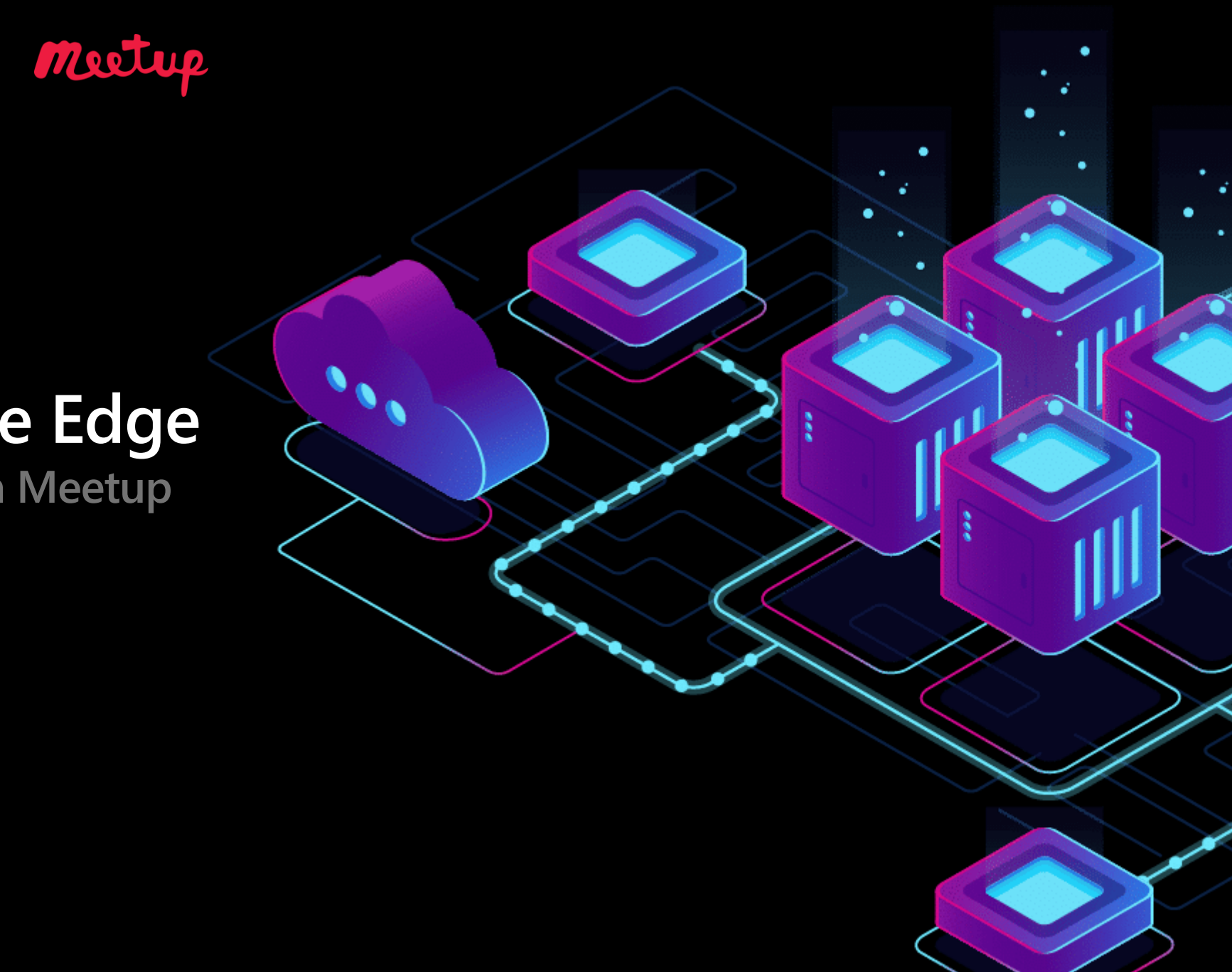
Microsoft

Meetup

# Kubernetes at the Edge

## 59th Data Science Leuven Meetup

Tom Claes – Microsoft



Microsoft

# Introduction

LinkedIn

2022 **Microsoft**

Cloud Solution Architect – Hybrid Solutions & IoT

2016 - 2022 **KU Leuven**

Master Artificial Intelligence
Master Information Management
Master Applied Economics

Microsoft

# Agenda

Why Kubernetes?

