



## Immersion Sessions

# Azure IoT w/ Azure Sphere

Jason Errett

Azure Specialist - Data & AI

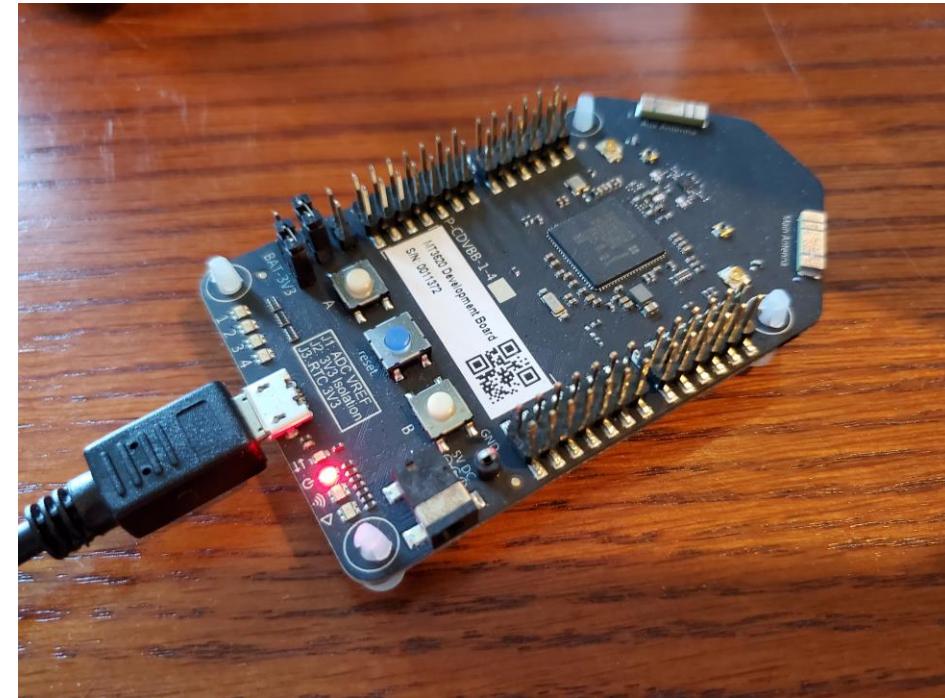
Microsoft Federal





# Agenda

- Overview of Azure Sphere
- Demo: IoT Central w/ Azure Sphere
- Azure IoT Landscape
- IoT Portfolio
  - Solutions
  - Services
  - Intelligent Edge
- What's next?
  - GitHub Resources, and Azure Docs

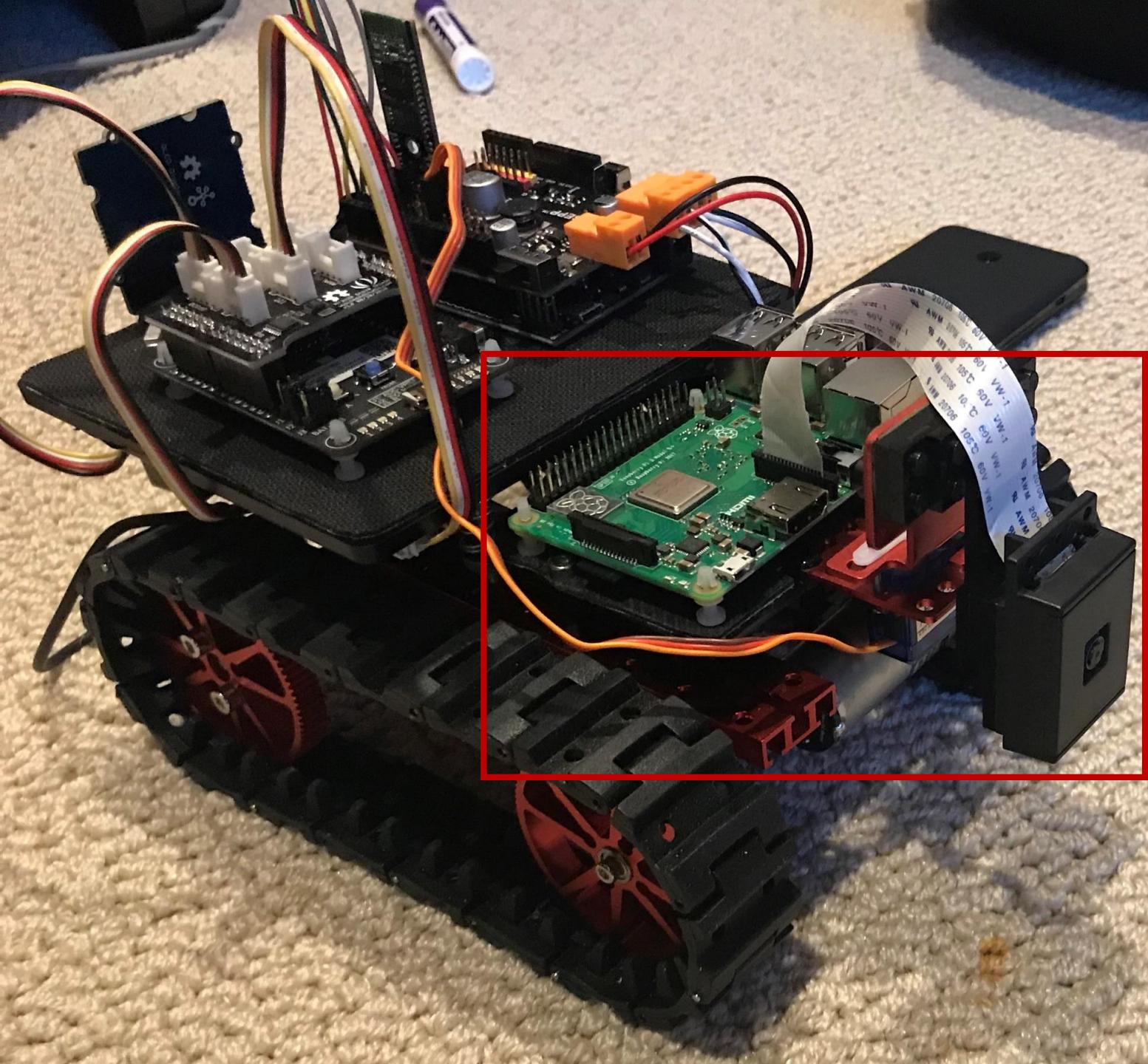


# Azure Sphere

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## Overview





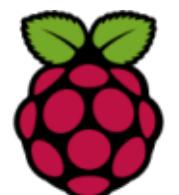
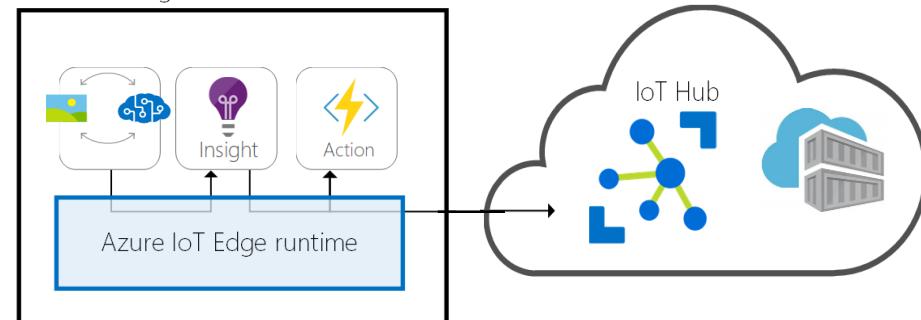
# Raspberry Pi w/ IoT Edge

This device is running a Linux distribution called Raspbian. OpenCV is also installed for image pre-processing of the camera asset.

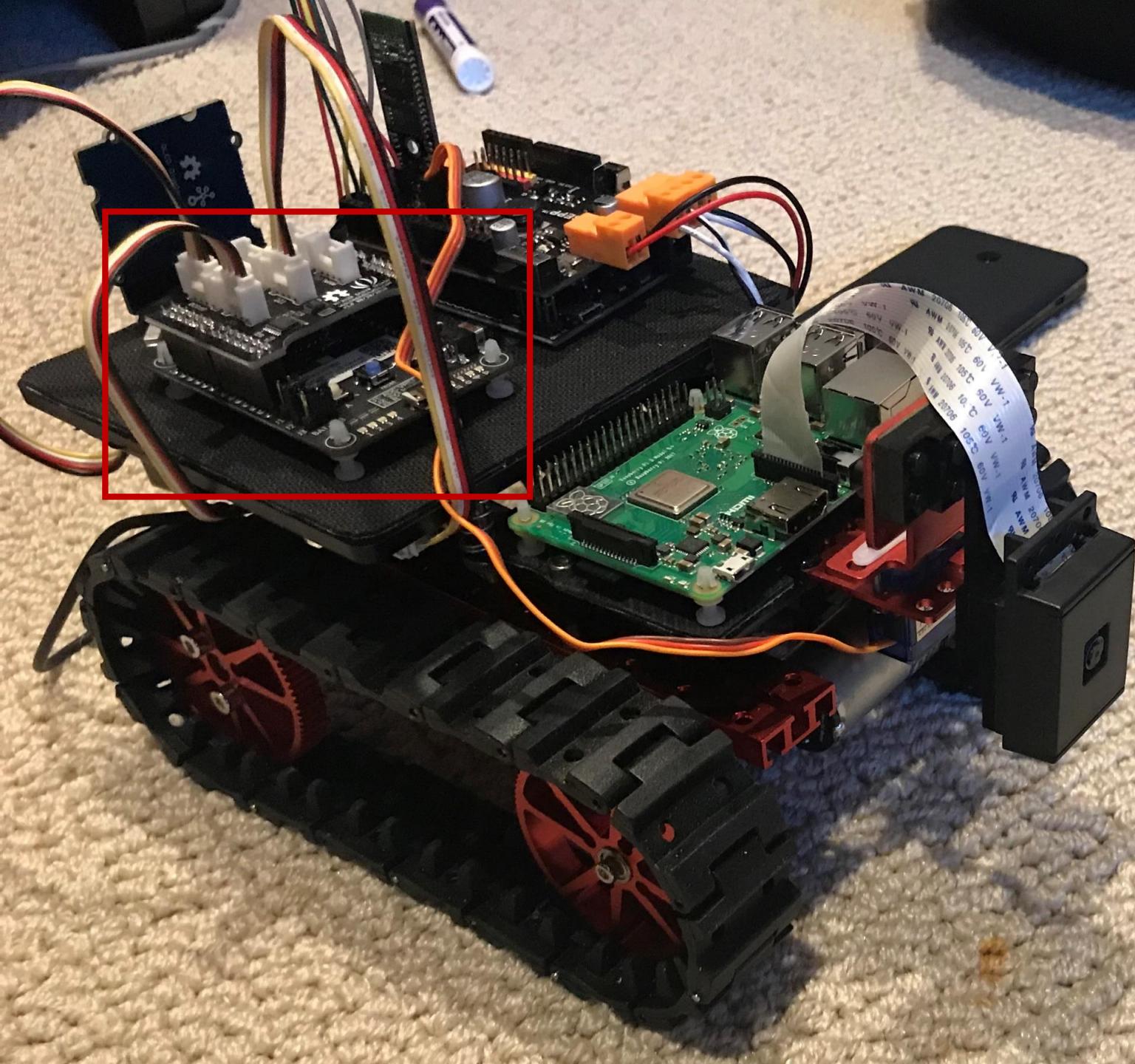
Additionally, the Azure IoT Edge runtime is installed and communicating with IoT Hub in order to pull down the latest containers in order to run analytics at the edge.

Custom Vision is running at the edge in a container capable of being hot-swapped for additional capabilities without downtime.

