



Intelligent Edge with Azure IoT and Windows IoT

Hands on Labs

Intelligent Edge in a Day Agenda

Microsoft IoT Overview

Hands on Lab environment

Windows 10 IoT Core

- Lab 1 – Build your device with Windows 10 IoT Core

Azure IoT Central

- Lab 2 – Connect your device to Azure IoT Central

Azure IoT Platform for the Edge

- Lab 3 – Deploy Azure IoT Edge on Windows 10 IoT Enterprise

Azure Stream Analytics at the Edge

- Lab 4 – Processing Data at the edge with Azure Stream Analytics

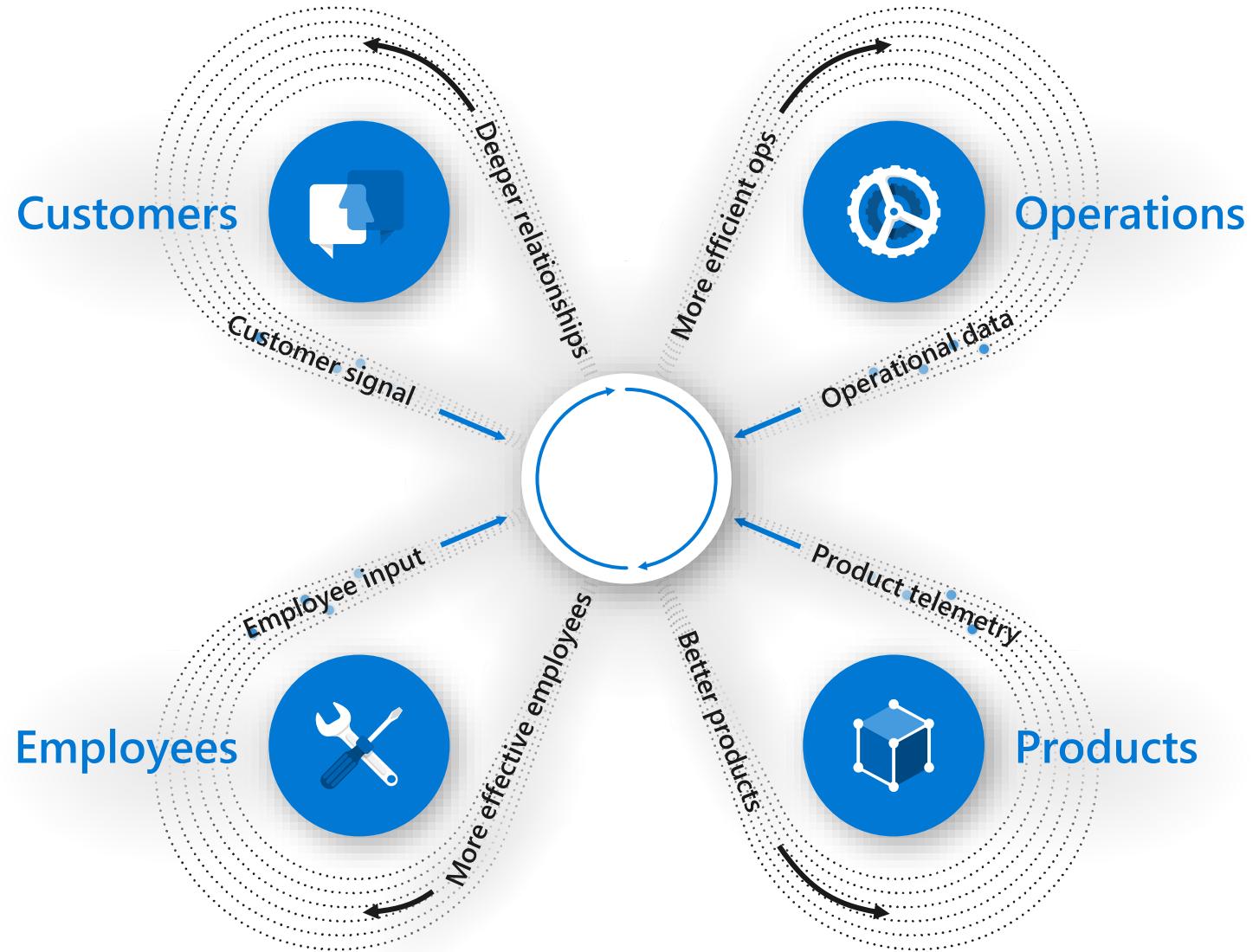
AI/ML at the Edge

- Lab 5 – Building a Computer Vision solution and deploying to the edge

Microsoft IoT Overview

IoT enables a digital feedback loop

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



IoT – The Gift that Keeps on Giving

Learnings from ThyssenKrupp

Once the digital feedback loop is experienced by the customer, they want to expand the incremental benefits it presents across more businesses and functions. This leads to an expanding opportunity for partners.



Remote Monitoring
(Elevators)

Predictive Maintenance
(Elevators)

Connected Field Service
(Elevators)

Expansion of solution to
Escalators

Mixed Reality in
Field Service

Digital Twins/Smart Spaces

Comprehensive IoT platform from Microsoft



Azure
IoT Hub



Azure
IoT Edge



Azure
IoT Central



Azure IoT
solution accelerators



Microsoft Azure

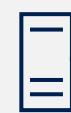
INTELLIGENT CLOUD



Sensors



PC-class



Server-class



Hybrid server

AZURE SPHERE

Peerless security for
microcontroller-based devices

WINDOWS 10 IOT

The power of Windows: from
small footprint to enterprise-
grade edge devices

WINDOWS SERVER IOT

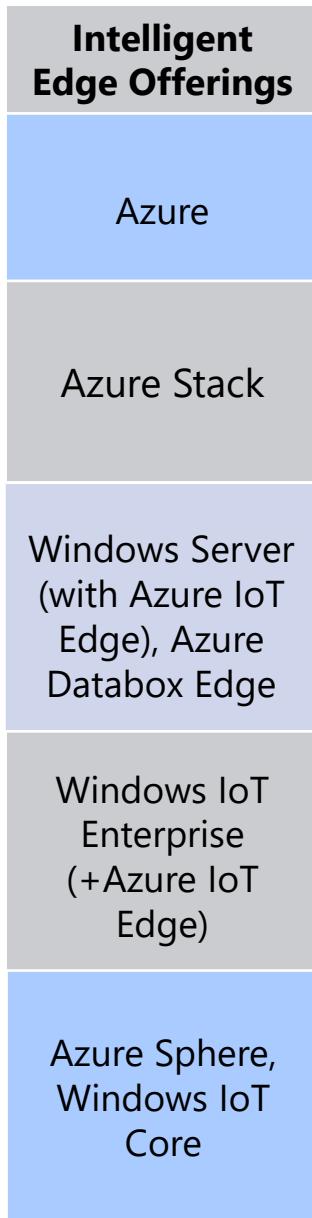
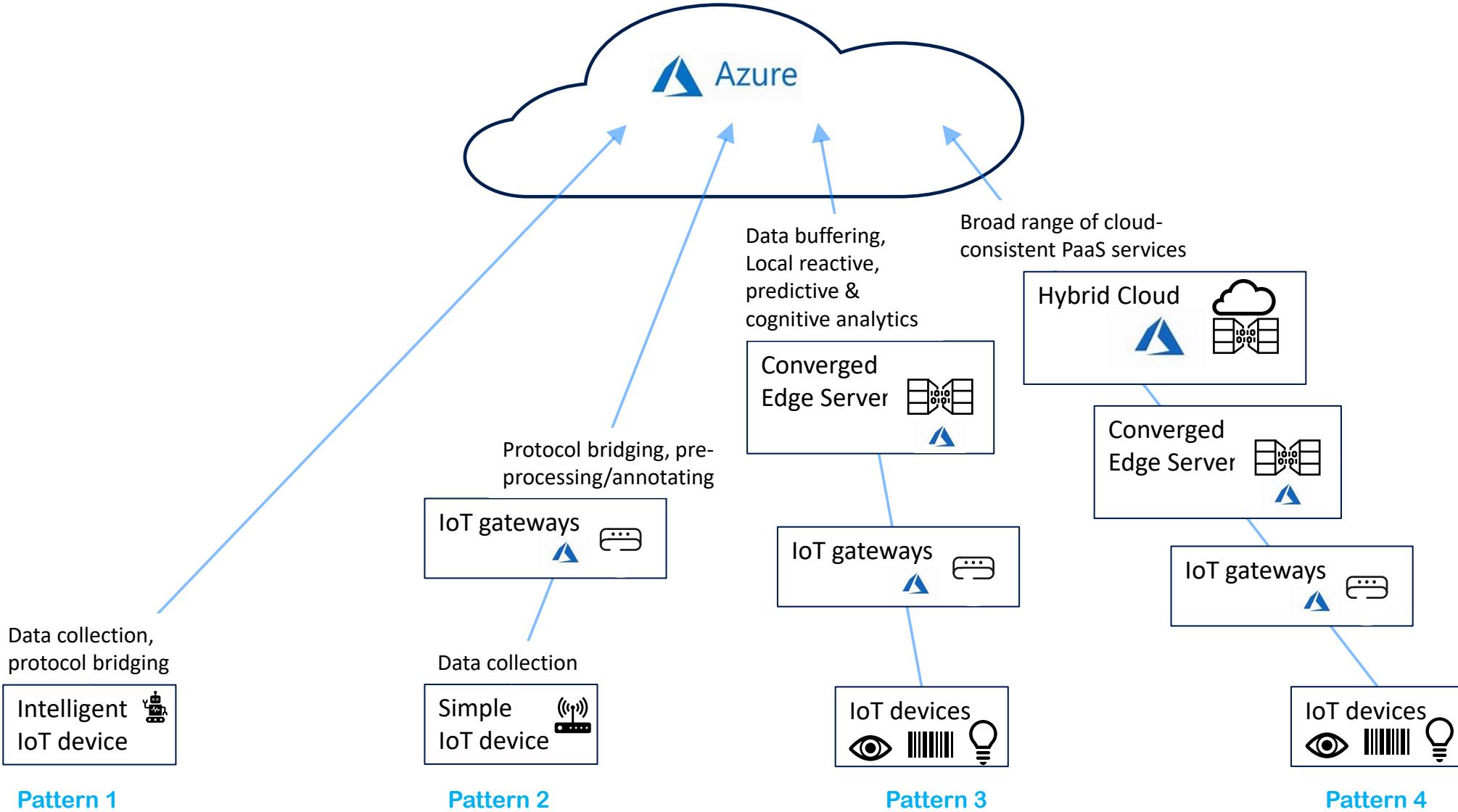
High performance
compute and storage

AZURE STACK

An extension of Azure to
consistently build and run
hybrid applications across
cloud boundaries

INTELLIGENT EDGE

Intelligent Edge: Deployment Patterns



Windows IoT

The foundation of your intelligent edge devices



Fast



Safe



Smart

- Built on Windows 10 which is running on 800 million devices worldwide
- Delivers enterprise-grade security, manageability and support
- Brings the full power of Windows 10 to IoT solutions including advanced features like Artificial Intelligence/Machine Learning and Natural User Interface
- Leverages existing skills and infrastructure with familiar development and management systems

Windows IoT editions

Windows 10 IoT Core

For small-footprint, smart devices

Enabling lower-cost devices

Windows 10 IoT Enterprise

For fixed-function, smart devices

Locked down, full edition of
Windows 10

Windows Server IoT 2019

Enhanced data analysis and storage

Advanced resiliency features



10 years of OS support. Security. Manageability.

