	Optional
Memory Footprint	Large memory footprint in MB range	low memory footprint. in KB range

Building Blocks of Azure RTOS

Seamless Turnkey Solution for Constraint Devices

ThreadX
a high-performance real-time operating system kernel

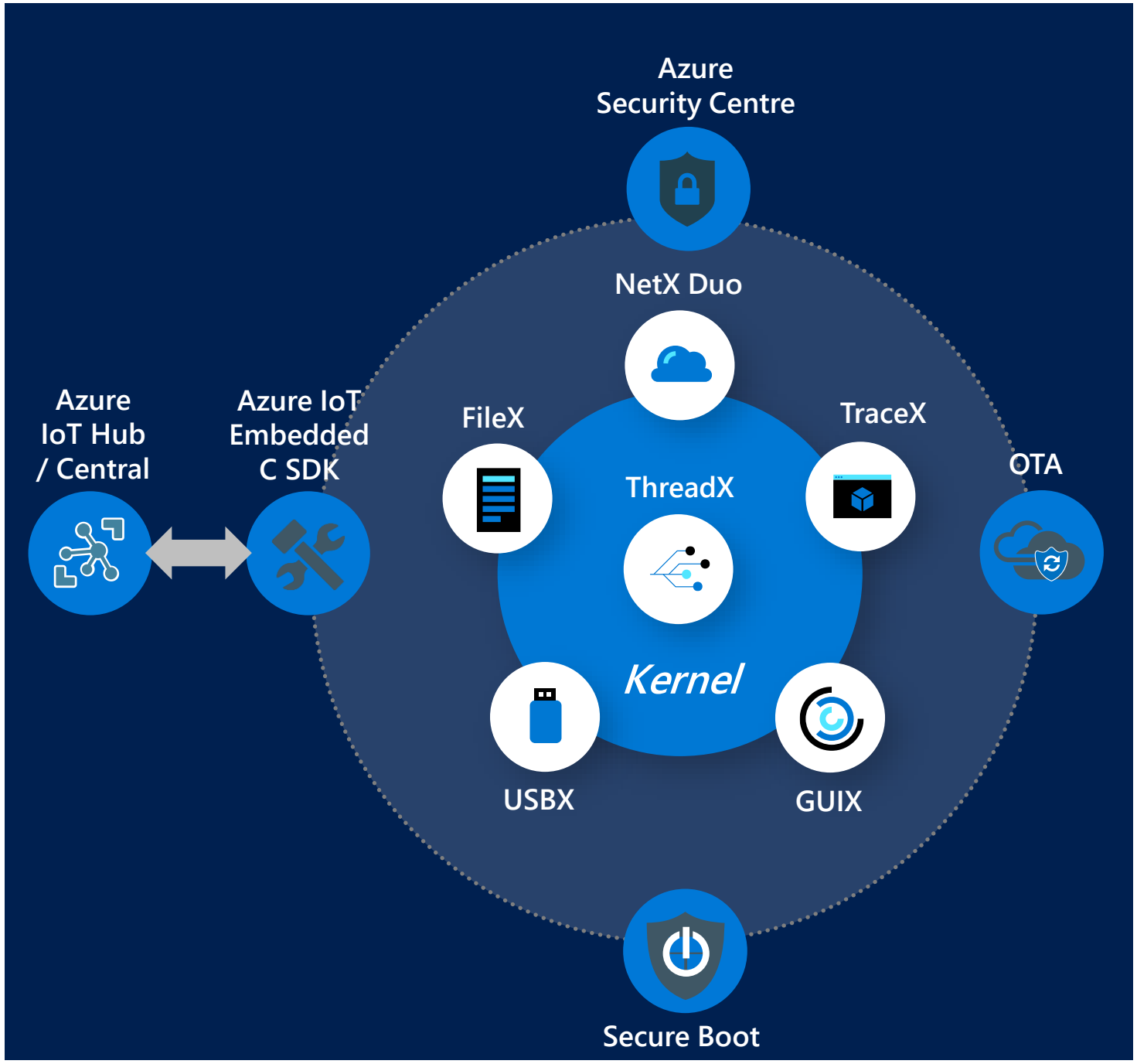
USBX
USB stack that provides host, device, and OTG support

FileX
High performance embedded FAT file system
(fault tolerance and flash memory wear leveling support)