Research

Cloud native EVERYWHERE

AKS Edge Essentials

Use cases

Questions

# Benefits of Kubernetes

- Container orchestration savings
- Increased DevOps efficiency for microservices architecture
- Deploying workloads in different environments
- Automation of deployment and scalability
- ...

# Organizations are adopting containers, Kubernetes and IoT to meet their needs

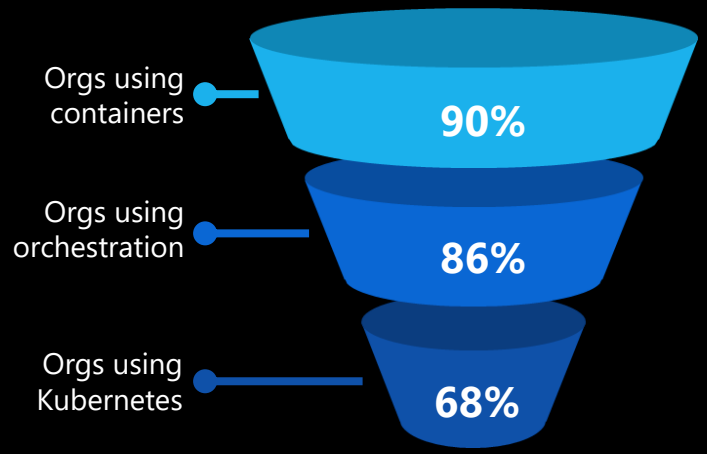
- 90% of companies use containers and 68% use Kubernetes today.  An additional 19% plan to use Kubernetes in the next years.
- 81% of companies manage their Lightweight Edge devices themselves and 71% of those devices already have a path to the cloud (an additional 22% are open to providing those devices with a path to the cloud).
- 68% of companies ranked “Easier to deploy new software or software updates” among their top 3 benefits with 42% ranking it #1.

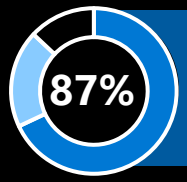
TLDR-Microsoft Research October 2022

# Most organizations are using containers, orchestration, and Kubernetes today

## CONTAINER & ORCHESTRATION USAGE

Most organizations are using containers, orchestration, and Kubernetes today to meet their needs at the edge and cloud




Of orgs are either using Kubernetes today (68%) or plan to in the next 12 months (19%).

*n=418*

## LIGHTWEIGHT EDGE DEVICE USAGE

**72%** of organizations deploy Lightweight Edge Devices into the field at branch locations

*n=398*

## QUANTITY OF LIGHTWEIGHT EDGE DEVICES

**190** Average number of branch locations*

*n=241*

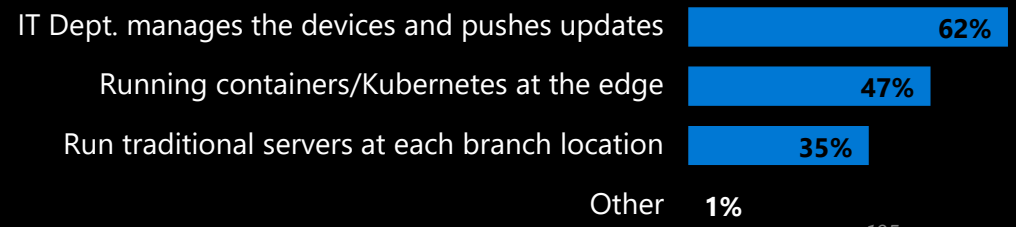
**x 23** Average number of Lightweight Edge Devices per location*

