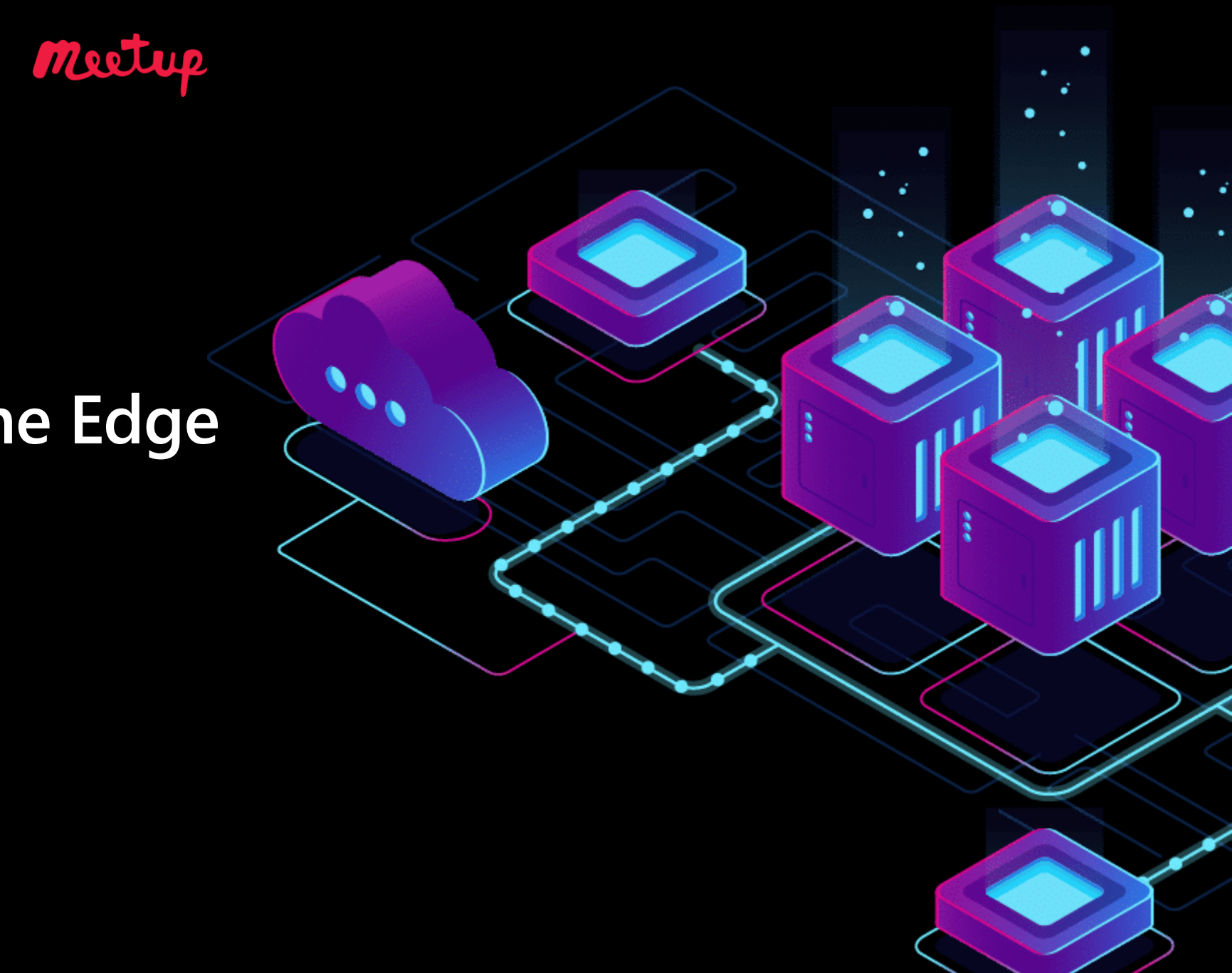
Microsoft

Meetup

Kubernetes on the Edge

MLOps Belgium 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 and Kubernetes to meet their needs