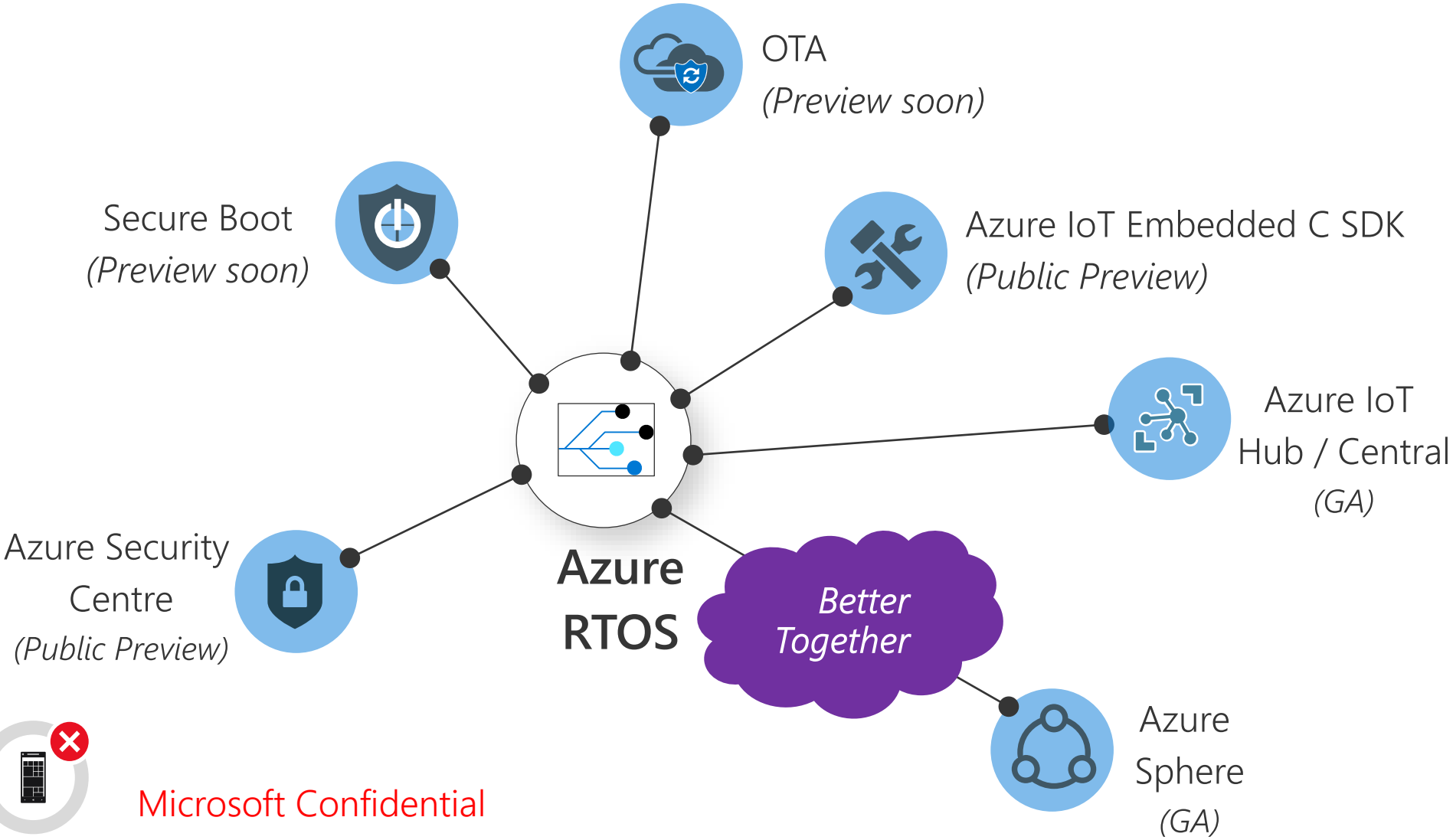
NetX Duo
TCP/IP IPV4/IPv6 embedded network stack that supports IPSec, TLS / DTLS security protocols

TraceX
Graphical view of real-time events tracing to analyze, debug and tune system-level behavior

