

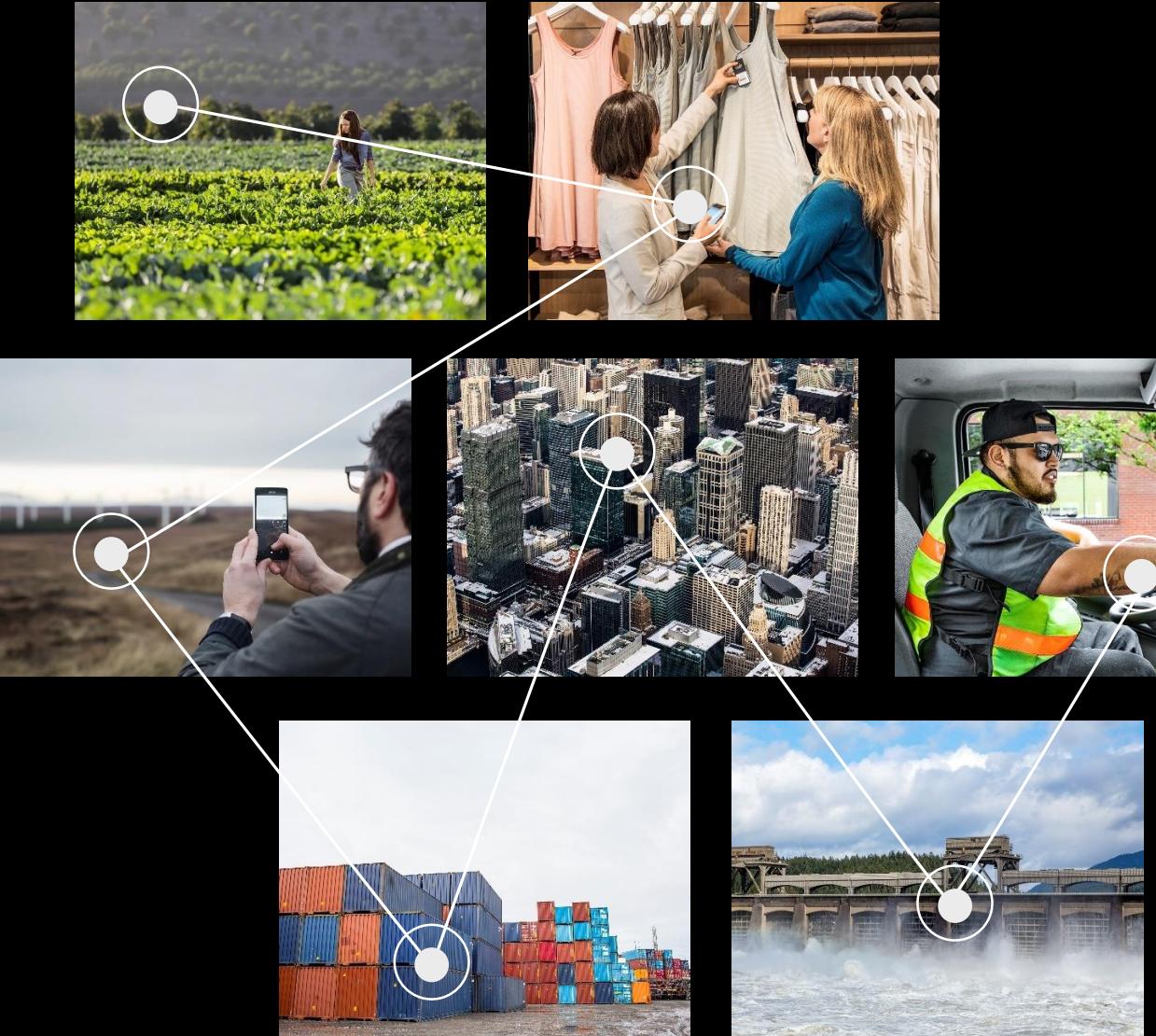
# Azure IoT

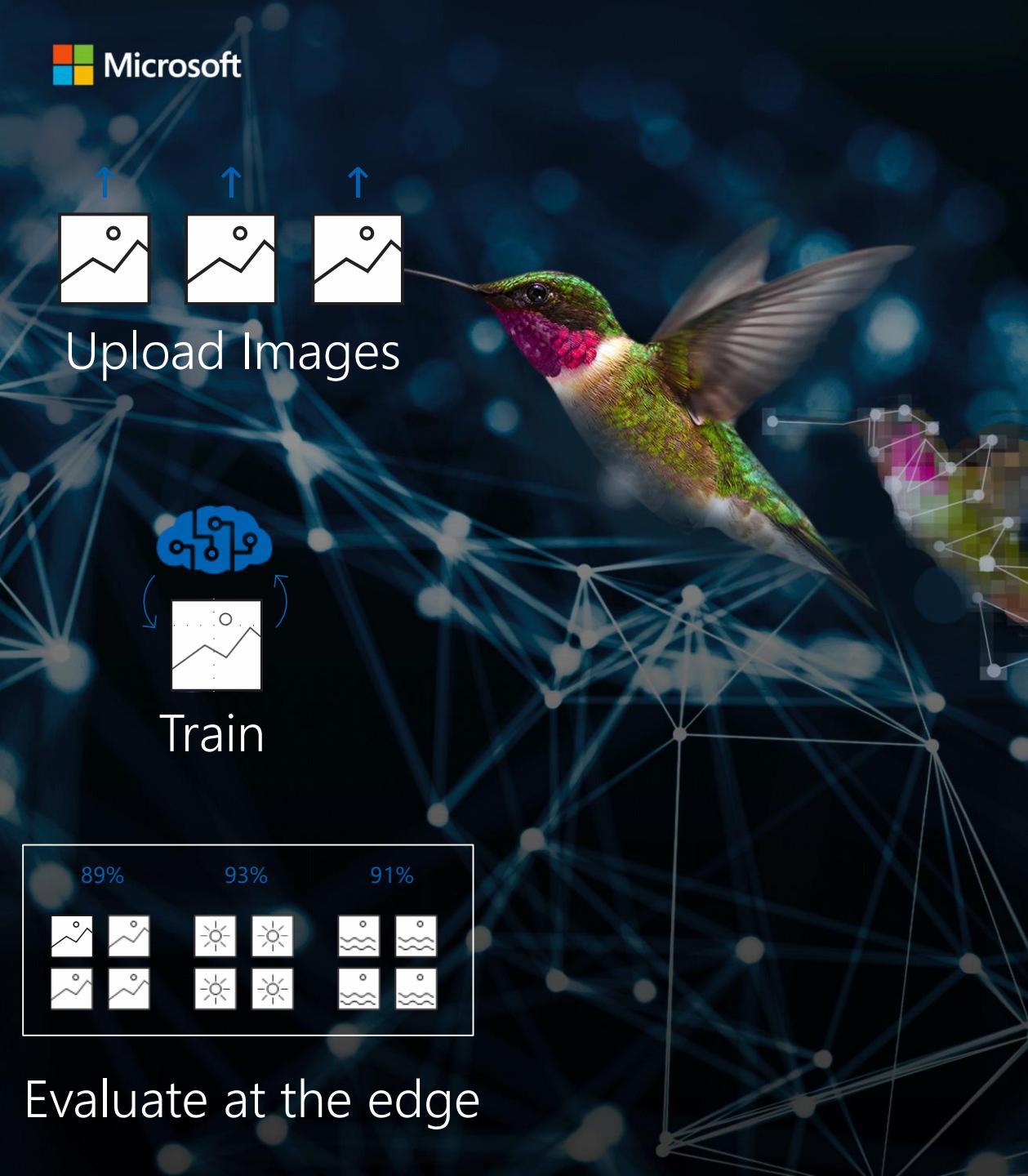
## Transforming your business

Kristina E. Florea

November 12, 2019

AIT





# AI at the Edge

- Defect detection
- Video surveillance
- [Example](#)

**94 % Data is at the Edge**



coop

MARS

btt<sup>TM</sup>

BUNN  
Quality Service Since 1946



powel



T-Systems



ATF  
SERVICES

thyssenkrupp

DUNAV  
NET

DRONEWORKS



RAC

Steelcase

Schneider  
Electric

SANDVIK  
Coromant

JABIL

ABB



weka health  
solutions

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evoQUA  
WATER TECHNOLOGIES

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YIELD  
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SOLUTIONS<sup>™</sup>

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SMART BUILDINGS-AS-A-SERVICE

STEIGENBERGER  
AIRPORT HOTEL  
FRANKFURT

FUJITSU

KONGSBERG

# Azure, Azure Stack, IoT Edge, and IoT

## Azure

- Available in Azure Regions
- Full functionality

## Azure Stack

- Azure Services & Management on-prem
- Managed by Azure or Locally

## 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

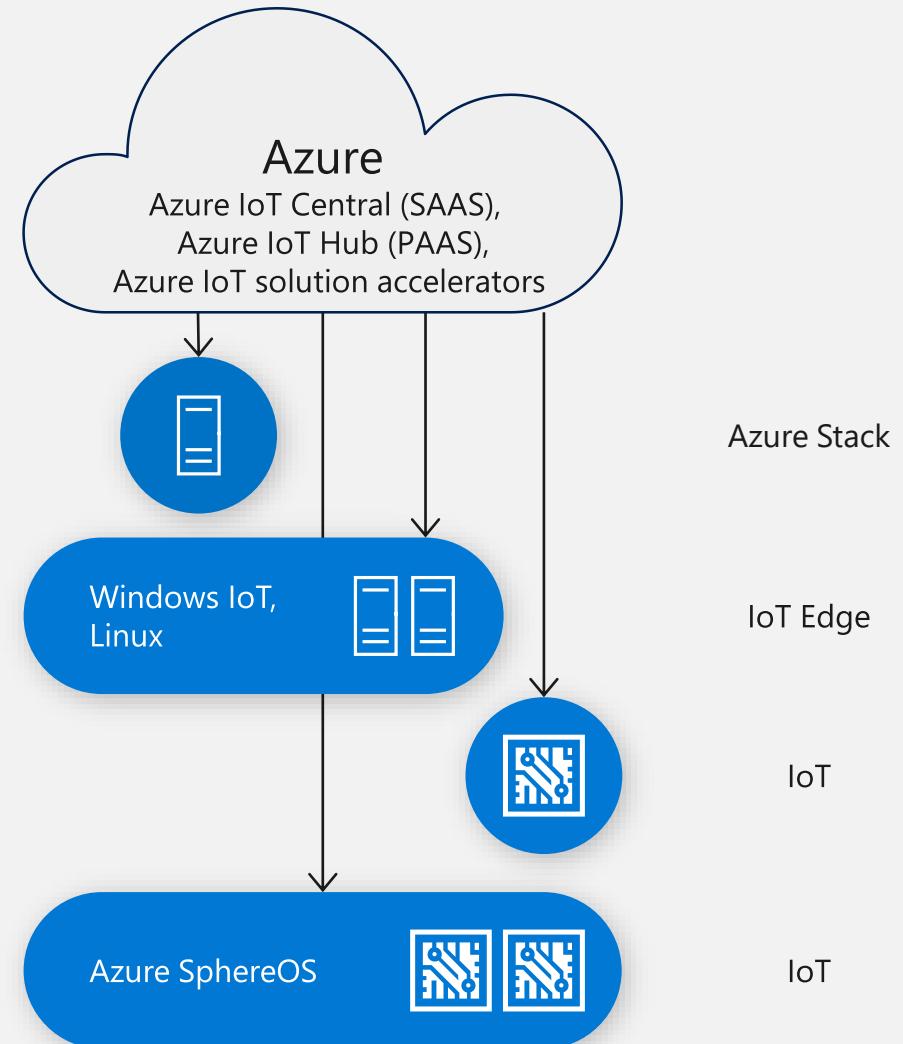
- Multi-device, multi-language, multi-OS
- iOS, Android, Windows, Linux