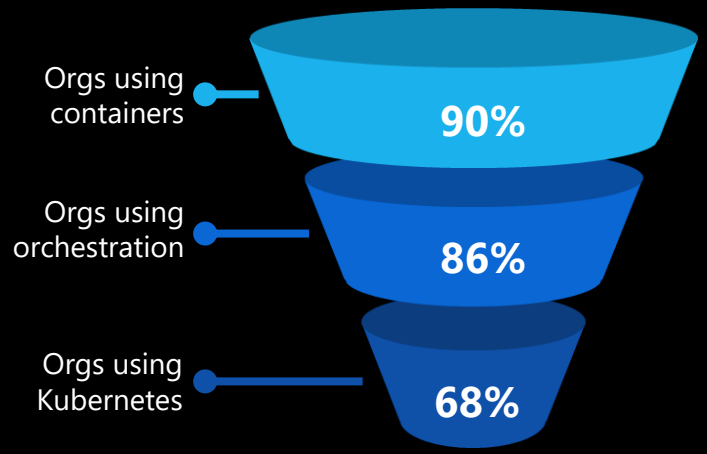
- 90% of companies use containers and 68% use Kubernetes today. An additional 19% plan to use Kubernetes in the next years.
- 81% of companies manage their Lightweight Edge devices themselves and 71% of those devices already have a path to the cloud (an additional 22% are open to providing those devices 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.

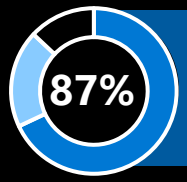
TLDR-Microsoft Research October 2022

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

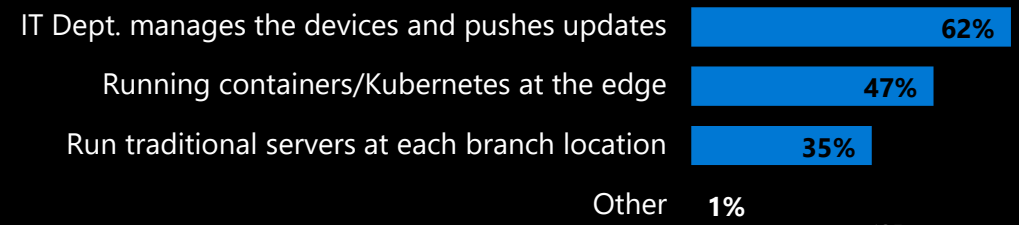
x **23** Average number of Lightweight Edge Devices per location*

n=241

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

*Responses capped using 1.5*IQR methodology

HOW IT'S HANDLED TODAY



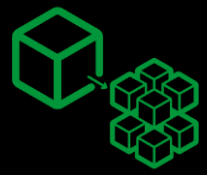
n=195

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

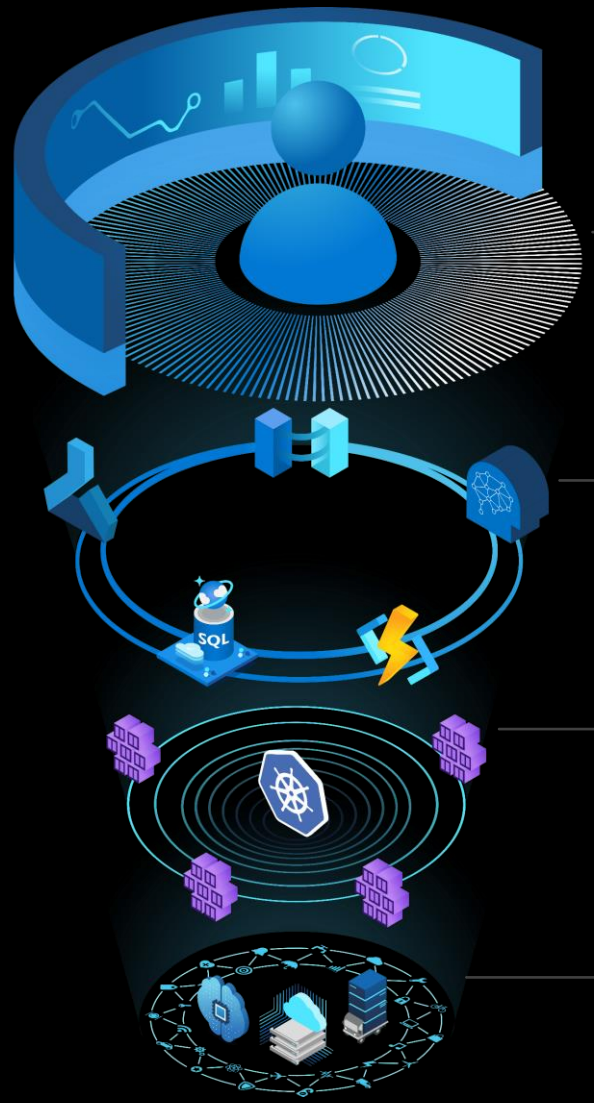
- Modern software practices
  - Agility
  - Microservices
- CI/CD & GitOps