*n=241*

**4,370** **Average total number of Lightweight Edge Devices**

*Responses capped using 1.5*IQR methodology

## HOW IT'S HANDLED TODAY



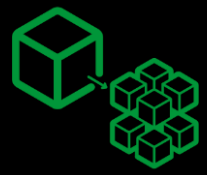

*n=195*

# Customer Needs For OT Transformation

**A common platform spanning cloud-to-edge for cloud-native workloads**

### Modernize Apps with Microservices

- Containerization
- OSS ecosystem
- AI/ML
- Re-use existing Windows & Linux code



### Increase Developer Efficiency

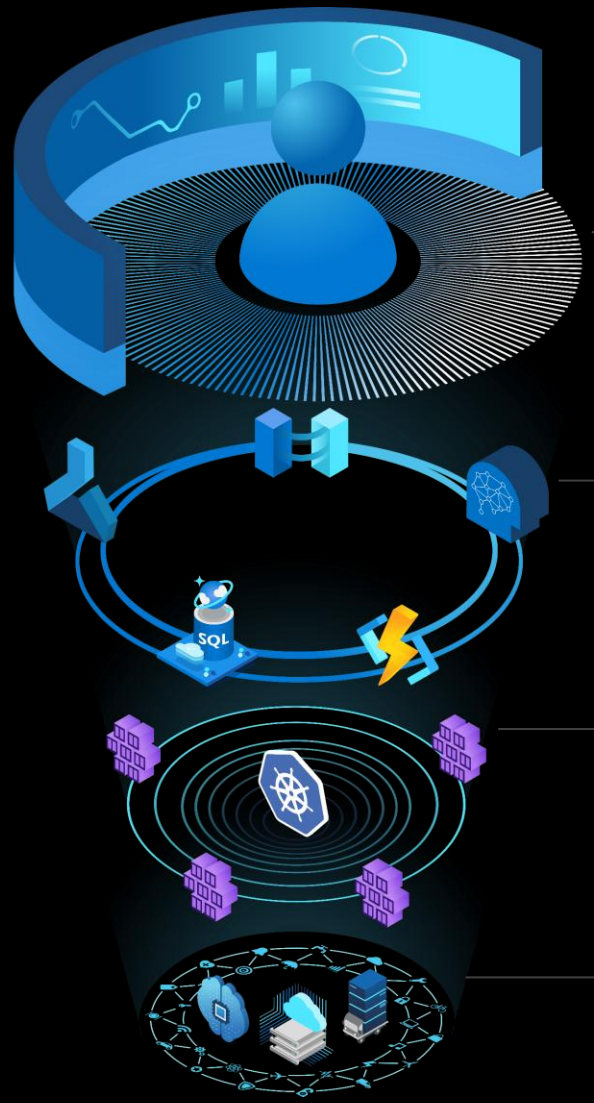
- Modern software practices
  - Agility
  - Microservices
- CI/CD & GitOps

### Run Cost Effective Operations

- Pre-process signals and insights before sending to the cloud
- Lowest latency
- Maximize hardware investments with existing & new machines

