Kubernetes on Azure

Build, run and monitor your container applications

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Session objectives
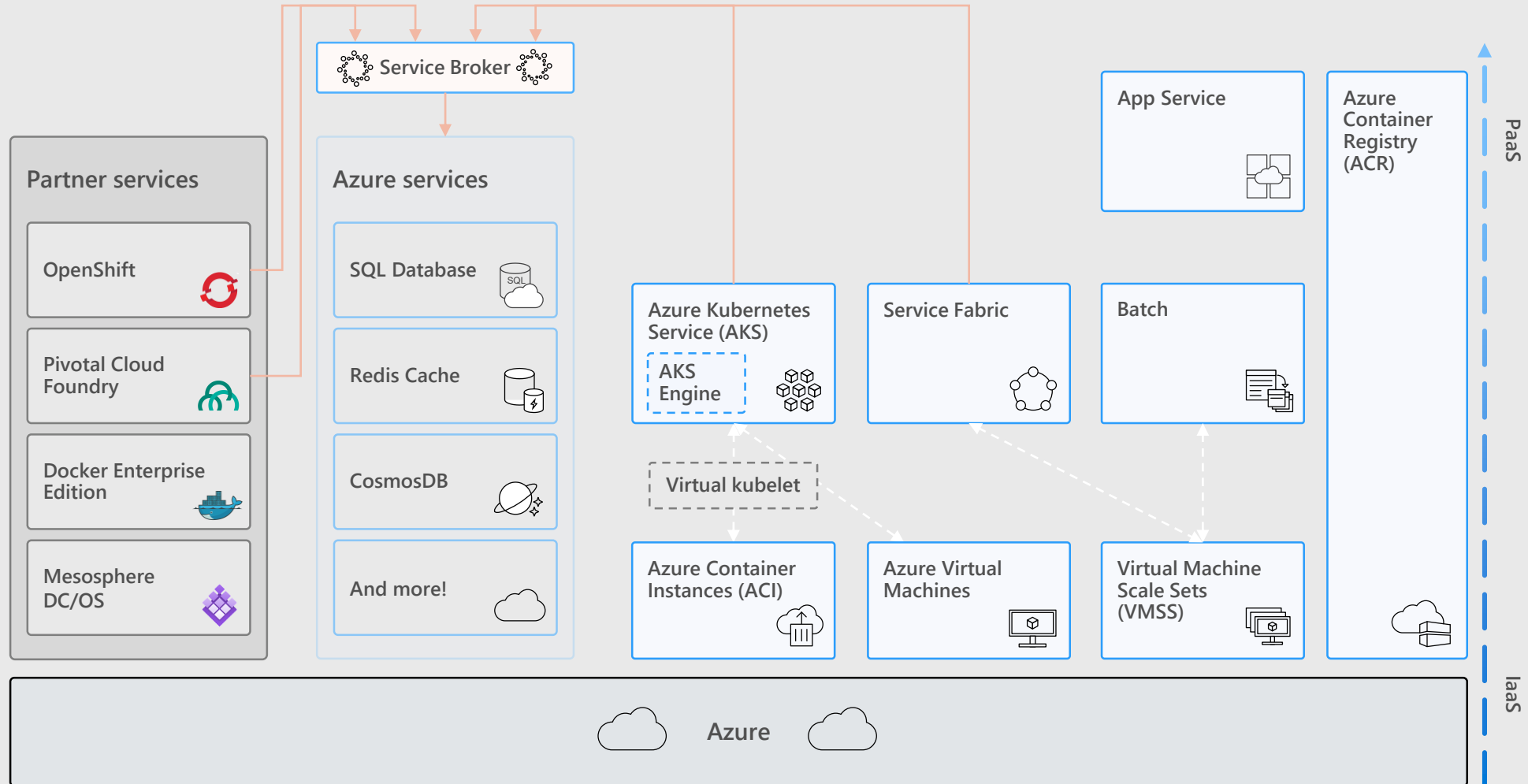
Learn how to build, run and monitor container applications with Microsoft Azure