## Azure Sphere

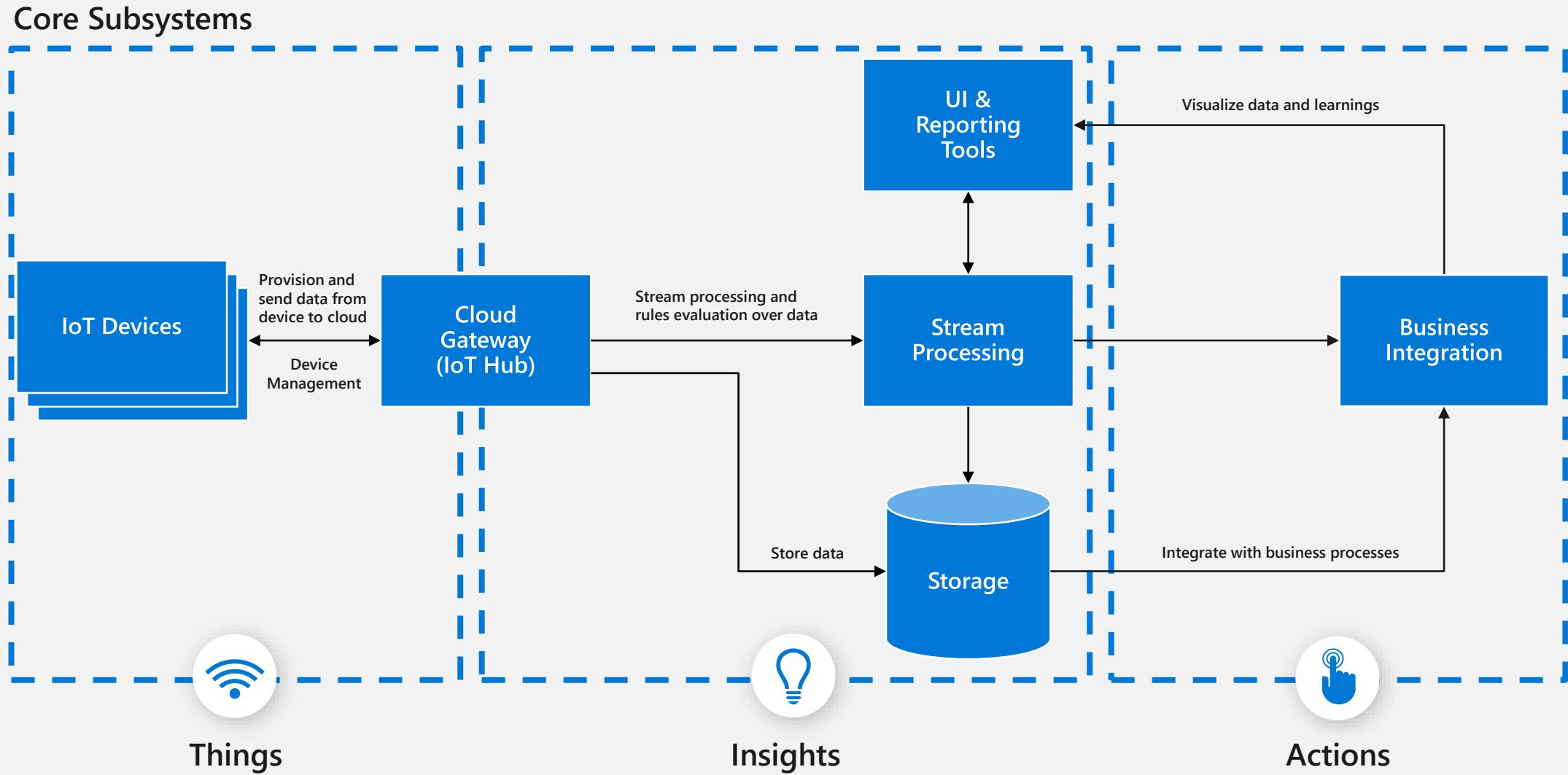
- Peerless

## Azure Sphere OS

- Linux Kernel that modernizes MCU devices



# Azure IoT reference architecture





# 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

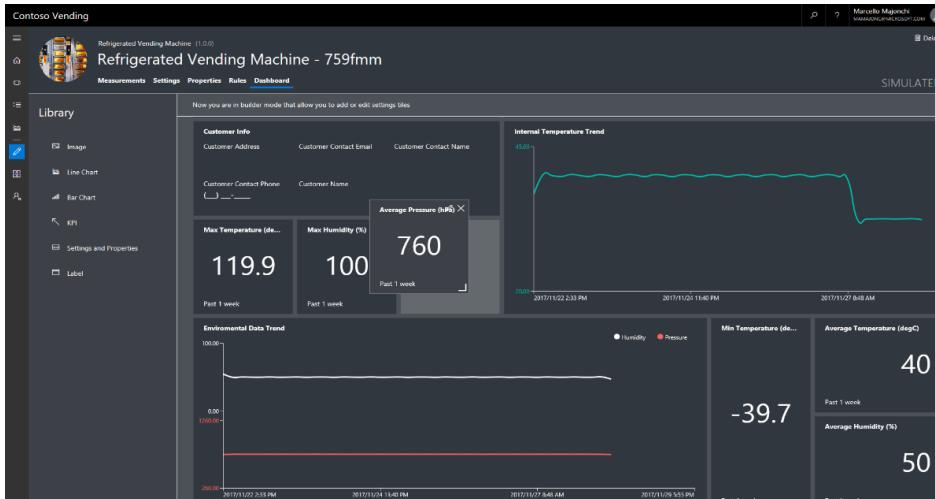


Analytics, dashboards and visualization



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

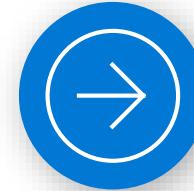


# Azure IoT solution accelerators

-  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



Finish with your  
IoT application



Get started in minutes

Modify existing rules and alerts

Add your devices and begin tailor to your needs

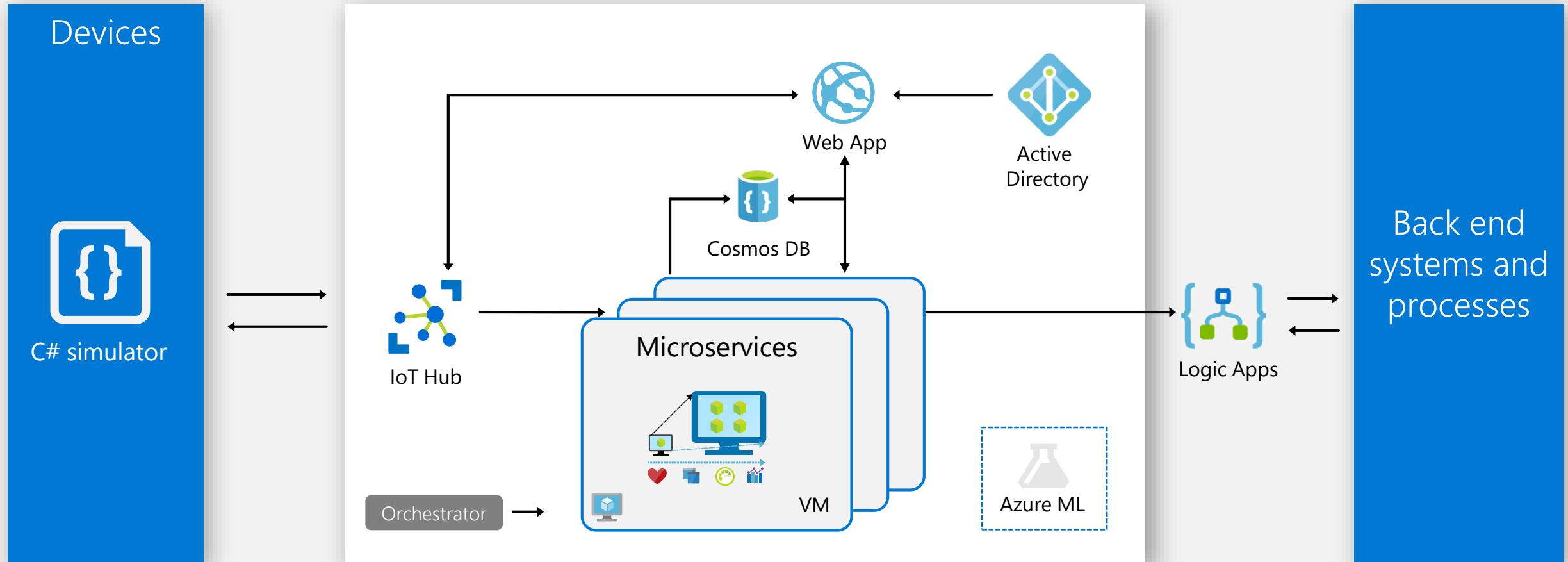
Fine-tuned to specific assets and processes

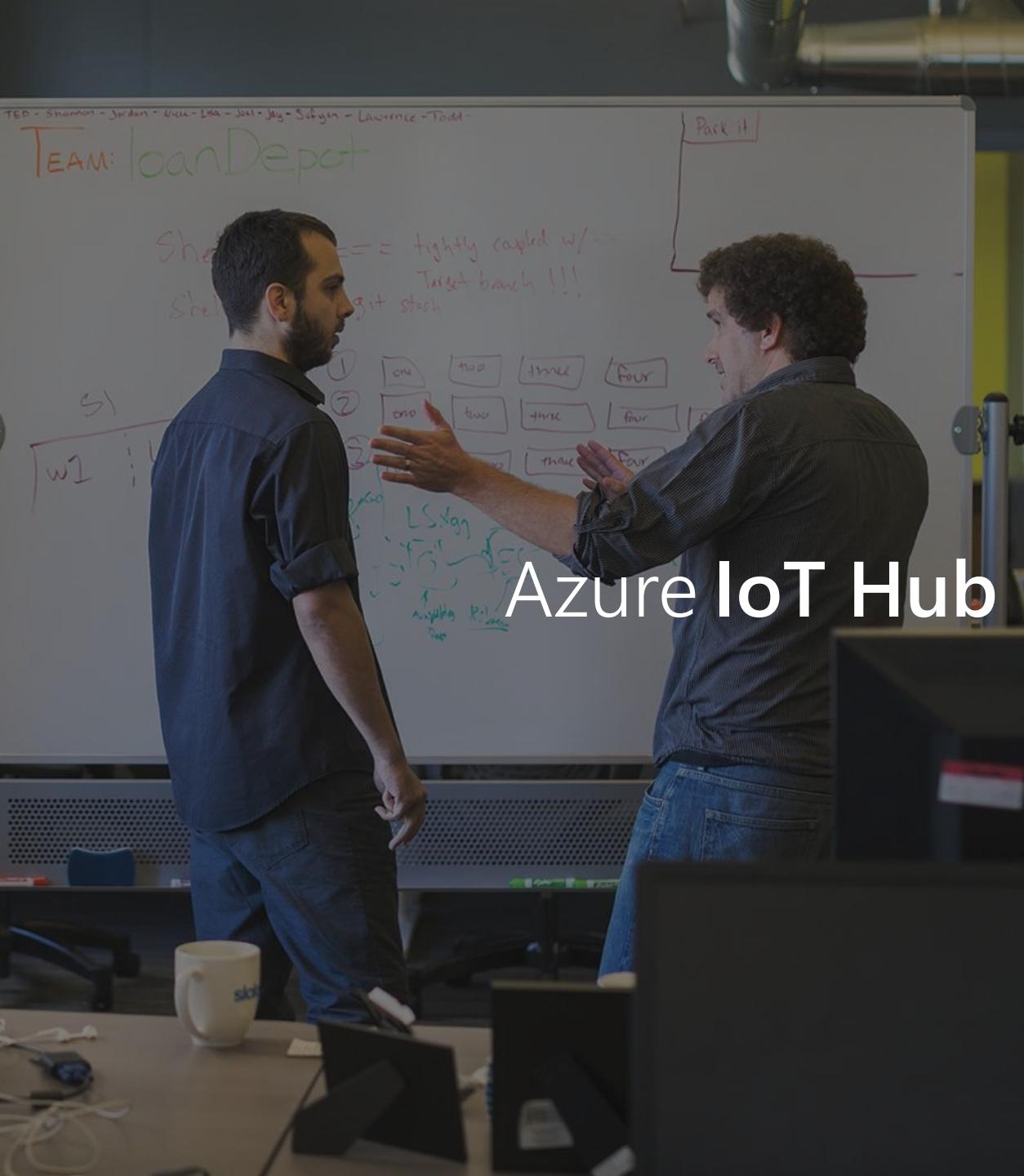
Highly visual for your real-time operational data

Integrate with back-end systems

# Components of a pre-configured solution

Remote monitoring | Predictive maintenance | Connected factory | Device simulation





# Azure IoT 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

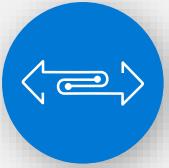


Manage devices at scale with device management



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 & 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