Azure IoT edge device



RaspberryPi

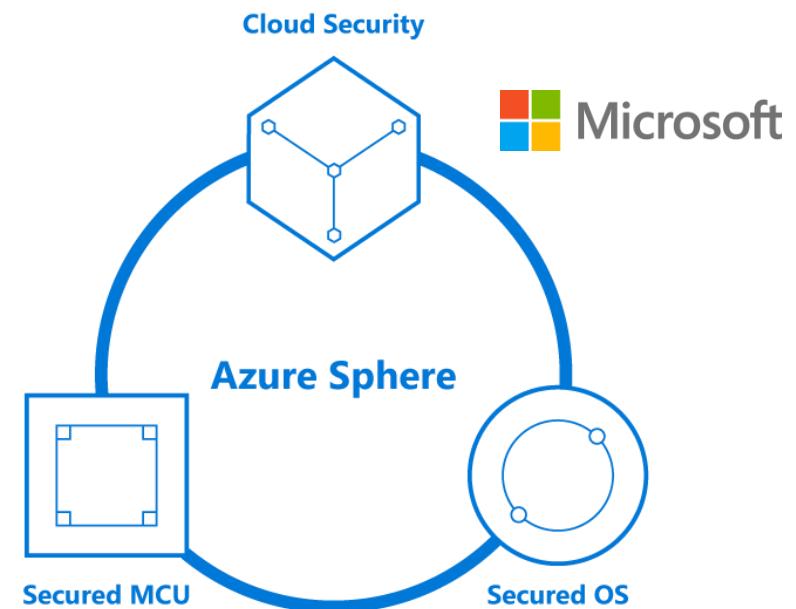


# Azure Sphere MT3620

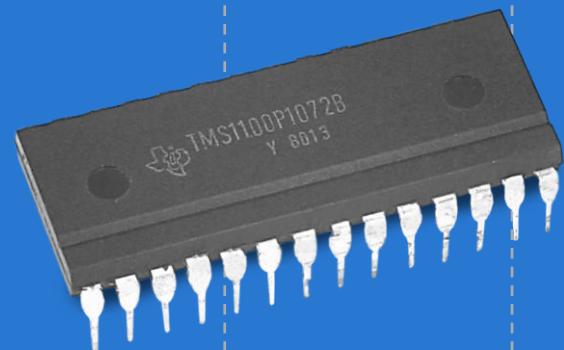
Azure Sphere is a solution for creating highly-secured, connected Microcontroller

This device is being utilized to securely relay cloud-to-device commands to the vehicle.

Embedded C is remotely deployed and updated to the MCU which controls the LCD screen, temperature/humidity sensor, and send 5v of electricity to peripheral devices via a relay switch.



# Microcontrollers (MCUs)



Wave 1:  
**The Microcontroller (MCU)**

1970's

1980's

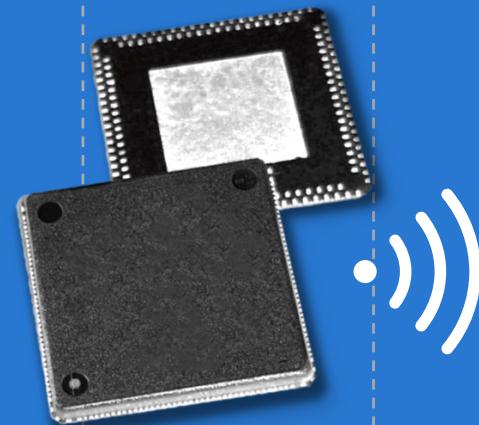
1990's

2000's

2010's

2020's

2030's



Wave 2:  
**Internet Connectivity**

# 9 BILLION new MCU devices deployed every year

IN TOYS...



IN APPLIANCES...



IN EQUIPMENT...



FEWER THAN 1% ARE CONNECTED TODAY.

# It will change your relationships with your customers



**How does** a consumer know the compressor  
in their fridge needs to be replaced?

**Option 1**

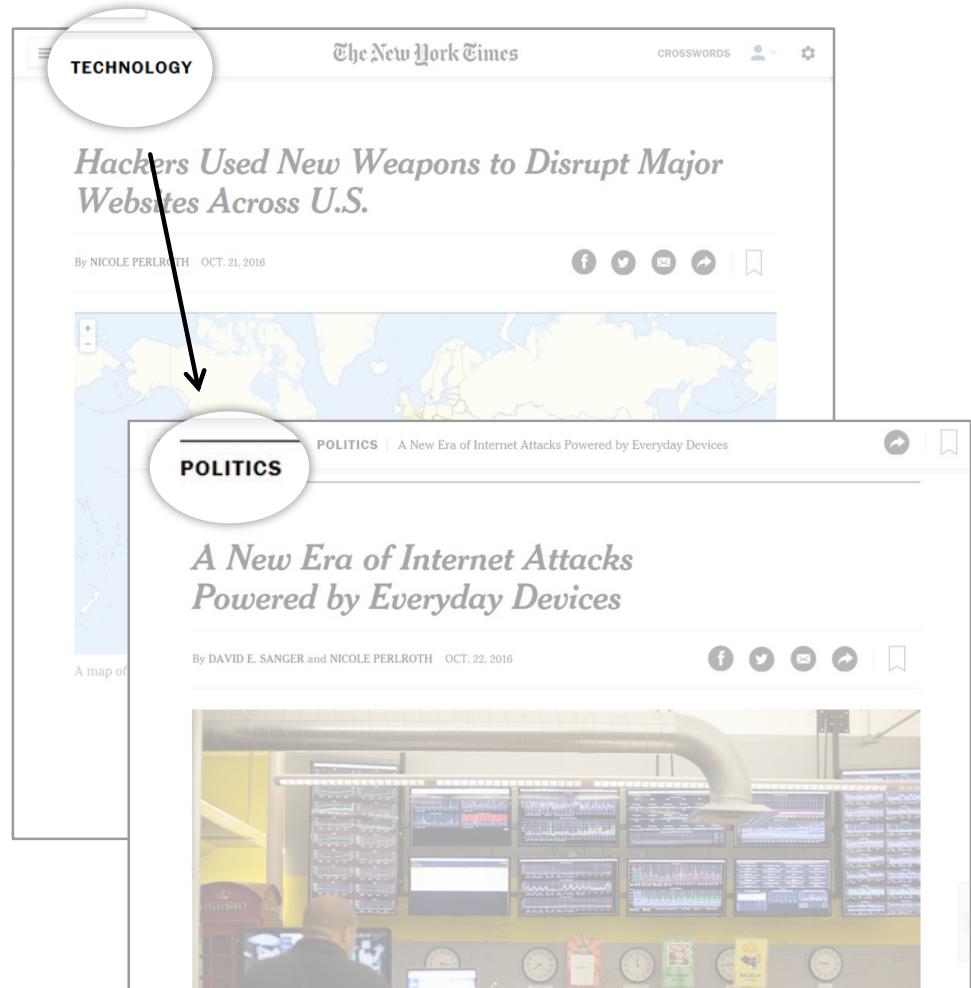
Melted ice cream

**Option 2**

Predictive maintenance

Connected devices create **profoundly  
better** customer experiences.

# And, expose your business to unequalled risks...



## Observations on October 21, 2016 Botnet Attack



### Device security is a socioeconomic concern

Day 1 the attack is Technology headline in NY Times  
Day 2 the attack is Politics headline



### The attack exploited well-understood weaknesses

Weak common passwords, no early detection, no remote update, etc.



### Future attacks could be much larger

This attack was small; just 100k devices  
Imagine a 100M-device attack



### Future attacks could create huge liability exposure

Hackers could "brick" an entire product line in a day  
Actuating devices could cause property damage or loss of life

# Highly-secured connected devices require 7 properties



## Hardware Root of Trust



Is your device's identity and software integrity secured by hardware?



## Defense in Depth



Does your device remain protected if a security mechanism is defeated?



## Small Trusted Computing Base



Is your device's TCB protected from bugs in other code?



## Dynamic Compartments



Can your device's security protections improve after deployment?



## Certificate-Based Authentication



Does your device use certificates instead of passwords for authentication?



## Failure Reporting



Does your device report back about failures and anomalies?



## Renewable Security



Does your device's software update automatically?



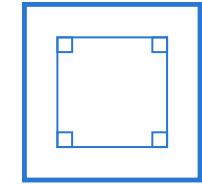
= Silicon support required



= OS support required



= Cloud Service support required



Some properties  
depend only on  
hardware support

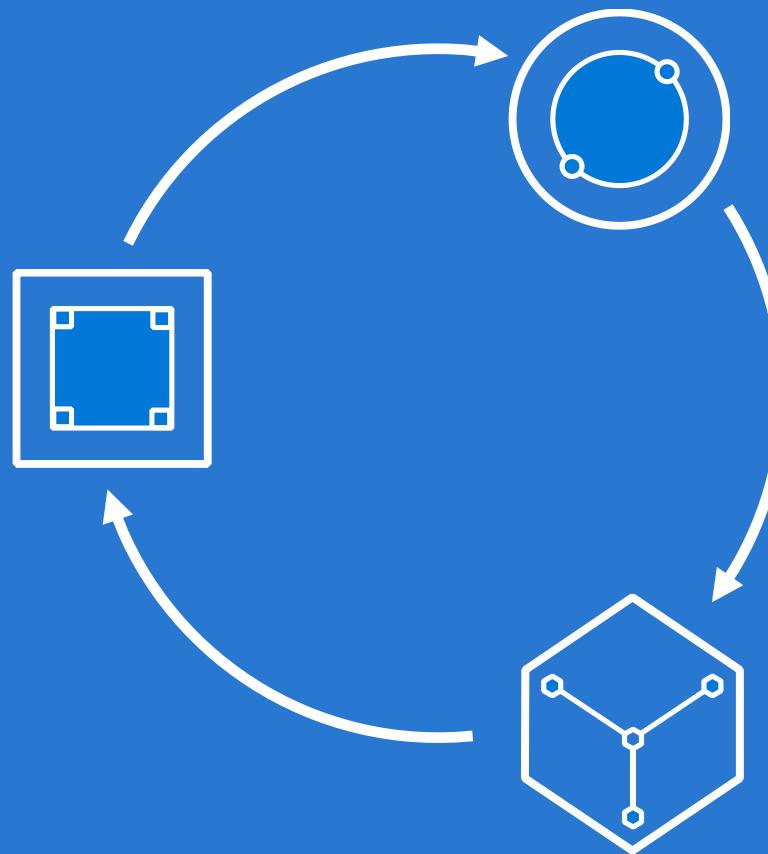
### Hardware Root of Trust

Unforgeable cryptographic  
keys generated and protected  
by hardware

*Is your device's identity  
and software integrity  
secured by hardware?*

- Hardware to protect **Device Identity**
- Hardware to **Secure Boot**
- Hardware to attest **System Integrity**

# Azure Sphere is an end-to-end solution for securing MCU powered devices



A new **Azure Sphere class of MCUs**, from silicon partners, with built-in Microsoft security technology provide connectivity and a dependable **hardware root of trust**.

A new **Azure Sphere OS** secured by Microsoft for the devices 10-year lifetime to create **a trustworthy platform** for new IoT experiences

The **Azure Sphere Security Service** guards every Azure Sphere device; it **brokers trust** for device-to-device and device-to-cloud communication, **detects emerging threats**, and **renews device security**.