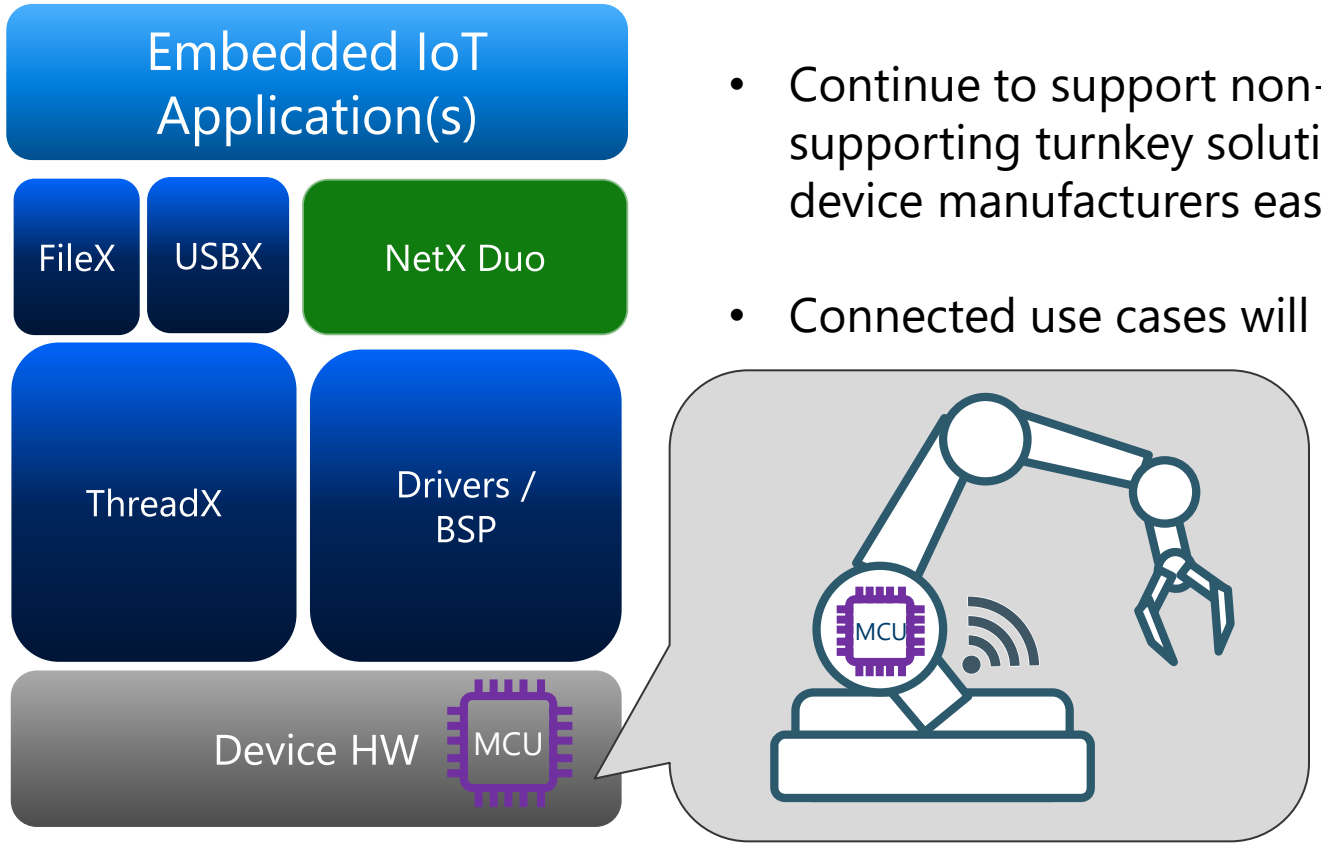
GUIX
2D graphical user interfaces



Azure RTOS x Supporting Azure Services & Features

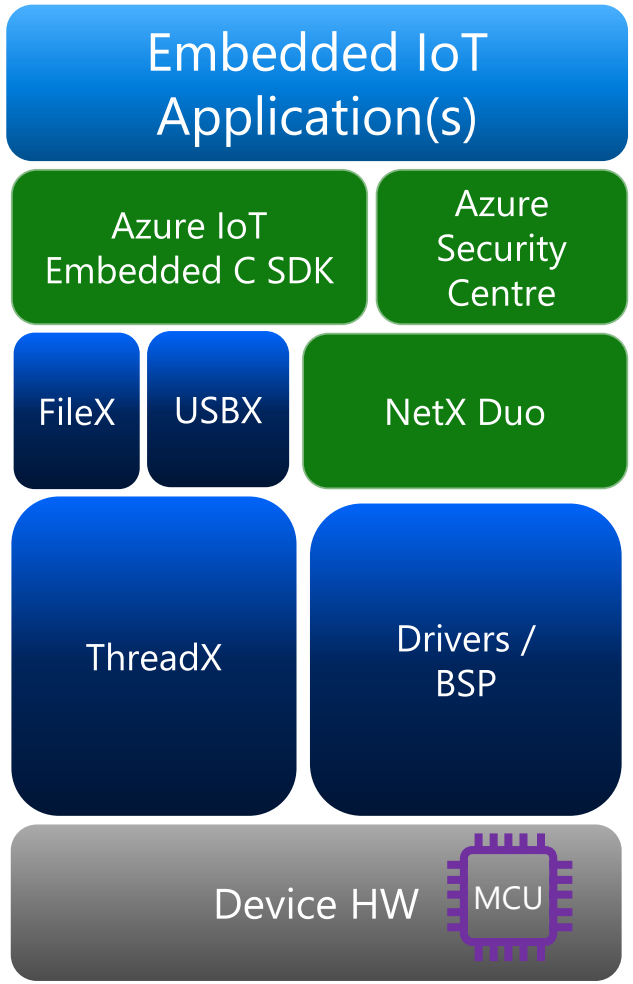


Azure RTOS benefit non-connected device

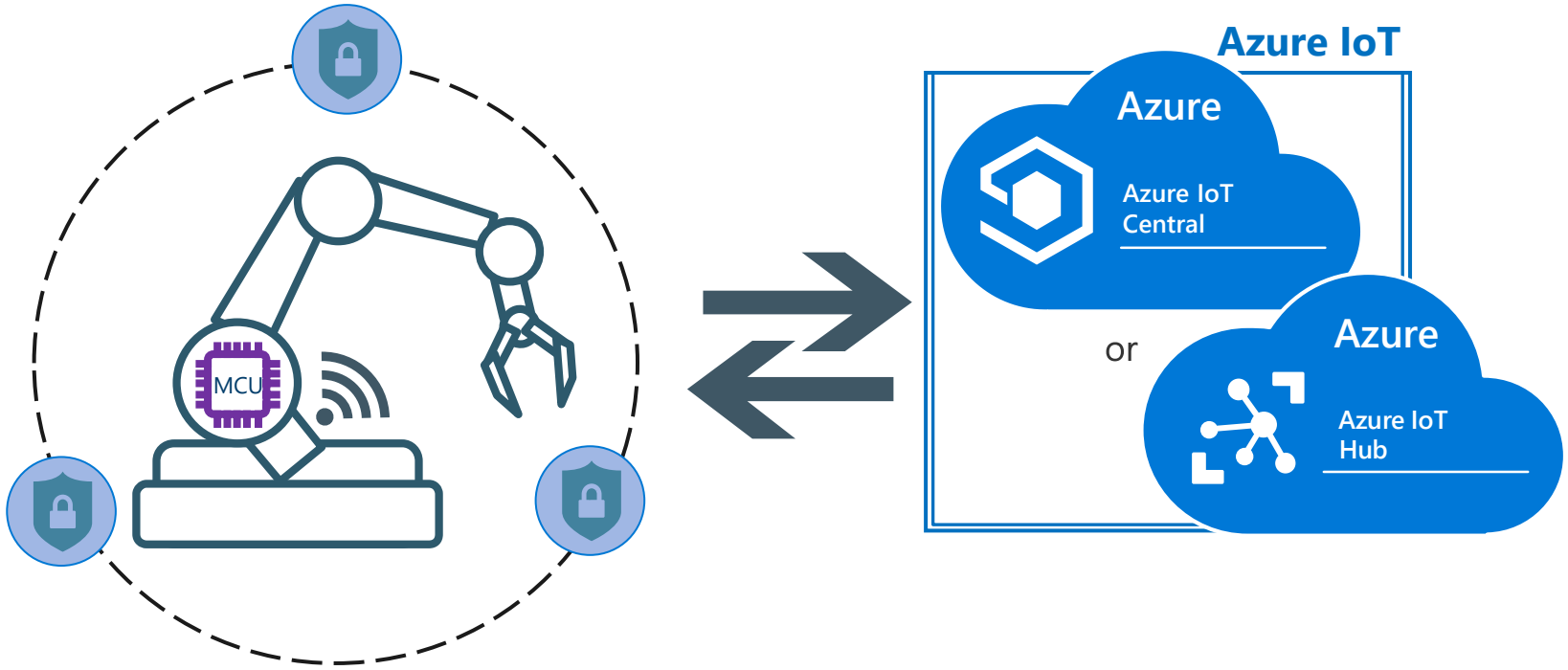


- 95% of use cases / deployment are for devices that are either not connected to the internet or the cloud.
- Continue to support non-connected scenarios and already available supporting turnkey solution (like NetX, Embedded C SDK) will help device manufacturers easily connect to the cloud in near future
- Connected use cases will likely increase significantly