Run Cost Effective Operations

- Bandwidth & resource constrained devices
- 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

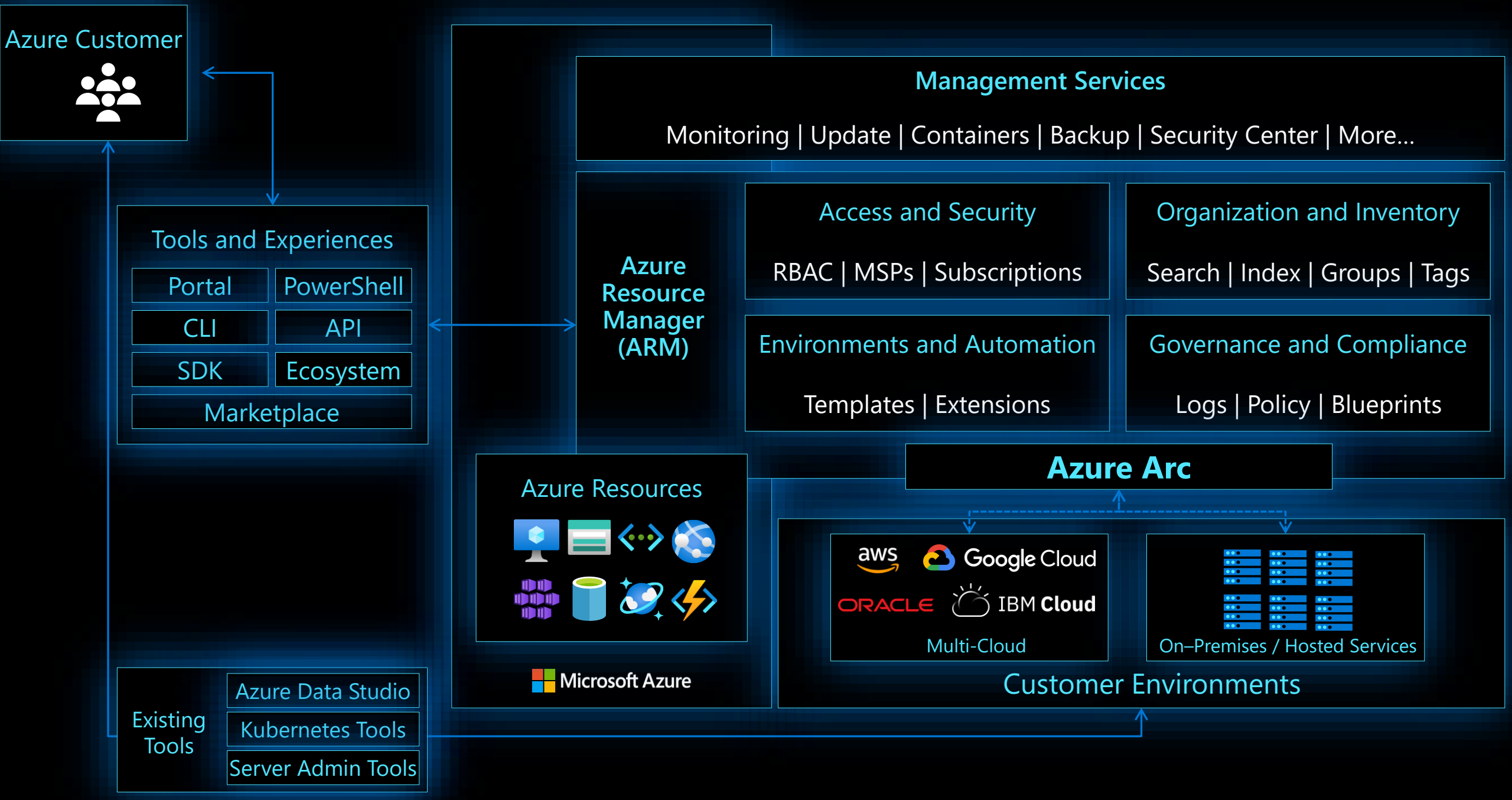
Azure Arc enabled services: Data Services | PaaS/Serverless | AI/ML