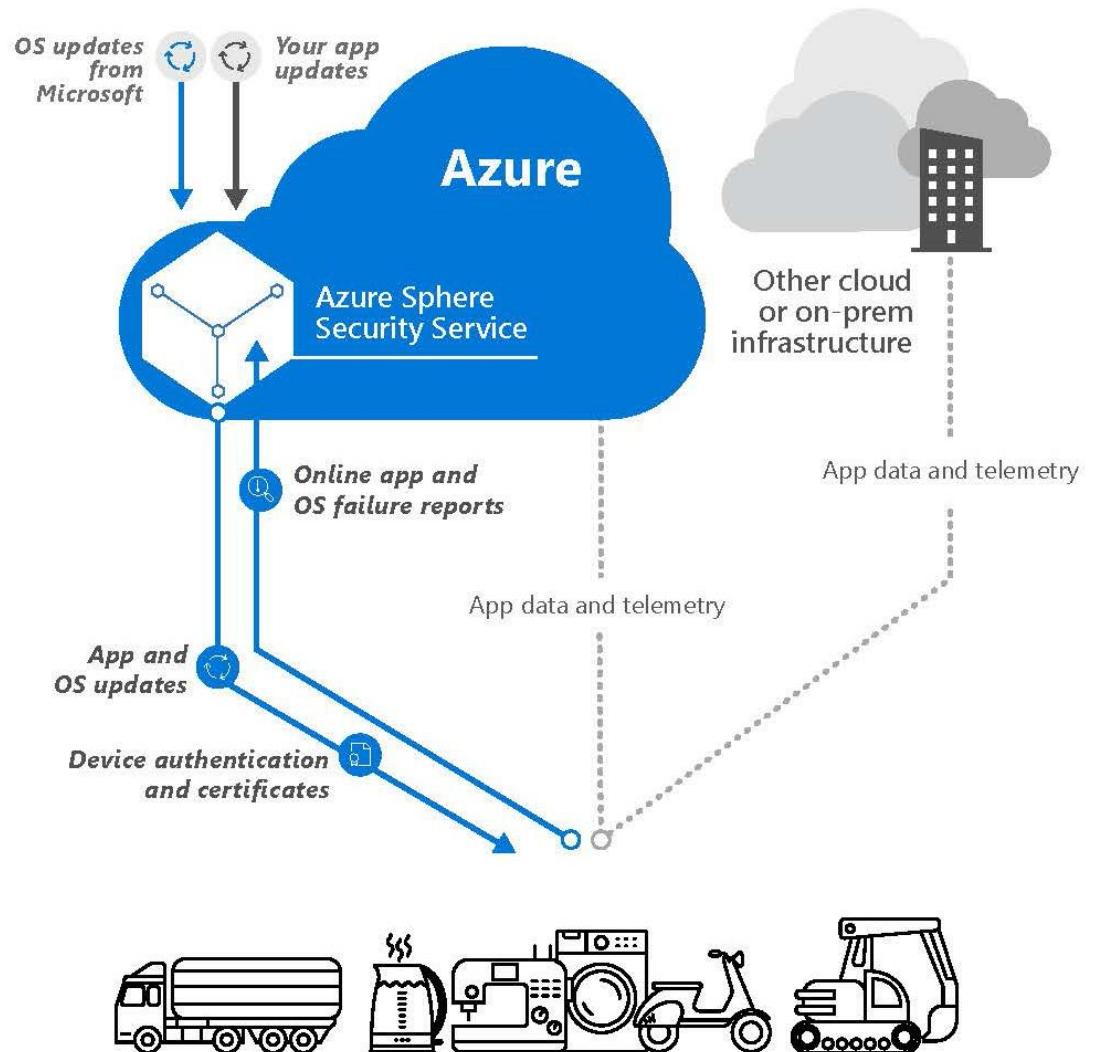
# The Azure Sphere Security Service connects and protects every Azure Sphere device

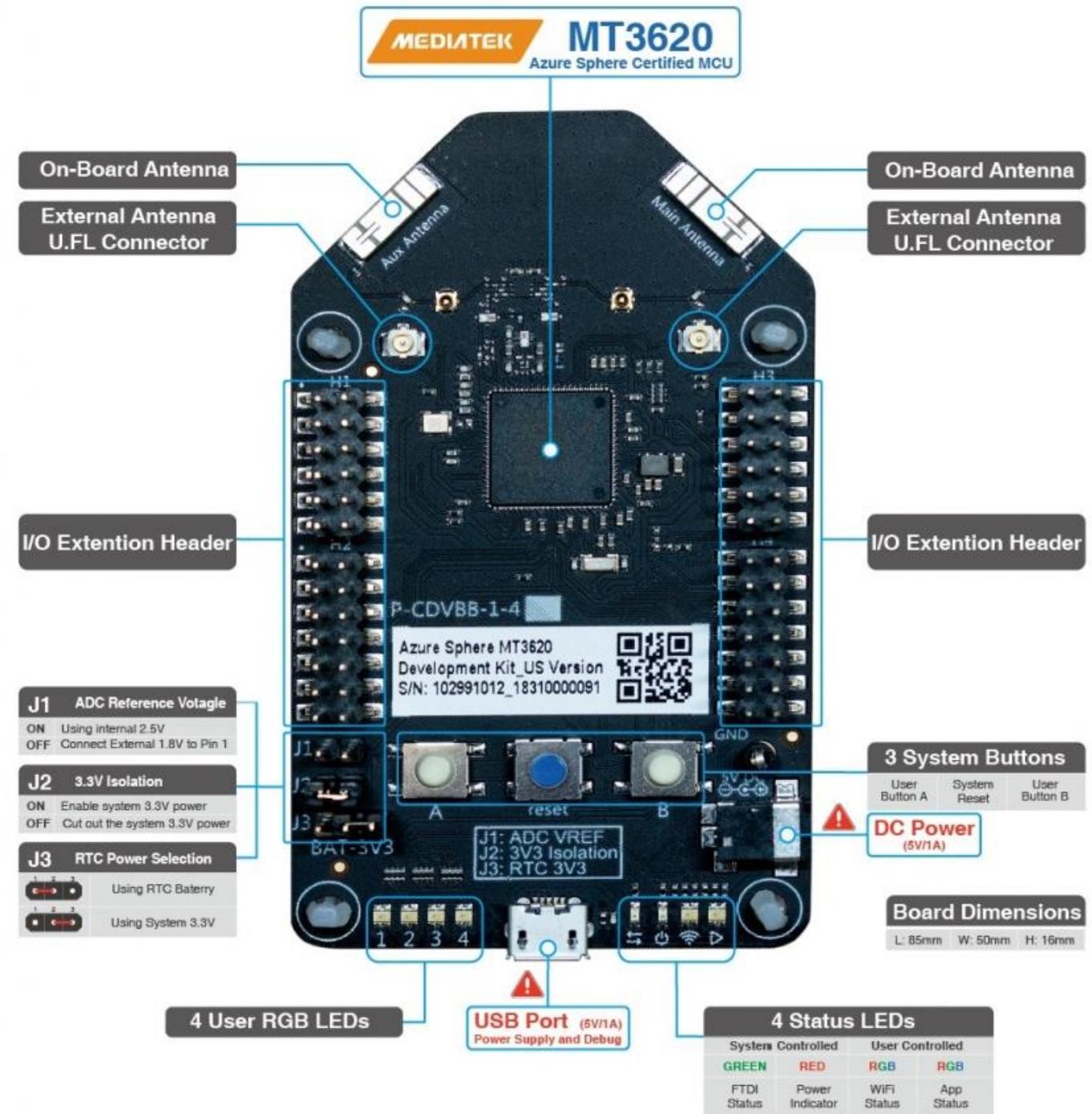
**Protects** your devices and your customers with certificate-based authentication of all communication

**Detects** emerging security threats through automated processing of on-device failures

**Responds** to threats with fully automated on-device updates of OS

**Allows** for easy deployment of software updates to Azure Sphere powered devices





# Interface Headers

| Header 1  |    |    |       |  |  |  |  |
|-----------|----|----|-------|--|--|--|--|
| SYS_RST_B | 1  | 2  | GND   |  |  |  |  |
| GPIO59    | 3  | 4  | GPIO0 |  |  |  |  |
| GPIO56    | 5  | 6  | GPIO1 |  |  |  |  |
| GPIO58    | 7  | 8  | GPIO2 |  |  |  |  |
| GPIO57    | 9  | 10 | GPIO3 |  |  |  |  |
| GPIO60    | 11 | 12 | GPIO4 |  |  |  |  |

| Header 2 |       |        |        |    |       |          |      |
|----------|-------|--------|--------|----|-------|----------|------|
| DATA0    | RXD0  | MISO0  | GPIO28 | 1  | 2     | GND      |      |
| TXD0     | SCLK0 | GPIO26 | 3      | 4  | GPIO5 |          |      |
| CTS0     | CSA0  | GPIO29 | 5      | 6  | GPIO6 |          |      |
| CLK0     | RTS0  | MOSI0  | GPIO27 | 7  | 8     | GPIO7    |      |
|          |       | CSB0   | GPIO30 | 9  | 10    | ADC_VREF |      |
|          |       | ADC0   | GPIO41 | 11 | 12    | GPIO43   | ADC2 |
|          |       | ADC1   | GPIO42 | 13 | 14    | GPIO44   | ADC3 |



| Header 3 |       |        |          |    |           |           |      |
|----------|-------|--------|----------|----|-----------|-----------|------|
| 5V_OUT   | 1     | 2      | GND      |    |           |           |      |
| 3.3V     | 3     | 4      | Reserved |    |           |           |      |
| TXD3     | SCLK3 | GPIO66 | 5        | 6  | IOM4-0 TX |           |      |
| DATA3    | RXD3  | MOSI3  | GPIO67   | 7  | 8         | IOM4-1 TX |      |
| CTS3     | CSA3  | MISO3  | GPIO68   | 9  | 10        | Reserved  |      |
|          |       |        | GPIO69   | 11 | 12        | GPIO70    | CSB3 |

| Header 4 |        |        |          |        |        |        |       |
|----------|--------|--------|----------|--------|--------|--------|-------|
| Reserved | 1      | 2      | GND      |        |        |        |       |
| Reserved | 3      | 4      | Reserved |        |        |        |       |
| DATA1    | RXD1   | MISO1  | GPIO33   | 5      | 6      | GPIO38 | MISO2 |
| TXD1     | SCLK1  | GPIO31 | 7        | 8      | GPIO36 | SCLK2  | TXD2  |
| CTS1     | CSA1   | GPIO34 | 9        | 10     | GPIO39 | CSA2   | CTS2  |
| CLK1     | RTS1   | MOSI1  | GPIO32   | 11     | 12     | GPIO37 | MOSI2 |
| CSB1     | GPIO35 | 13     | 14       | GPIO40 | CSB2   | RTS2   | CLK2  |

# Modernize MCU development with Azure Sphere and Visual Studio

## Simplify development

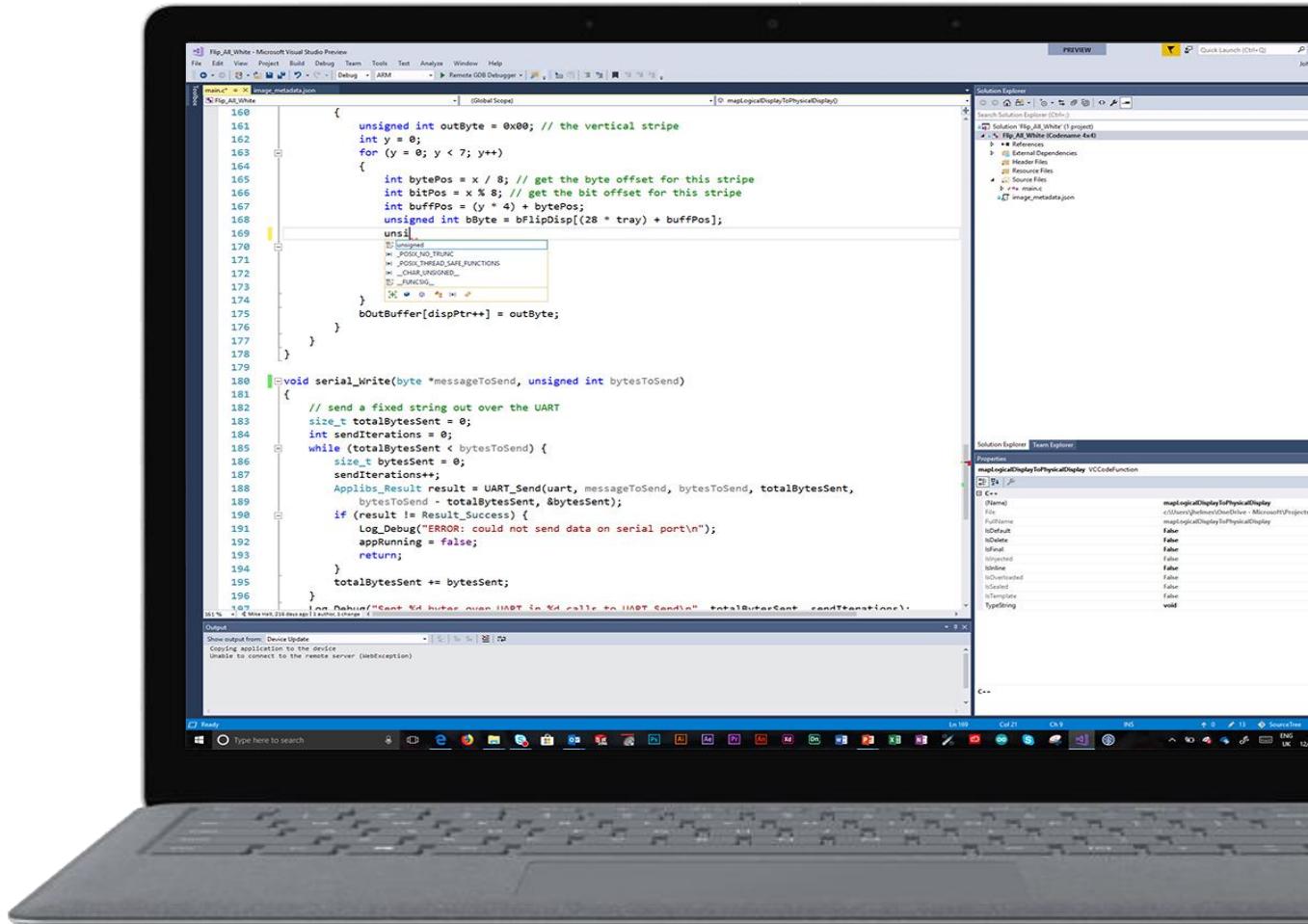
Focus your device development effort on the value you want to create