Windows 10 IoT editions

Windows 10 IoT Core

- 400 MHz x86, x64 or ARM CPU
- 256MB RAM (512MB with display)
- 2 GB storage

Small-footprint smart edge devices

- Familiar Windows security, tools, apps and manageability
- Optimized for devices with and without displays
- No OS-shell UX
- Universal Windows Platform (UWP) app experience
- No OS royalty, Windows 10 IoT Core Services subscription available

Windows 10 IoT Enterprise

- 1GHz x86 or x64 CPU
- 1 GB RAM (2 GB for 64-bit)
- 16 GB Storage (20 GB for 64-bit)

Powerful smart devices

- A rich user experience with Win32 and UWP apps
- Same deployment, manageability and servicing as desktops
- Familiar interface with lockdown features to control user experience
- Functionally identical to Windows 10 Enterprise, but sold through the OEM channel with dedicated use licensing rights

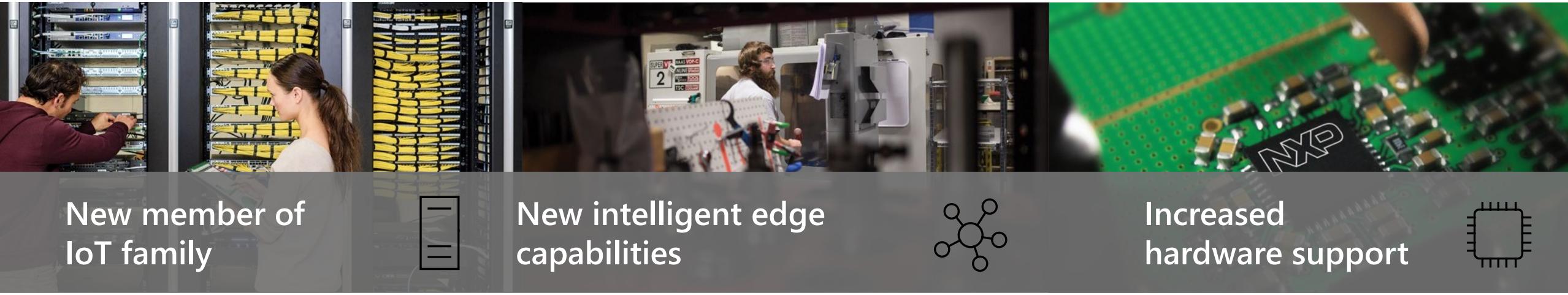
Windows Server IoT 2019

- 1.4GHz x64 CPU
- 512 MB RAM (2 GB for desktop)
- 32GB Storage

Advanced data analysis and storage

- Enhanced security capabilities
- Unique hybrid platform – Integrate your on-premise and cloud infrastructures
- Improved container support with Azure IoT Edge management
- CAL-less option available

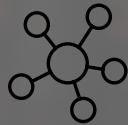
What's New for 19H1



New member of IoT family



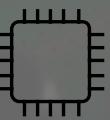
New intelligent edge capabilities



- **New Windows Server IoT 2019**
- Designed for demanding edge scenarios requiring large scale compute, connections and/or storage
- Provides full capabilities of Windows Server 2019 for fixed function server class devices

- Azure IoT Edge support for Windows 10 IoT - GA
- Azure IoT Device Agent v2 for Windows 10 IoT - Public Preview
- Robot Operating System (ROS) for Windows 10 IoT Enterprise - GA
- Azure IoT Edge security with enclaves
- AzureML support for Windows Containers
- Windows CE Platform Abstraction Layer
- Shell Launcher v2

Increased hardware support

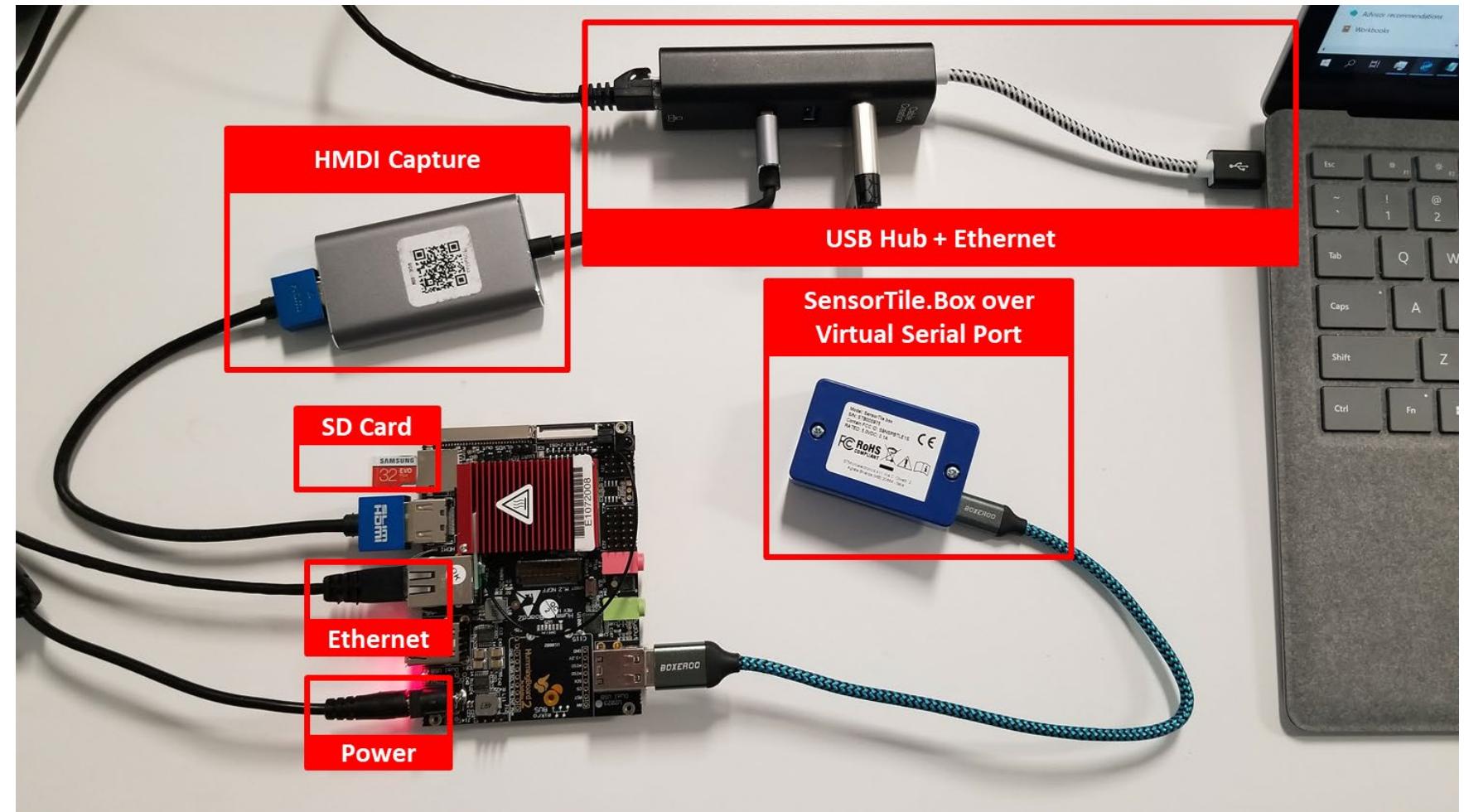


- Windows 10 IoT Core on NXP i.MX6 and i.MX7 - GA H1 2019
- Windows 10 IoT Core on NXP i.MX8M and i.MX8M Mini - Public Preview
- Windows 10 IoT Enterprise on Qualcomm Snapdragon 850

Lab Environment

What's on your desk

- Surface Laptop 2
 - Windows 10 IoT Enterprise 1809 LTSC
 - Visual Studio 2019
 - Azure CLI
- Hummingboard (iMX6) Windows 10 IoT Core
- STM SensorTile.Box MCU with various sensors
- HDMI Capture Card for output into Camera app
- Micro SD Card & Adapter



Environment Details

- Azure Username: LAB.USER##@msiotlabs.com
- ## is on the lower left of your lab pc screen
- Azure Password: 1!Microsoft
- IoT Core Device User: administrator
- IoT Core Device Password: p@ssw0rd
- GitHub Lab Docs – link on your desktop or <http://aware.to/iialab>

Windows 10 IoT Core



Step 1

**Windows 10
IoT Core**

Royalty-free operating system (OS) for prototyping, developing and testing IoT devices

Step 2

**Windows 10
IoT Core Services**

Commercialization of your IoT devices with ongoing services

Windows 10 IoT Core

For small-footprint, smart devices

MINIMUM REQUIREMENTS

400 MHz

x86, x64 or
ARM CPU

512 MB

RAM

2 GB

Storage

Provides a small footprint with familiar Windows security and manageability

Enables lower BOM costs

Supports ARM and Intel hardware

Easily connects to the cloud to scale intelligence at the edge

Offers a modern app platform and flexible UI customizations

Easily implements advanced features including machine learning, computer vision and containers

For details see <https://docs.microsoft.com/windows-hardware/design/minimum/minimum-hardware-requirements-overview>

Build your intelligent device with Windows 10 IoT Core



Prototype

Windows 10 IoT Core



Commercialize

Windows 10 IoT Core
+
Windows 10 IoT Core Services



Step 1

**Windows 10
IoT Core**

Royalty-free OS for
prototyping, developing
& testing IoT devices

Step 2

**Windows 10
IoT Core Services**

Commercialization of
your IoT devices with
ongoing services

Windows 10 IoT Core Services

Commercializing Windows 10 IoT Core-based devices with updates and support

INNOVATE WITH WINDOWS 10 IOT CORE SERVICES



Improve ROI with a predictable long-term operational cost model. Flexible purchase channels include a monthly subscription or OEM pre-pay options