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

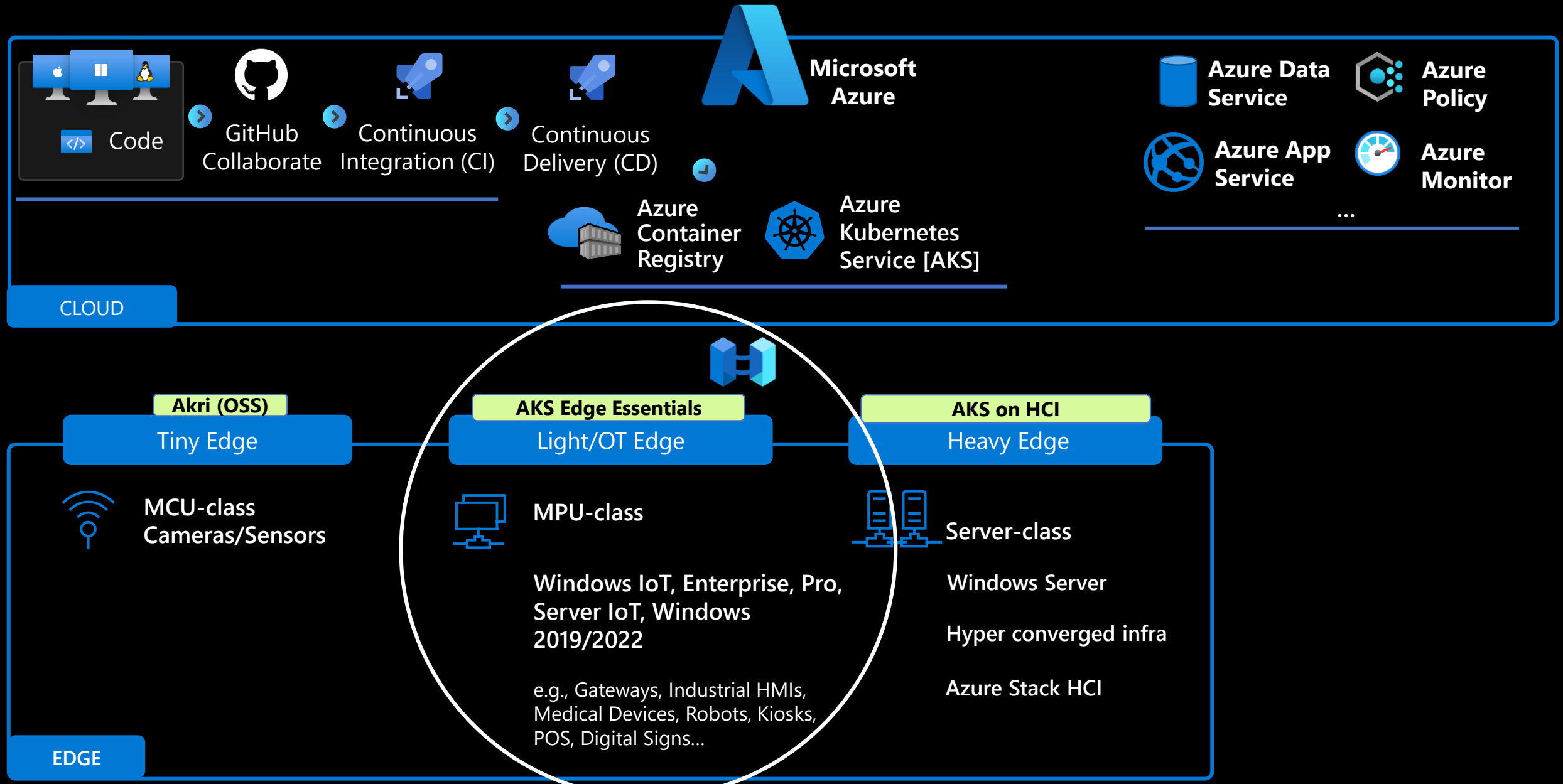
Update infrastructure and efficiency is critical