Learn how to build a CI/CD pipeline with Azure DevOps for Kubernetes

Overview

Azure container ecosystem

Kubernetes: the industry leading orchestrator

Portable

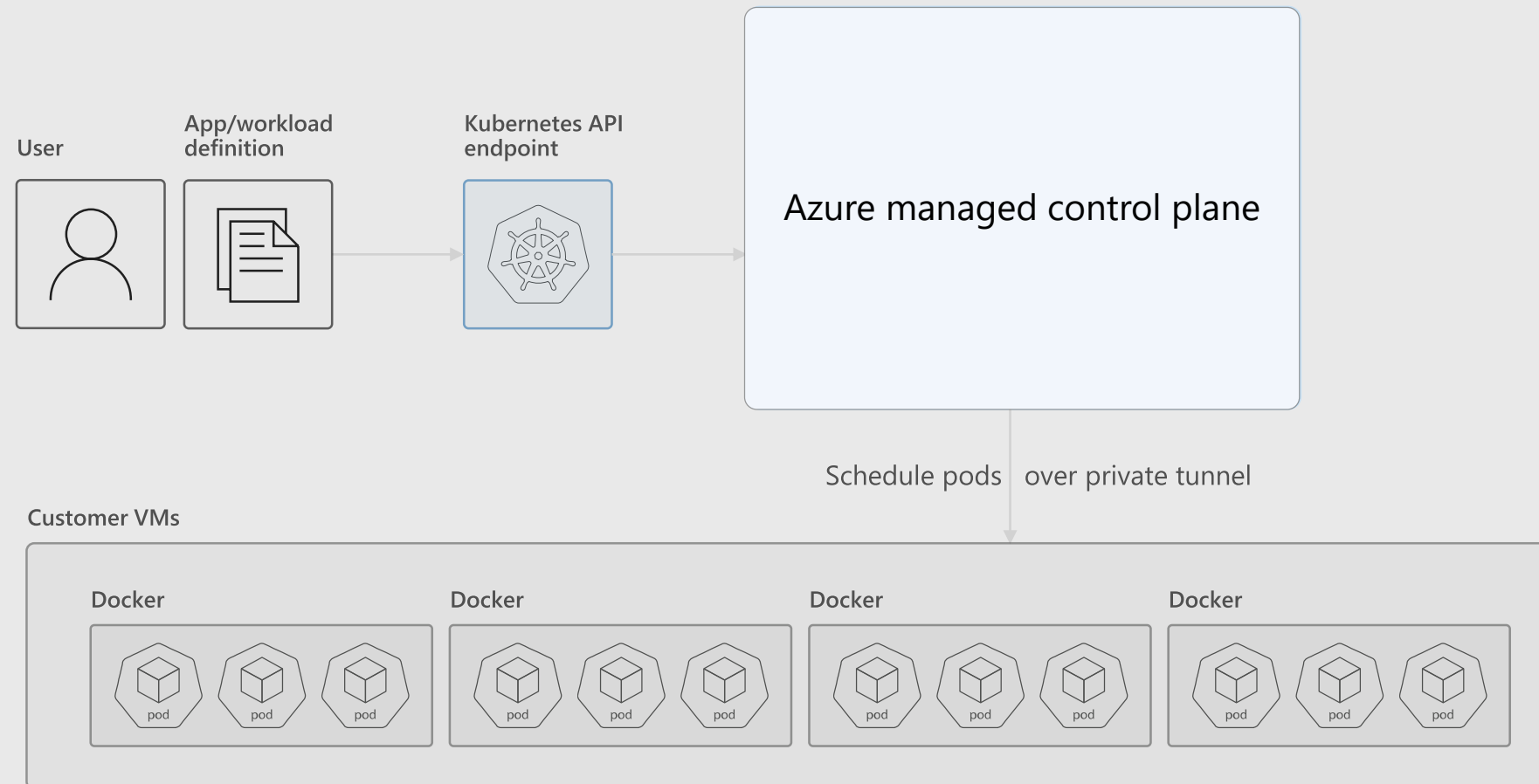Public, private, hybrid, multi-cloud

Extensible

Modular, pluggable, hookable, composable

Self-healing

Auto-placement, auto-restart, auto-replication, auto-scaling
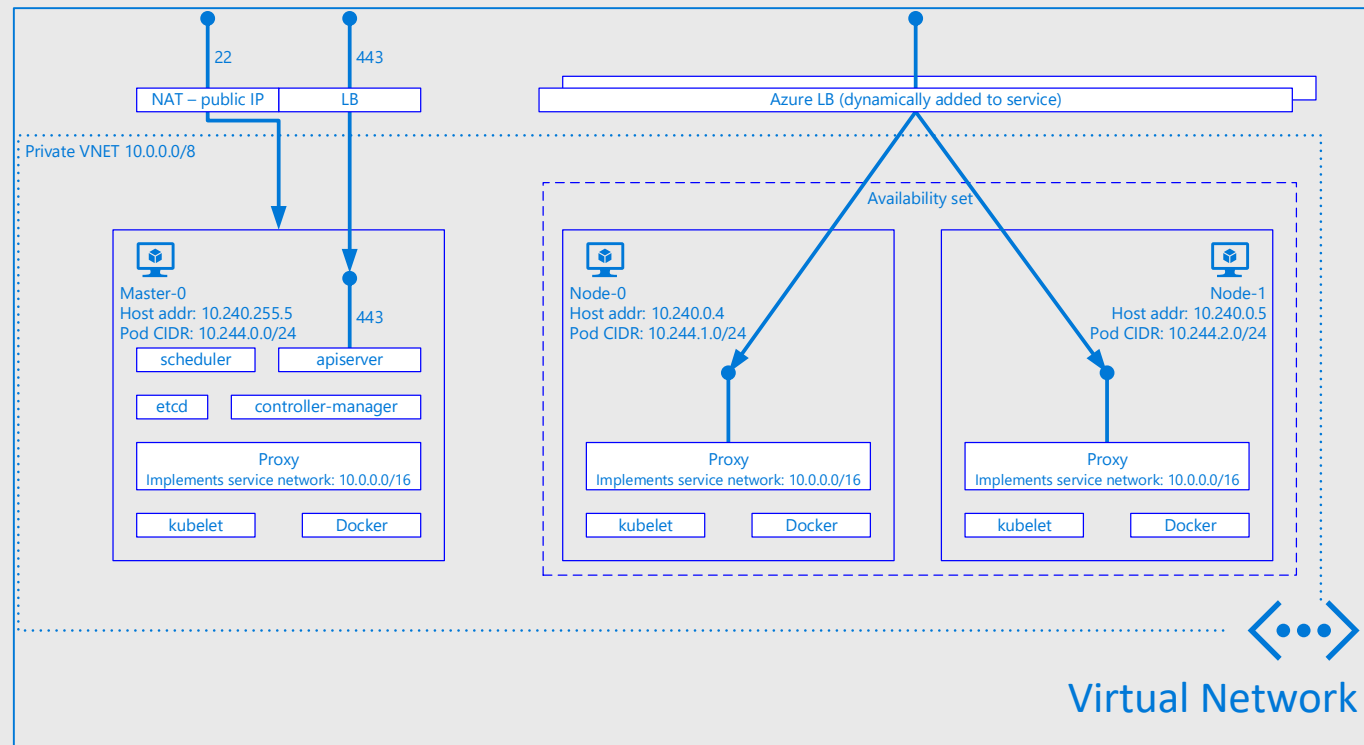
How managed Kubernetes on Azure works

User

App/workload definition

Kubernetes API endpoint

Azure managed control plane

Schedule pods over private tunnel

Customer VMs

Docker

pod pod pod

Docker

pod pod pod

Docker

pod pod pod

Docker

pod pod pod

AKS-Engine

AKS-Engine

Creates a customized Kubernetes cluster on Azure

AKS-Engine

Multiple agent pools where each agent pool can specify:

- Standard or premium VM sizes
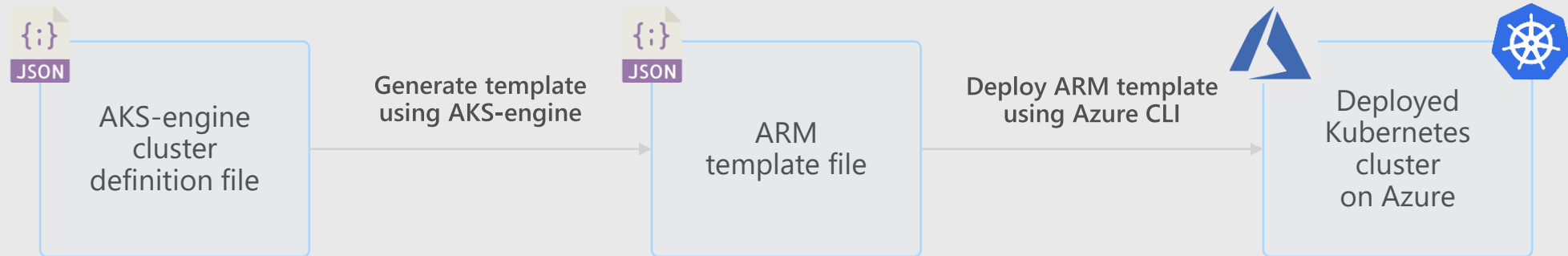- Node count
- VM Scale Sets or Availability Sets