Azure RTOS – Connected Environment



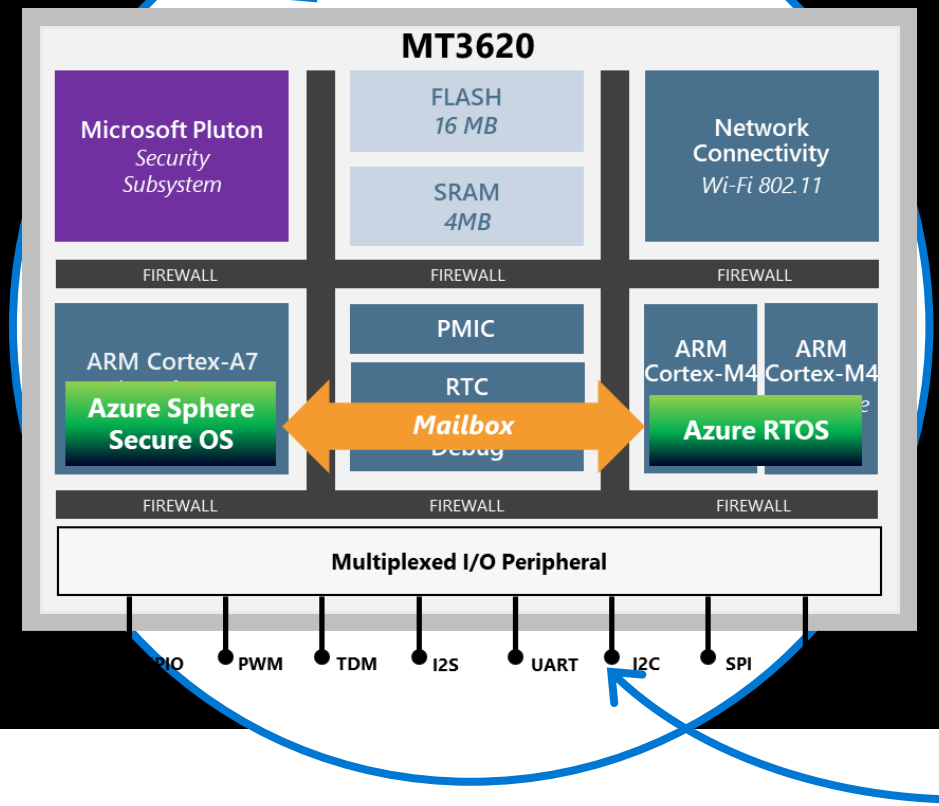
Azure RTOS provides out-of-the-box secure connectivity to Azure IoT Hub and as well as Azure IoT Edge devices for local edge computing.