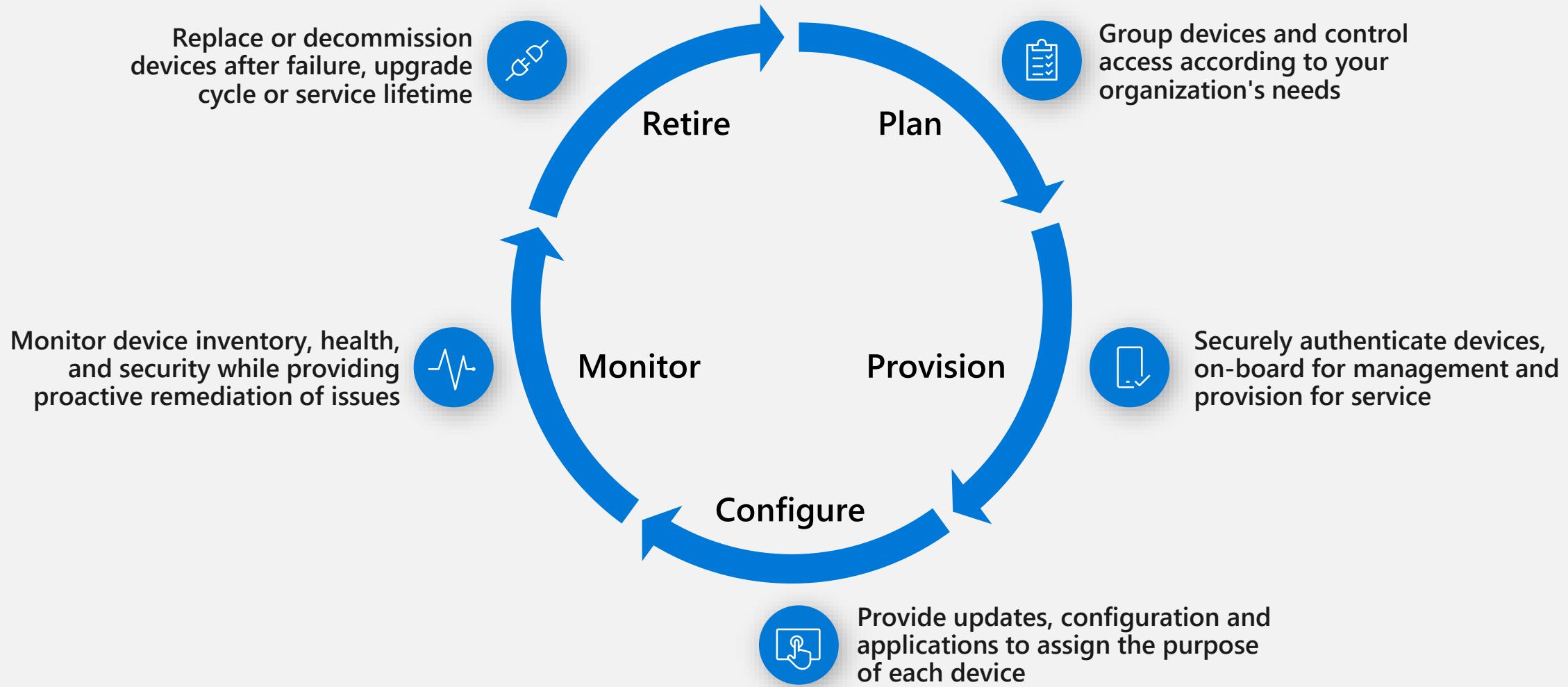
X.509 Support

IP Whitelisting/Blacklisting

Shared Access Policies

Firmware/Software Updates

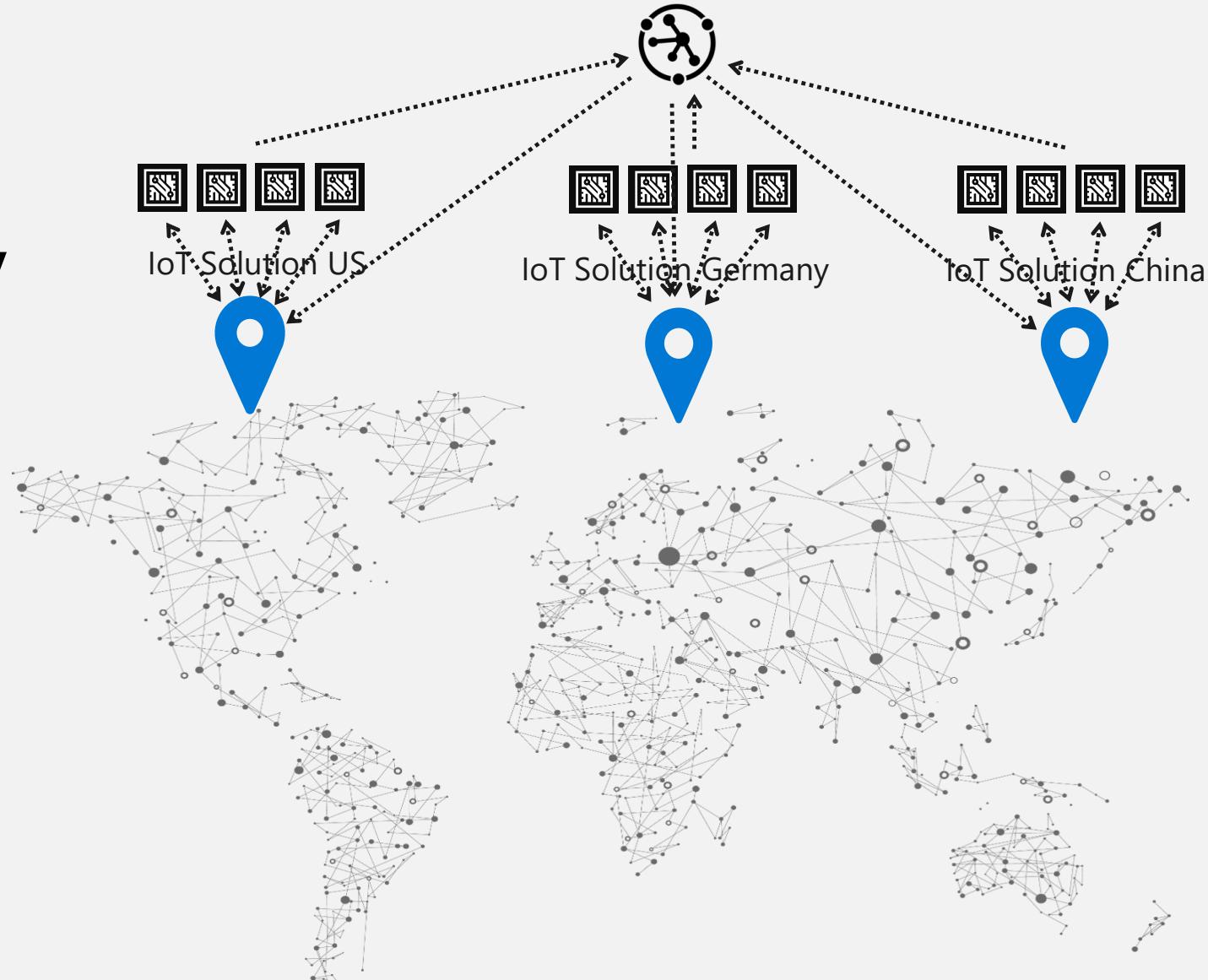
# Azure IoT Hub: IoT device management lifecycle

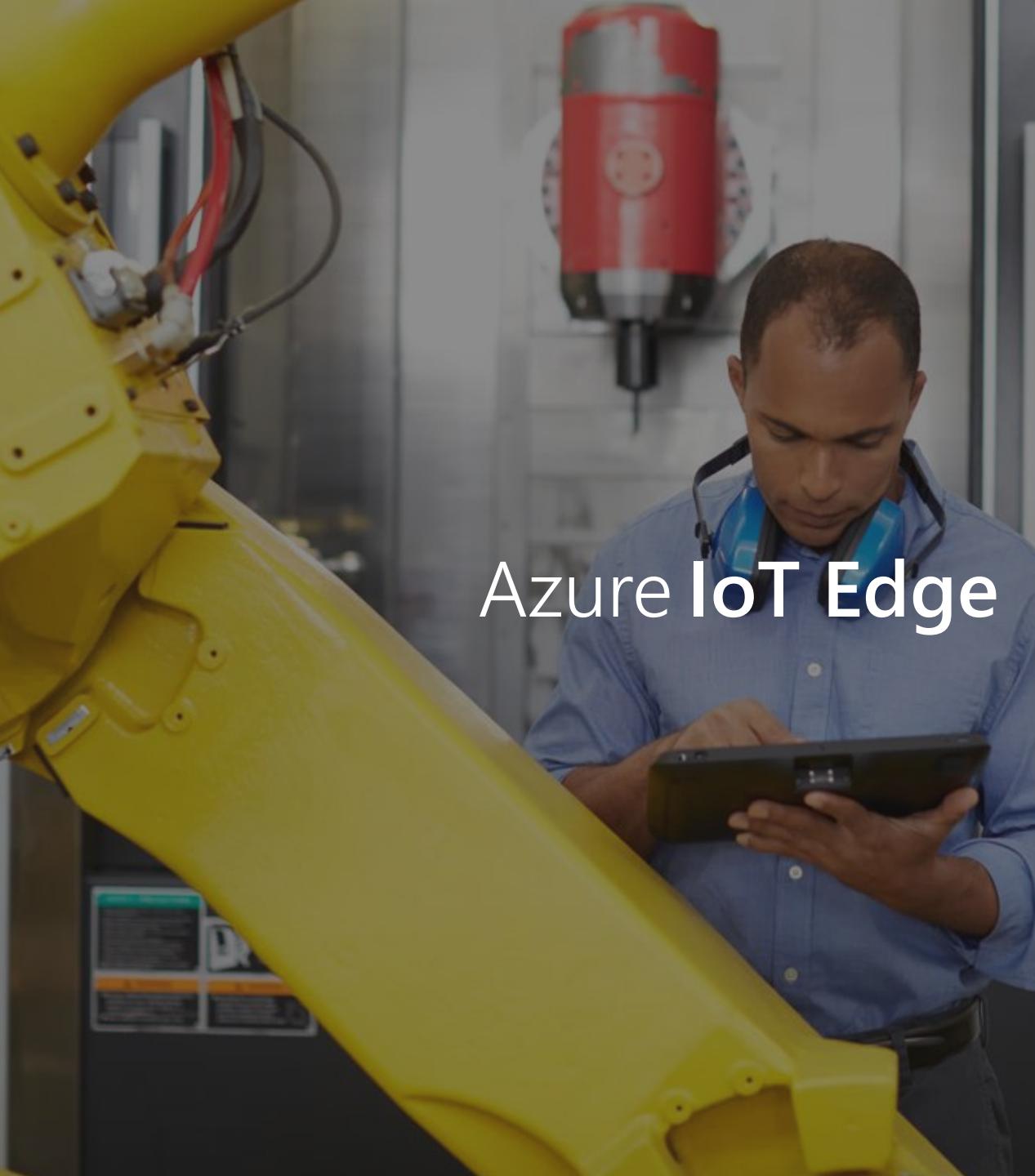


# Azure IoT Hub Device Provisioning Service

**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 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

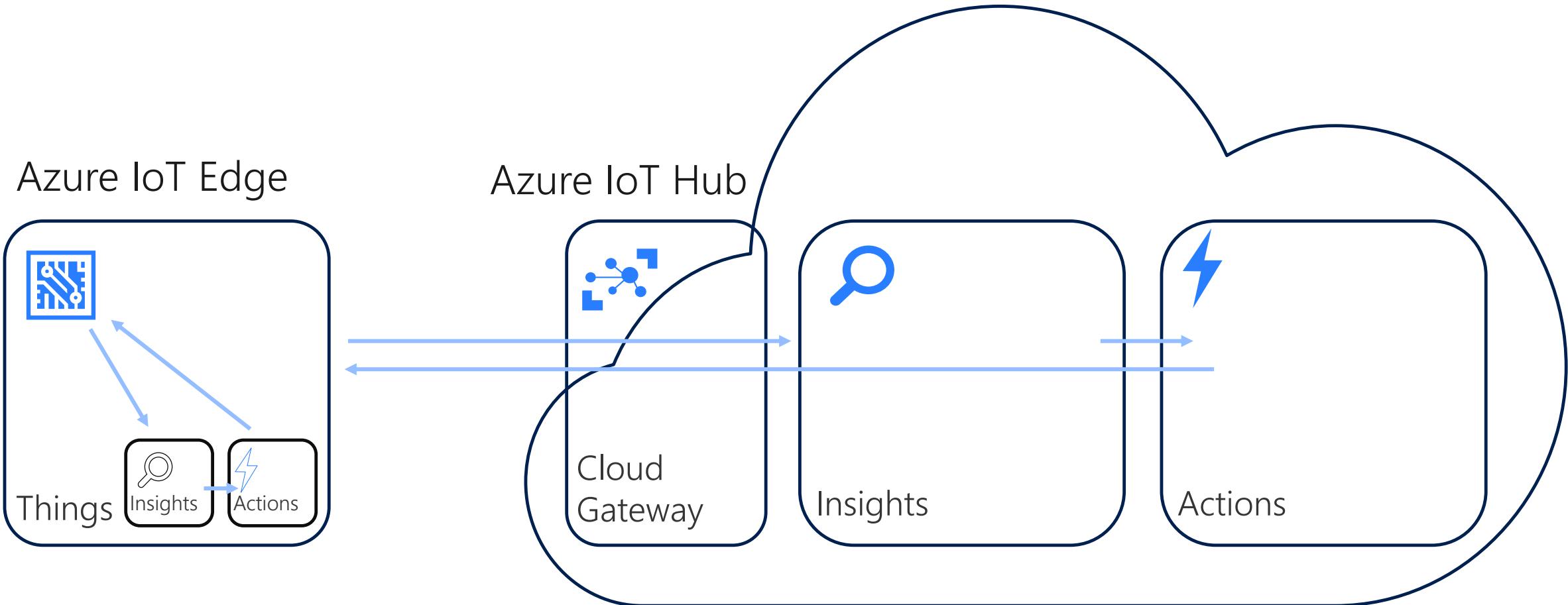


Code symmetry between cloud and edge for easy development and testing



Secure solution from chipset to cloud

# IoT Pattern + Edge



# Project BrainWave *at the Edge*

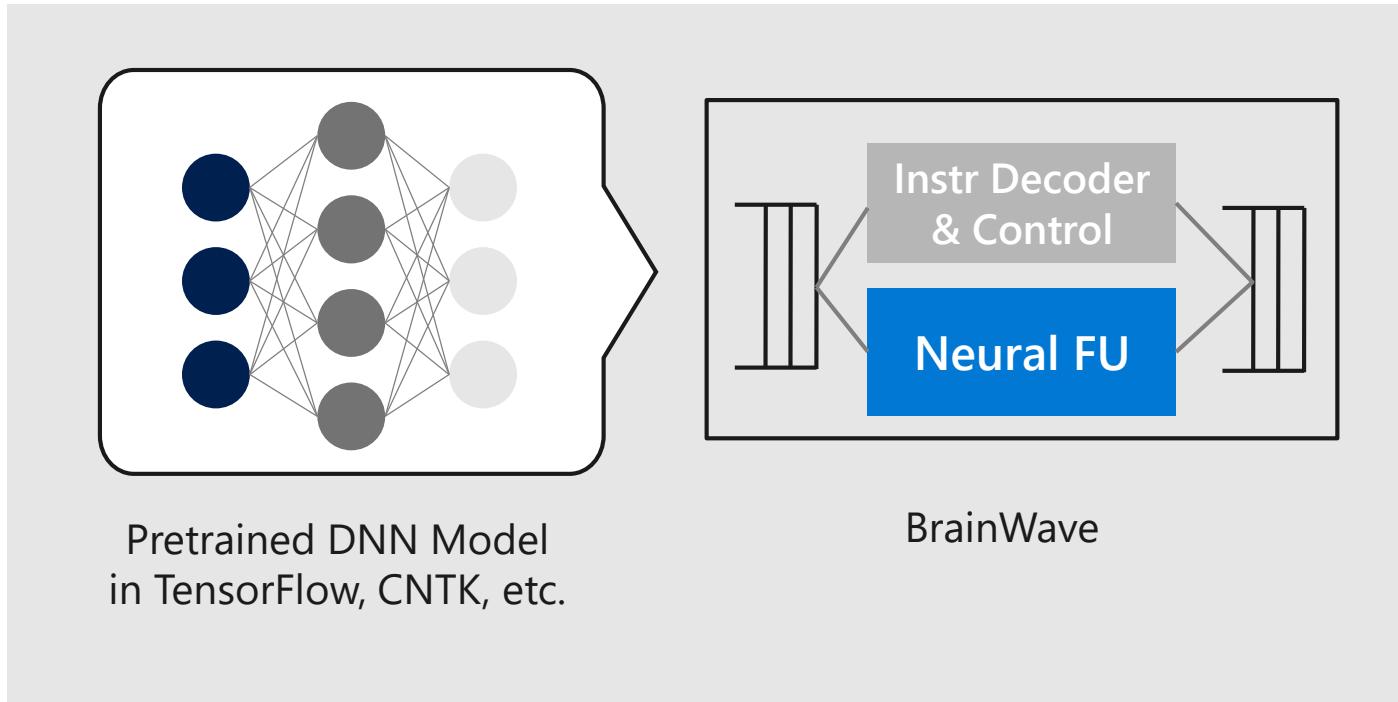
## An accelerated AI Platform – FPGA powered