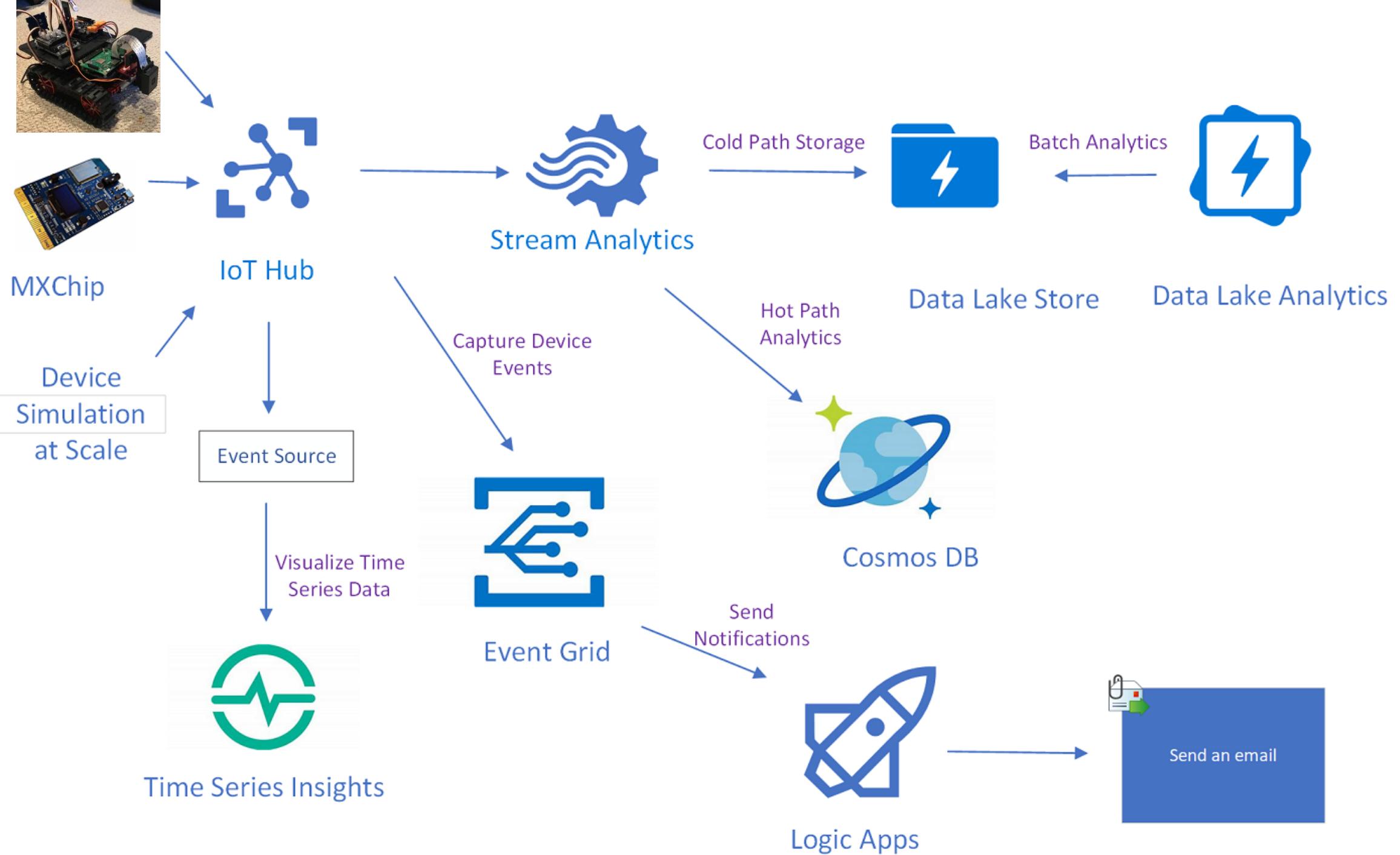
## Streamline debugging

Experience interactive, context-aware debugging across device and cloud

## Simplify Azure connect

Connect your Azure Sphere devices quickly and easily to Azure IoT





# Azure IoT

## IoT Central Demo

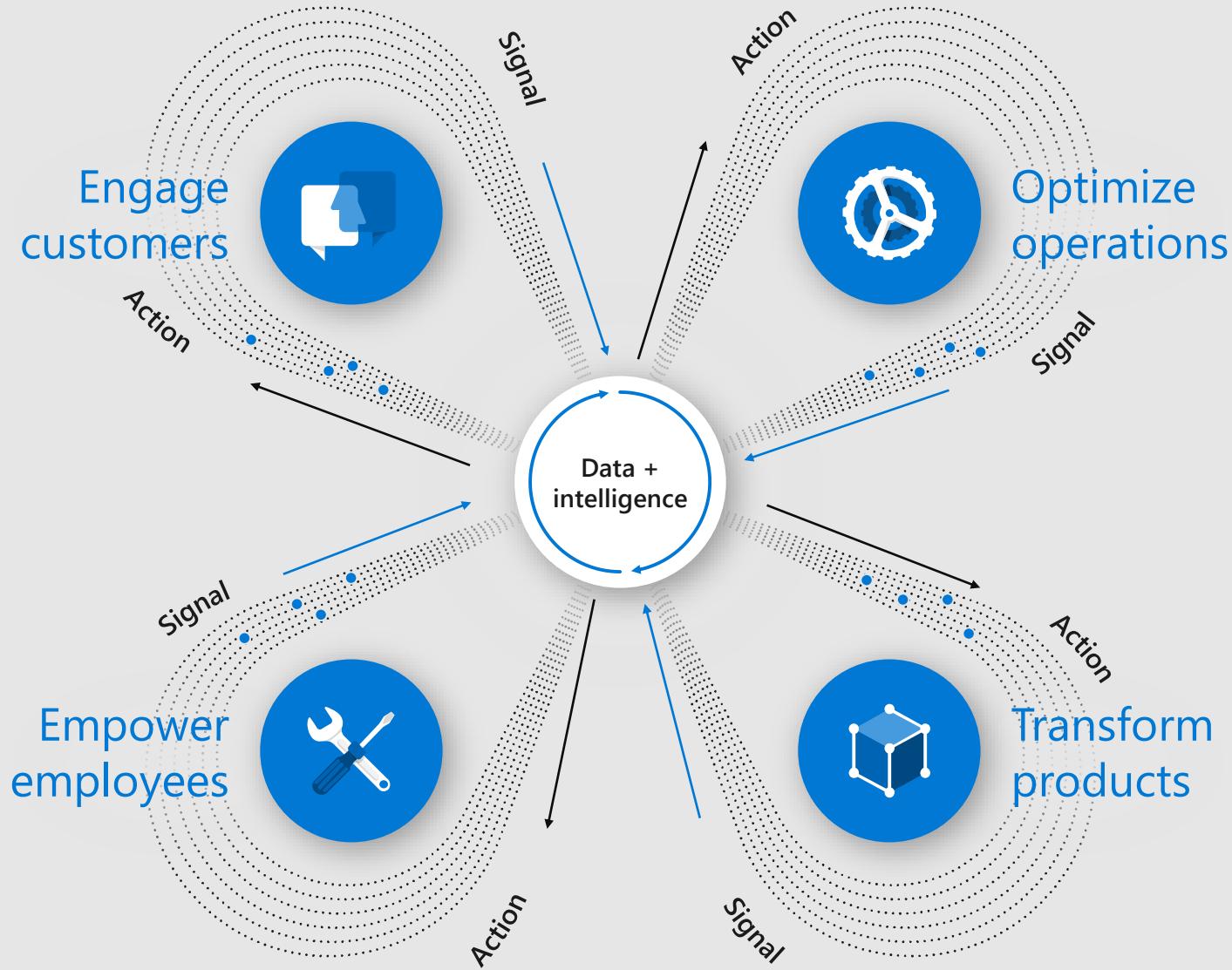
<https://apps.azureiotcentral.com/>



# Azure IoT Landscape

**Jason Errett**  
[jaerrett@microsoft.com](mailto:jaerrett@microsoft.com)





**80B**

Connected “things” by 2025 generating 180ZB of data



**\$130B**

New monetization avenues due to IoT-related services



**80%**

Companies that increased revenue as a result of IoT implementation



**\$100M**

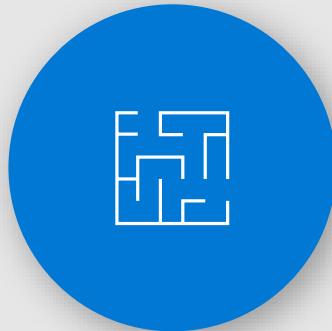
Average increase in operating income (avg. 8%) among the most digitally transformed enterprises

# However, IoT projects are complex



## Security

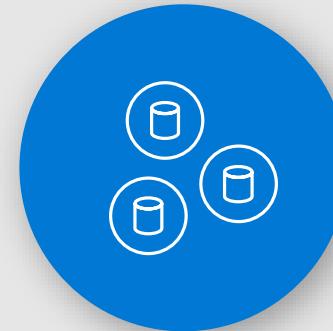
IoT poses unique security, privacy, and compliance challenges



## Complexity

Lack of IT/OT integration impedes efficiencies. Difficult to know where to start

Heavy up-front investments can be cost-prohibitive and costs unpredictable



## Siloed Data

Large portions of the business are not digitized

Data is siloed across different parts of the company

# Unlocking the value of IoT

## The IoT opportunity across industries



**Energy**  
More efficient,  
cleaner power, and  
using less of it  
across industries



**Smart Cities**  
More sustainable,  
prosperous, and  
economically  
competitive cities



**Healthcare**  
Improved quality  
and better  
outcomes for  
patients, anywhere



**Retail**  
Better customer  
experiences  
New market  
opportunity



**Transportation**  
People and goods  
moving reliably,  
more safely, and  
using less energy



**Agriculture**  
Better yields and  
higher quality with  
fewer resources  
and less waste



**Manufacturing**  
Realize efficiency,  
automation,  
customer centricity  
and tap into new  
revenue sources



**Johnson  
Controls**

Connected chillers come back online **9x faster** than unconnected equipment, avoiding more than **\$300,000** in hourly downtime costs



**DUNAV**  
NET

Keeping farmers informed about when to irrigate, how to control diseases, and how to fight pests, has led to **increased yields of 30%**, and a **20% reduction** in water use



**ROLLS**  
**R**  
**ROYCE**

**Rolls-Royce**

Rolls Royce provides maximize aircraft availability by employing “power by the hour” model; cutting fuel usage by 1 percent could save **\$250,000** per plane per year