Azure RTOS + Azure Sphere: Better together

Azure Sphere

Everything an embedded developer needs to build a highly secured device



Azure RTOS

Enables embedded developers to quickly build real-time software

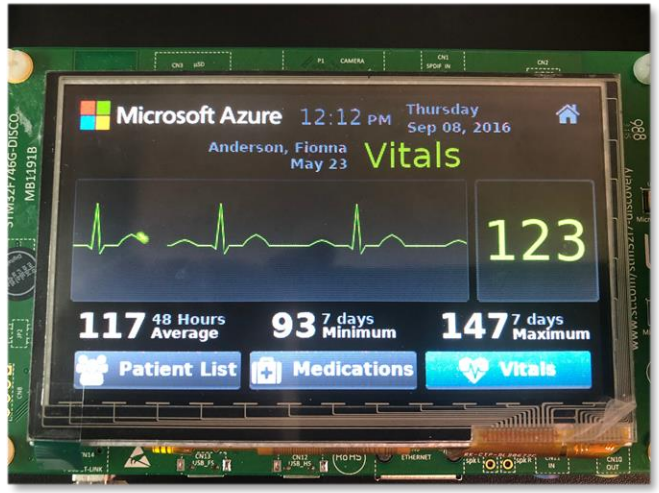
Microsoft Azure

Demo

Azure RTOS github repository

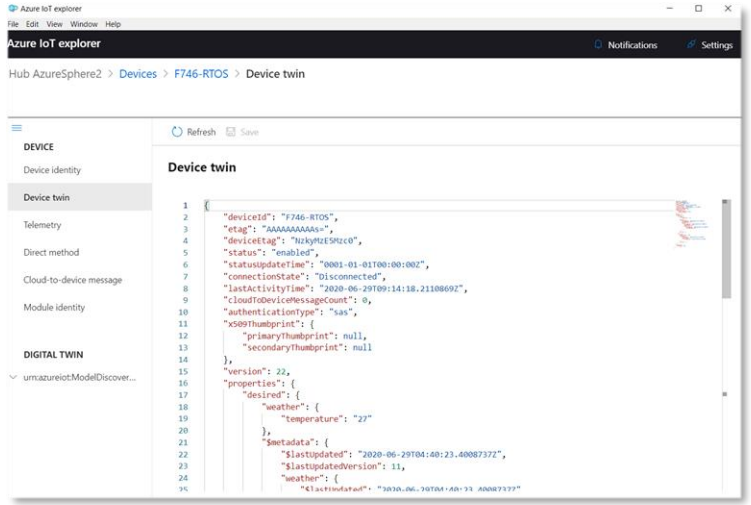
Azure RTOS 예제 및 소스코드

https://github.com/azure-rtos



Azure RTOS SDK for Azure IoT 예제 및 소스코드

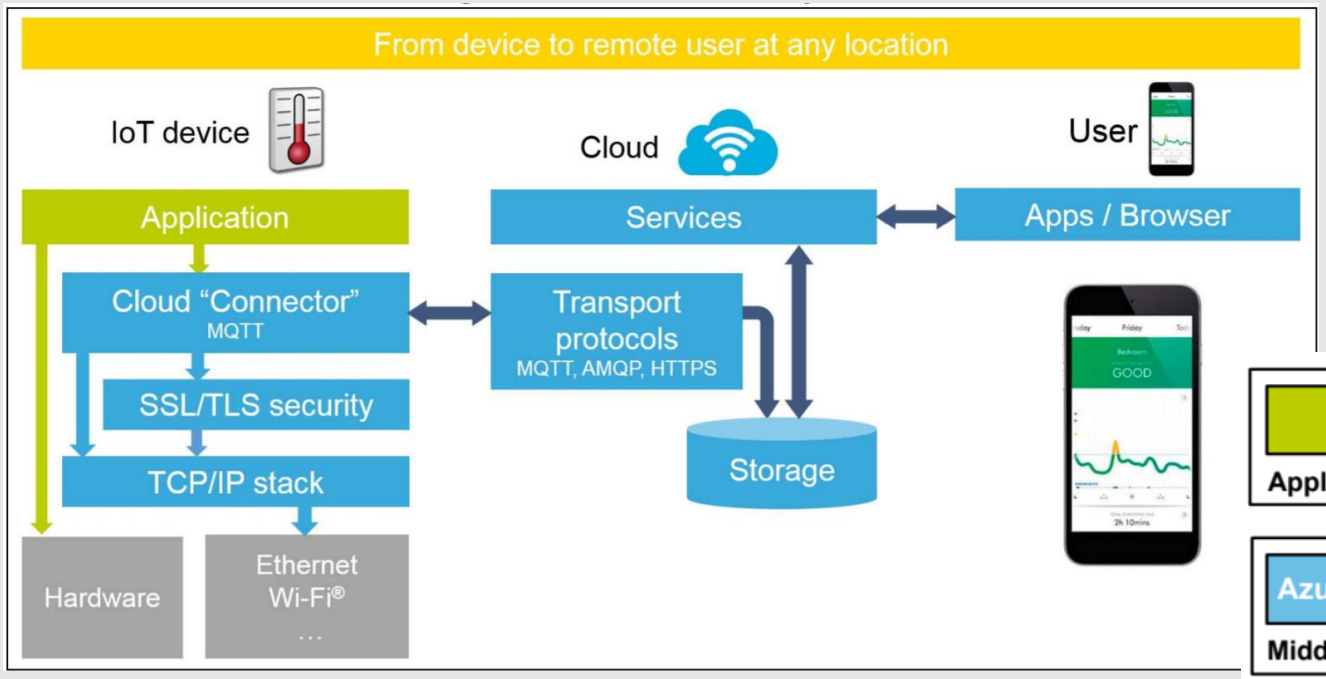
https://github.com/azure-rtos/azure-iot-preview