# Cloud-native anywhere

## Azure Unified Blueprint




### Control plane via Azure Arc

Consistent security, governance, and development practices | GitOps

### Modern apps and data

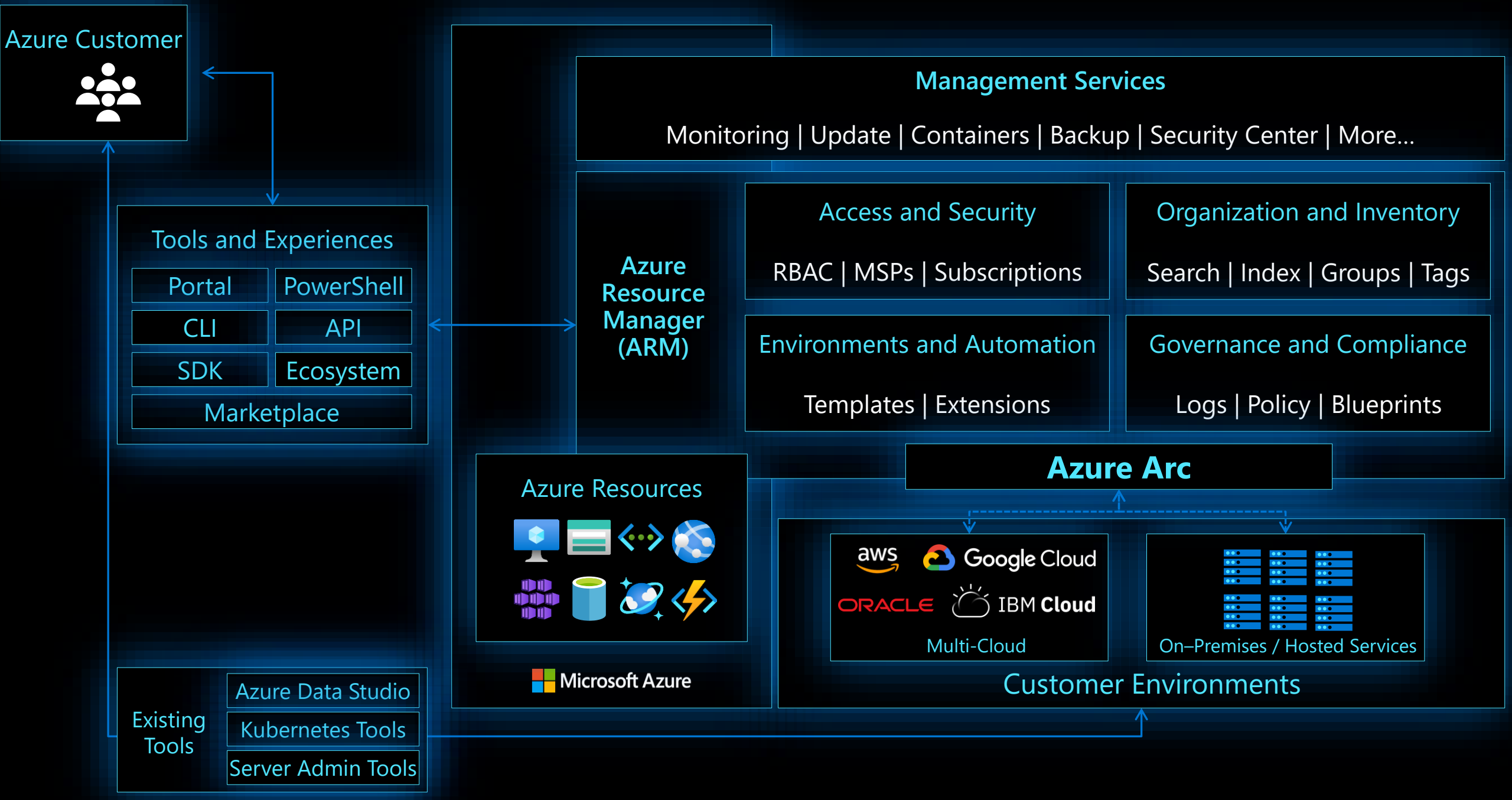
Azure Arc enabled services: Data Services | PaaS/Serverless | AI/ML

### Kubernetes

Containers | Microservices | OSS Ecosystem
AKS | Arc enabled Kubernetes

### Any environment

Azure Arc enabled infrastructure: Windows | Linux | Kubernetes | Azure Stack HCI | Multicloud


Azure Customer
Management Services
Monitoring | Update | Containers | Backup | Security Center | More...
Tools and Experiences
Portal
PowerShell
CLI
API
SDK
Ecosystem
Marketplace
Azure Resource Manager (ARM)
Access and Security
RBAC | MSPs | Subscriptions
Organization and Inventory
Search | Index | Groups | Tags
Environments and Automation
Templates | Extensions
Governance and Compliance
Logs | Policy | Blueprints
Azure Arc
Azure Resources
aws
Google Cloud
ORACLE
IBM Cloud
Multi-Cloud
On–Premises / Hosted Services
Microsoft Azure
Customer Environments
Existing Tools
Azure Data Studio
Kubernetes Tools
Server Admin Tools