# Smart Cities



**Schneider  
Electric**

## Proactive responses with edge analytics

Schneider Electric transformed their solution to better help customers protect their assets and the environment and boost workplace safety by leveraging edge intelligence

[Click to learn more](#)

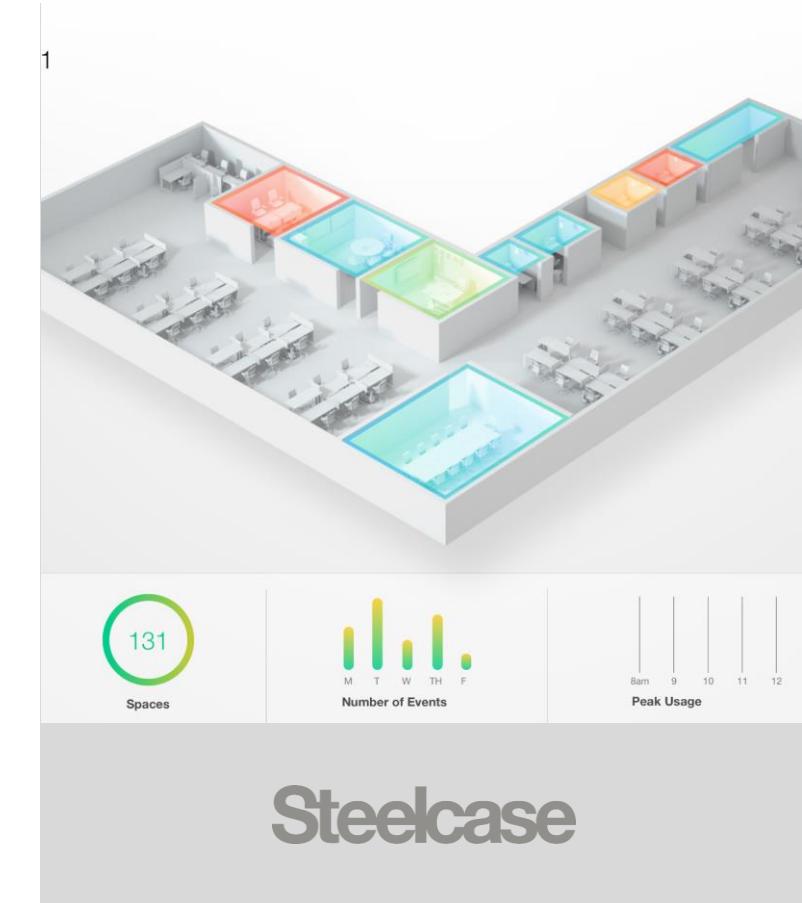


**Johnson  
Controls**

## Building efficiency with IoT

Connected chillers are back online 9x faster than unconnected equipment, avoiding more than \$300,000 in hourly downtime costs

[Click to learn more](#)

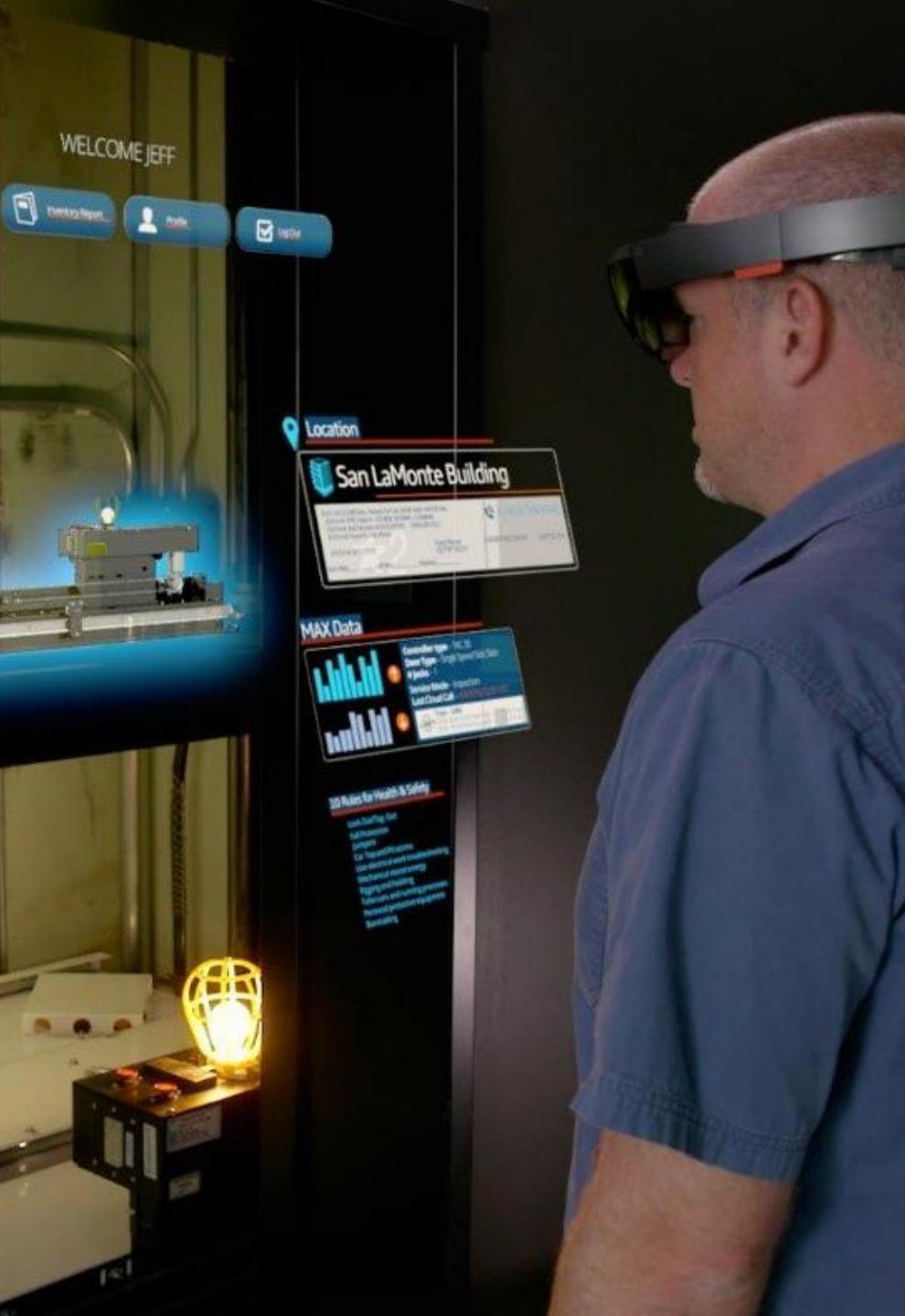


**Steelcase**

## Increasing value with smart workspaces

A network of wireless infrared sensors on furniture allowed Steelcase to revolutionize the value their solutions bring to customers through real-time usage statistics and insights

[Click to learn more](#)



WELCOME JEFF

Thyssenkrupp

Profile

New

Location

San LaMonte Building  
Address: 1000 San LaMonte Blvd., Suite 100, San Jose, CA 95131  
Phone: +1 408 265 1000  
Email: info@slm.com  
Latitude: 37.377777  
Longitude: -122.027778

MAX Data



100 Rules for Health & Safety  
- Insulating Gels  
- Self-Assembly  
- Proper  
- Use Thyssenkrupp  
- Safe Handling  
- Safe Working  
- Safe Working  
- Safe Working  
- Safe Working  
- Safe Working

## Transforming elevators with predictive service

thyssenkrupp's elevators predict the maintenance needs using Azure IoT reduces the costs of maintaining elevators and improving uptime for its customers. Using Hololens, thyssenkrupp technicians receive remote assistance by subject matter experts who can provide visual and audible advice

[LEARN MORE >](#)

 thyssenkrupp

# A large and growing ecosystem

System integrators



Solution providers



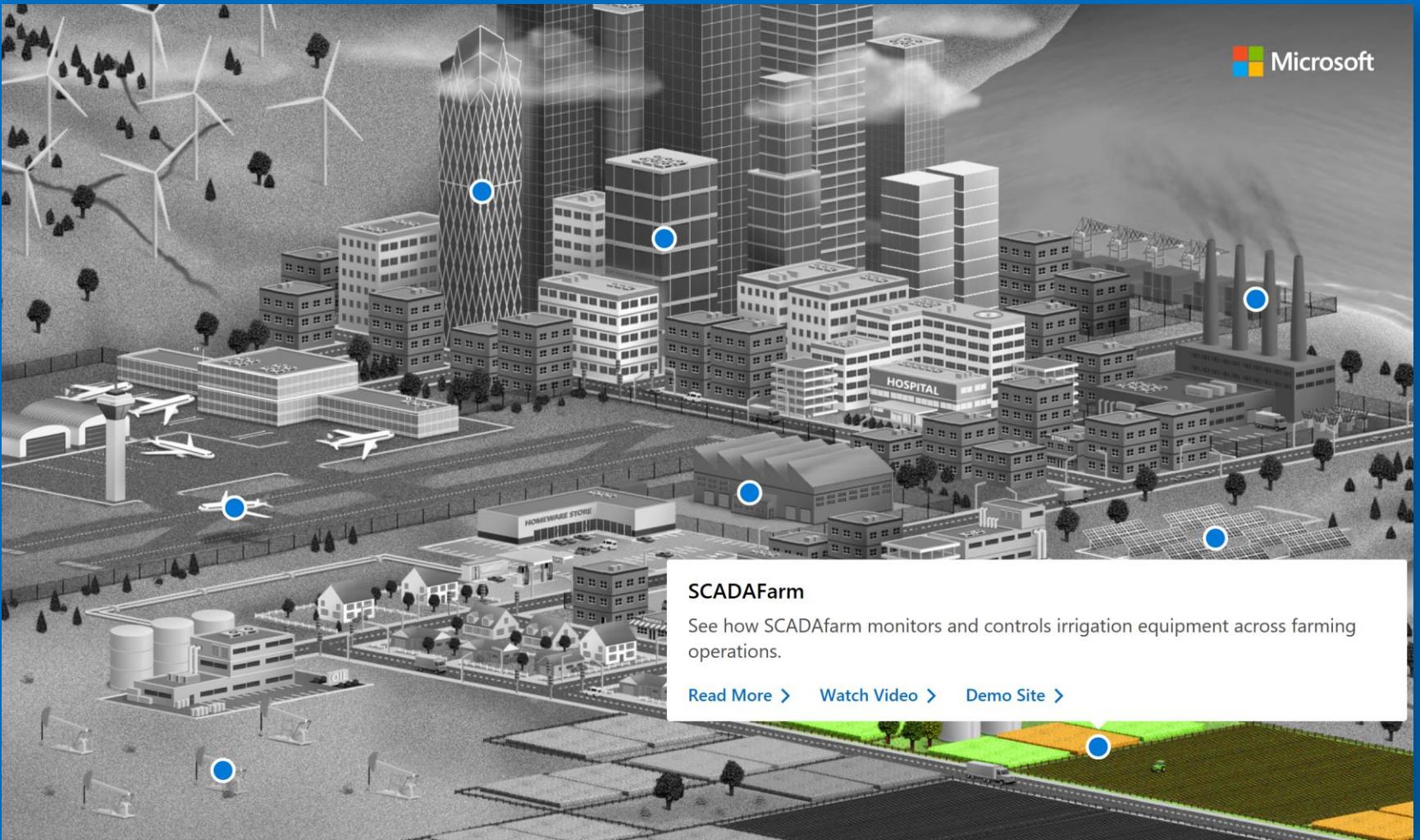
Azure certified  
for IoT



Developer, IT  
and, productivity



# Demos



# Get Started Today

## Looking to USE an IoT Solution?

Use managed and industry-specific solutions to get started quickly and easily. [Try IoT solutions](#)

## Ready to BUILD IoT Applications?

Find everything you need to develop advanced IoT apps using familiar languages and tools. [Build IoT apps](#)

1

[Go to Azure.com/IoT](#)

2

[Skill up at IoT School](#)

3

[Select a partner](#)

4

[Contact Us](#)

# Browse Devices

## Certified devices and starter kits

Tell us what you are looking for

[Become a Partner](#)[Learn More](#)

Certified

- ▶ IoT Plug and Play
- ▶ Microsoft Azure IoT Starter Kit
- ▶ Azure IoT Edge
- ▶ Chip Manufacturers
- ▶ Cloud Protocol
- ▶ Connectivity
- ▶ Device Security Services
- ▶ Device Type
- ▶ Geo Availability
- ▶ I/O Hardware Interfaces
- ▶ Industrial Protocols
- ▶ Industry
- ▶ Industry Certification
- ▶ Operating System
- ▶ Programming Languages
- [▶ Secure Hardware](#)
- ▶ Tested Built-in Sensors



### VIA Mobile360 D700

By: VIA Technologies, inc

The VIA Mobile360 D700 Drive Recorder integrates dual 1080p front dash and interior cameras in a robust and st...