**Fast:** Ultra-low latency, high-throughput serving of DNN models at low batch sizes

**Flexible:** Future proof, adaptable to fast-moving AI space and evolving model types

**Friendly:** Turnkey deployment of TensorFlow/CNTK/Caffe/etc.

**FPGA powered edge:** Bringing the power of the worlds fastest cloud to your edge



# Deploying and run a model

Azure ML



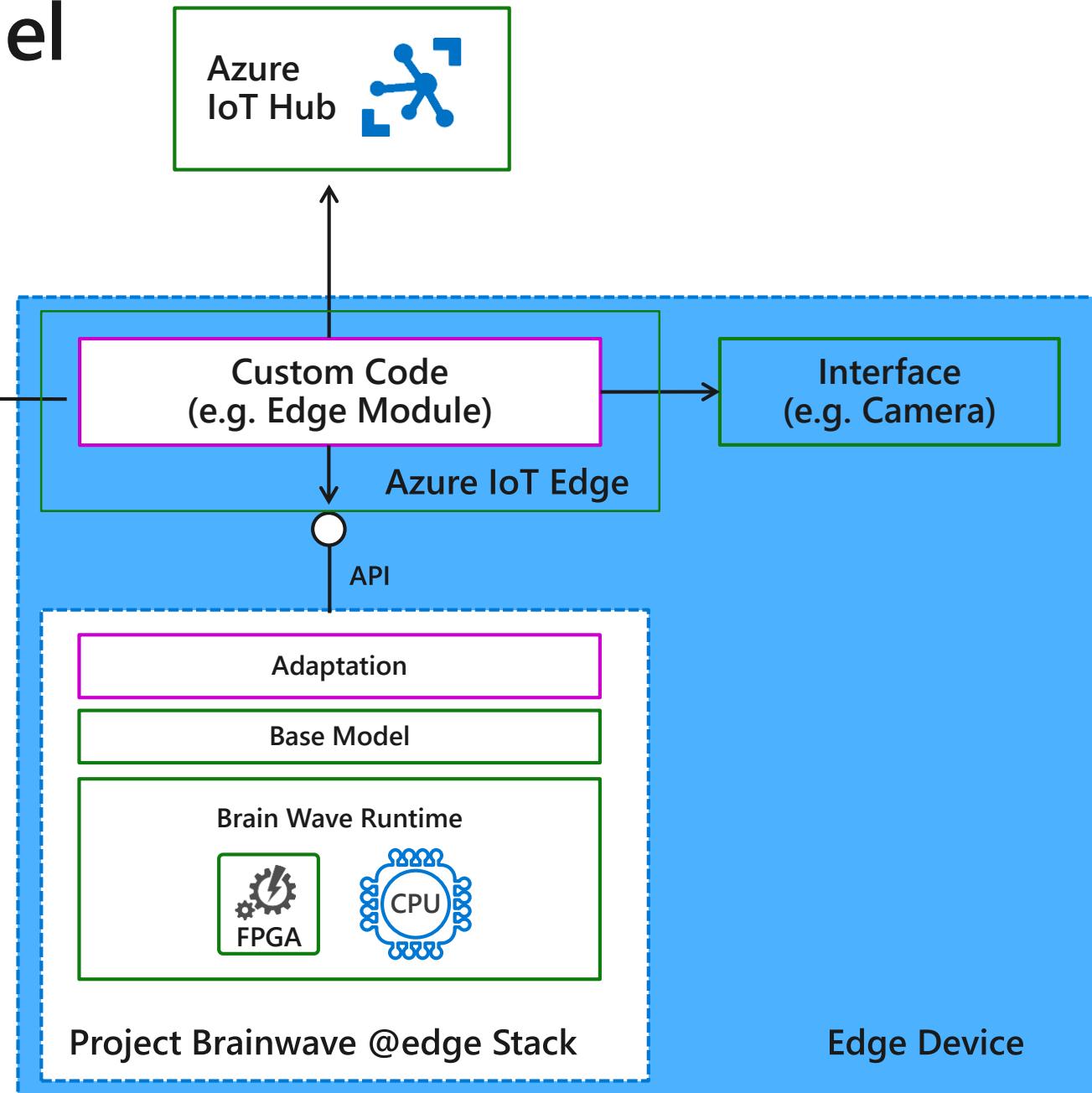
Service def

Model Management Service

Azure IoT Hub



1. Use Azure ML to create your **custom model**
2. Use Model Management Service to pull it to the Edge Device
3. Run custom model with **FPGA** on Edge Device
4. Use your **custom code** to interface with a camera or microphone
5. Use **IoTHub** to manage your Edge Module and data streams

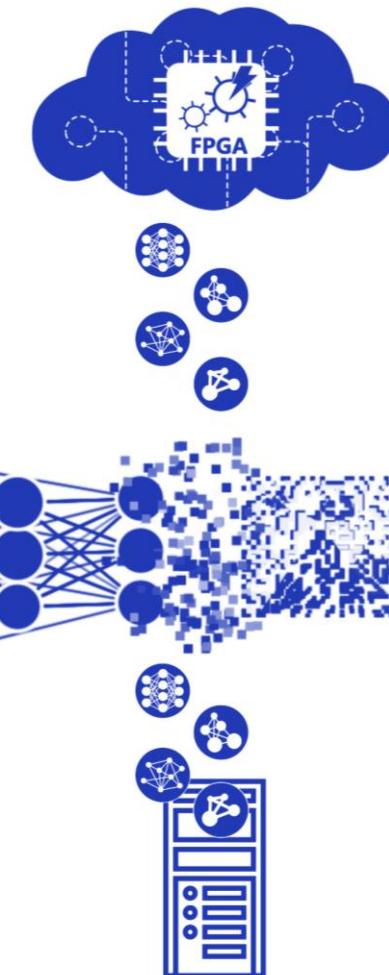
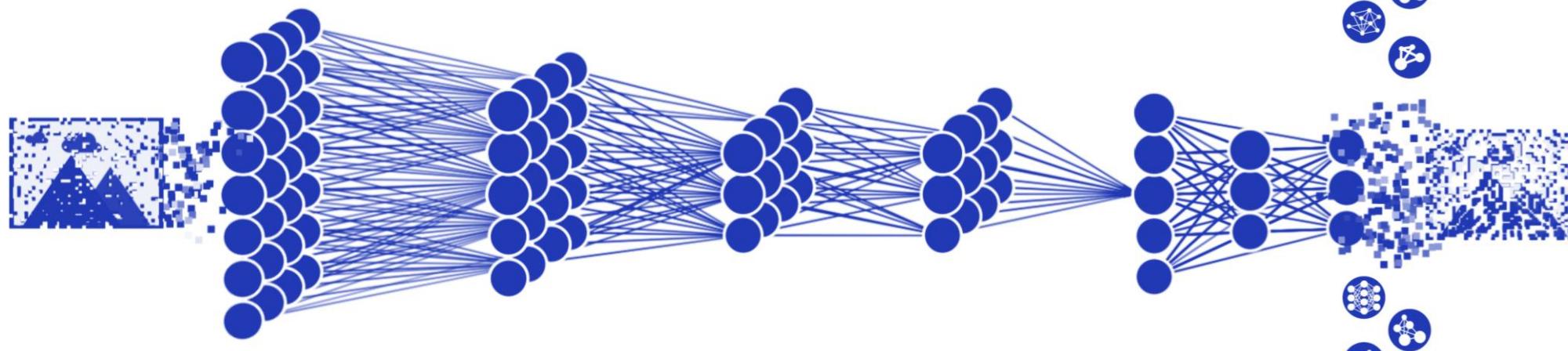


# Azure ML with Project Brainwave on cloud or edge

Models are easy to create and deploy into Azure cloud

Write once, deploy anywhere – to intelligent cloud or edge

Manage and update your models using Azure IoT Edge

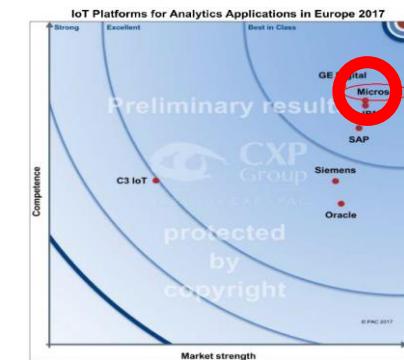
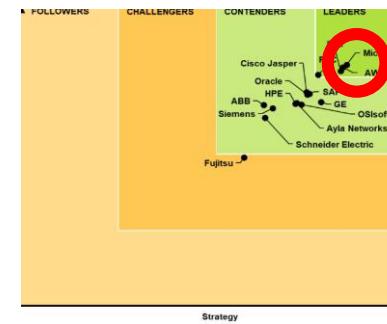


<http://aka.ms/aml-real-time-ai>  
brainwave-edge@microsoft.com

# Microsoft is the first hyperscale cloud solution provider to deliver

IoT solution accelerators | SaaS and PaaS for IoT | AA/AI at the edge

Solve device provisioning at scale | Support OPC UA O&G



**FORRESTER®**

Microsoft is a leader in the Forrester Wave for IoT Software Platforms

**IDC**  
Analyze the Future

Microsoft is a Leader in the IDC MarketScape for IoT platforms across various use cases

**NAVIGANT**

Microsoft is a leader in the Research Leaderboard assessment of strategy and execution for 15 IoT platform providers

**PAC**  
A CX Group Company

Azure IoT is the only cloud platform that was determined as best in class in every category

# The new era of digitization across industries



## Manufacturing

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



## Retail

Better customer experiences, new market opportunity



## Energy

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



## Smart Cities

More sustainable, prosperous, and economically competitive cities



## Transportation

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



## Healthcare

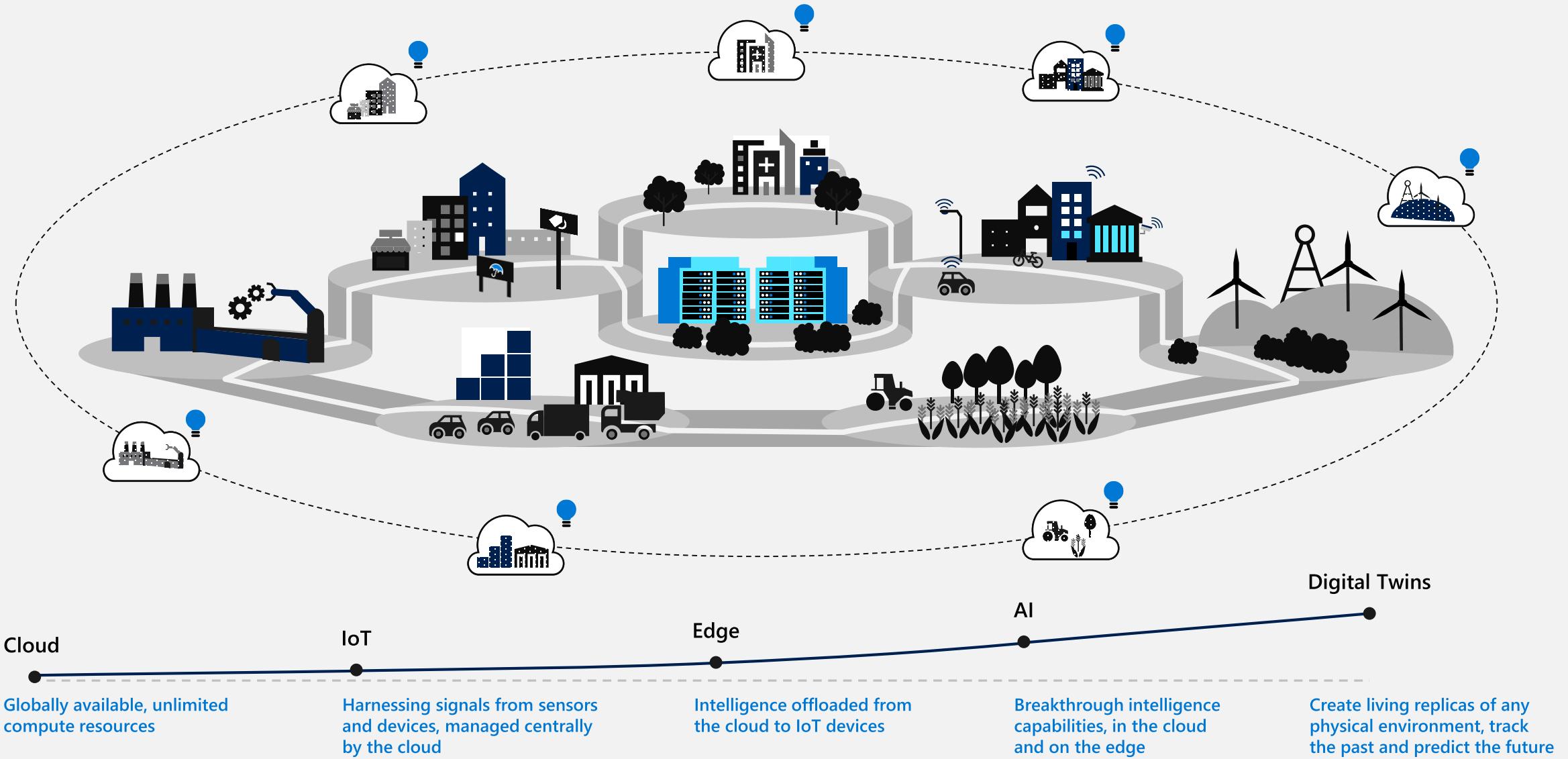
Improved quality and better outcomes for patients, anywhere