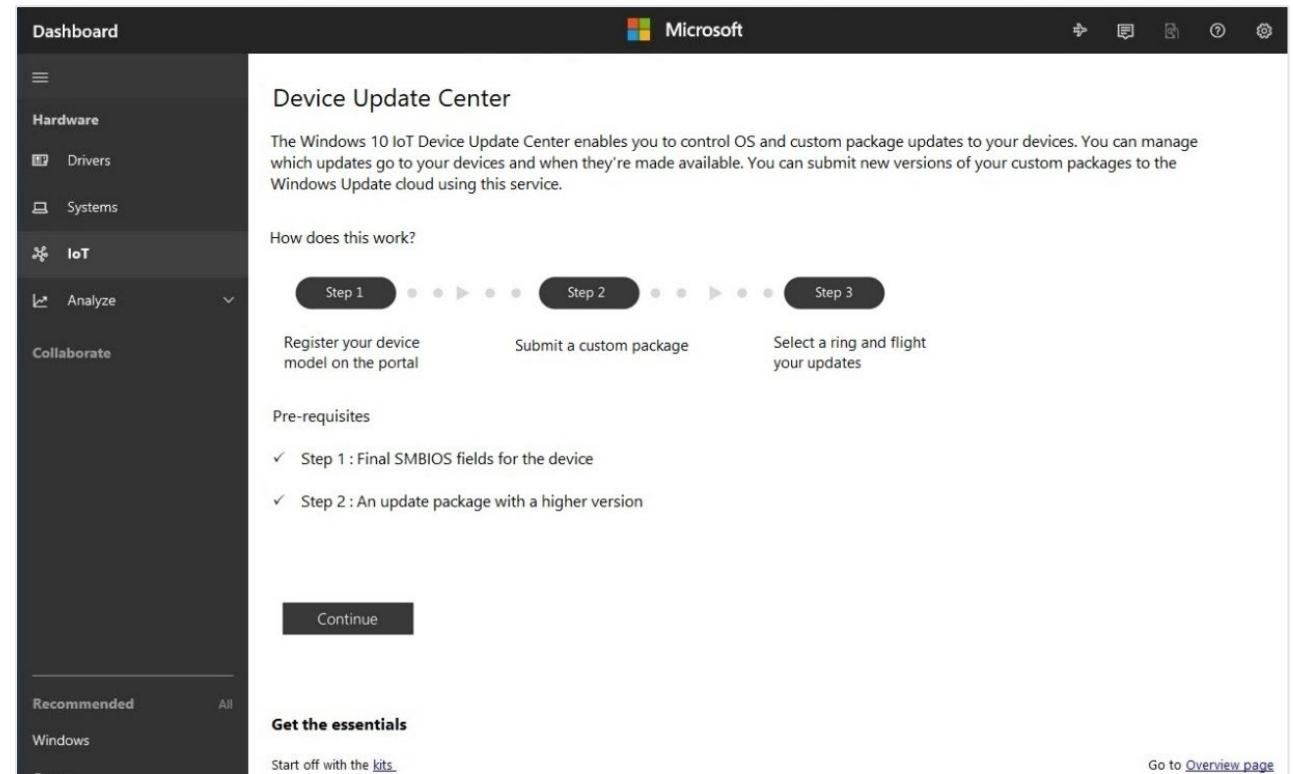
Delivers device stability with 10 years of operating system support

Reduces operating costs with over-the-air (OTA) updates for the operating system, as well as your apps and drivers

Enhances security with Device Health Attestation

Device Update Center

- Subscription service enabling OEM to
 - *Publish OEM custom packages to the Windows Update Cloud*
 - *Flight OEM custom packages to their devices based on flight rings*
 - *Flight OS updates to their devices based on flight rings*
- Puts OEM in control of the update publishing/roll-out
- Enables OEM to leverage world-class Microsoft infrastructure (CDNs)



Sign up for DUC

- EV cert
- OEM name

Define new device model

- Device attributes (SMBIOS)
- Architecture

Upload custom packages

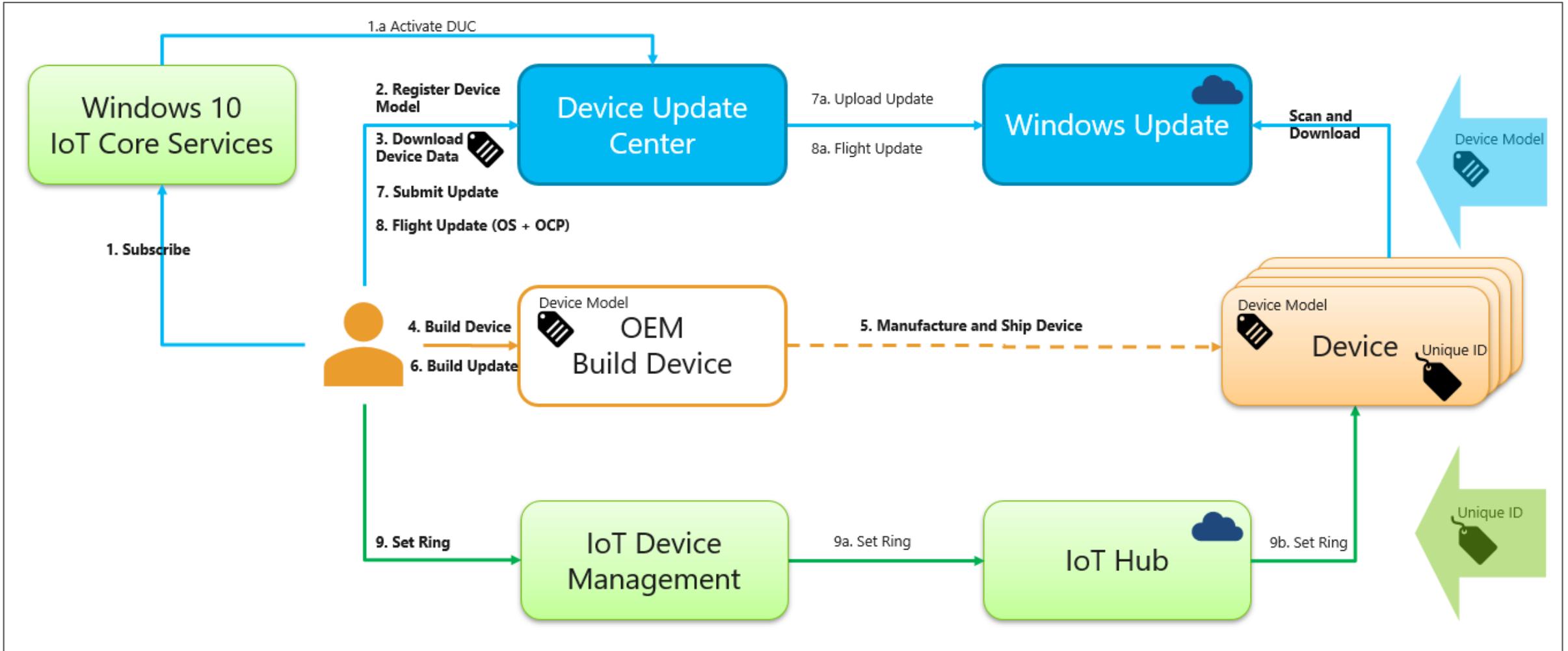
- Version details

Flight updates

- Specify OS
- Specify custom package version
- Specify ring

Validate on device

Update control with DUC



To learn more visit: <https://docs.microsoft.com/en-us/windows-hardware/manufacture/iot/iotcoreservicesoverview>



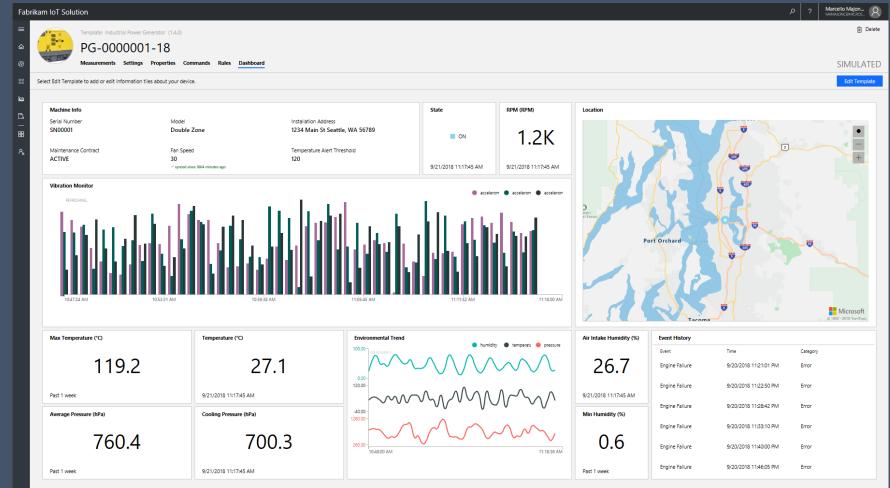
LAB 1

Build your device with Windows IoT Core



Azure IoT Central

Azure IoT Central



Fully hosted and managed by Microsoft



No cloud development expertise required



Device connectivity and management



Monitoring rules and triggered actions



Extensibilities (Flow, Dynamics, Webhooks, etc.)