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

Microsoft

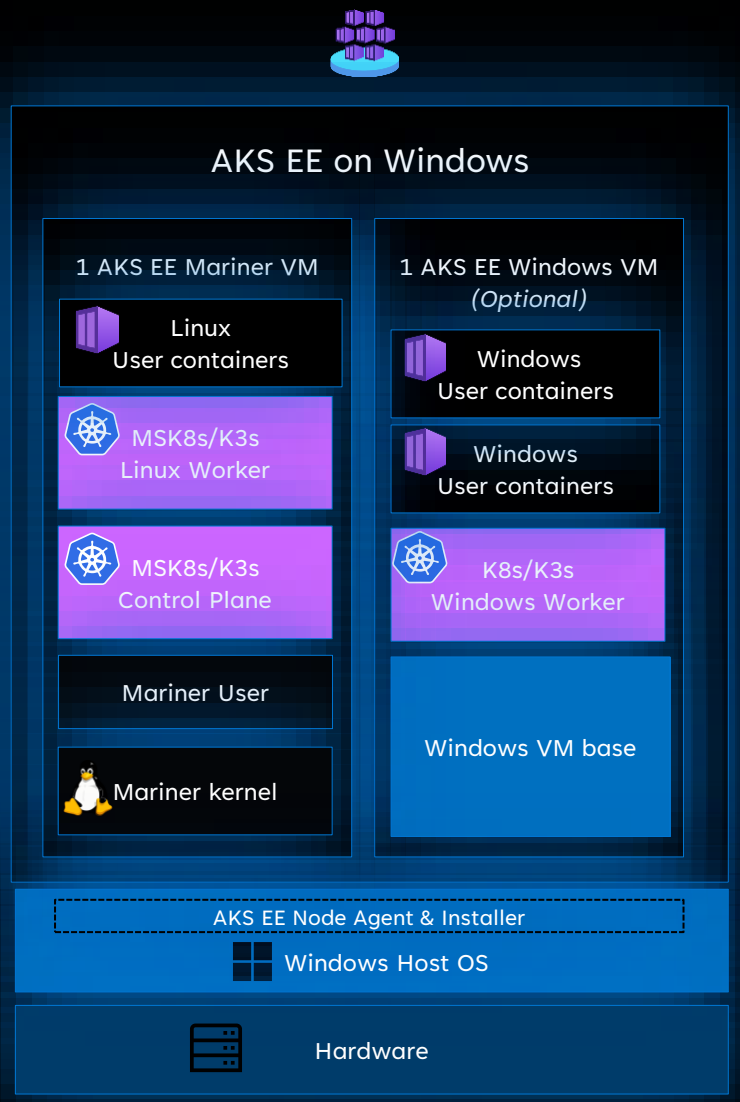


Azure Kubernetes Service (AKS) Edge Essentials

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

AKS Edge Essentials: a fully managed stack from Microsoft



User **choice** of world-class Windows OS management & deployment tools for host device config/update

- Azure Arc-enabled servers
- Microsoft Endpoint Manager
- Ecosystem of MDMs & Tooling

Use ARM, Arc, and GitOps to manage all your Container deployments and Kubernetes configs across cloud and on-prem with Arc-enabled Kubernetes

Managed Kubernetes

- One Linux VM with Control/Worker per Machine
- Kube Version-matched with AKS Cloud
- Fixed purpose app-like behavior with RAM, Storage, and vCPU restricted to static allocation assigned at install

Mariner VM

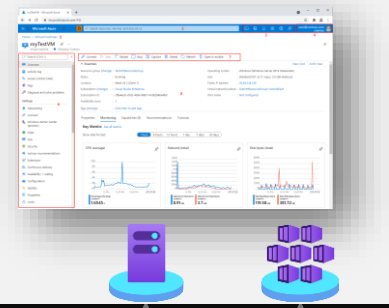
- Curated and locked CBL Mariner image
- Lightweight composition for better performance and security
- Reliable A/B updates using Microsoft Update; managed with Windows Policy