# Best practices to run Kubernetes commercially on Edge

## Bring cloud-native best practices to edge

**Running Kubernetes on all your platforms is difficult**

You need to maintain same versions of Kubernetes distributions across cloud and edge

Technology

## Keep your container infrastructure secure

**Adhere to security best practices**

Entire stack including host OS, clusters, worker nodes VM images need to incorporate layer specific security

Security

## Deploy & Update Quickly at Global Scale

**Update infrastructure and efficiency is critical**

You must have the logistics and operational excellence to deliver, deploy updates globally to your machines in hours

Scale

# Consistent Cloud and Edge Developer Experience

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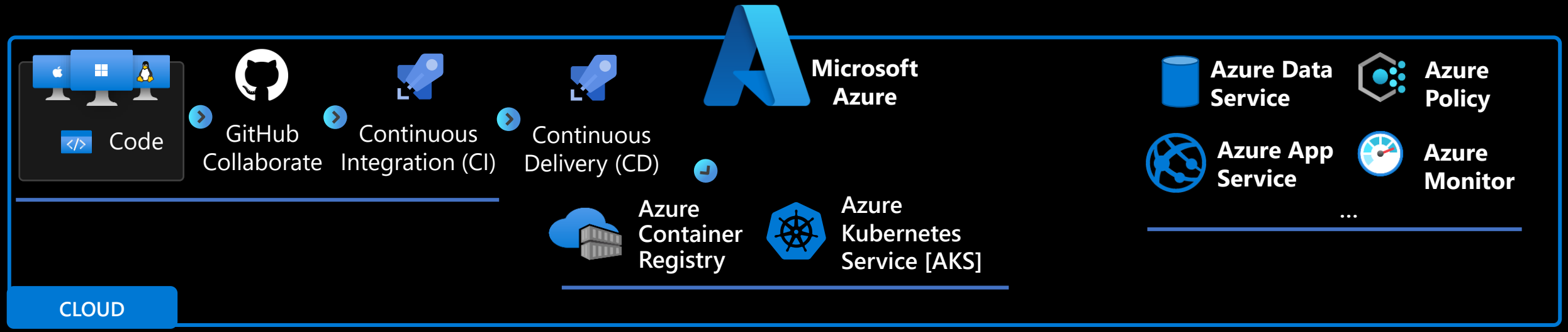
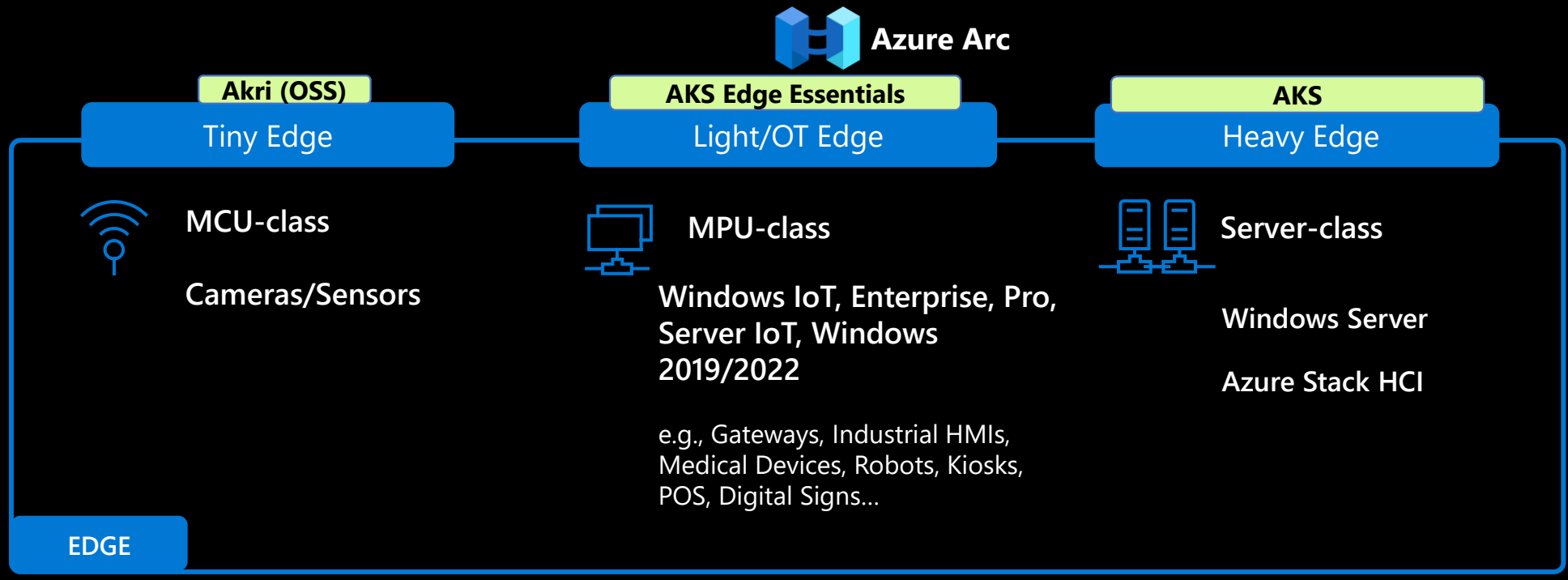