Custom VNET

Support non-public Internet cluster deployments
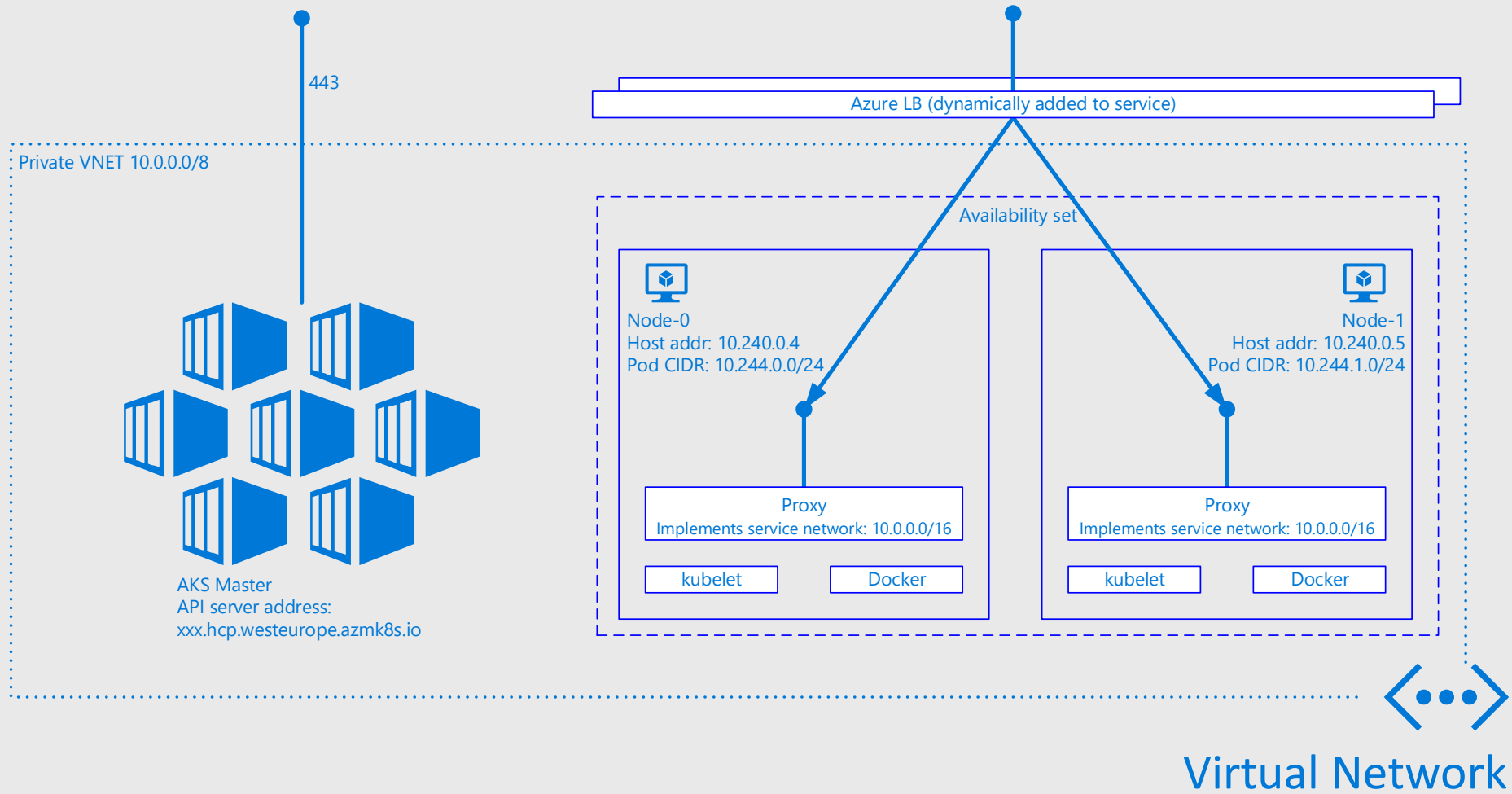
Azure Stack support

https://github.com/Azure/aks-engine

How AKS-Engine works

AKS-engine cluster definition file → Generate template using AKS-engine → ARM template file → Deploy ARM template using Azure CLI → Deployed Kubernetes cluster on Azure

Azure Kubernetes Service

443

Private VNET 10.0.0.0/8

Azure LB (dynamically added to service)

Availability set

Node-0
Host addr: 10.240.0.4
Pod CIDR: 10.244.0.0/24

Node-1
Host addr: 10.240.0.5
Pod CIDR: 10.244.1.0/24

Proxy
Implements service network: 10.0.0.0/16

Proxy
Implements service network: 10.0.0.0/16

kubelet

Docker

kubelet

Docker

AKS Master
API server address:
xxx.hcp.westeurope.azmk8s.io

Virtual Network

Azure Kubernetes Service

Simplify the deployment, management, and operations of Kubernetes

Automated Kubernetes version upgrades and patching

- Automated reboot: https://github.com/weaveworks/kured

Easy cluster scaling

- Cluster Autoscaler

- Horizontal Pod Autoscaler

VMSS support

Network policy support

- Calico

- Azure NPM

Azure Kubernetes Service

A fully managed Kubernetes cluster

Custom VNET with Azure CNI

Integration with Azure Monitor

Master logs export

RBAC support

Azure Active Directory integration
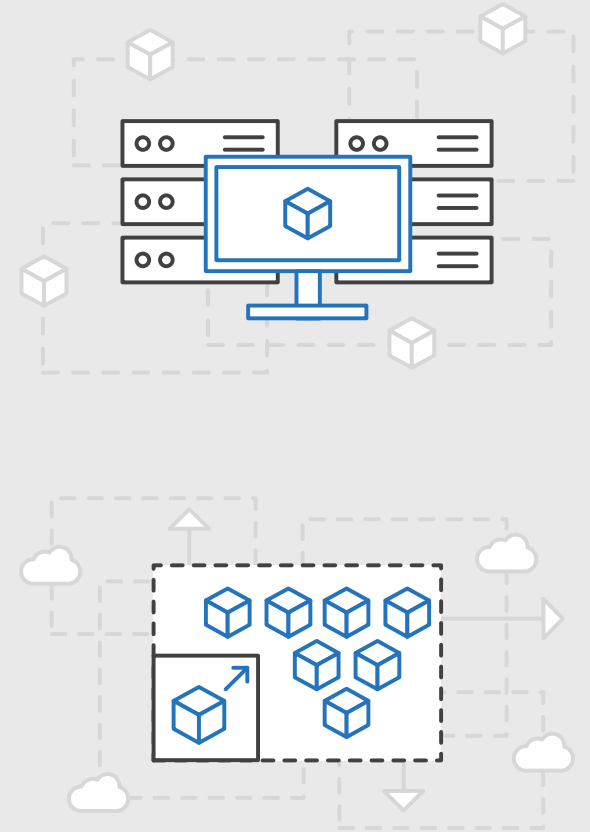
Azure Kubernetes Service

Extending AKS capabilities

Easily connect Azure managed services with Open Service Broker for Azure (OSBA)

https://github.com/Azure/open-service-broker-azure

https://docs.microsoft.com/en-us/azure/aks/integrate-azure

https://osba.sh/

Azure services

Azure Kubernetes Service (AKS)

Open Service Broker for Azure (OSBA)