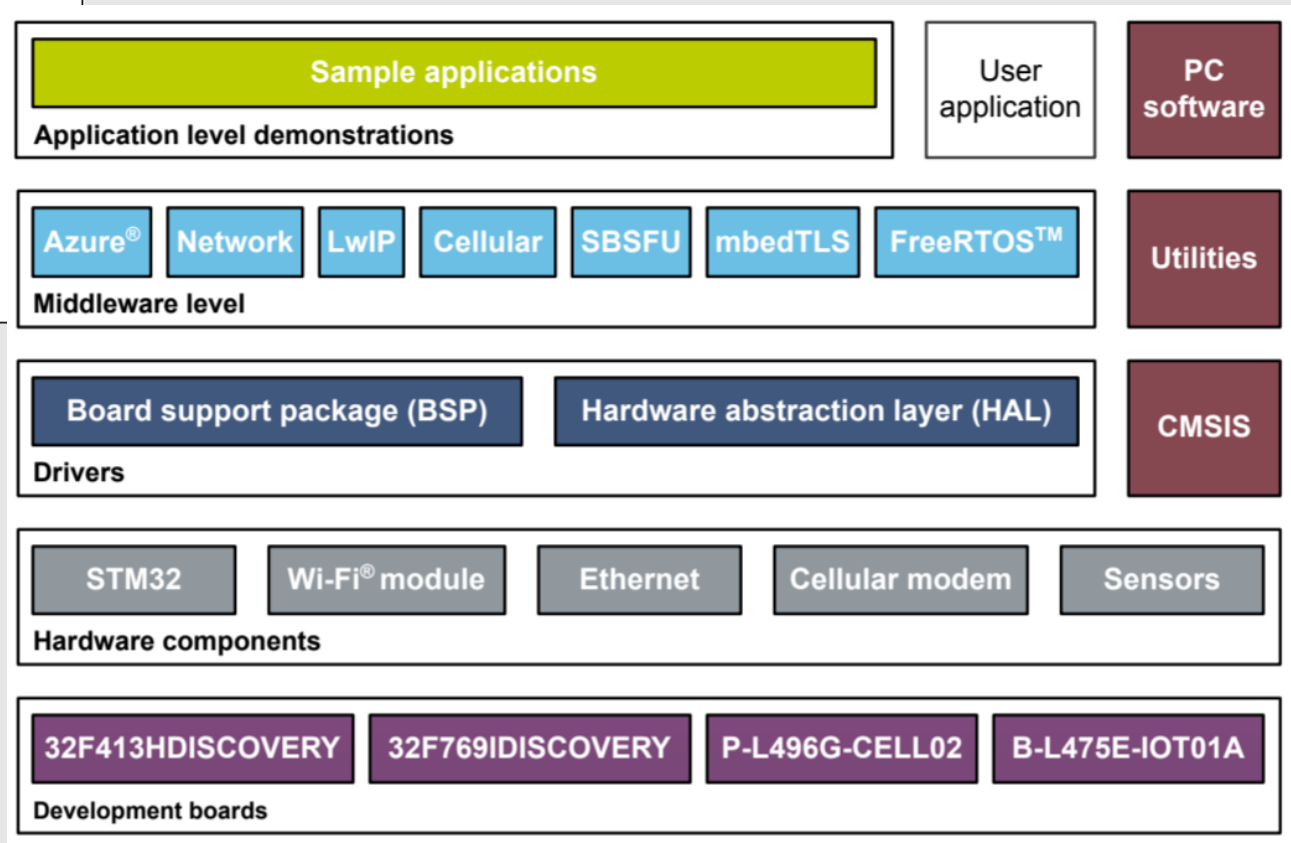
Microsoft Azure

Available Resources

Available Software for Azure IoT - X-CUBE-AZURE



- STM32L4 Series, STM32F4 Series, STM32F7 Series
  - Secure boot / Secure Firmware update



- FreeRTOS / Firmware
- Ethernet / Wi-Fi / LTE Cellular
- Azure IoT Device C SDK
  - Azure IoT Hub
  - X.509 authentication & Azure DPS
  - Azure IoT Central