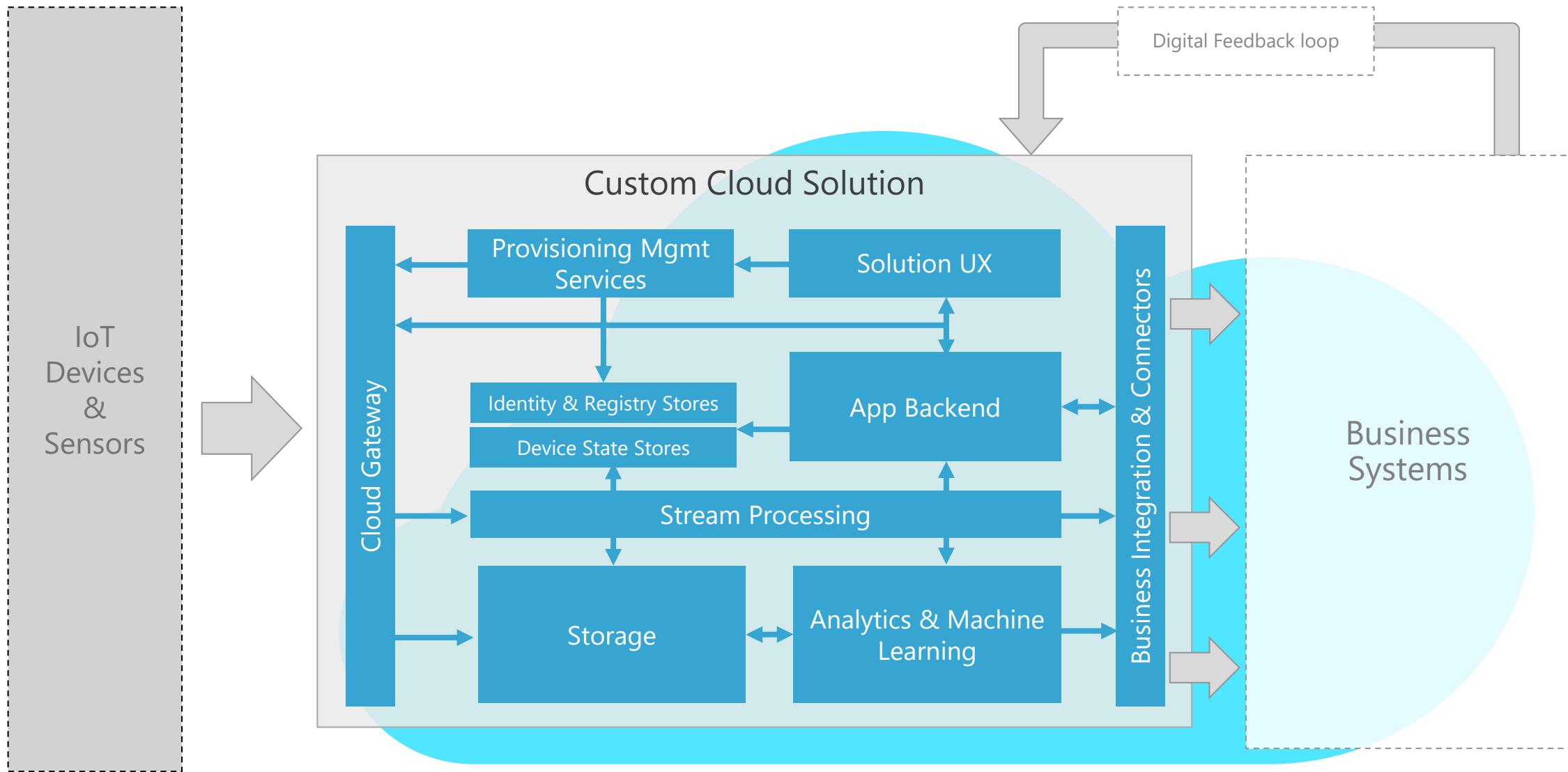


Analytics, dashboards and visualization

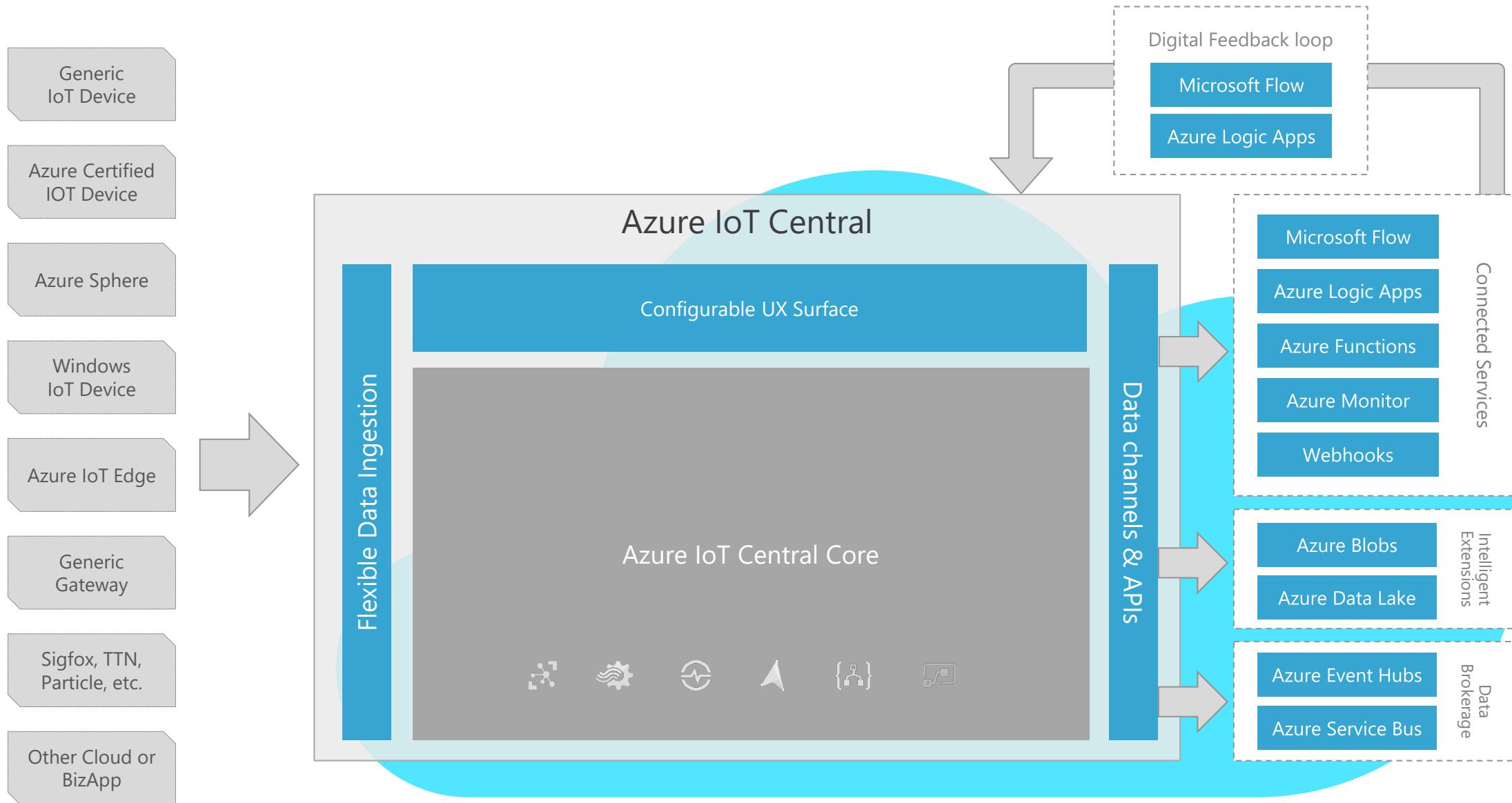


Risk-free trial with simplified pricing

Solution Architecture - DIY



Solution Details – IoT Central

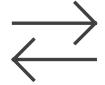


IoT Central Roadmap

Available Now



Device connectivity and management



Telemetry ingestion and command & control



Monitoring rules & triggered actions



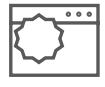
User roles and permissions



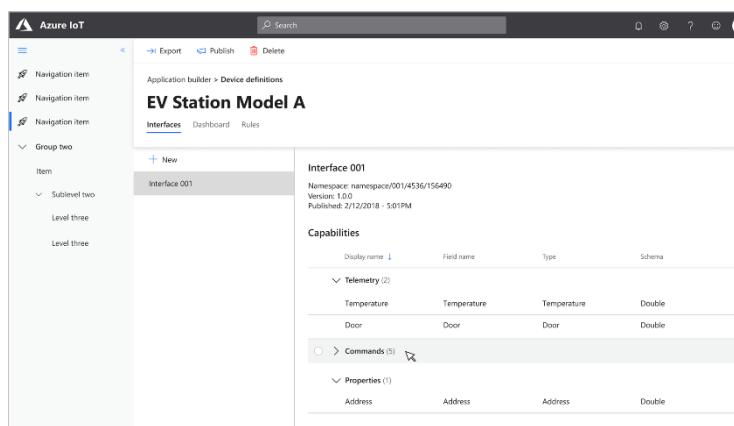
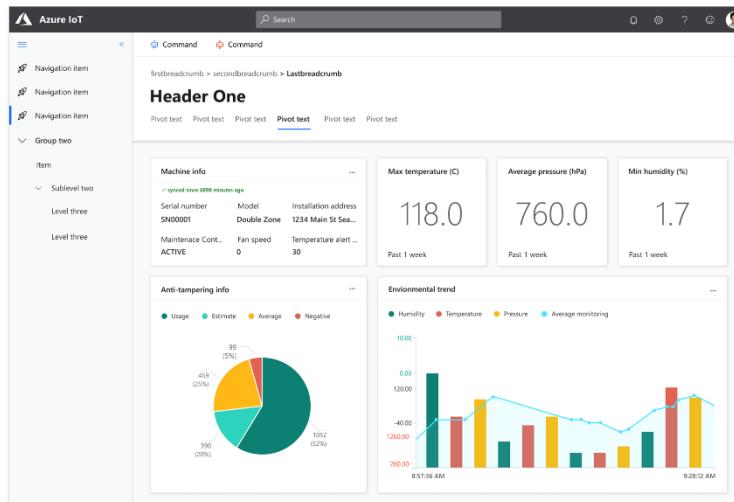
Dashboards, visualization & insights



Fully hosted and managed by Microsoft



White Labeling



Coming Soon



Multi-tenancy



Edge support



Plug-and-Play
Public Preview



Extensibility & Customization
CDE, custom connectors, ...



Location Telemetry and Geofence



Industry Solution Accelerators
for Priority Industry Verticals



Continuous data export to
Azure EventGrid

IoT Central Roles

Our promoted and guided point of entry

Device-focus

| Builders | Administrators | Operators |
|---|--|--|
|  Product Modeler |  App Manager |  Asset Visualizations |
|  Template Management |  User Management |  Time-series Insights |
|  Rules & Workflows |  Identity Management |  Device Management |

Solution-focus

Next: entry point that resonates with customers



LAB 2

Connect your device to Azure IoT Central



Azure Platform with Azure IoT Edge on Windows 10 IoT Enterprise

Accelerating PaaS Architectures

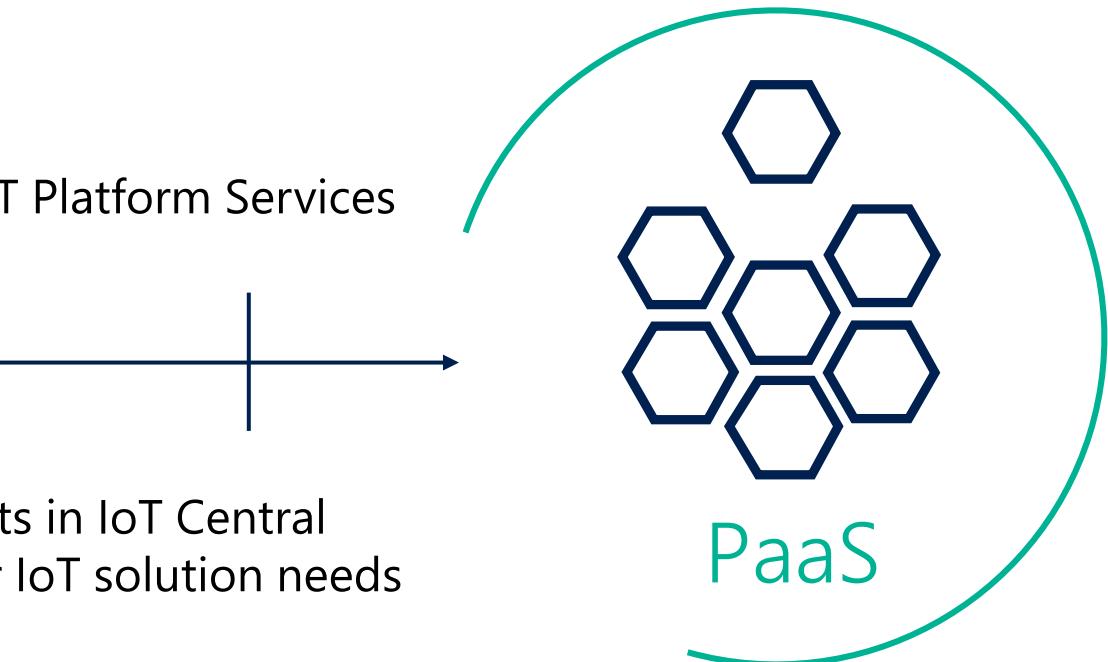
Azure IoT Central

Fully managed IoT SaaS
No cloud solution expertise required



Azure IoT Solution Accelerators

Solution accelerators for customers with cloud solution expertise and the need to fully customize