ACS Engine

SQL Database

Event Hubs

Redis Cache

Azure Database for MySQL

CosmosDB

Azure Database for PosgreSQL

Service Bus

Azure Storage
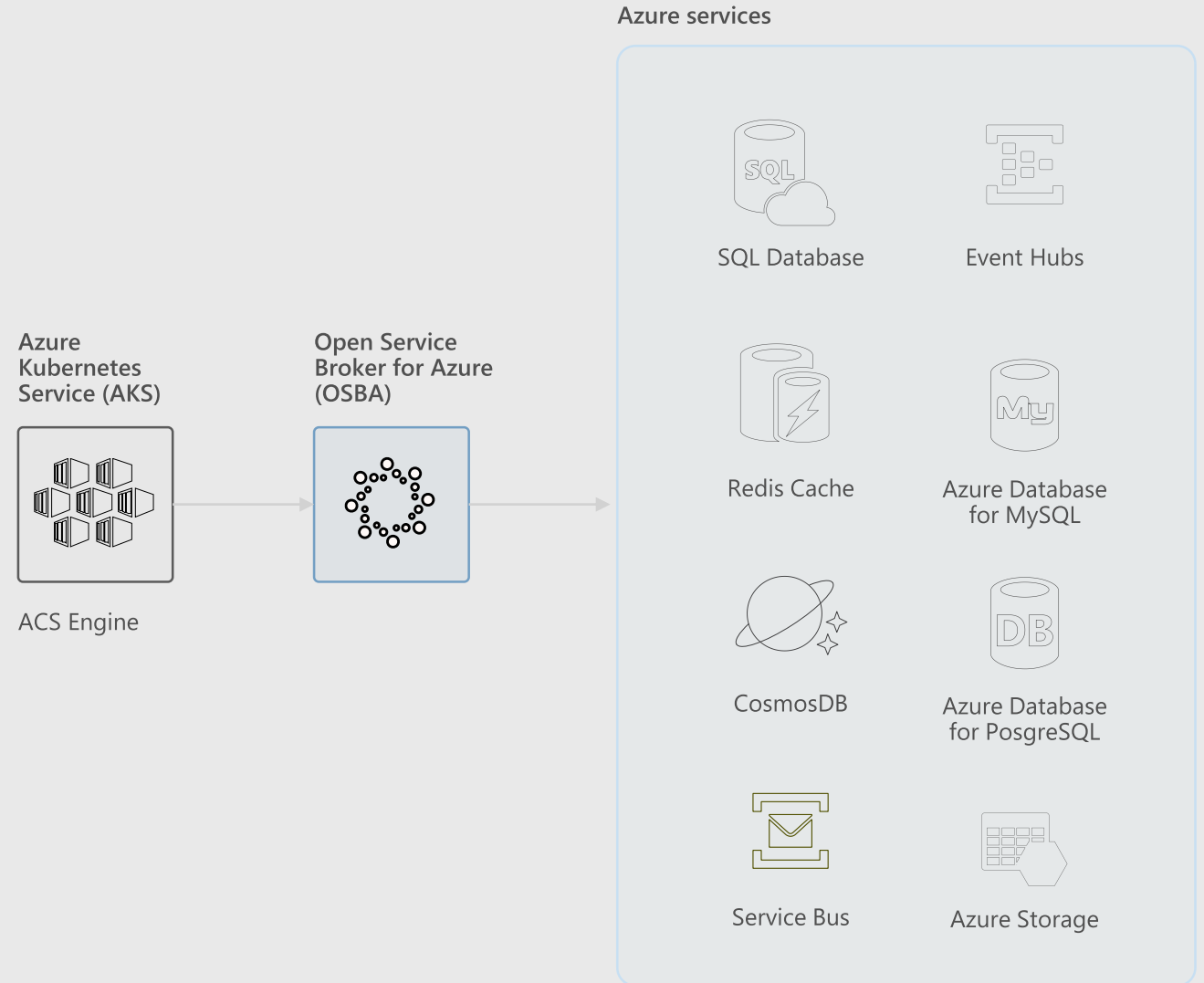
Azure Kubernetes Service

Extending AKS capabilities

AAD Pod Identity

Assign Azure Active Directory Identities to Kubernetes applications.
https://github.com/Azure/aad-pod-identity

Kubernetes KeyVault FlexVolume

With the Azure Key Vault FlexVolume, developers can access application-specific secrets, keys, and certs stored in Azure Key Vault directly from their pods.
https://github.com/Azure/kubernetes-keyvault-flexvol

kube-advisor

kube-advisor is a diagnostic tool for Kubernetes clusters. At the moment, it returns pods that are missing resource and request limits.
https://github.com/Azure/kube-advisor

Azure Kubernetes Service

Extending AKS capabilities

Azure Application Gateway Ingress Controller

The App Gateway ingress controller enables the use of the Azure Application Gateway service as a layer 7 load balancer in front of Kubernetes services, providing a fully managed alternative to running something like Nginx directly inside the cluster.

https://github.com/Azure/application-gateway-kubernetes-ingress

Create Azure Kubernetes Service

1. `az group create --name aks-demo-rg --location westeurope`

2. `az aks create --resource-group aks-demo-rg --name aks-demo-cluster --node-count 3 --node-vm-size Standard_D2s_v3 --generate-ssh-keys`

3. `az aks get-credentials --resource-group aks-demo-rg --name aks-demo-cluster`

Azure Container Instances

Azure Container Instances

Easily run containers on Azure without managing servers
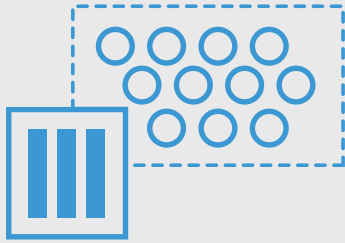
Run containers
without managing
servers
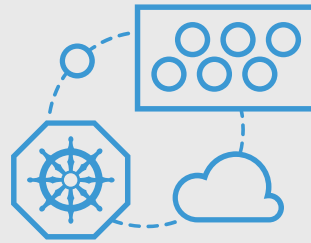
Increase agility
with containers on
demand
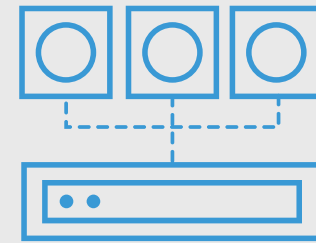
Secure applications
with hypervisor
isolation

Azure Container Instances
Common scenarios

Azure Cloud Shell

Event-driven applications

CI/CD agents

Data processing jobs
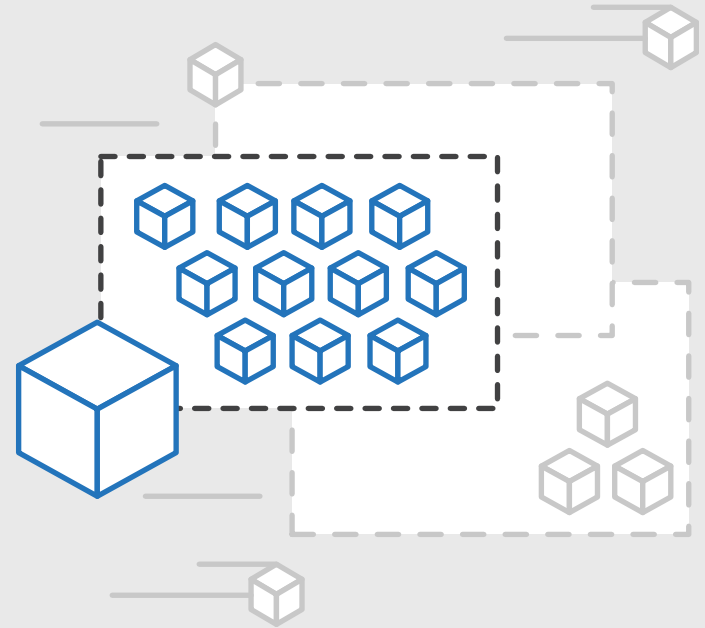
Azure Container Instances

Previews

Azure Virtual Network integration

- Australia East

- East US / West US

- North Europe / West Europe

- https://docs.microsoft.com/en-us/azure/container-instances/container-instances-vnet

GPU enabled

- East Asia

- Central India

- East US / West US 2 / South Central US

- North Europe / West Europe

- https://docs.microsoft.com/en-us/azure/container-instances/container-instances-gpu

Create Azure Container Instances

1. `az group create --name aci-demo-rg --location westeurope`

2. `az container create --resource-group aci-demo-rg --name acidemocontainer --image microsoft/aci-helloworld --dns-name-label aci-demo-container --ports 80`

3. `az container exec --resource-group aci-demo-rg --name acidemocontainer --exec-command "/bin/sh"`

4. `http://aci-demo-container.westeurope.azurecontainer.io/`

Virtual Kubelet / AKS Virtual Node

Virtual Kubelet

Virtual Kubelet is an open source Kubernetes kubelet implementation that masquerades as a kubelet for the purposes of connecting Kubernetes to other APIs.