Azure RTOS github repository

Azure RTOS 예제 및 소스코드

https://github.com/azure-rtos

STM32F746 / STM32L475 samples

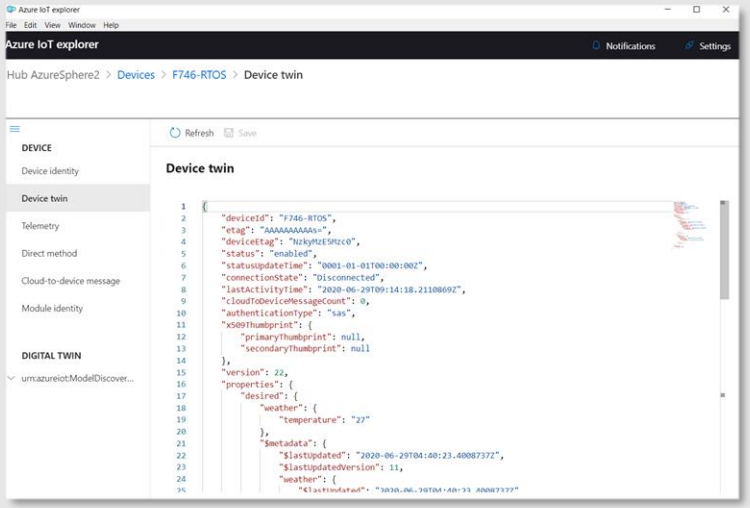
https://github.com/azure-rtos/samples

Azure RTOS SDK for Azure IoT 예제 및 소스코드

https://github.com/azure-rtos/azure-iot-preview

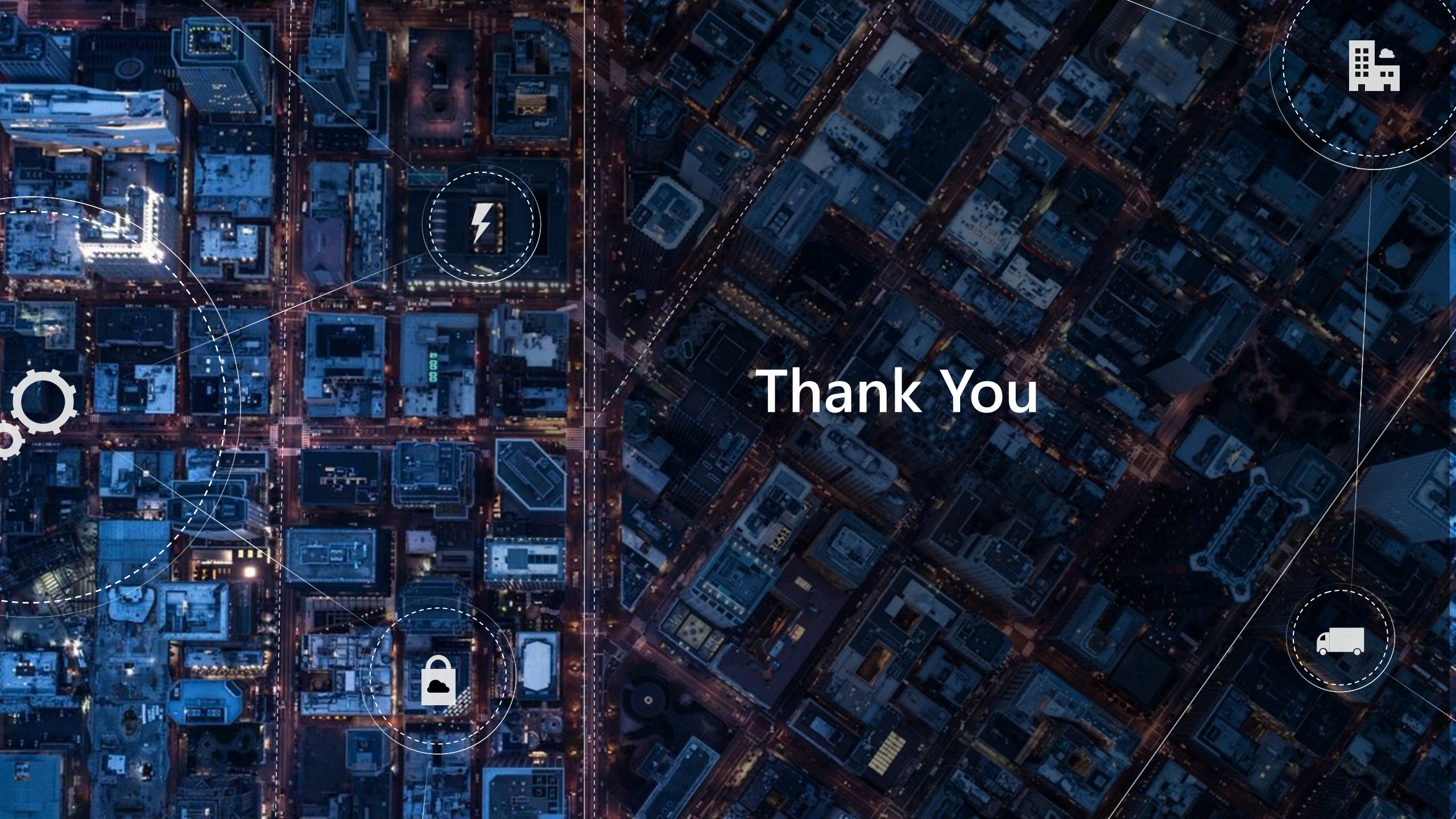
STM32F746 / STM32L475 samples

https://github.com/azure-rtos/azure-iot-preview/releases



Resources

- X-CUBE-AZURE
  - STMicroelectronics Link
- Azure C SDK (current)
  - https://github.com/Azure/azure-iot-sdk-c
  - https://github.com/Azure/azure-c-shared-utility/blob/master/devdoc/porting_guide.md
- Azure SDK for embedded C (preview)
  - https://github.com/Azure/azure-sdk-for-c
- Azure RTOS 소개 및 문서
  - https://azure.microsoft.com/ko-kr/services/rtos/
- Azure IoT Central
  - http://www.azureiotcentral.com
- Build with Azure IoT Central and IoT Plug and Play
  - https://azure.microsoft.com/ko-kr/blog/build-with-azure-iot-central-and-iot-plug-and-play/
- IoT Plug and Play Bridge
  - https://github.com/Azure/AzurePnPBridgePreview


Thank You