[IoT Plug and Play](#)

### Temp and Humidity Sensor

By: Seeed

SenseCAP is an industrial-grade sensor network developed by Seeed to enable environmental physical data collec...

[IoT Plug and Play](#)

### VIA AMOS-3005

By: VIA Technologies, inc

The VIA AMOS-3005 is a compact and ruggedized fanless system designed to meet the most demanding indoor and ou...

[IoT Plug and Play](#)

### VIA ARTiGO A820

By: VIA Technologies, inc

The VIA ARTiGO A820 is an ultra-slim fanless enterprise IoT gateway system featuring robust networking connect...

[IoT Plug and Play](#)

### Wistron-Tracker

By: Wistron

With Qualcomm advance connectivity functionality, the LTE Hotspot GPS Tracker can support smart city, commerci...



### Windows Connected Display

By: Sharp Electronics

The system includes a next generation 4K '70' Class ('69.5' diagonal) interactive display, built-in



### APAL – Ruggedized Asset Tracker

By: Compal Electronics, INC.

Asset Tracker makes it possible to follow your valuables anytime & anywhere. Wide area coverage over

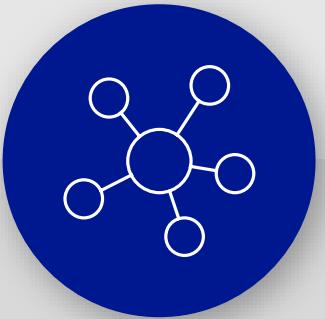


### Dashcam Smart Camera

By: ASKEY computer corp.

The Askey Connected Car Cam+, equipped with LTE/Wi-Fi functions, provides uninterrupted connection for IoT app...

# Azure IoT portfolio



## Solutions

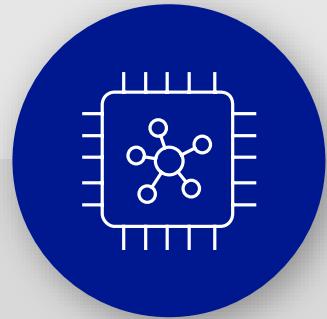
### Azure IoT Central

Azure IoT Remote Monitoring  
Azure IoT Predictive Maintenance  
Azure IoT Device Simulation  
Azure IoT Connected Factory



## Services

Azure Digital Twins  
Azure IoT Hub  
Azure IoT Security



## Edge

Azure IoT Edge  
Azure Sphere  
Windows IoT



# 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



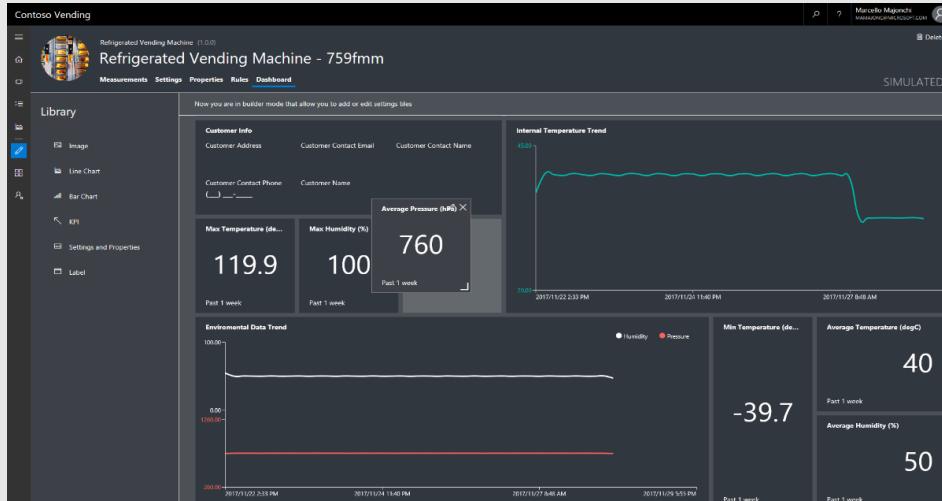
Analytics, dashboards and visualization



Risk-free trial with simplified pricing

Try today: <http://azureiotcentral.com>

# Builder



# Operator



Product modeler



Device settings



Template management



Rules workflows



User and identity management



Device management



Analytics and dashboards

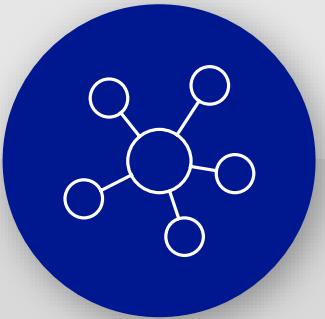


Time-series insights



Alerts and actions

# Azure IoT portfolio



## Solutions

Azure IoT Central

**Azure IoT Remote Monitoring**

**Azure IoT Predictive Maintenance**

**Azure IoT Device Simulation**

**Azure IoT Connected Factory**

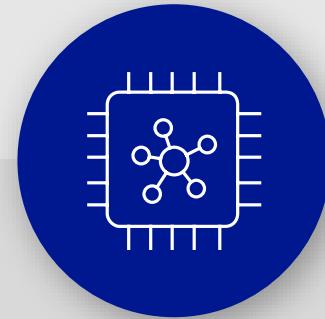


## Services

Azure Digital Twins

Azure IoT Hub

Azure IoT Security



## Edge

Azure IoT Edge

Azure Sphere

Windows IoT



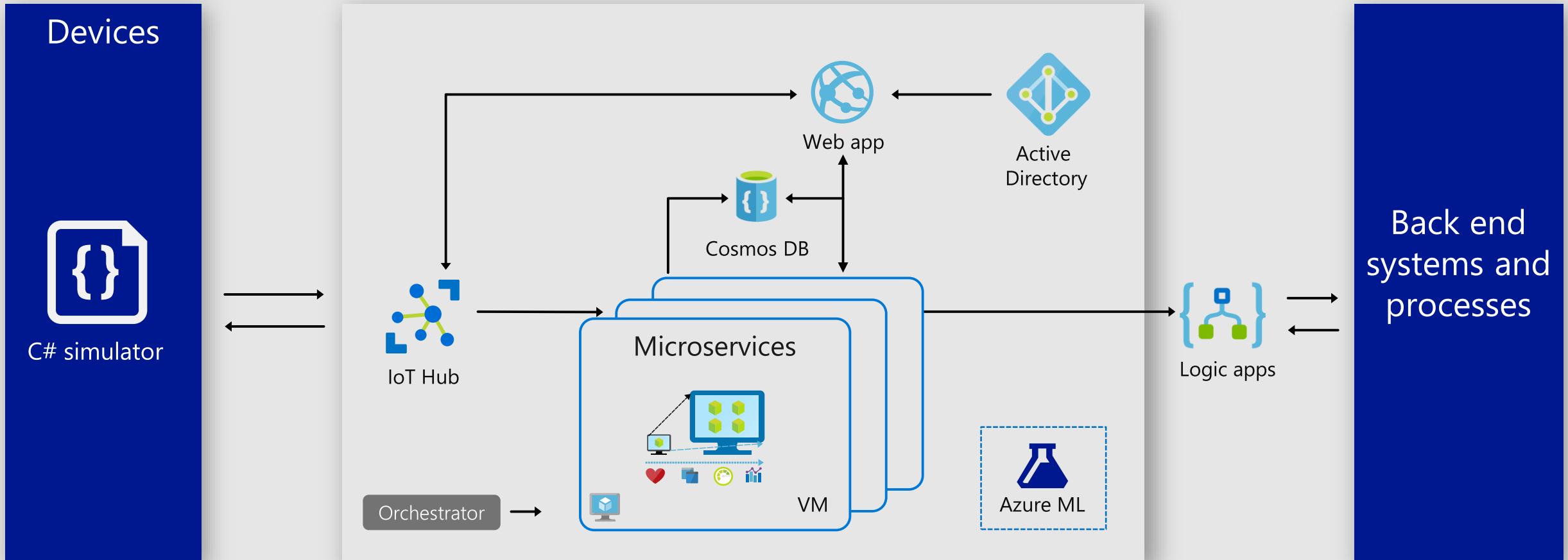
Generally available

# Azure IoT solution accelerators

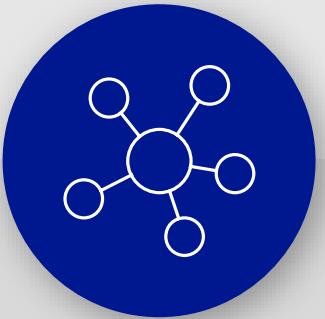
-  End-to-end implementation
-  Completely customizable
-  Open-source microservices based architecture
-  Device connectivity and management
-  Dashboards, visualization, and insights
-  Workflow automation and integration
-  Command and control
-  Preconfigured solutions
-  Remote monitoring
-  Connected factory
-  Predictive maintenance
-  Device simulation

# Components of a pre-configured solution

Remote monitoring | Predictive maintenance | Connected factory | Device simulation



# Azure IoT portfolio



## Solutions

Azure IoT Central

Azure IoT Remote Monitoring

Azure IoT Predictive Maintenance

Azure IoT Device Simulation

Azure IoT Connected Factory

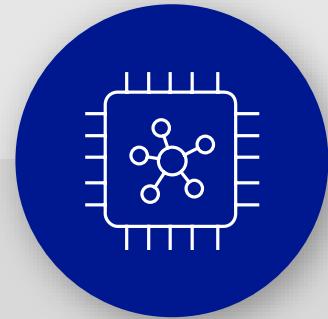


## Services

### Azure Digital Twins

Azure IoT Hub

Azure IoT Security



## Edge

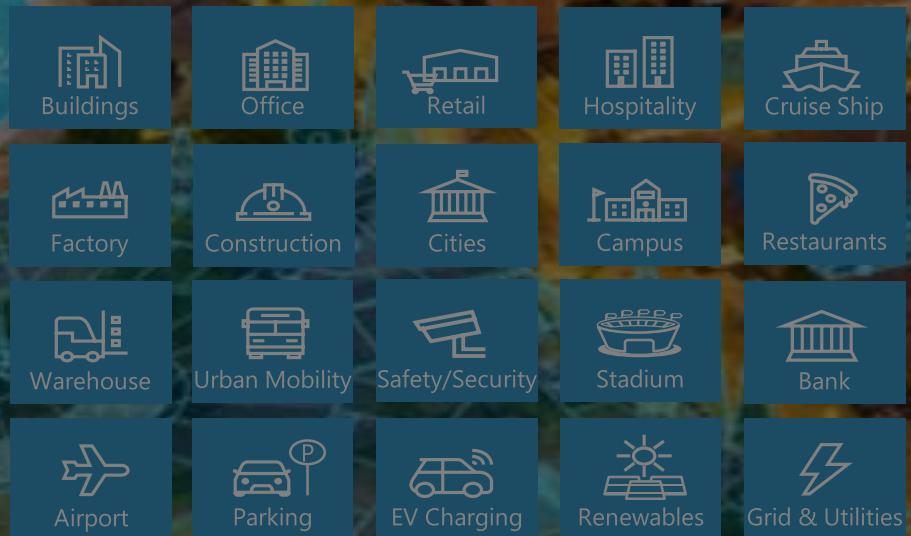
Azure IoT Edge

Azure Sphere

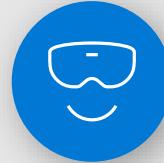
Windows IoT

Public preview

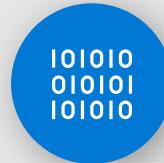
# Azure Digital Twins



Build next generation IoT solutions with Azure Digital Twins



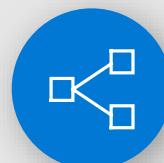
Virtually represent the physical world with a digital twin that models the relationships between people, places and devices