Azure Container Instances Connector

Azure IoT Edge Connector

Azure Batch Connector

Service Fabric Mesh Connector

https://github.com/virtual-kubelet/virtual-kubelet

https://github.com/Azure/iot-edge-virtual-kubelet-provider/

ACI Connector for Kubernetes
aka Virtual Kubelet
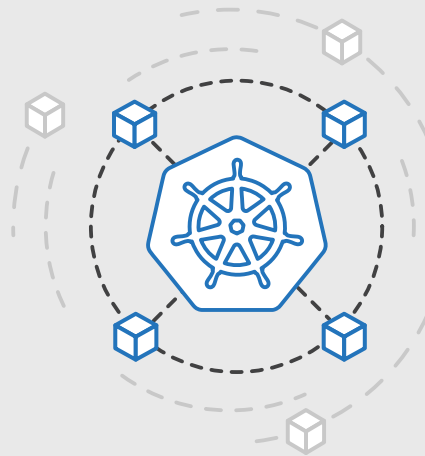
Kubernetes provides rich orchestration capabilities
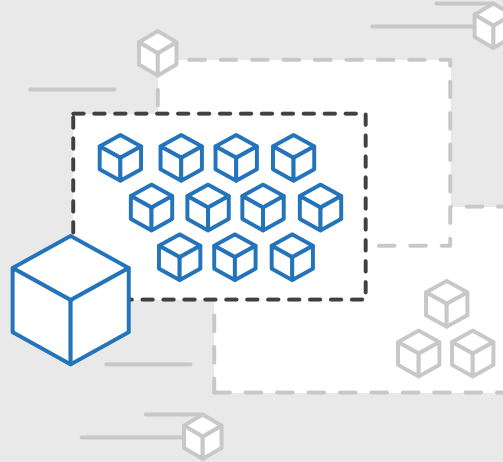
ACI provides infinite container-based scale
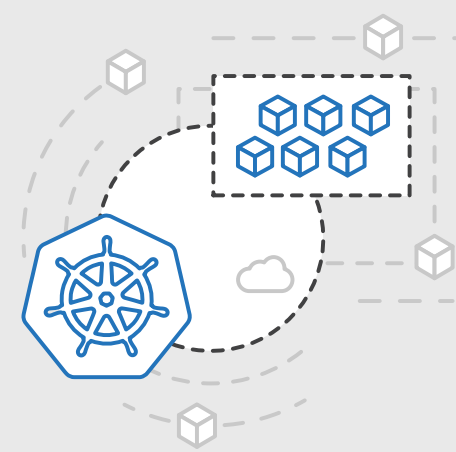
The ACI Connector for K8s brings them together
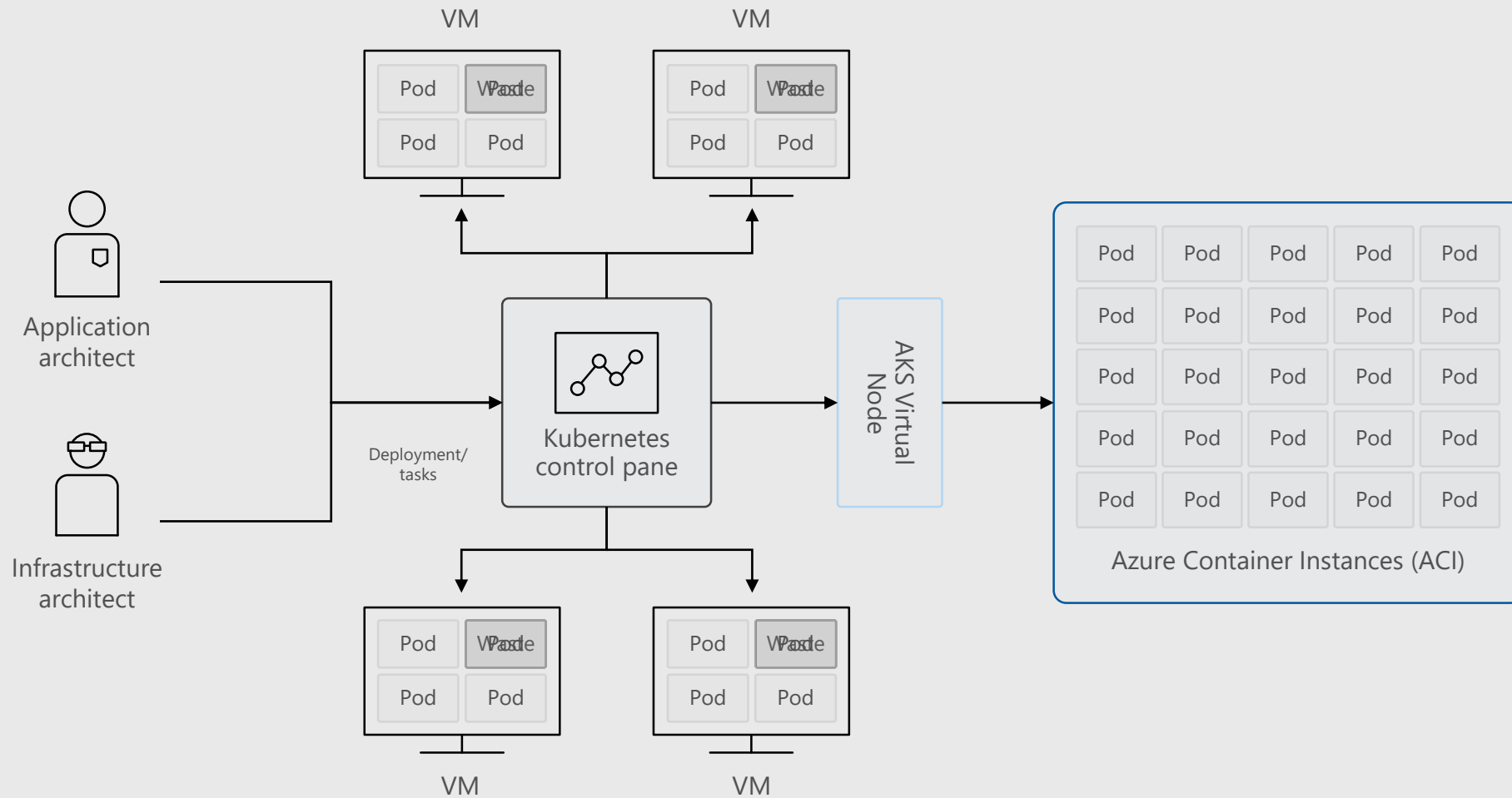
Virtual Kubelet