Windows Host OS

- 10-year LTS support
- Support for BSP and Drivers
- EDIB for image building
- OS Polices
- OS Configurations, Updates, and Certificates

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

Connect via Arc-connected cluster

AKS-EE Kubernetes Platform
K8s / K3s

Linux VM | Windows VM

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

Connect via Arc for servers

Hardware

EDGE

Flexible deployment options for cloud-native apps

Configuration	**AKS Edge Essentials**
Deployment Options	Windows 10/11 Pro/Enterprise Windows 10/11 IoT Enterprise Windows Server 2019/2022
Value	Small, easy to install, manage, and update, HA workloads & customer provided HA storage
Functionality	Fixed memory, networking, & compute, nodes are static & stay on each machine, basic HA support via workload failover and BYO HA storage
Target Devices	OT or IoT devices e.g., NUC gateway w/ core i3
Min HW Config	8 GB with at least 2.5 GB free RAM (8GB recommended), Core i3, standard NIC, 2 vCPUs
Supported OS	Windows 10/11 Pro/Enterprise Windows 10/11 IoT Enterprise Windows Server 2019/2022
Exists in Azure Resource Manager?	Yes, via Arc

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

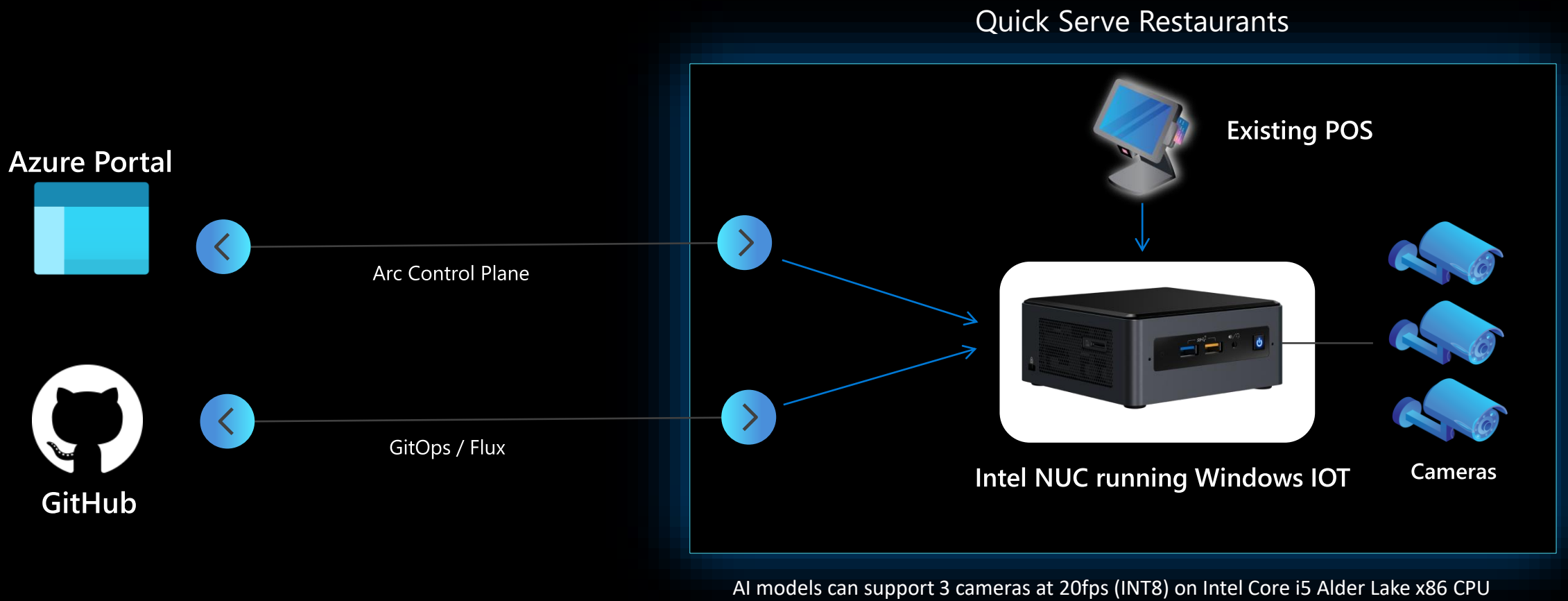
Intelligent chatbots

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