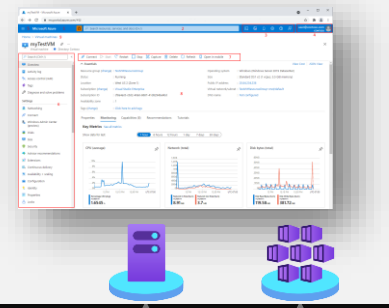
# Azure Kubernetes Service (AKS) Edge Essentials

Easily manage your application deployments across all clusters with Azure Arc.

- **Microsoft managed lightweight Kubernetes distribution** runs with minimal 8GB memory and 2vCPUs compute
- **Simplified installation experience** via an included Microsoft managed VM for easy cluster installation and configuration
- **Ongoing monthly security updates** from Microsoft keep Linux and Windows VM images secured over time
- **Microsoft provides automatic updates** to stay aligned with your cloud Kubernetes version
- **Chose to run Linux, Windows containers or both** when creating a Kubernetes cluster on AKS Edge Essentials

## Azure Resource Manager

### Azure Portal
Build & manage everything from simple web apps to complex cloud deployments



## Deploy Arc-Connected Services

### Azure Monitor
Monitor servers in Azure, machines on-prem or at other cloud providers.

### Azure Policy
Enforce organizational standards and assess compliance at-scale.

### Azure App Service
Quickly build, deploy, and scale web apps and APIs on Kubernetes or Azure.

...