IoT Edge Connector
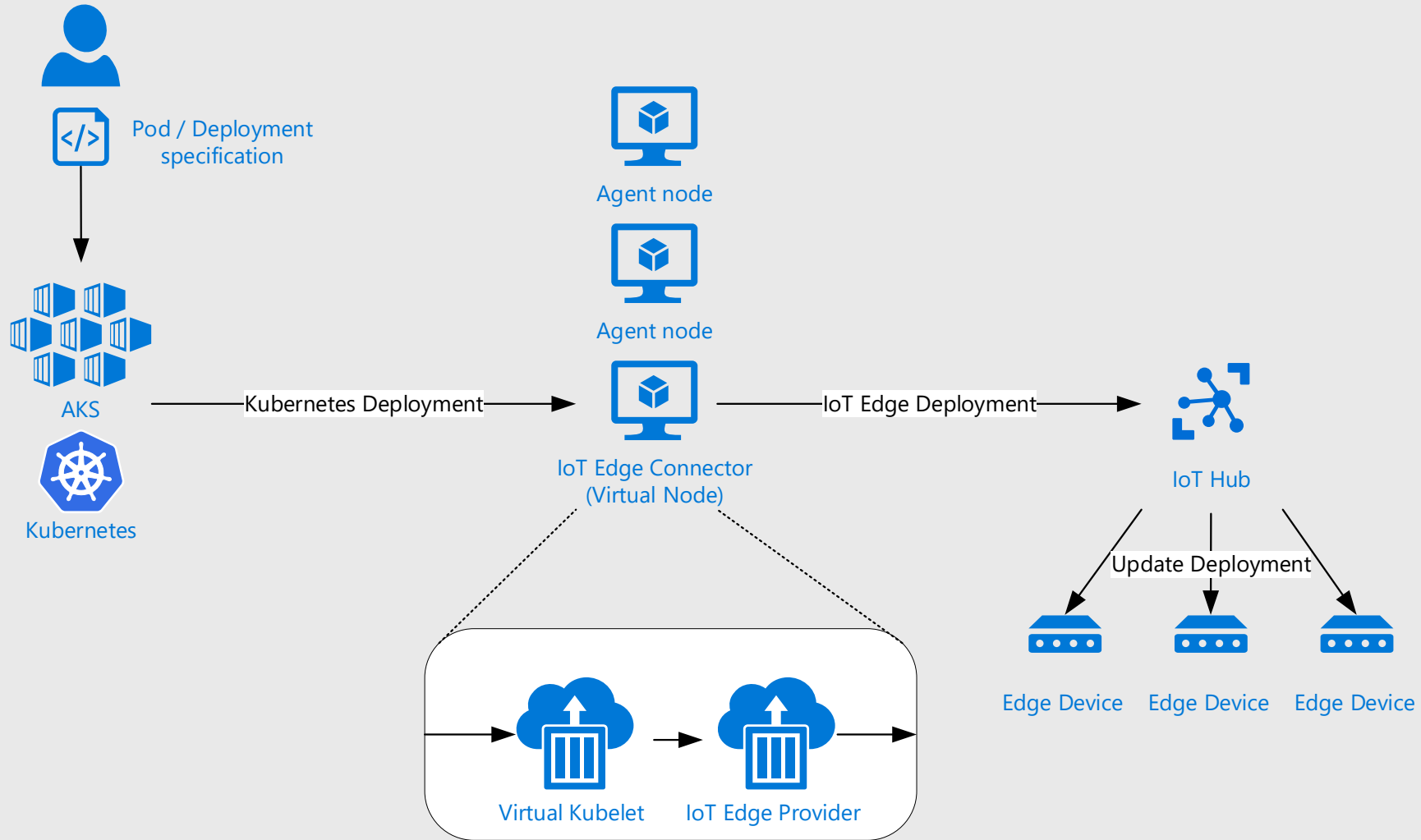
FROM /messages/modules/tempsensor/
outputs/temperatureOutput INTO
BrokeredEndpoint(\"/modules/function/
inputs/input1\")

FROM /messages/modules/tempsensor/
outputs/temperatureOutput INTO
BrokeredEndpoint(\"/modules/
streamanalytics/inputs/temperature\")

FROM /messages/modules/
streamanalytics/* INTO
BrokeredEndpoint(\"/modules/
tempsensor/inputs/control\")

FROM /messages/modules/
streamanalytics/* INTO $upstream

FROM /messages/modules/function/
outputs/* INTO $upstream
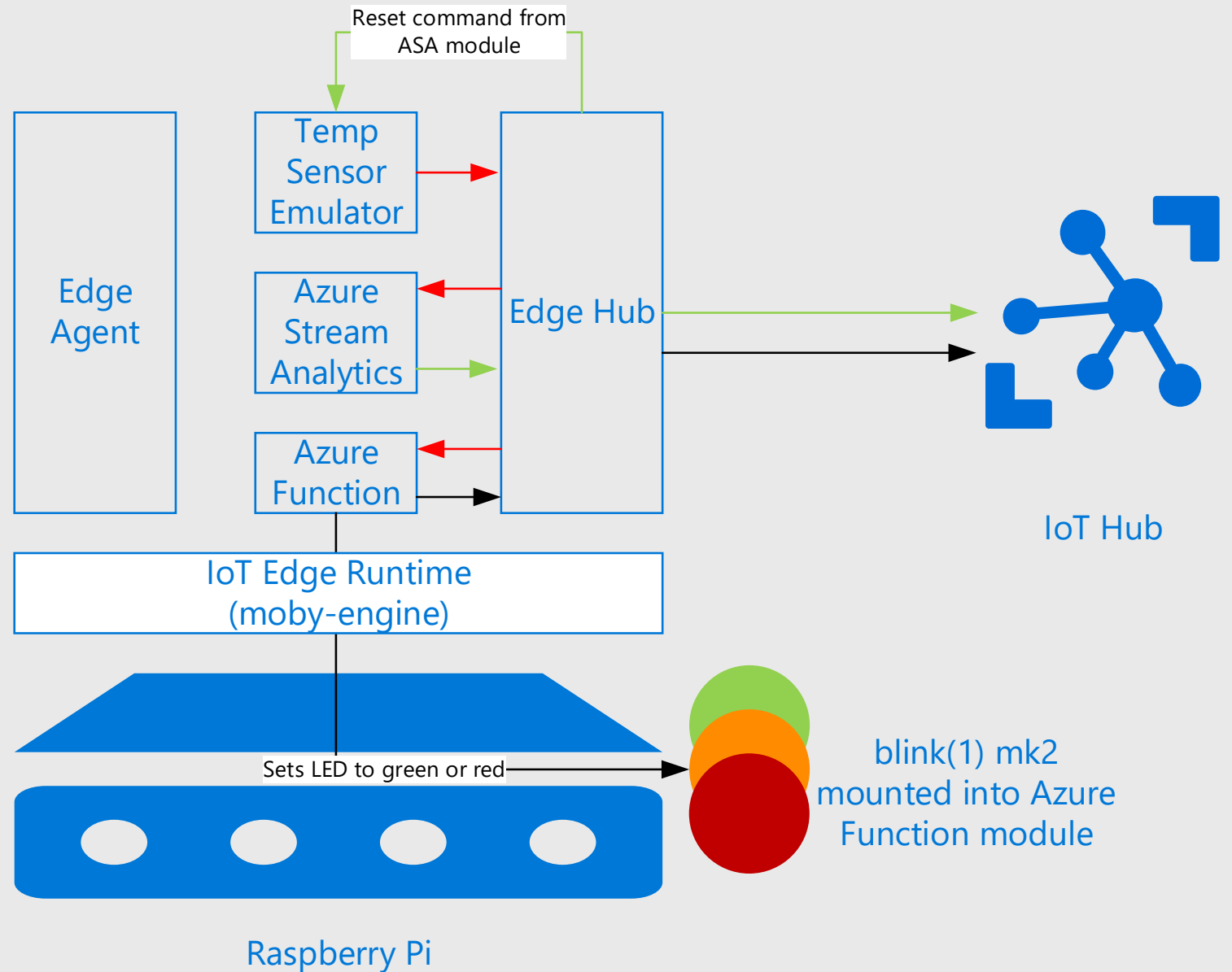
Reset command from
ASA module