Built on the same Azure IoT Platform Services

Rich extensibility points in IoT Central
Continuum of support for IoT solution needs

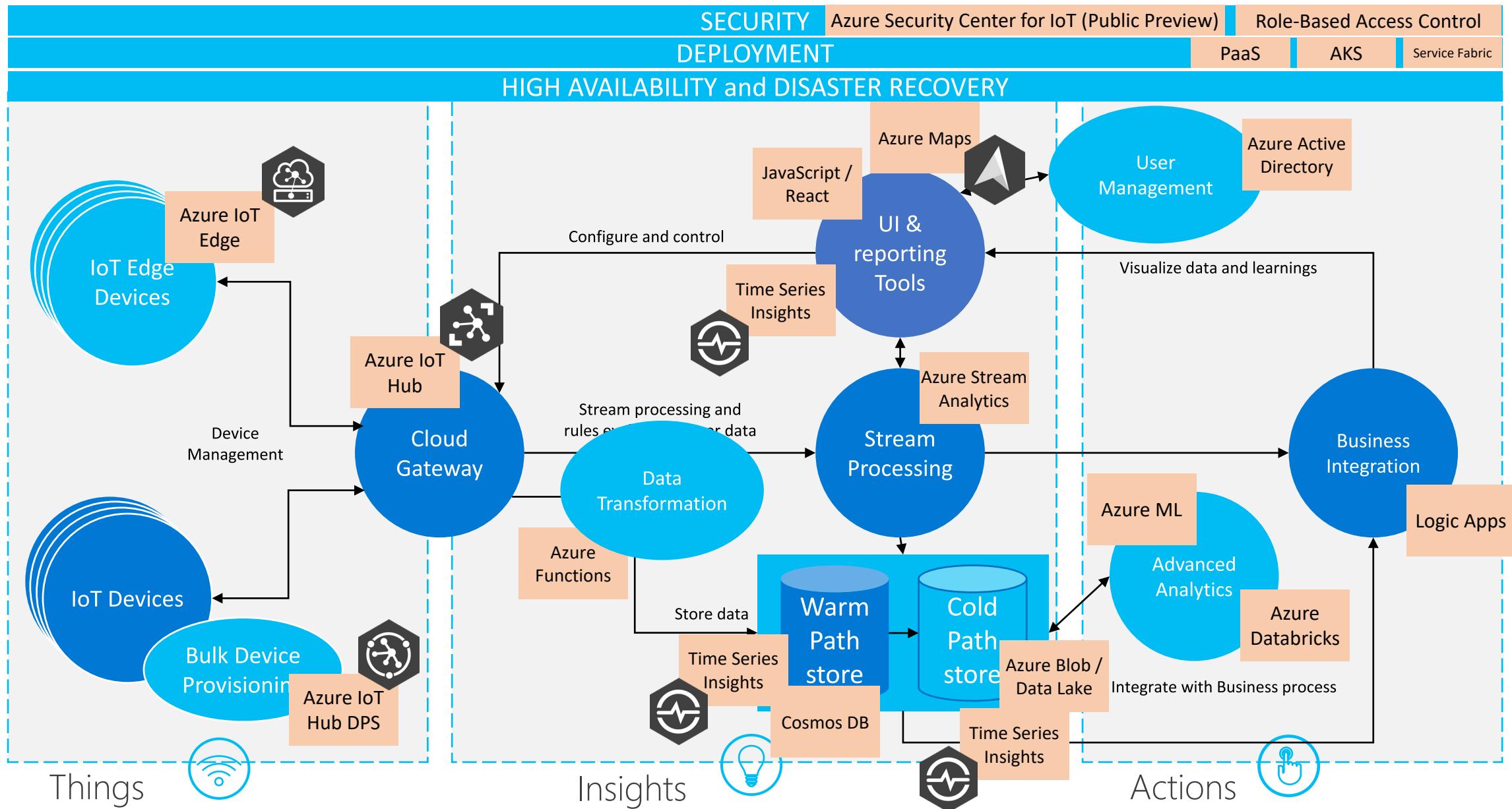
Azure IoT solution accelerators

Kick-start your implementation of common Internet of Things (IoT) scenarios like remote monitoring, industrial IoT (IIoT), predictive maintenance, and device simulation.

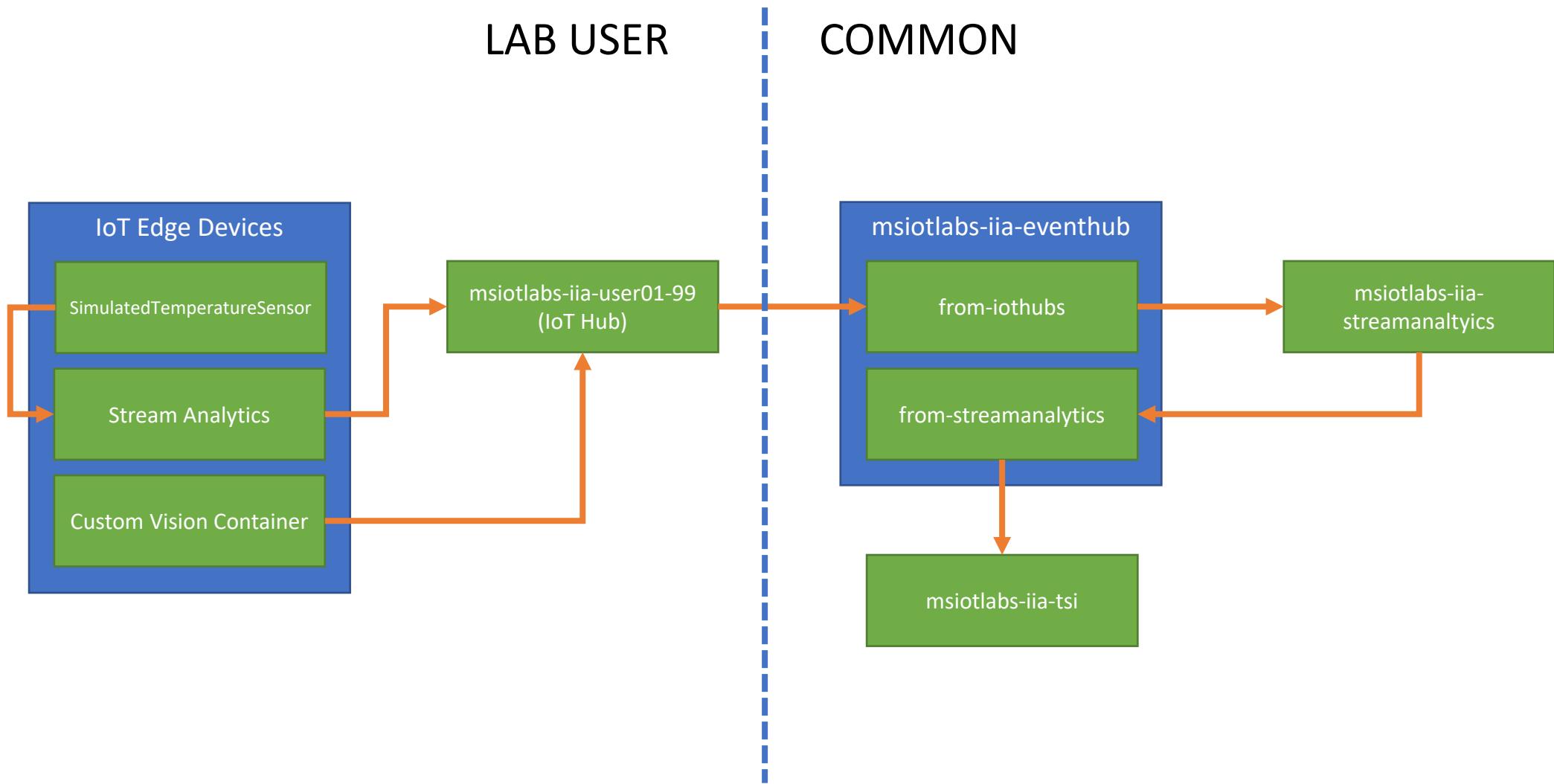
Get all the required cloud-based services you need—including all required application code—for a successful, efficient, and streamlined build and deployment.

-  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

Azure Reference Architecture



Lab 3 Architecture



Azure IoT Edge on Windows 10 IoT

Extend cloud intelligence and analytics to edge devices



Securely move cloud and custom workloads to the edge



Leverage the familiar security, manageability and enterprise support of Windows 10 IoT