Leverage predefined and extensible Twin Object Models to build contextually-aware solutions uniquely attuned to your industry domain

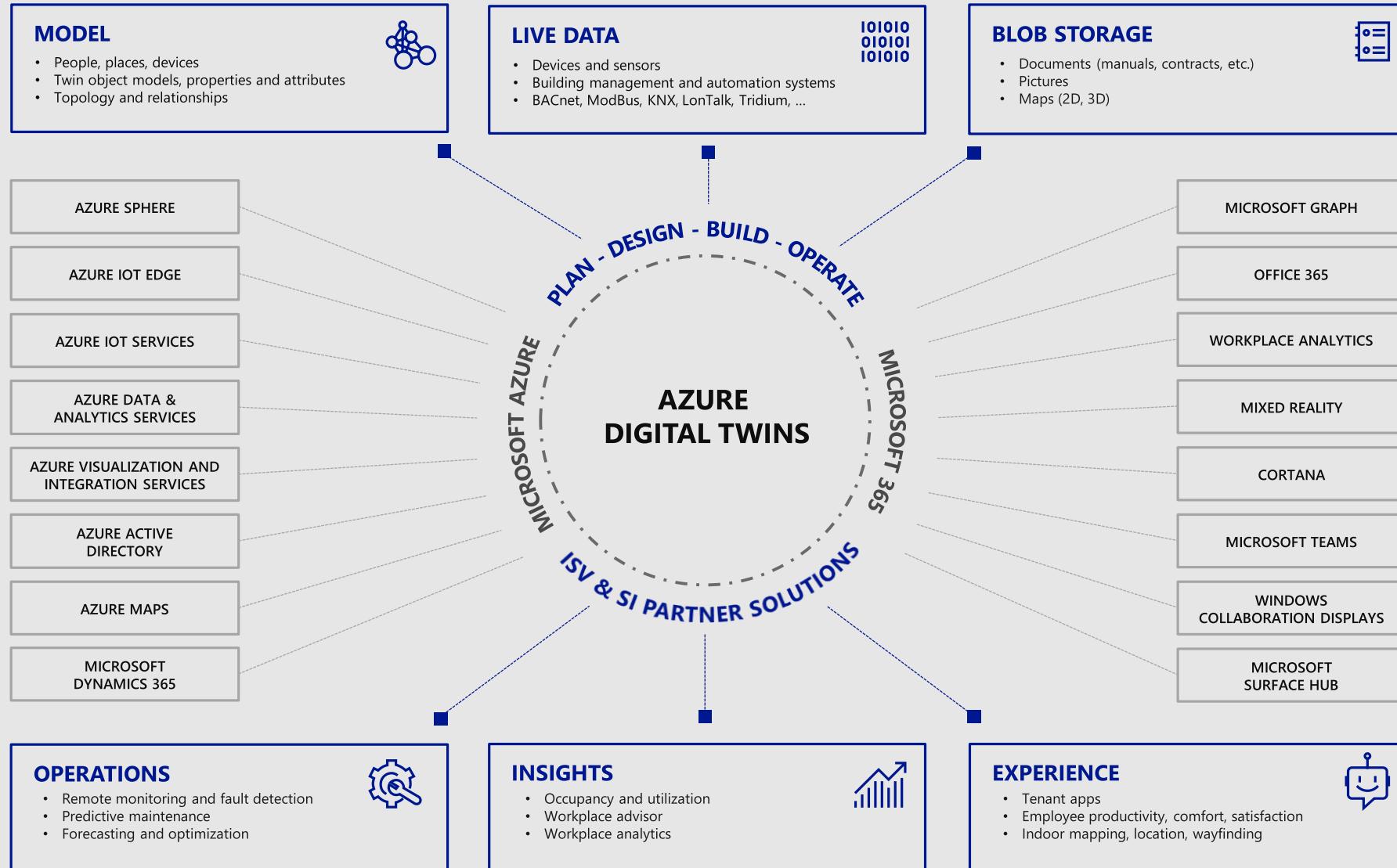


Automate actions in a space with custom functions that send events and/or notifications to endpoints based on incoming telemetry

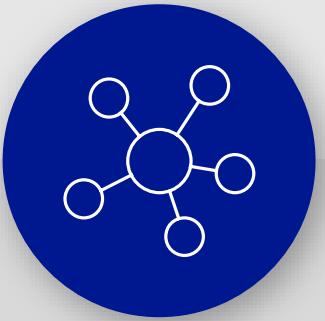


Securely replicate solutions across multiple tenants through built-in multi and nested-tenancy

# Azure Digital Twins for Smart Spaces



# Azure IoT portfolio



## Solutions

Azure IoT Central

Azure IoT Remote Monitoring

Azure IoT Predictive Maintenance

Azure IoT Device Simulation

Azure IoT Connected Factory

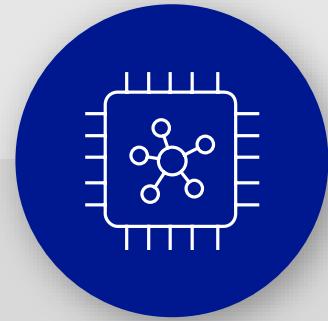


## Services

Azure Digital Twins

### Azure IoT Hub

Azure IoT Security

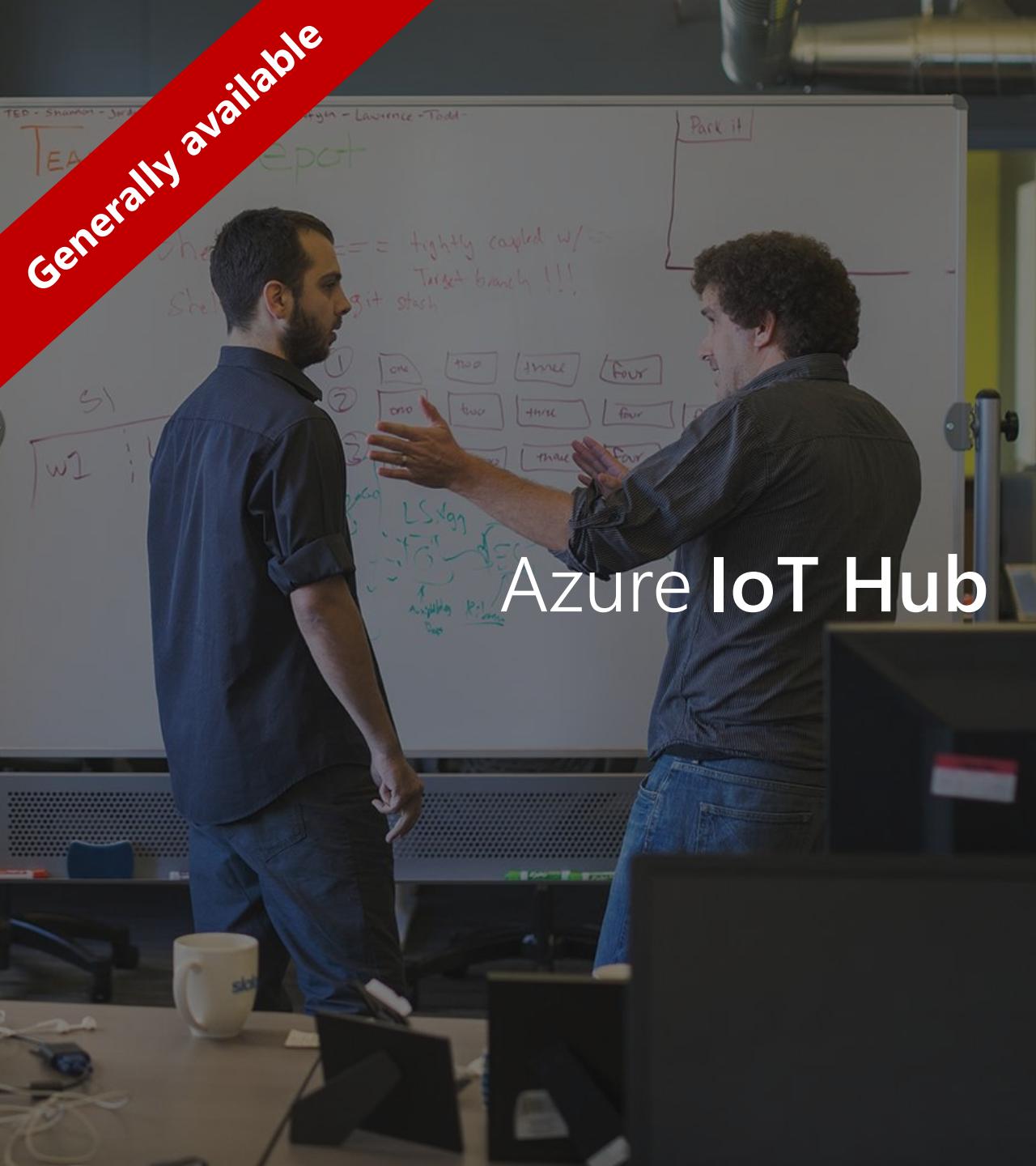


## Edge

Azure IoT Edge

Azure Sphere

Windows IoT



Generally available

# 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

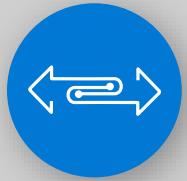


Manage devices at scale with device management



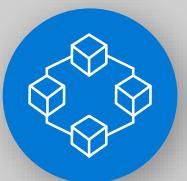
Multi-language and open source SDKs

## Azure IoT Hub



### Bi-directional communication

Millions of devices  
Multi-language, open source SDKs  
HTTPS/AMQPS/MQTT-S  
Send Telemetry  
Receive commands  
Device management  
Device Twins  
Queries and jobs



### Enterprise scale and integration

Billions of messages  
Scale up and down  
Declarative message routes  
File Upload  
WebSockets and 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 policies  
Firmware/software updates  
Azure security center support

## Azure IoT Hub Device Provisioning Service



### IoT-scale automated provisioning

Zero-touch provisioning  
Centralize your provisioning workflow  
Load balance across multiple IoT Hubs  
Re-provisioning support  
Supports TPM + X.509