Temp
Sensor
Emulator

Edge
Agent

Azure
Stream
Analytics

Edge Hub

Azure
Function

IoT Hub

IoT Edge Runtime
(moby-engine)

Sets LED to green or red

blink(1) mk2
mounted into Azure
Function module

Raspberry Pi

Azure Container Registry

Azure Container Registry

Docker private registry

Use familiar, open-source Docker command line interface (CLI) tools

Simplify registry access management with Azure Active Directory
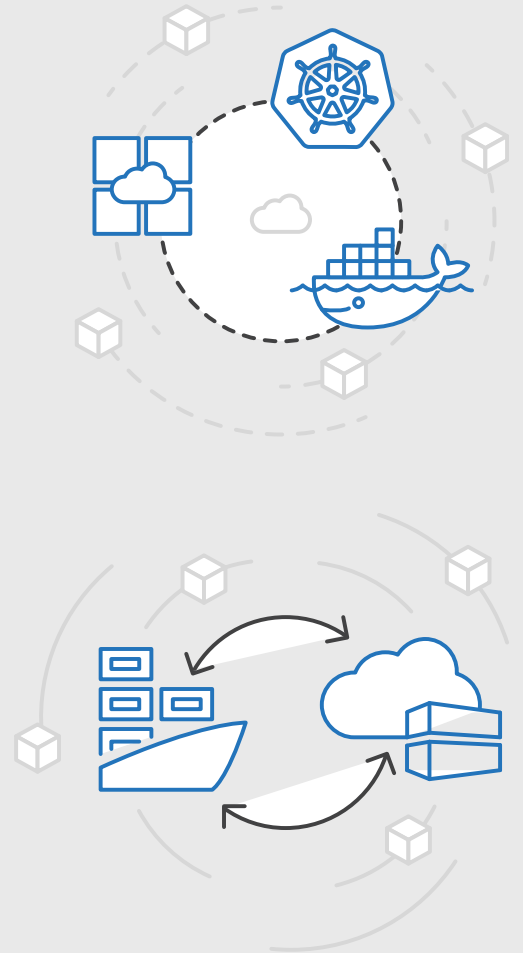
Azure Container Registry

Geo-replication support

Helm Charts repository support

ACR Build

Lifecycle Management, OS & Framework Patching

Secure by default container registries

Aqua Security and Twist Lock integration

Trusted images support
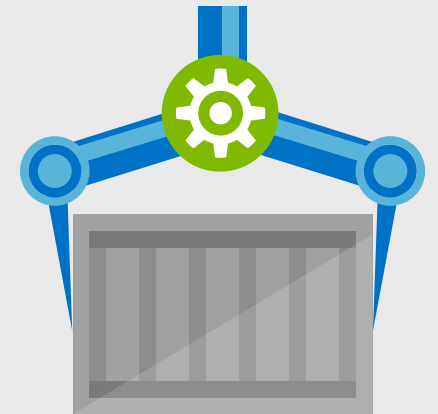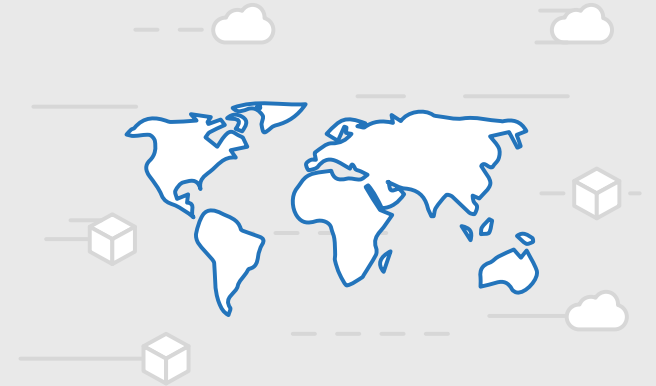
Containers as the application packaging format
Deploy to your preferred environment

Azure clients:
PS, CLI, Portal, SDK

Developer tools:
VS, VS Code, Azure DevOps

OSS clients:
GitHub, Terraform, Draft, Helm, etc.

Azure Container Registry (ACR)

Azure Kubernetes Service (AKS)

Azure Container Instances (ACI)

Service Fabric

App Service

Machine Learning

IoT
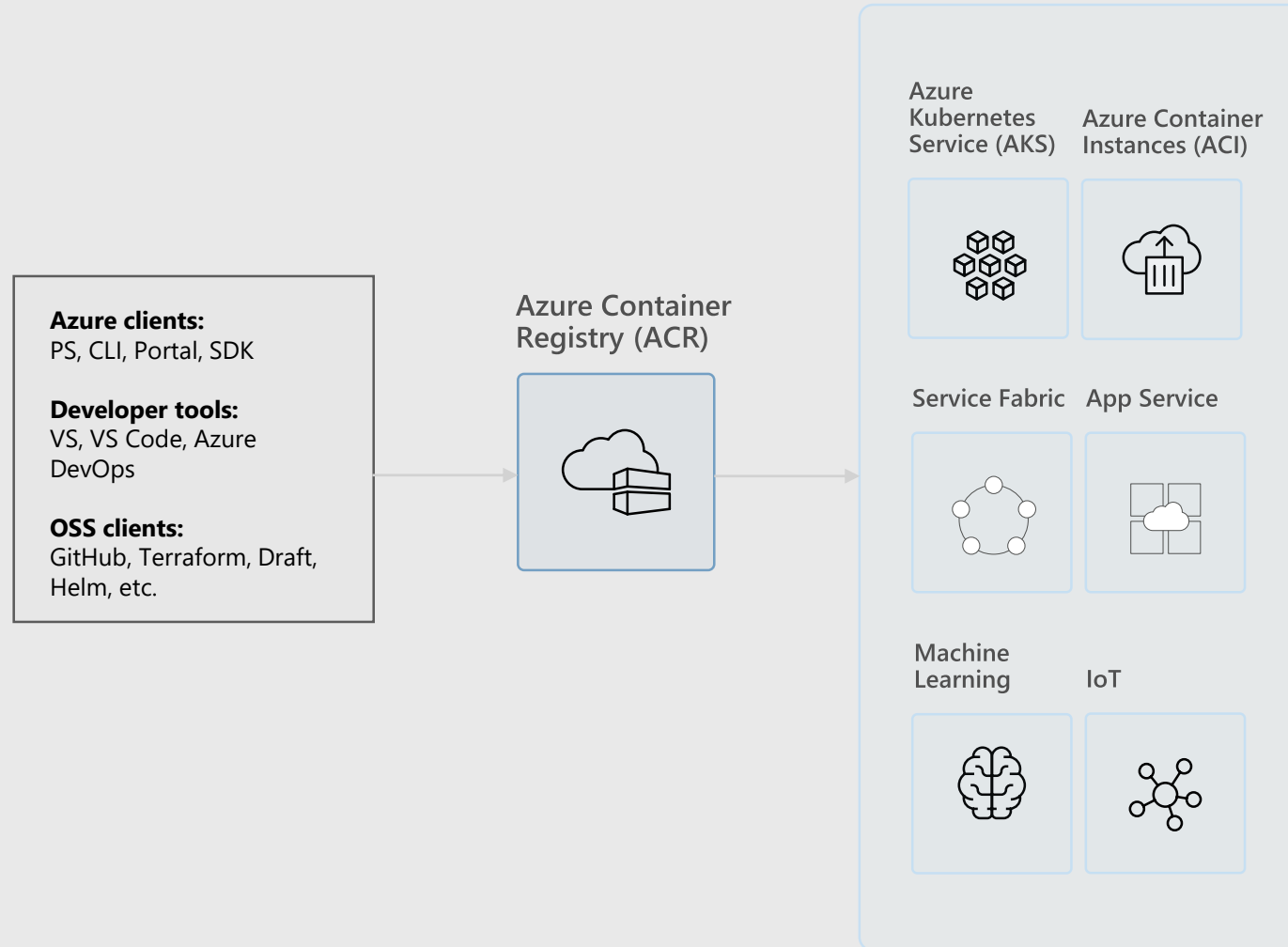
Create Azure Container Registry

1. ```
   az group create --name acr-demo-rg --location westeurope
   ```

2. ```
   az acr create --resource-group acr-demo-rg --name aksdemoacr --sku Basic --admin-enabled $true
   ```