## Agriculture

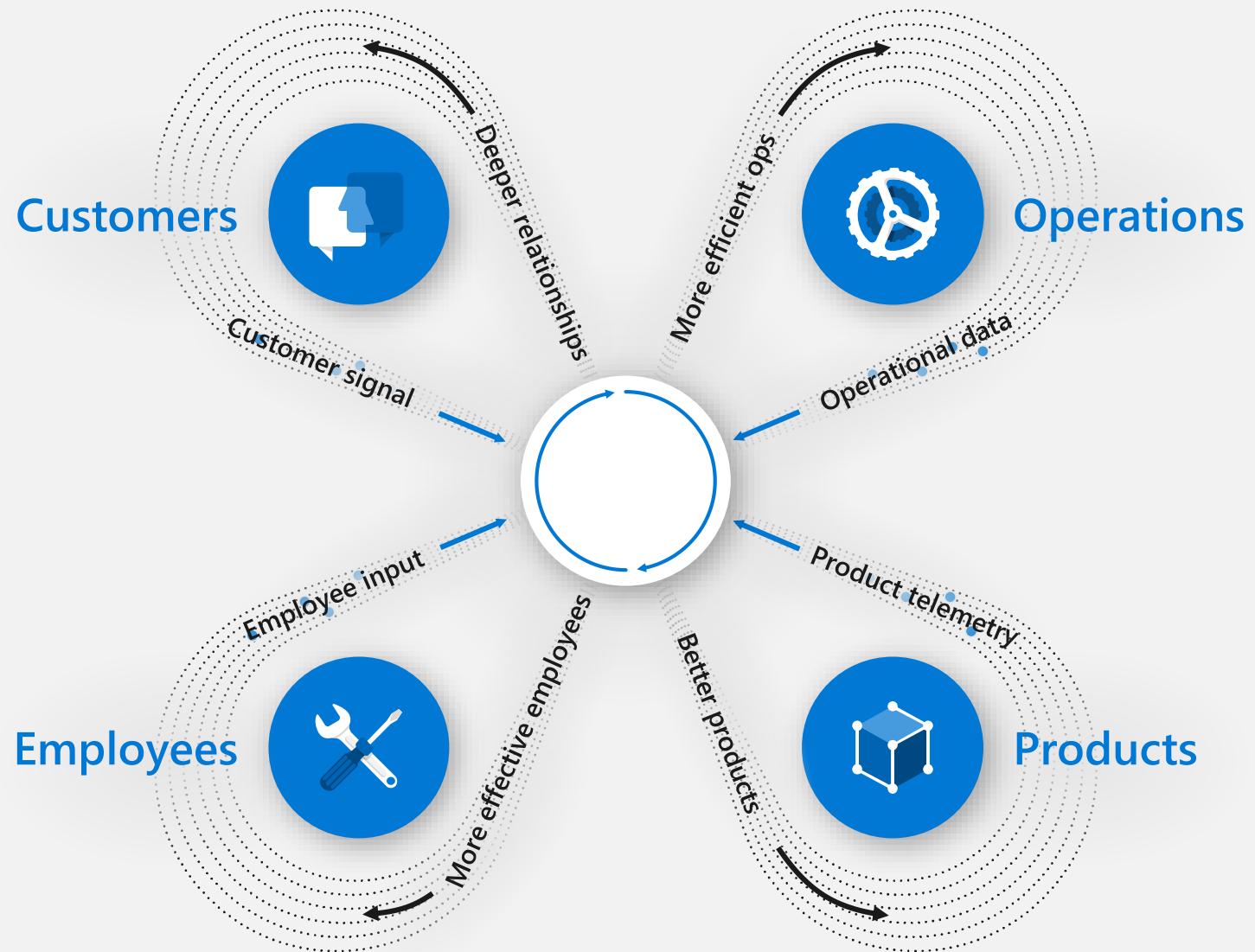
Better yields and higher quality with fewer resources and less waste

# Innovations enabling new opportunities

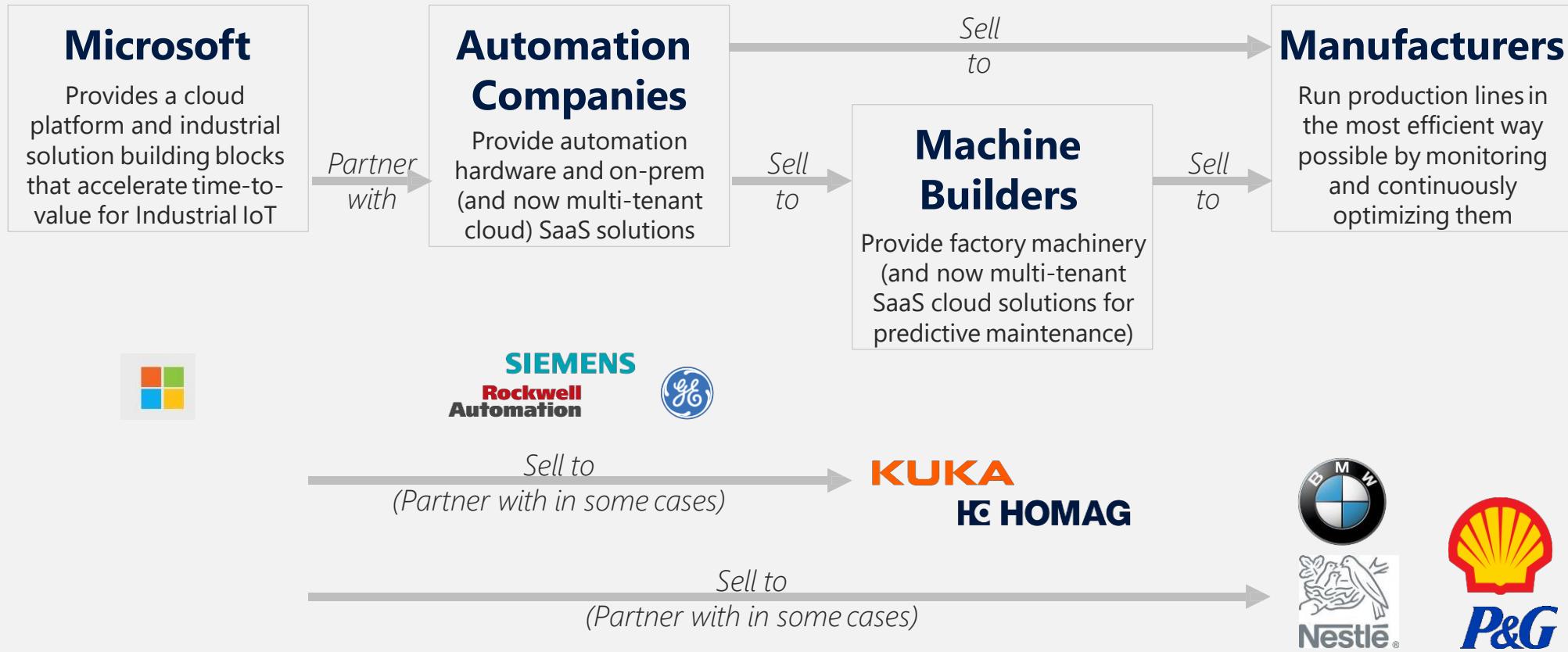


# Enabling a digital feedback loop

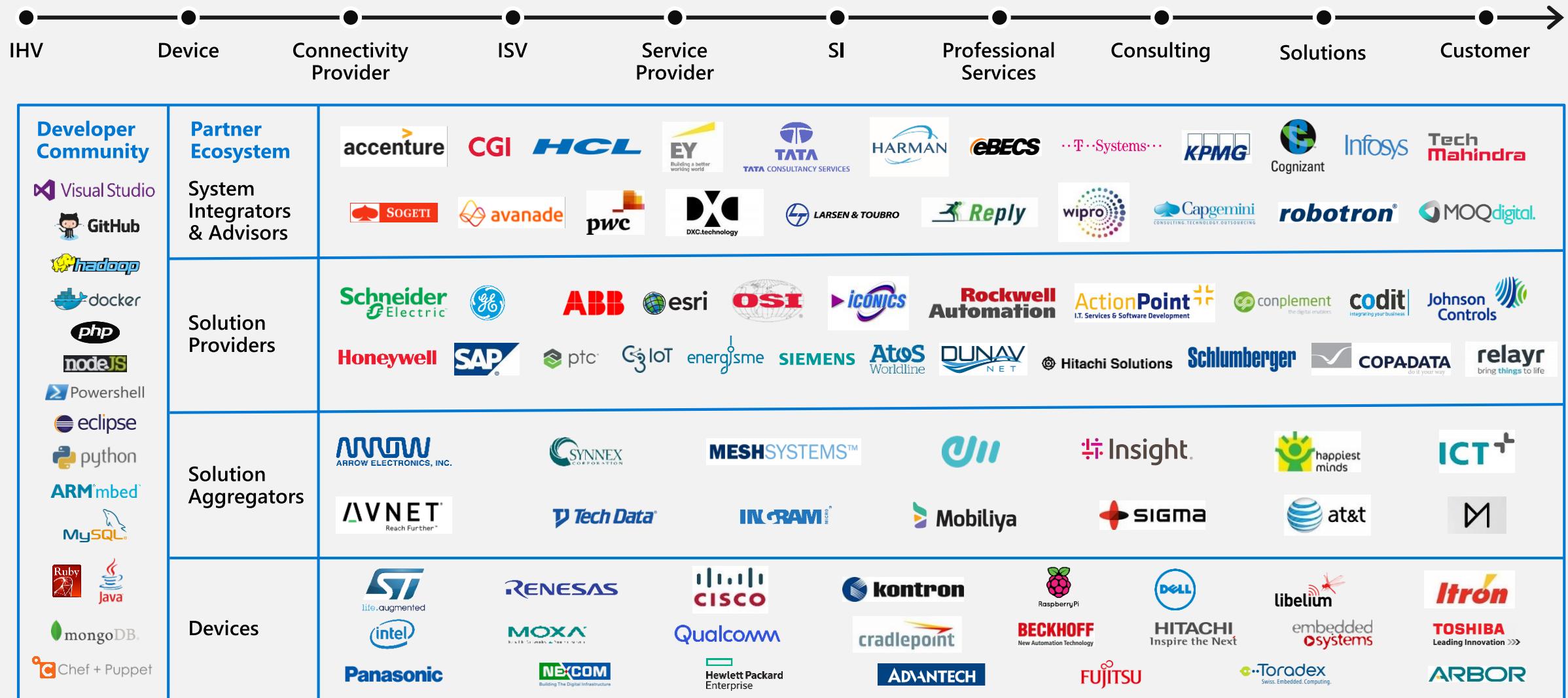
- 1 Data: Capture digital signal across business
- 2 Insight: Connect and synthesize data
- 3 Action: Improve business outcomes