## Deploy your own workloads

PR Pipeline

App Repo

### GitOps
Manage the desired state of your Kubernetes cluster configurations with Git

CI Pipeline

CD Pipeline

GitOps Repo

### Azure Container Registry
Build, store, and manage container artifacts for your deployments

## OS and VM updates

### Windows Update
Get the latest fixes, updates and security improvements

## Azure Arc

CLOUD

Flux

### Containerized Applications
Azure Services

User workloads

Pull desired cluster state

Cache containers

Cache updates

Install AKS-IoT on a device like an app

### AKS-EE Kubernetes Platform
K8s / K3s

Linux VM

Windows VM

Connect via Arc-connected cluster

## Disconnected on-prem

### On-prem container registry
Set up private Docker registry

GitOps Repo

### WSUS
Windows Server Update Services enables IT admins to deploy Microsoft updates.

Hyper-V

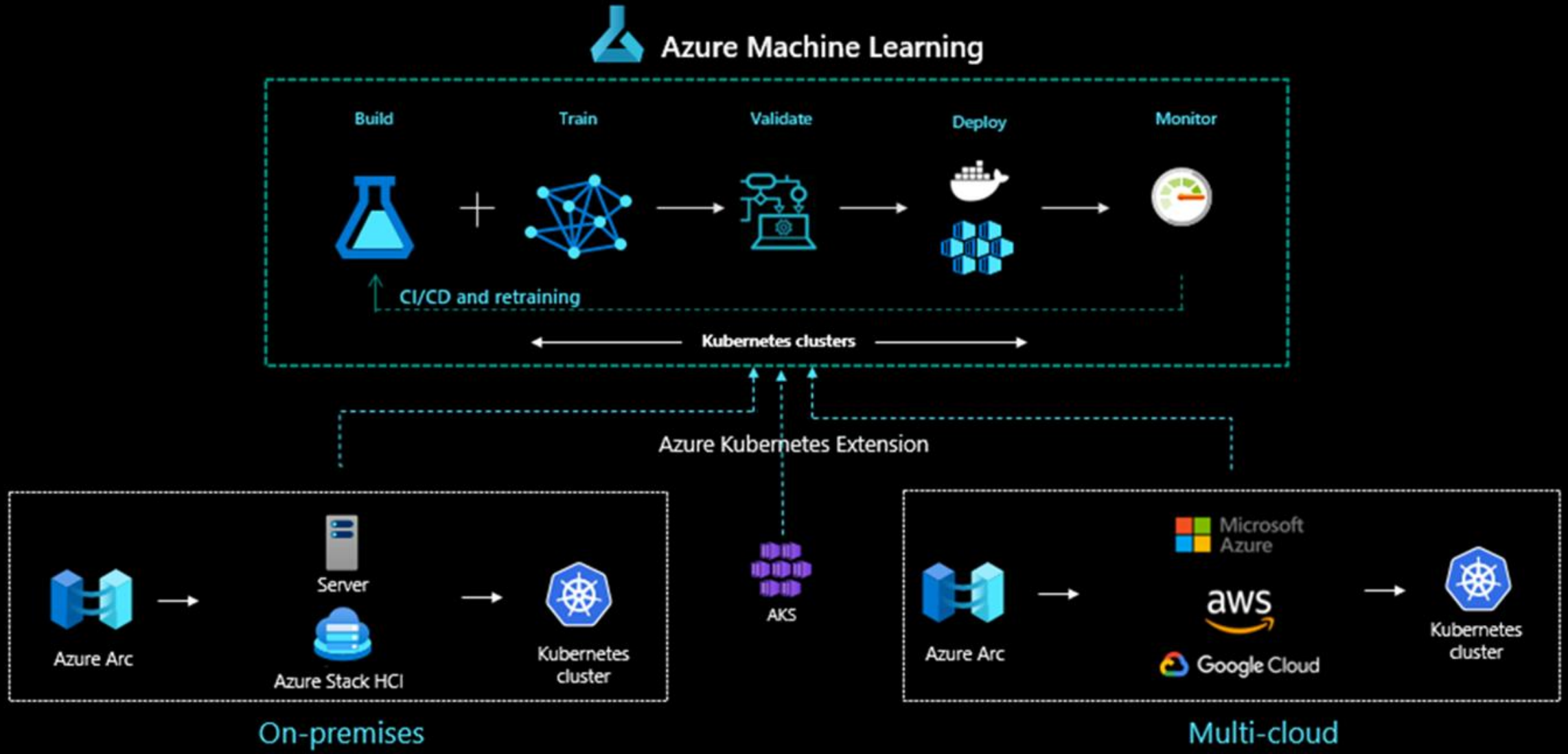
Windows Host OS

Hardware

Connect via Arc for servers

EDGE

# Machine learning anywhere



# Use cases

# Cloud to edge use cases span businesses and industries

## Manufacturing

Defect detection

Worker safety & loss prevention

Automated supply chain & assembly

Damaged box detection

## Retail

Space & assortment