# Azure IoT Hub Device Provisioning Service

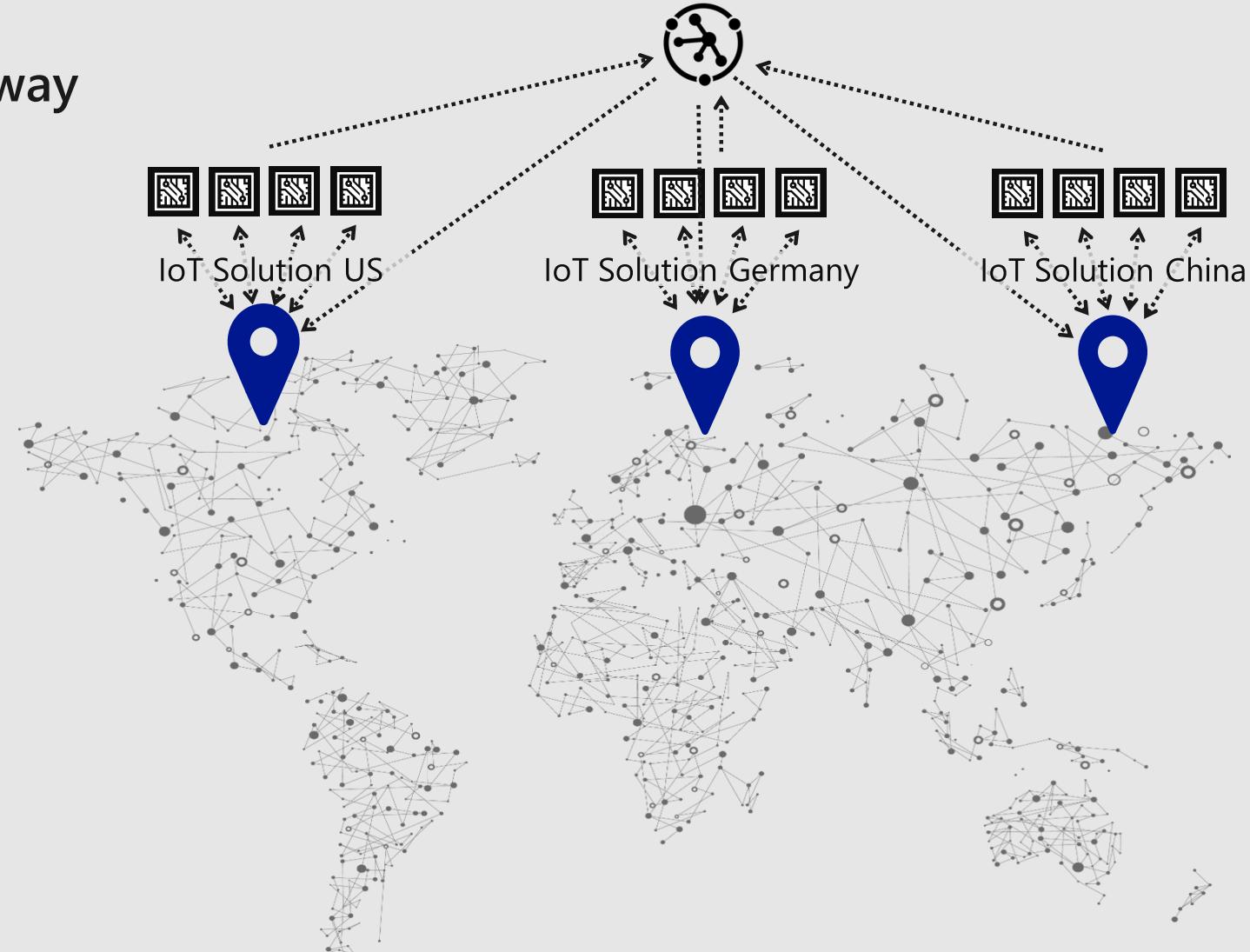
Register and provision devices with zero-touch in a secure and scalable way

Simple "plug and play" provisioning

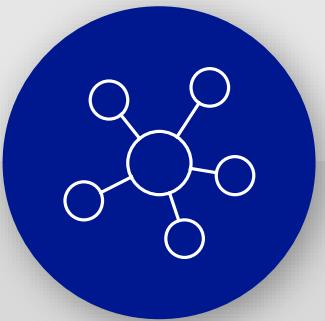
Minimize manual connection requirements

Enhanced security through HSM

Global availability



# Azure IoT portfolio



## Solutions

Azure IoT Central

Azure IoT Remote Monitoring

Azure IoT Predictive Maintenance

Azure IoT Device Simulation

Azure IoT Connected Factory

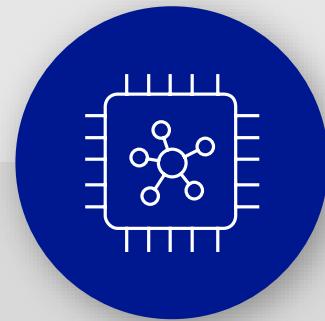


## Services

Azure Digital Twins

Azure IoT Hub

Azure IoT Security

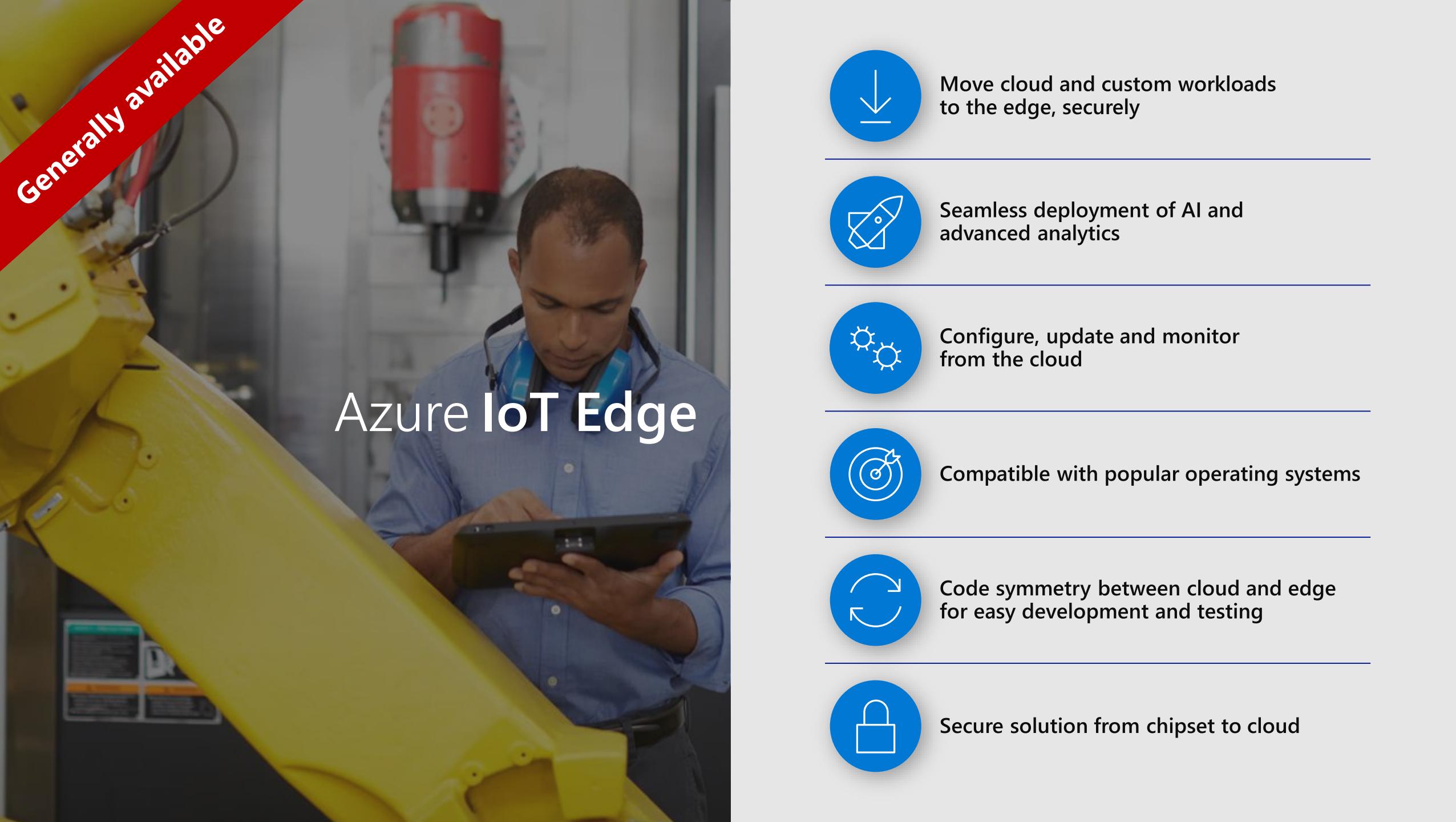


## Edge

### Azure IoT Edge

Azure Sphere

Windows IoT



Generally available

# 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

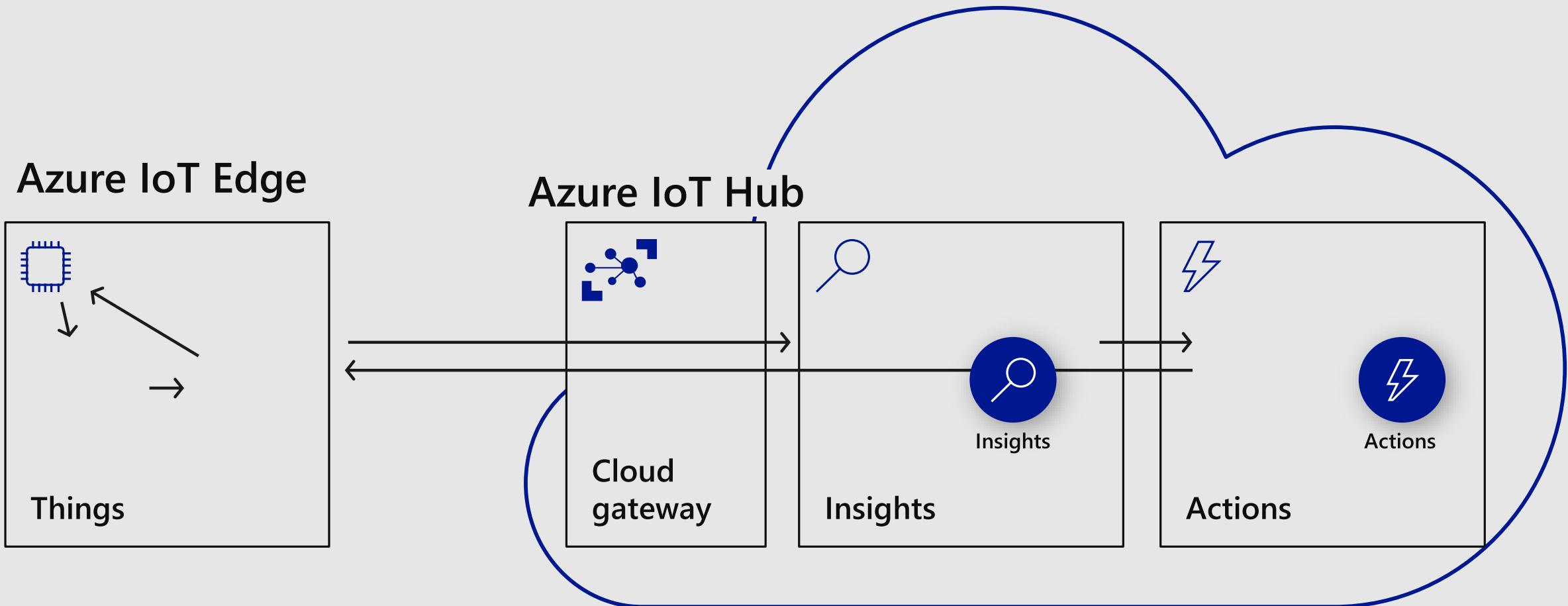


Code symmetry between cloud and edge for easy development and testing



Secure solution from chipset to cloud

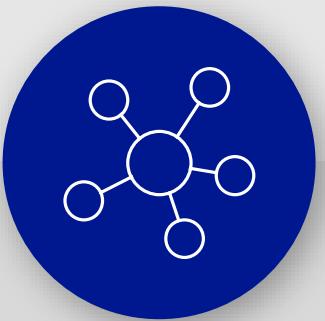
# IoT pattern + edge



# Cognitive Services at the Edge

- Anomaly Detector
- Computer Vision
- Face
- Form Recognizer
- Language Understanding
- Speech Service API
- Text Analytics

# Azure IoT portfolio



## Solutions

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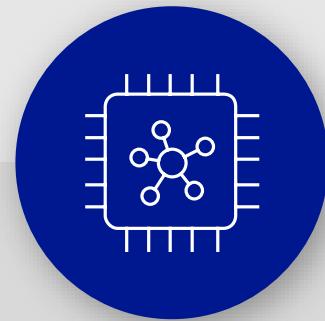


## Services

Azure Digital Twins

Azure IoT Hub

Azure IoT Security



## Edge

Azure IoT Edge

## Azure Sphere

Windows IoT

# Additional Documentation on GitHub

[https://github.com/jasonerrett/AzureIoT\\_HelloSphere](https://github.com/jasonerrett/AzureIoT_HelloSphere)



Thank you

감사합니다 TEŞEKKÜRLER

DANK U WEL СПАСИБО

ευχαριστώ OBRIGADO

הודות MULTUMESC நன்றி

HVALA SALMAT PO MERCI