# The Industrial IoT Landscape



# Ecosystem momentum



# Step by Step to Digital Transformation



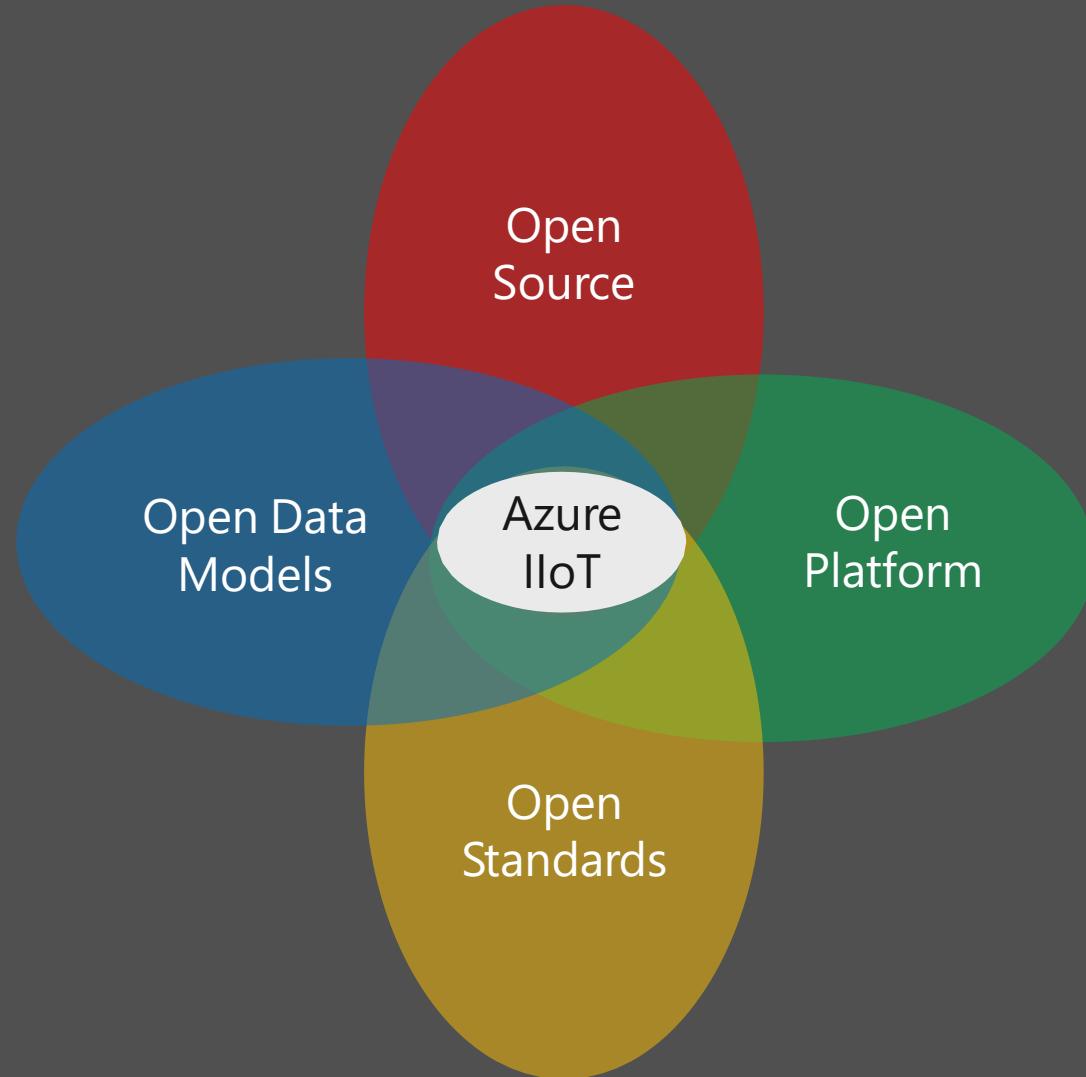
# Our Business Principles

- Modular Industrial IoT PaaS platform
- Managed and hyper-scale
- Secure by default
- Follows Microsoft's Security Development Lifecycle (SDL)
- Scales through Ecosystem
- World's largest partner network to solve any complex problem
- Largest hardware OEM ecosystem for gateways
- Most certified/compliant cloud
- Partnership with OT companies
- Creating a win-win for IT/OT merger
- Most datacenter regions & world's largest network plus sovereign clouds in US, Germany & China

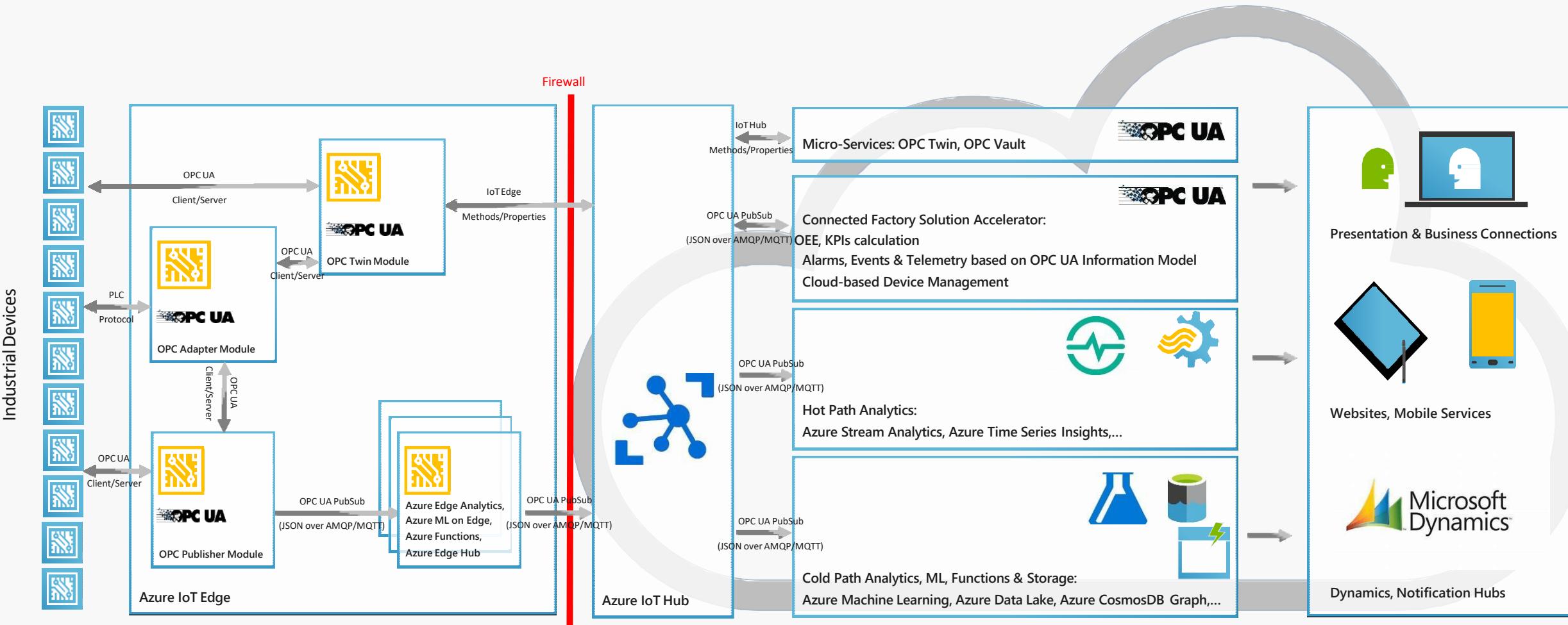
# Our Technology Principles

- Open Source  
No proprietary solutions,  
Support for Micro-Services and managed container services on the edge and in the cloud
- Protocol independent, platform independent  
Works just as well with AMQP, MQTT and HTTPS as well as Linux and Windows
- Uses an open data/information model along with open-source tools
- Based on Open Industrial Interoperability Standards  
Compatible with the Plattform I4.0's Reference Architecture Model Industrie (RAMI) 4.0 and using OPC UA
- Non-intrusive  
Connected your machines without modifying them

# Our IIoT Strategy



# Azure Industrial IoT Cloud Platform



On-Premises: Machine Interoperability

Azure Cloud: Data Ingestion & Processing, Command & Control

Azure Cloud: Presentation

# IoT Security

7 properties of highly secure IoT device - the minimum for critical infrastructure. It can be implemented without much effort with Azure Sphere.

For real critical infrastructure, implement Trusted Cyber Physical Systems via the Open Enclave SDK

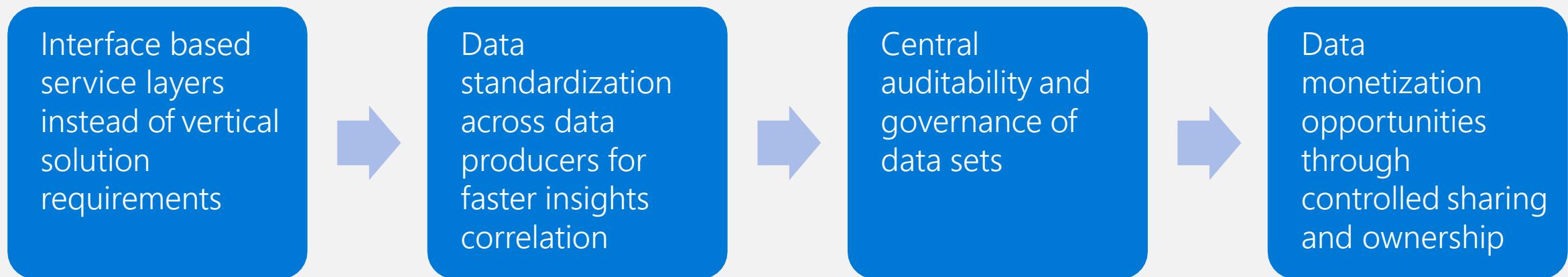
# Azure Industrial IoT Partnerships

**Mindsphere** runs on Azure IoT  
**Ability** runs on Azure IoT  
**Plantweb** runs on Azure IoT  
**EcoStruxure** runs on Azure IoT  
**FactoryTalk** runs on Azure IoT  
**Predix** runs on Azure IoT  
**Sentience** runs on Azure IoT  
**Yokogawa** runs on Azure IoT  
**Hana** runs on Azure IoT  
**ThingWorx** runs on Azure IoT  
**C3IoT** runs on Azure IoT  
**T-Systems** runs on Azure IoT



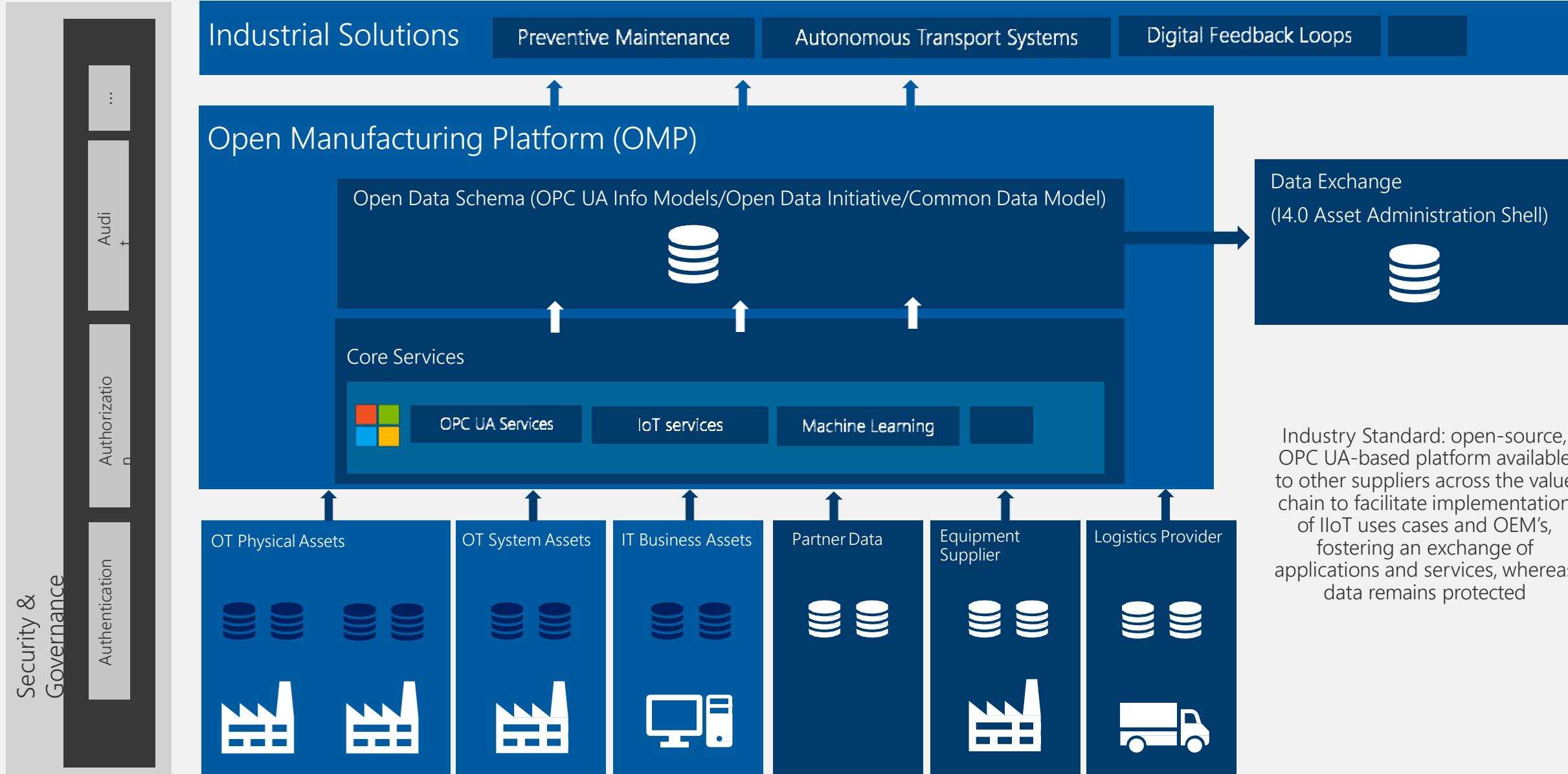
# Open Manufacturing Platform (OMP)

Open Industrial IoT platform as a service reference layer accelerating production and logistics optimization



Community approach ensuring standardization and requirement prioritization to shape the open platform

# OMP Reference Architecture



# Join OMP

Inform Learn more about OMP online:

[www.microsoft.com/omp](http://www.microsoft.com/omp)

[www.bmwgroup.com/de/innovation/unternehmen/open-manufacturing-cloud.html](http://www.bmwgroup.com/de/innovation/unternehmen/open-manufacturing-cloud.html)