Traffic patterns

Personalization

Inventory management

Optimal product placement

## Healthcare

Medical imaging devices

Digital health platforms

Store data on prem

Real-time analysis

Online updates

## Sustainability

Decarbonizing the Electrical Grid

Waste Reduction in Supply Chain Ops

Carbon Capture & Storage

## Core business systems

### Marketing

Customer insights

Dynamic pricing

### Sales

Lead scoring

Sales insights

### Finance

Financial forecasting

Risk management

### Workforce

Employee insights

Employee safety

### Service

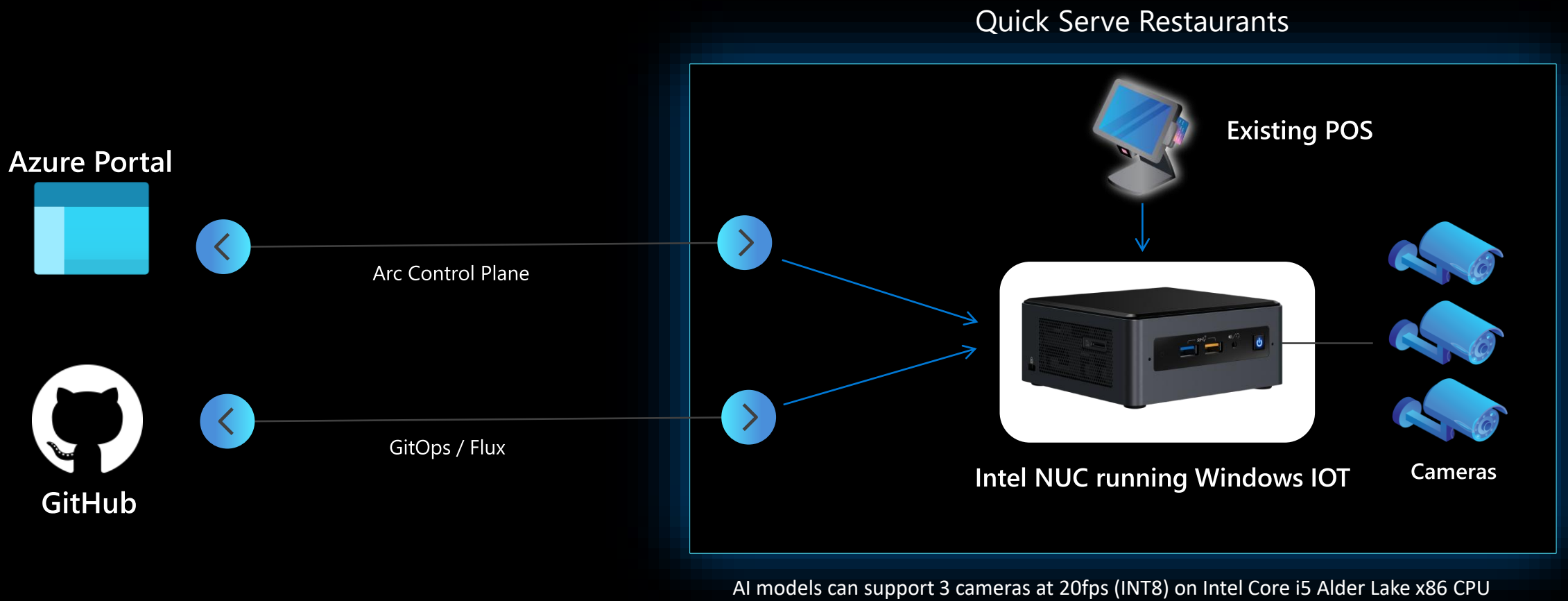
Intelligent chatbots

Virtual assistants

# Solving Order Accuracy with Edge AI

Business problem: Order Accuracy

Solution: AI to track and alert for the wrong food items added to the bags in real-time




AI models can support 3 cameras at 20fps (INT8) on Intel Core i5 Alder Lake x86 CPU

# Thank You

# Resources

About AKS Edge Essentials - AKS hybrid | Microsoft Learn
Azure Arc-enabled Kubernetes | Microsoft Learn
Overview | Azure Arc Jumpstart
Azure Arc-enabled Kubernetes | Azure Arc Jumpstart
Introduction to Kubernetes - Training | Microsoft Learn
AKS Edge Essentials - Pricing | Microsoft Azure
Pricing – Azure Arc | Microsoft Azure