Seamlessly deploy AI and advanced analytics



Configure, update and monitor edge devices from the cloud

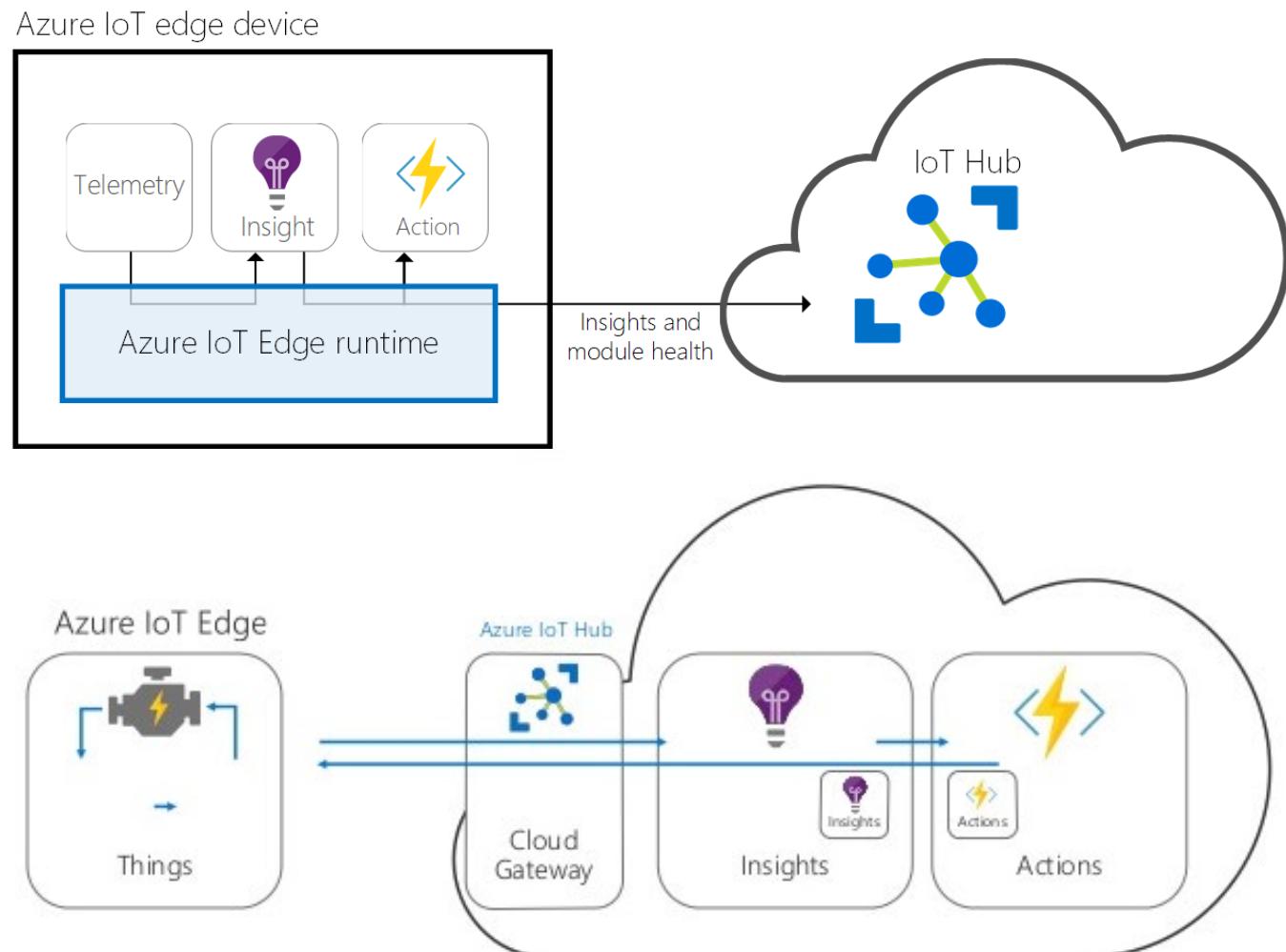


Code symmetry between cloud and edge for easy development and testing



Azure IoT Edge

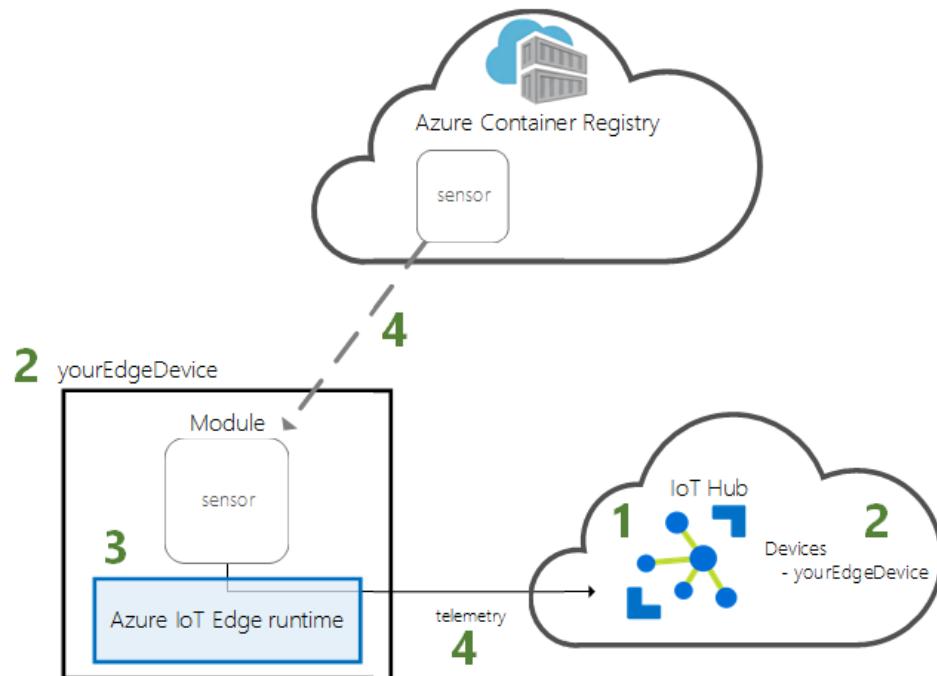
- Open source, cross platform, container-based edge runtime
- Run Azure services & your own code on IoT class and larger devices—fully extensible
- Manage the devices and IoT Edge workloads centrally
- Supports offline operation
- Fully Visual Studio + Visual Studio Code developer support
- Azure DevOps + Jenkins CI/CD support
- <https://github.com/Azure/iotedge>



System Modules

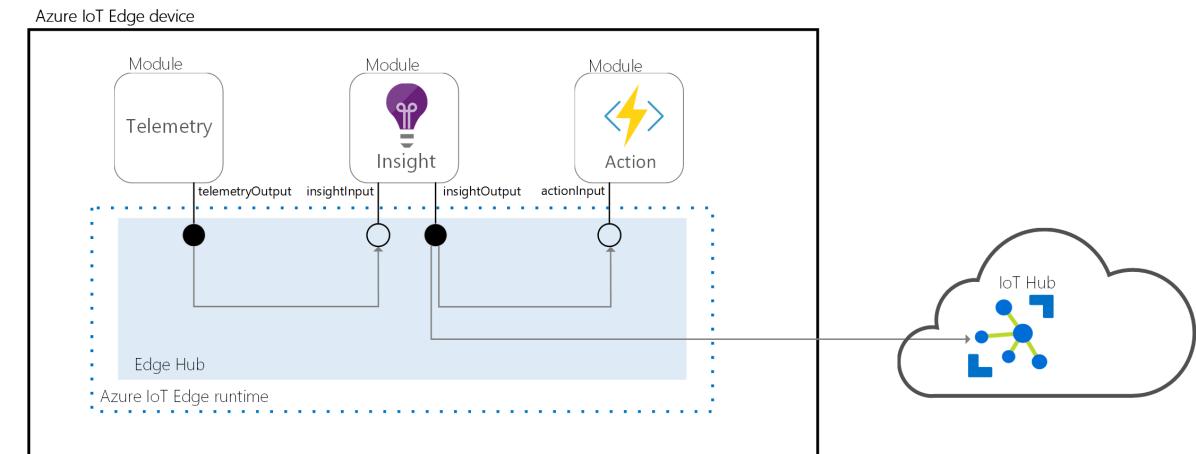
edge-agent:

- Deployment & Container orchestration
- Ensures module uptime



edge-hub:

- Communication to/from Azure IoT Hub
- Inter-module communication





LAB 3

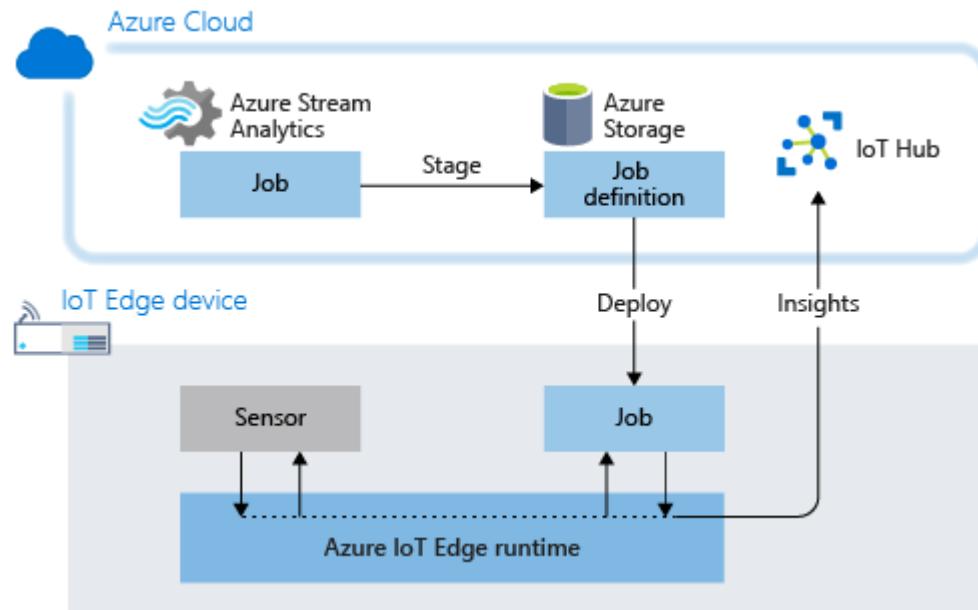
Deploy Azure IoT Edge on Windows 10 IoT Enterprise