Azure Monitor for containers

Azure Monitor for containers

Requirements

- Azure Log Analytics workspace
- Container Insights solution

Supports

- Azure Kubernetes Service
- AKS-Engine
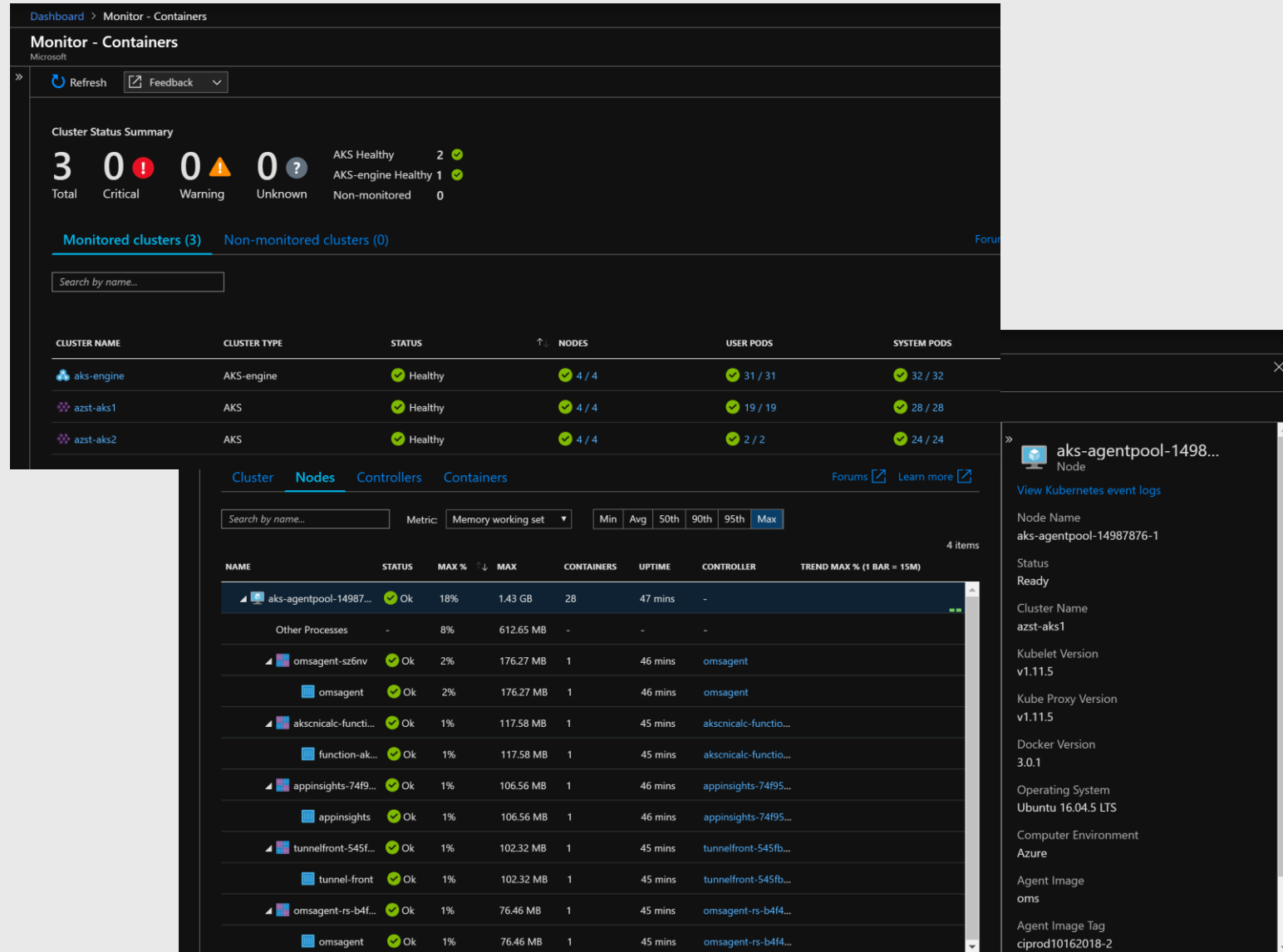
Azure DevOps

Azure DevOps

Azure Repos – Unlimited free private Git repositories

Azure Pipelines – Cloud-powered CI/CD

Azure Boards – Track bugs, work items, feedback, and more

Azure Test Plans – Test and ship with confidence using testing tools

Azure Artifacts – Create, host, and share packages with your team

Free for up to five users

Azure DevOps Project

Azure DevOps Project

Built-in support for popular application frameworks

.NET, Java, PHP, Node, Python, Go, ...

Deploy to the platform of your choice

Azure Kubernetes Service, Azure Web App, ...

Application Insights integration

Cloud-powered CI/CD

Azure Pipelines

Serverless
Azure Functions on Kubernetes

Serverless

Azure Functions on Kubernetes

Azure Functions Core Tools

The Core Tools will build and push a Docker image of the function to a given registry and create corresponding Kubernetes objects including a Deployment, Service and Horizontal Pod Autoscaler.

https://github.com/Azure/azure-functions-core-tools#getting-started-on-kubernetes

Open Source Tooling

Microsoft builds open source projects

Helm – The de-facto package manager for Kubernetes (https://helm.sh), Top level CNCF project

Draft – A rapid-development environment for new Kubernetes developers (https://draft.sh)

Brigade – Easy to use JavaScript based workflow definition for Kubernetes (https://brigade.sh)

Kubernetes + VS-Code (https://github.com/Azure/vscode-kubernetes-tools)

Work how you want with opensource tools and APIs

	Development	DevOps	Monitoring	Networking	Storage	Security
Take advantage of services and tools in the Kubernetes ecosystem	HELM DRAFT	Jenkins Terraform BRIGADE JFrog CODESHIP	Prometheus fluentd Grafana OPENTRACING DATADOG JAEGER	CNI Networking TIGERA	MAPR portworx	Twistlock aqua heptio HASHICORP RBAC
OR, **Leverage growing Azure support**	VS Code	DevOps ARM	Azure Monitor	Azure VNET	Azure Storage	Azure Container Registry AAD Key Vault

Summary

Take aways

Azure Kubernetes Service is the future

- Simplified management
- Focus on your container workloads

Azure Container Registry

- Managed Docker private registry with geo-replication support for simplified management and operations

Azure Monitor for containers

- Azure Kubernetes Service monitoring integrated into the Azure portal

Azure DevOps & DevOps Projects

- The swiss army knife