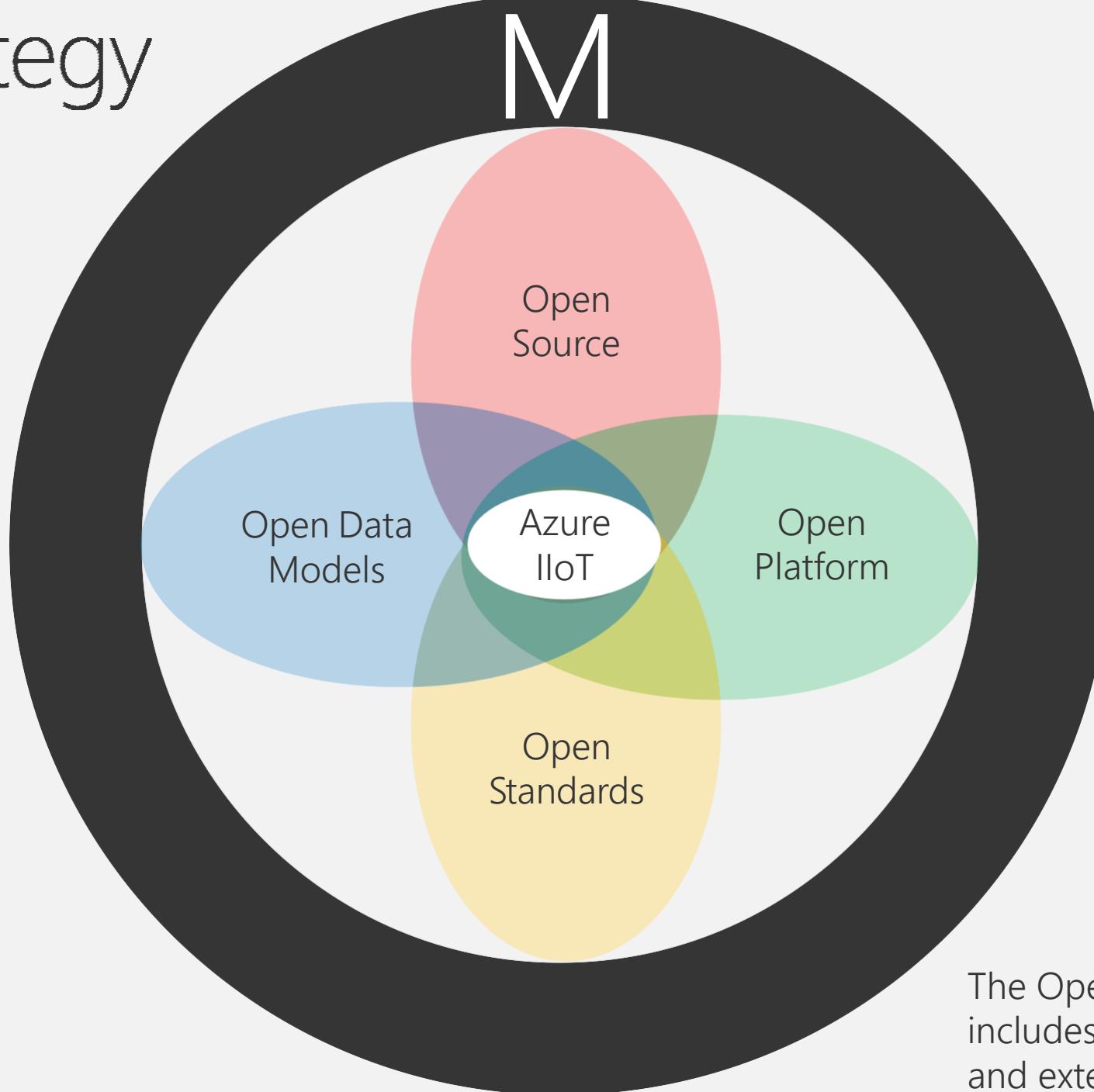
Engage You'd like to become part of the OMP community?

Please reach out to your Microsoft contact or send an e mail to:

[OMP\\_enquiry@microsoft.com](mailto:OMP_enquiry@microsoft.com)

[OMP@bmwgroup.com](mailto:OMP@bmwgroup.com)

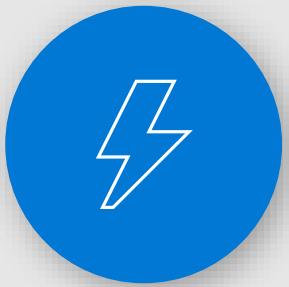
# OMP Strategy



The Open Manufacturing Platform includes Azure IIoT/IoT services and extends it with partner solutions



# Azure: IoT for every business



Accelerate  
your IoT  
journey



Build on the most  
**comprehensive**  
IoT portfolio &  
ecosystem



Work with a  
**trusted** IoT  
leader

# 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

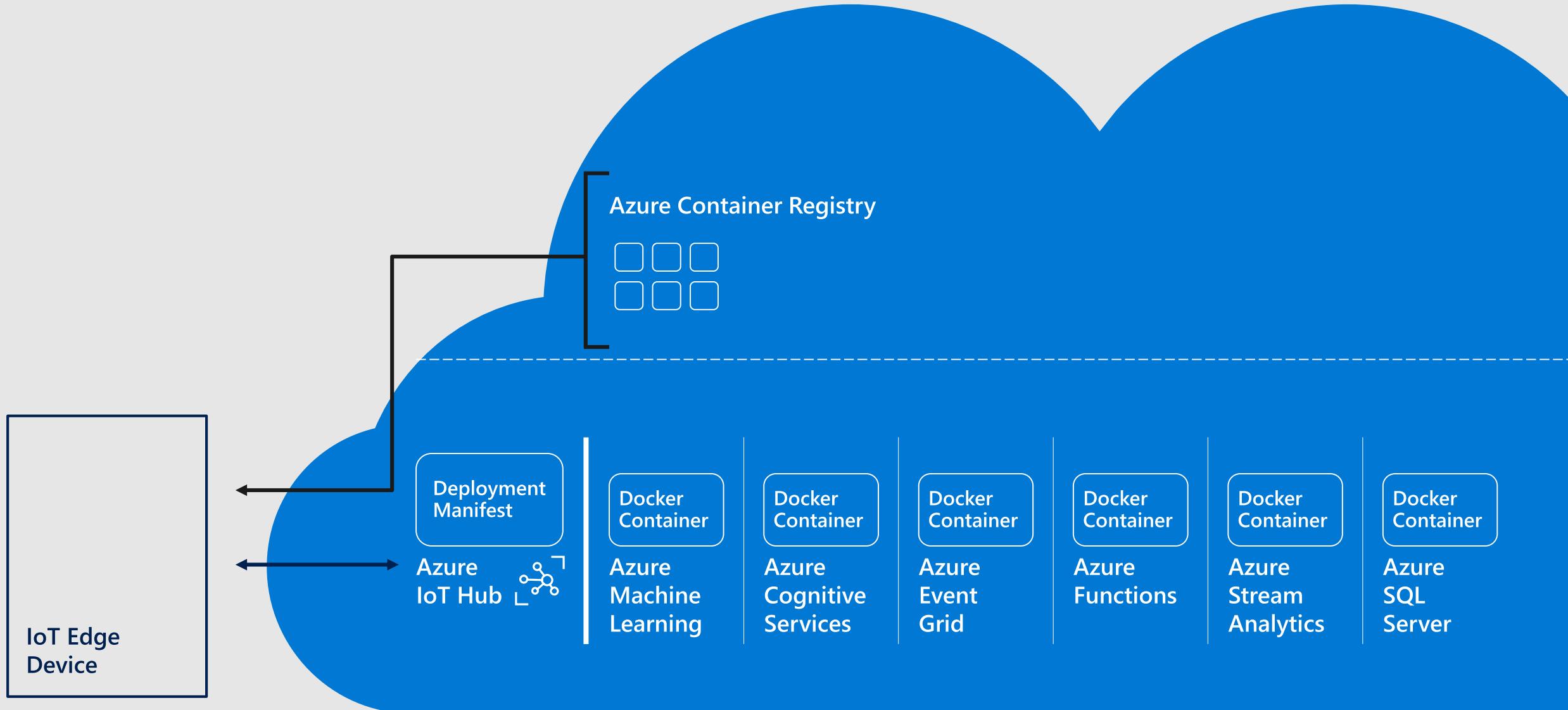
[Select a partner](#)

4

[Contact Us](#)



# Azure IoT Edge Deployment



# Azure Time Series Insights



IoT scale time-series data store



Schema-less store, just send data



Easy IoT Hub connection



Store, query, and visualize billions of events



Get near real-time insights in seconds



Build apps using Time Series Insights APIs

# Azure Time Series Insights

## New features coming!

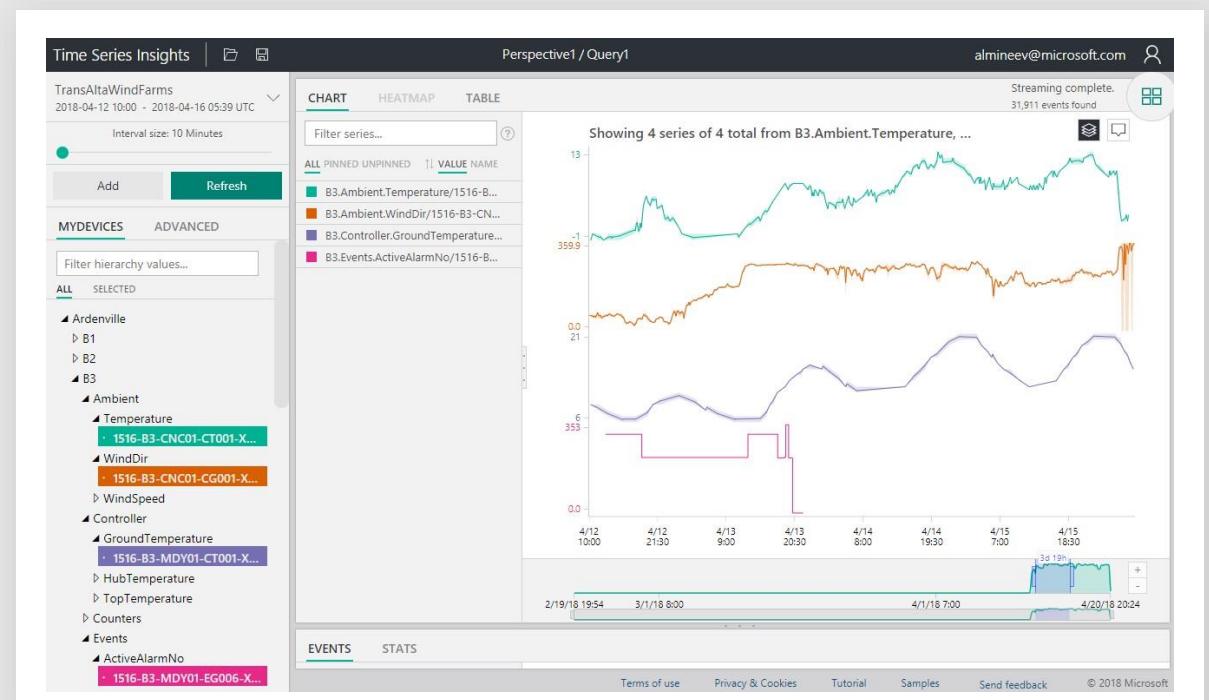
"Tag-based" user experience that makes it easy to group time series data into logical "things" and hierarchies of "things"

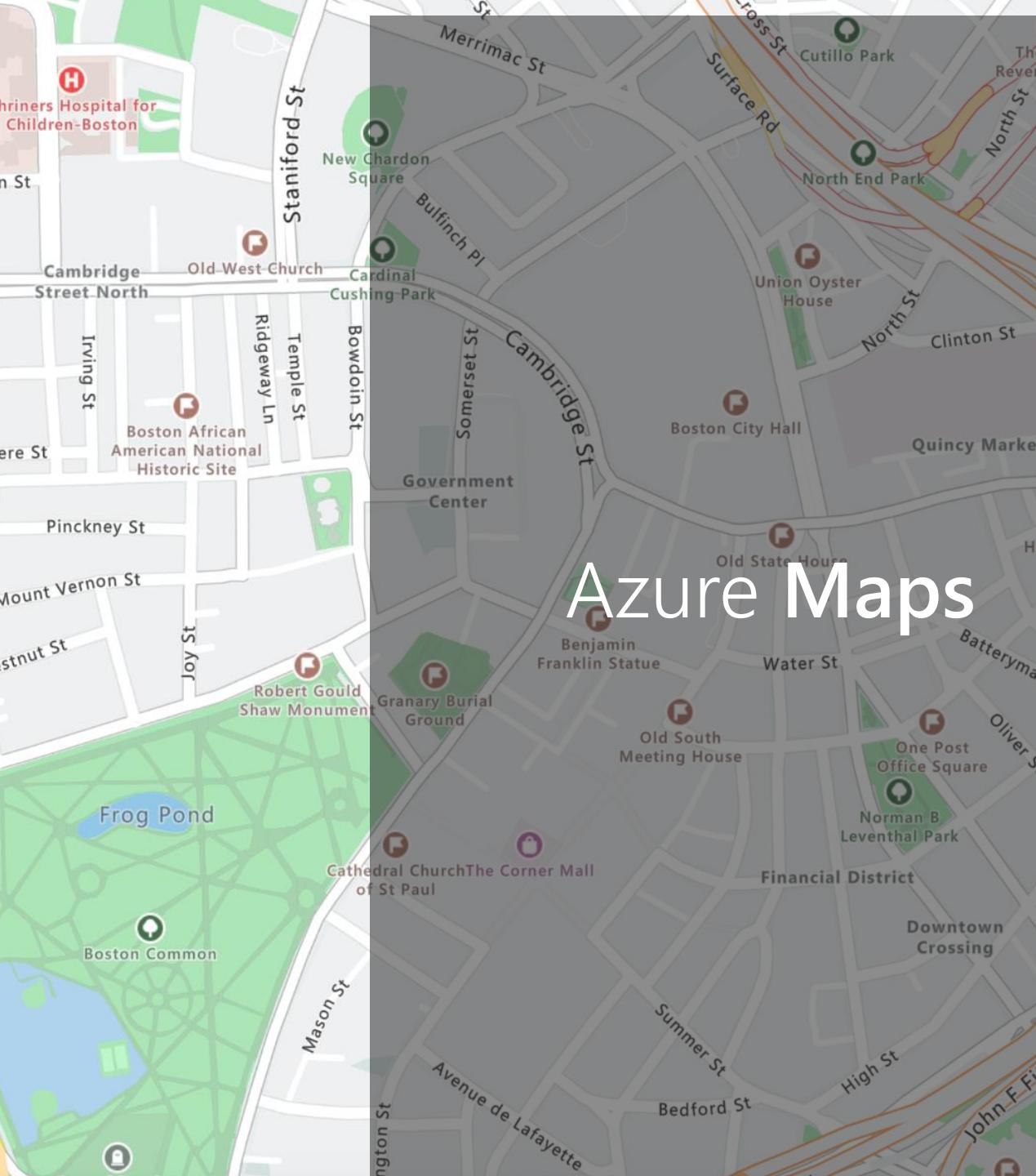
Business reports with Power BI integration