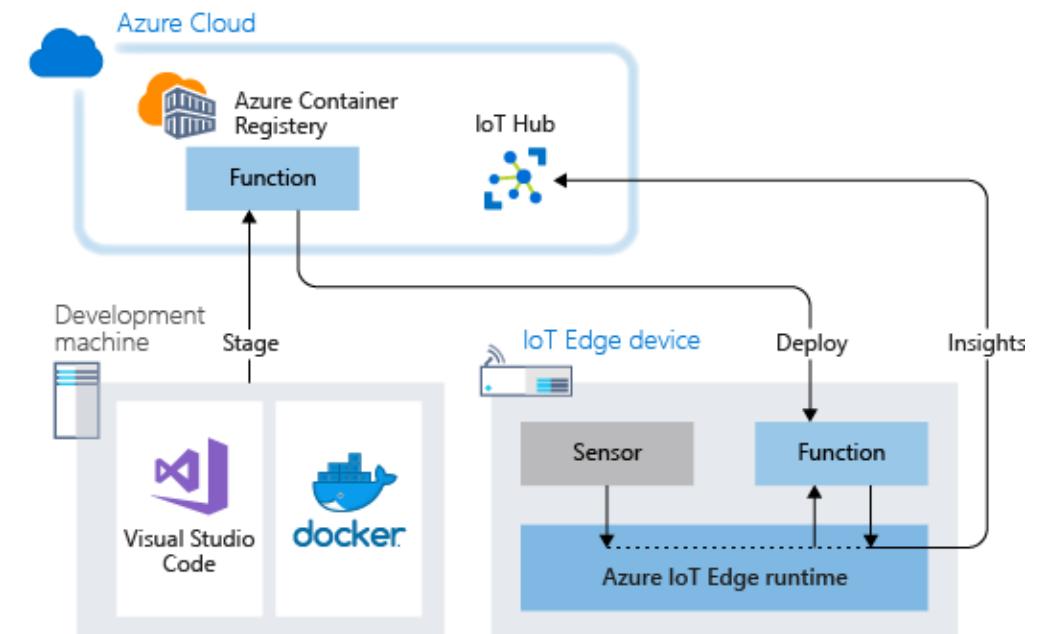
Azure Stream Analytics at the Edge

Azure Services as Edge Modules

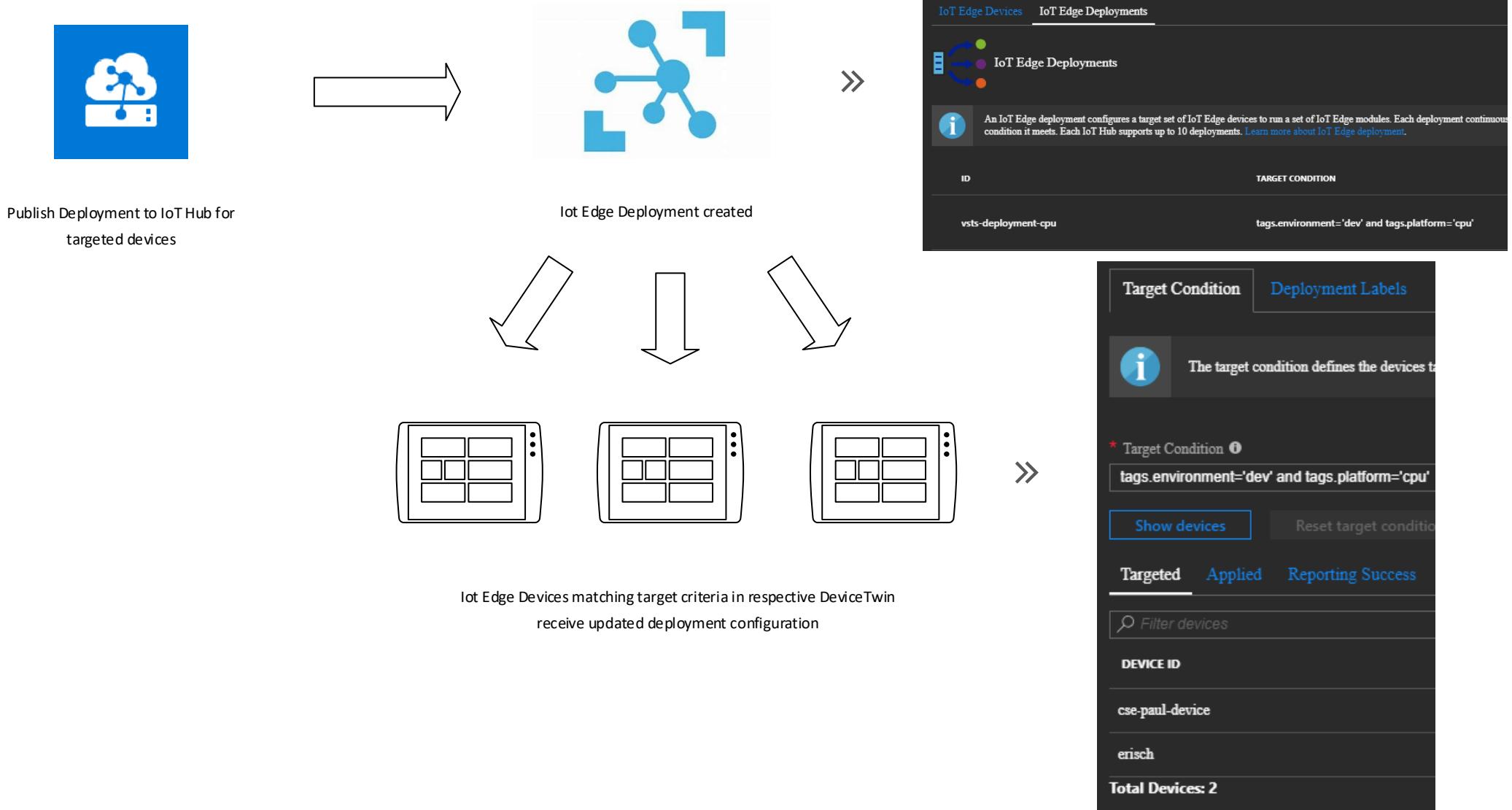
- Azure Stream Analytics



- Azure Functions



IoT Edge Deployment Process





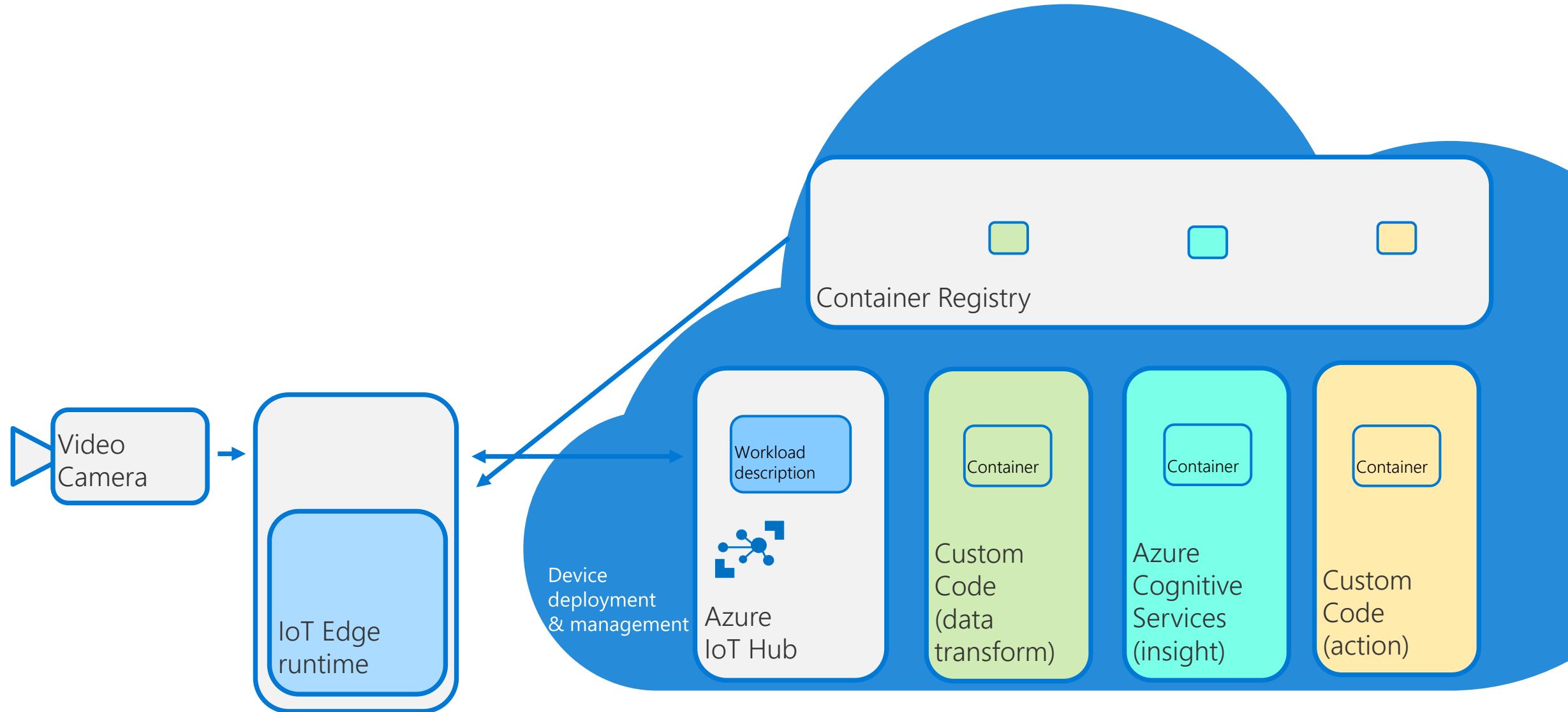
LAB 4

Azure Stream Analytics at the Edge



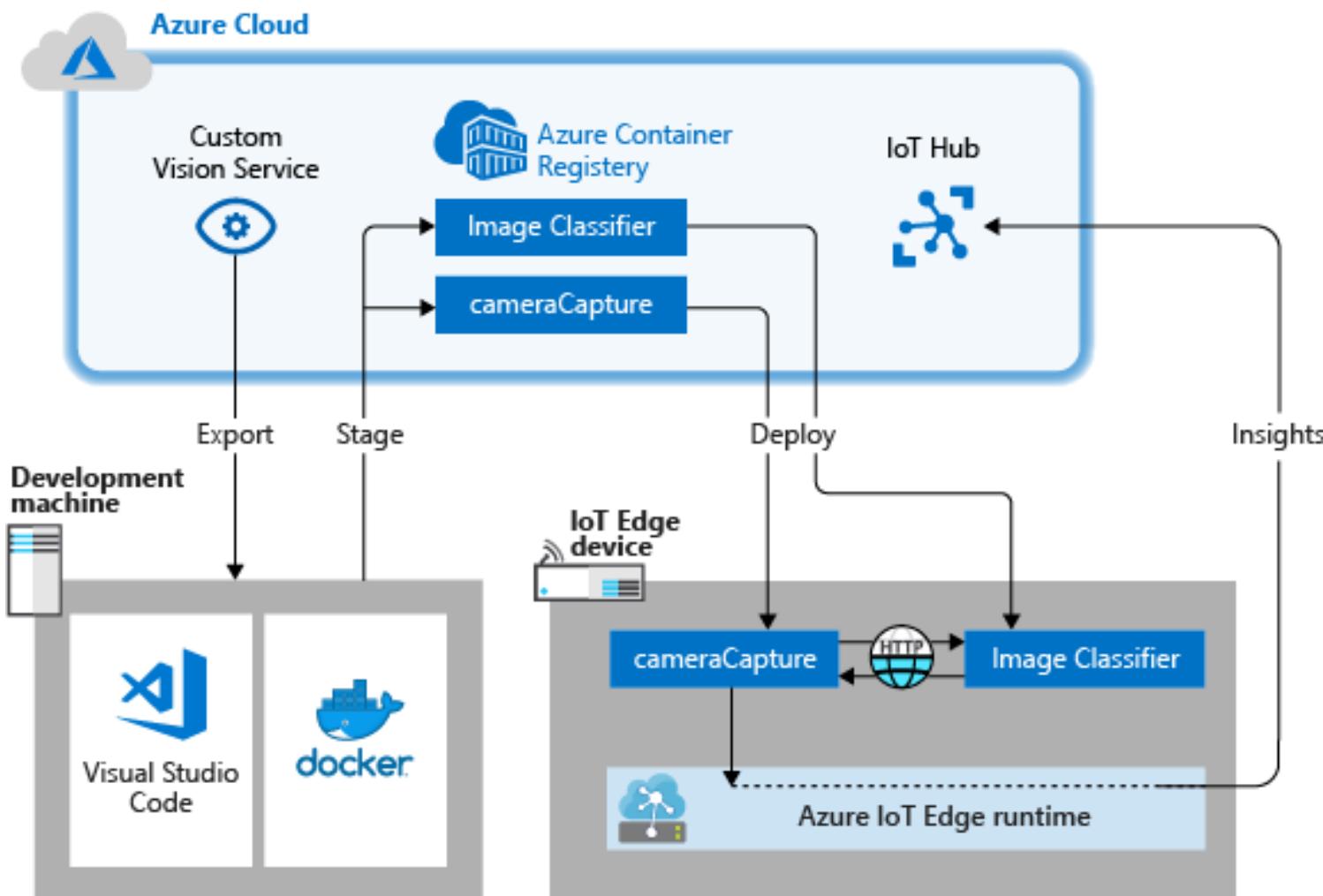
AI/ML at the Edge

Edge intelligence enabled with Azure IoT Edge

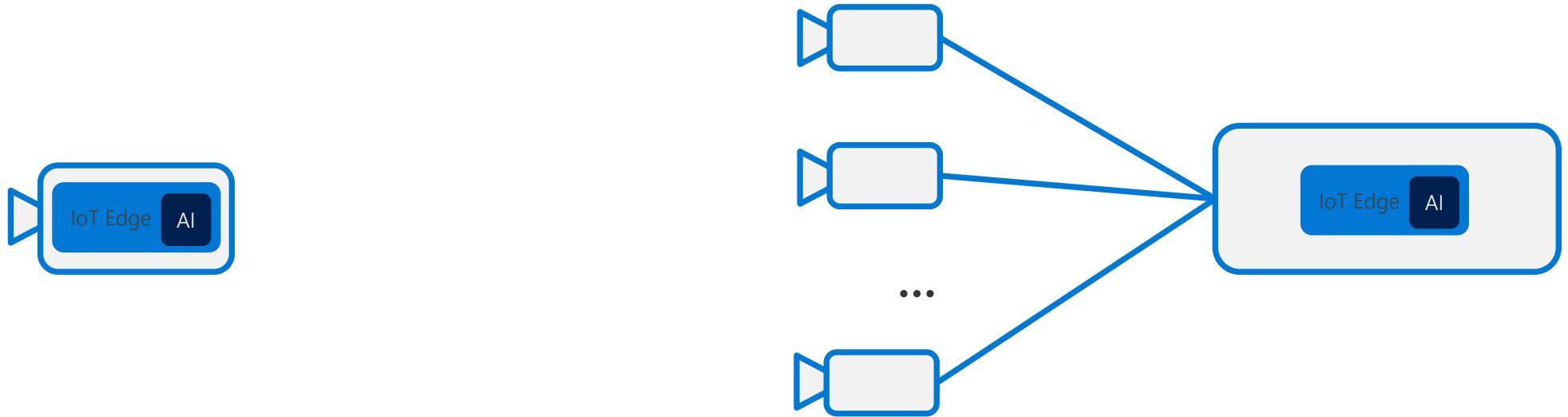


AI/ML Modules

- Cognitive Services including:
 - Text Analytics - Key Phrase Extraction, Language Detection, Sentiment Analysis
 - Face – Detection, Verification, and Emotion
 - Computer Vision – Text Recognition, custom vision module allows to finds whatever you train it to find
- Azure Machine Learning at the Edge
 - Export AML models to run Edge modules



2 topologies for computer vision scenarios



- Intelligent camera
 - A handful of cameras per site
 - Small internal bandwidth consumption
 - Requires new cameras
 - Requires AI capable cameras

- Intelligent gateway
 - Many cameras per site
 - Heavy internal bandwidth consumption
 - Works with existing CCTV networks
 - Requires AI capable gateway

Inferencing on Edge with Windows ML

Azure IoT Edge on Windows supports on-device AI inferencing.

Build models in the Azure ML Service, export to ONNX

Or use one of several pre-trained models for state-of-the-art deep learning from the ONNX Model Zoo.

Or take advantage of Custom Vision Service for hyper-efficient training.

Combine with app logic in container, then deploy to Edge devices.

Sample available today on GitHub

Windows ships with an inferencing engine built-in! "Windows ML"

Features blazing fast CPU evaluation.

Provides vendor-independent GPU access to any DirectX 12 GPU.

Preview: Windows ML container enables the quick creation of AI powered IoT solutions

- Provides a specialized Windows container for ML workloads
- Includes its own inferencing stack: Windows ML
- Small image size requires less resources to deploy and run
- Takes advantage of commodity GPU hardware for high performance
- Runs Windows 10 IoT Enterprise as the host for security, manageability and hardware choice.
- Gives direct access to sensors and low-power busses, including cameras

Targeting under

350MB

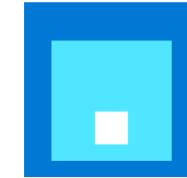
on-disk size



Compare with
TensorFlow
containers at

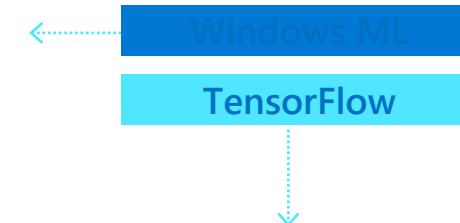
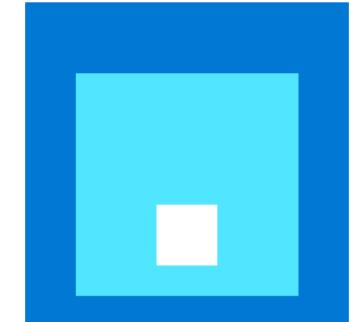
1GB

for CPU interfacing



3.5GB

for GPU interfacing





LAB 5

Computer Vision at the Edge



IoT Security

Security in IoT must be End-to-End

Securely connect millions of devices...

...over a secure internet connection...

...to Microsoft Azure – built with security from the ground up



Device Security

Device SDKs in multiple languages
Any OS | Any HSM including Azure Sphere



Connection Security

X.509/TLS-Based Handshake and Encryption

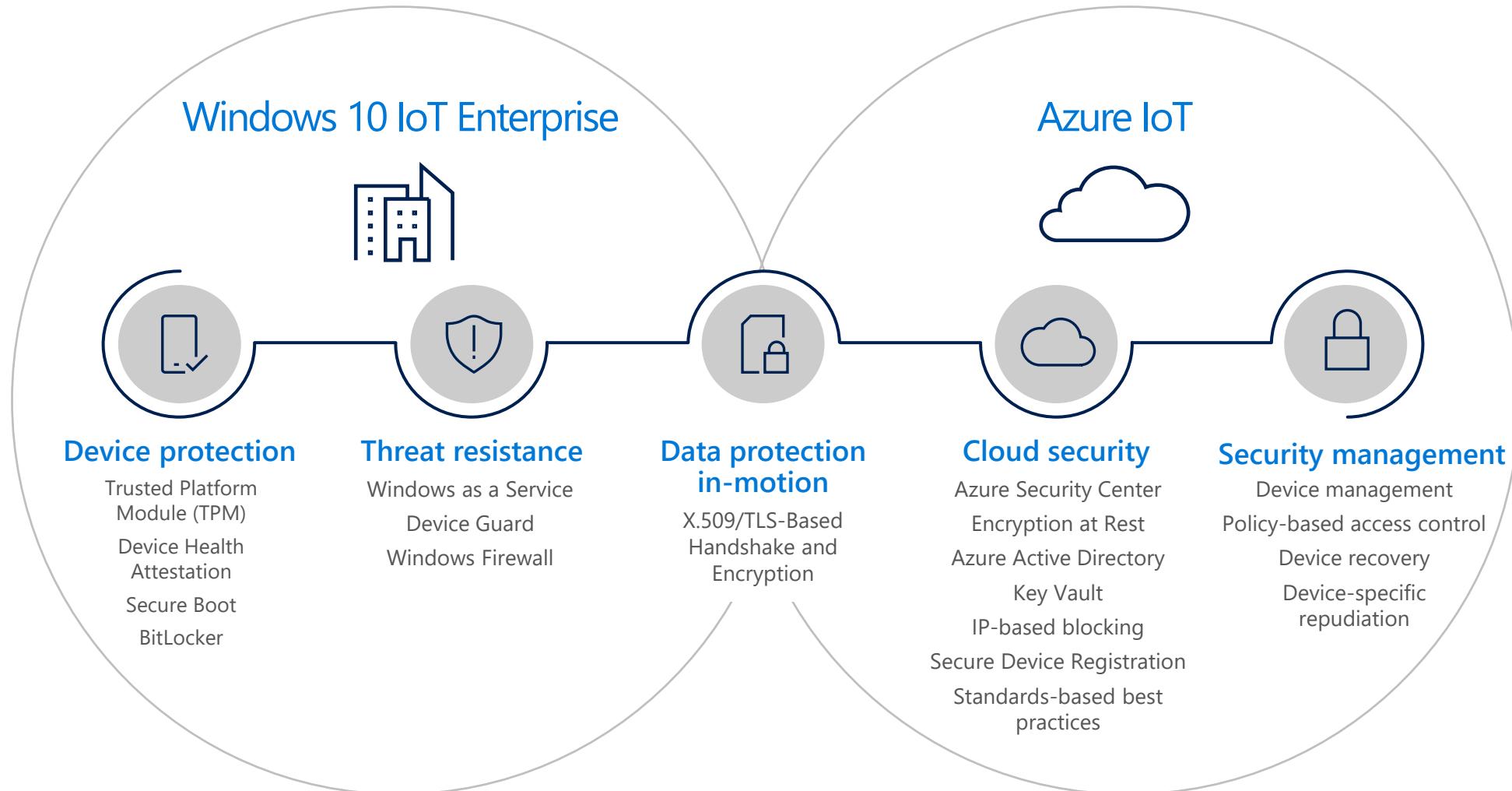


Cloud Security

IoT Hub | Windows IoT | Azure Sphere Services
Azure Trust Center | Azure Compliance Offerings

End-to-end IoT security offering

Our security expertise lets you focus on business



Azure Security Center for IoT

Monitor the security posture of your entire IoT deployment

Policy & compliance

Secure score

 332 OF 680

⚠️ Secure score impact changed. [Learn more](#)

[Review your secure score >](#)

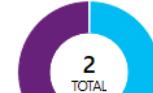
Regulatory compliance

 View and monitor your compliance posture relative to industry standards and regulations

[Enable Regulatory Compliance →](#)

PCI DSS 3.2 26 of 26 passed controls

Subscription coverage

 2 TOTAL
1.7K Covered resources

| Coverage Status | Count |
|-------------------|-------|
| Fully covered | 1 |
| Partially covered | 1 |
| Not covered | 0 |

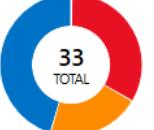
Manage and govern your security posture

 Define and assign Azure Security Center policies in order to review and track compliance to security standards

[Learn more >](#)

Resource security hygiene

Recommendations

 33 TOTAL
1.6K Unhealthy resources

| Severity Level | Count |
|-----------------|-------|
| High Severity | 11 |
| Medium Severity | 7 |
| Low Severity | 15 |

Resource health monitoring

 1K Compute & apps

 49 Networking

 100 IoT hubs & resources

 496 Data & storage

 29 Identity & access

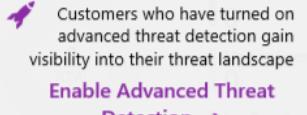
Review and improve your secure score

 Review and resolve security vulnerabilities to improve your secure score and secure your workload

[Learn more >](#)

Threat protection

Security alerts by severity

 Customers who have turned on advanced threat detection gain visibility into their threat landscape

[Enable Advanced Threat Detection →](#)

 0 Attacked resources

Security alerts over time

 Customers who have turned on advanced threat detection gain visibility into their threat landscape

[Enable Advanced Threat Detection →](#)

14 Sun 21 Sun 28 Sun

Most prevalent alerts

No results

No security alerts

Enterprise grade security for mission critical devices



Next Generation
Credentials

BitLocker

Device Guard

Windows Defender
Advanced Threat Protection

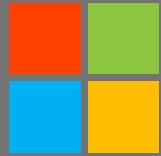
Enterprise Data Protection



LAB 6

Lock down Windows 10 IoT Enterprise





Microsoft