Predictive analytics with Azure Machine Learning integration

Data analysis with Jupyter and Apache Zeppelin notebook integration

Advanced analytics with Azure Databricks, Apache Hadoop and Apache Spark integration





# Azure IoT solution accelerators integration

## Azure IoT Central integration in progress



### Maps

Render maps and satellite imagery across many geographies



### Map Control

Integrate rich mapping visualizations into applications



### Routing

Calculate routes from N to N points for optimal calculations



### Search and Geocoding

Convert places and addresses to coordinates; or, convert coordinates to addresses or cross streets



### Traffic

Show real time traffic information



### Time Zones

Obtain time zone and current time information

# Azure Maps

## Location is at the heart of everything

Accurate, real time geospatial data is fundamental to the digital transformation of a wide range of industries and use cases, among them...



Mobility Solutions



Field Service



Automotive



Internet of  
Things (IoT)



Logistics



Web & Mobile Apps

## Why use Azure Maps?

Key reasons for customers to opt for Azure Maps for their geospatial needs



In-vehicle use  
licensing rights



Unrivalled traffic data  
and commercial routing



30+ languages  
supported



Integrated into  
Azure IoT



Custom data  
visualizations



Enterprise  
scale



# Azure Sphere



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**



Open platform that seamlessly connects things, endpoints, and the cloud



Commercial OS for IoT devices and a modern user experience



Supports the languages and frameworks you already know



Trusted platform for security and servicing of cloud-connected devices



Bring power and capability to the edge



Enable a more natural user interface

# Windows 10 IoT + Azure

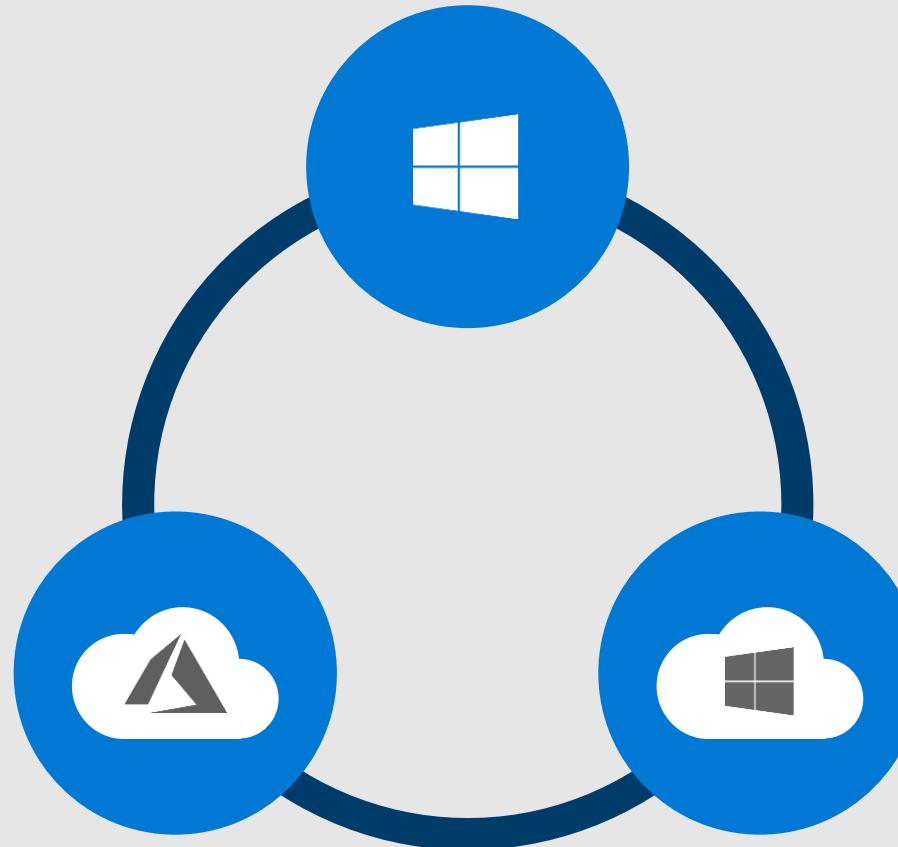
Device-to-cloud platform for secure, manageable intelligent edge devices

Azure ML + Azure IoT  
Edge + Windows AI  
Brings accelerated AI  
to your device

Windows 10 IoT  
Secure, and manageable IoT  
OS with long-term support

Windows 10 IoT  
Device Management  
Provided by Azure IoT  
Hub and enterprise  
device management

Windows Update +  
Device Update Center  
Keeps devices secure,  
giving full control to  
the device maker



# Manufacturing



## Selling Packaging as a Service

Connecting machines to collect real-time data has enabled performance and future failure monitoring, allowing Tetra Pak to revolutionize their business model

[LEARN MORE >](#)



## Optimizing the factory floor

Used IoT, machine learning, artificial intelligence, and CRM to optimize processes, planning, and predictive maintenance scheduling to avoid downtime

[LEARN MORE >](#)



## Filtering the signal from the noise

Used analytics to discover actionable insights around fuel usage, predictive maintenance and stop unscheduled delays

[LEARN MORE >](#)

# Manufacturing



## Transforming the urban landscape

Gathered data from sensors and systems to create valuable business intelligence and shift from reactive to proactive maintenance

[LEARN MORE >](#)



## Connecting the factory floor

Saving 17% on scrap and re-work and 10% on energy by using predictive maintenance on machinery and the factory floor

[LEARN MORE >](#)



## Keeping power on when it's needed most

Scheduling maintenance for generators with predictive models prevents potential issues from impacting customers

[LEARN MORE >](#)

# 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

[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

[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

[LEARN MORE >](#)

# Smart Cities



## Saving lives from earthquakes in Mexico

Utilizing IoT and analytics to predict disasters and send millions of notifications in less than two seconds—notifying citizens of earthquakes up to two minutes ahead of time

[LEARN MORE >](#)



## Using the intelligent edge to save water

Farmers in New Zealand integrate weather predictions and sensor data to adjust irrigation, saving 50% of water usage

[LEARN MORE >](#)



## 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

[LEARN MORE >](#)

# Transportation



**fathym**

## Enabling officials to keep drivers safe

Using highly localized road condition and weather data, Fathym keeps drivers safe by recommending reroutes, and avoiding unnecessary use of expensive assets

[LEARN MORE >](#)



**TEXA**

## Creating efficiency and agility with IoT

Texa S.P.A saw product orders increase 100% after using IoT to enhance their product offering, support business growth, reduce costs, and increase mechanic efficiency and safety

[LEARN MORE >](#)



 Transport  
for London

## Low cost connectivity for train sensors

Using Azure IoT and TV whitespaces, an infrastructure not built for connected devices now supports delivery of timely insights about traffic conditions and cable car equipment

[LEARN MORE >](#)

# Transportation



## DAIMLER

### Connecting vehicles for the long haul

Daimler connects their fleets for predictive maintenance, optimized fleet management and routing, and to create better vehicles for the future

[LEARN MORE >](#)



### Revolutionizing air-traffic control

Rich streams of data sent in-flight increases safety, reduces aircraft separation standards, allows more flights at peak times, and greater utilization of efficient routes

[LEARN MORE >](#)



### Ensuring forklifts never run out of power

This power management system, using IoT-enabled real-time alerts and predictive maintenance, cuts battery and power supply costs by 25%

[LEARN MORE >](#)

# Retail



**HERSHEY**  
THE HERSHEY COMPANY

## Machine learning + Twizzlers

Combining ML with data from licorice extruders allows Hershey to save on expensive ingredients and learn more about customer behavior

[LEARN MORE >](#)



**Mondelēz**  
International

## Smarter snack food

Using customer location and preference data allows Mondelez to provide highly personalized, informative customer snacking experiences

[LEARN MORE >](#)



**STEIGENBERGER**  
AIRPORT HOTEL  
FRANKFURT

## Personalized, efficient guest experiences

Using a wearable powered by Windows IoT and Azure IoT, hotel staff are able to execute up-to-the-minute service and provide an experience unique to each customer

[LEARN MORE >](#)

# Retail



**coop**

## The supermarket of the future

Coop Italia uses IoT technology to track customer behaviors and create interactive, informative displays based on customer location

[LEARN MORE >](#)



**MARS**

## Revolutionizing air-traffic control

Rich streams of data sent in-flight increases safety, reduces aircraft separation standards, allows more flights at peak times, and greater utilization of efficient routes

[LEARN MORE >](#)



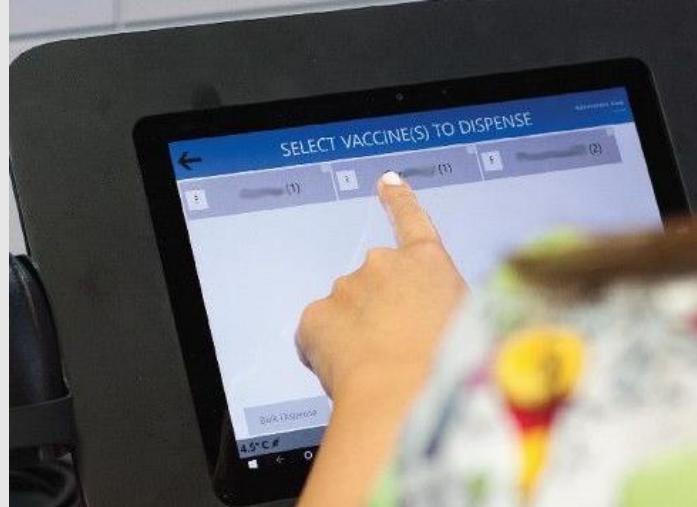
**BUNN**  
Quality Since 1840

## Connected coffee machines

Analyzing data from their customer's espresso machines allows BUNN to provide predictive maintenance, saving customers up to \$250 per incident

[LEARN MORE >](#)

# Health



## Smart fridge saves lives

Smart-fridges ensure the \$60k worth of life saving vaccines stored in each fridge are kept at the required temperature, delivered at the expected locations, and at the right times

[LEARN MORE >](#)



## Creating healthier hospitals

Using IoT to connect sanitization stations in hospitals, Gojo ensures hospital staff are properly and frequently sanitizing their hands to avoid spreading diseases

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## Wearables providing life-saving insights

Working with partner, ixto GmbH's digilog platform, Ruppiner is using wearable technology to give patients 'boundary-less' health care that is saving lives

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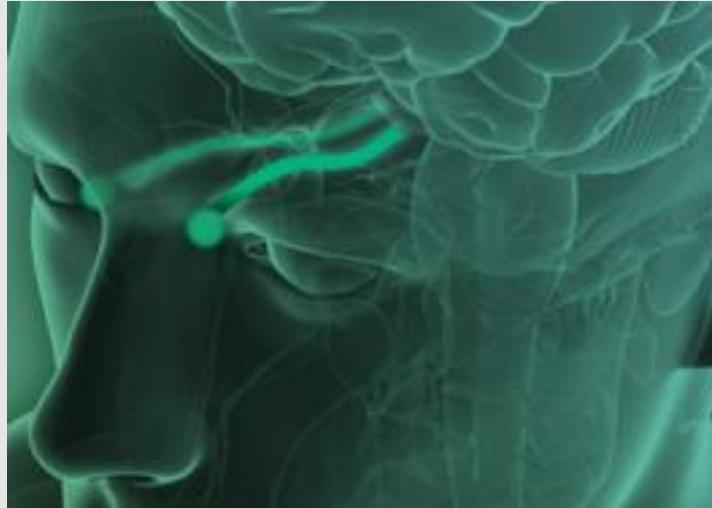
# Health



## Optimizing diagnostic devices

IoT enabled remote monitoring of diagnostic devices, optimized device utilization via predictive maintenance, and enhanced device recommendations based on patient data

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## Understanding brain disease

BTT Corp uses Microsoft IoT technology to detect, track, and analyze hyper-localized, minor changes in brain temperature to prevent and research brain diseases

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## Creating smarter diabetes management

Zion China uses personalized IoT solutions to help patients with diabetes manage their behavior and dietary habits to live healthier lives

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