

#ScottishSummit2024

Multi-Cloud Management and On-Premises Integration

Wolfgang Ofner



Thank You to our Sponsors...



Platinum Sponsor

Capgemini 

Gold Sponsors

resco

WGW

dox42[®]
automate your documents
integrate your data

 Kerv Digital

#ScottishSummit2024

Thank You to our Sponsors...



With Thanks



#ScottishSummit2024

Wolfgang Ofner



- Freelance Cloud Architect, Toronto, Canada
- Azure, Kubernetes, DevOps, and .NET
- Love to teach and talk tech



<https://linktr.ee/WolfgangOfner>



Freelance
Cloud
Architect

#ScottishSummit2024

Agenda



Introduction to Hybrid Cloud

Azure Arc and Kubernetes

Integration On-Premises with Cloud

Conclusion

#ScottishSummit2024

Hybrid Cloud



Hybrid Cloud Definition



Hybrid Cloud is a combination of public and private cloud services, along with on-premises infrastructure, creating a unified computing environment that offers greater flexibility, scalability, and cost-effectiveness.

Types of Hybrid Cloud



Split cloud and on-premise usage

Extend on-premise usage with simple cloud services

- Storage or database services
- VPN or ExpressRoute into the cloud

Unify on-premises and cloud environment

- Run cloud services in your datacenter

Benefits of Hybrid Cloud



Data Sovereignty

Security

Latency

Cost

Resiliency

Challenges of Hybrid Cloud



Complex infrastructure

Security and compliance

Data integration

Skill set

Run Azure Services On-Premises



Hardware solutions:

- Azure Stack Edge
- Azure Stack Hub
- Azure Stack HCI

Software solutions:

- Azure Arc

Azure Stack HCI



Azure Stack HCI OS is an operating system based on Windows Server

Built on proven technologies such as Hyper-V, Storage Spaces Direct, and Azure-inspired SDN

Each cluster consists of 1 to 16 physical servers

Azure Stack HCI



Often used in disconnected scenarios:

- Cruise ships
- Planes
- Factories with unreliable internet
- Remote locations



Azure portal, ARM and bicep templates, Azure CLI and tools

Microsoft
Entra ID



Azure Site Recovery



Azure Backup



Azure File Sync



Azure Update Manager



Additional
Azure services
integration via
Arc



Azure Policy



Azure Monitor



Azure Key Vault



Microsoft Defender for Cloud



Azure Stack HCI solution



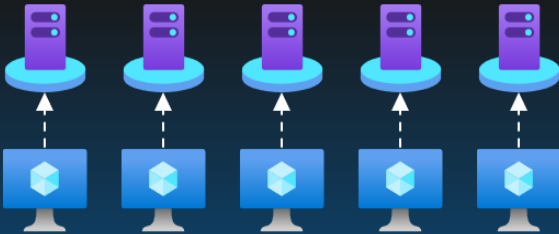
Traditional, non-containerized applications



Kubernetes-based
applications



Arc-enabled services



Windows and Linux virtual machines as Arc-enabled servers



Azure Virtual Desktop



AKS enabled by Azure Arc



Hyper-V



Storage Spaces Direct

Azure Stack HCI Operating System



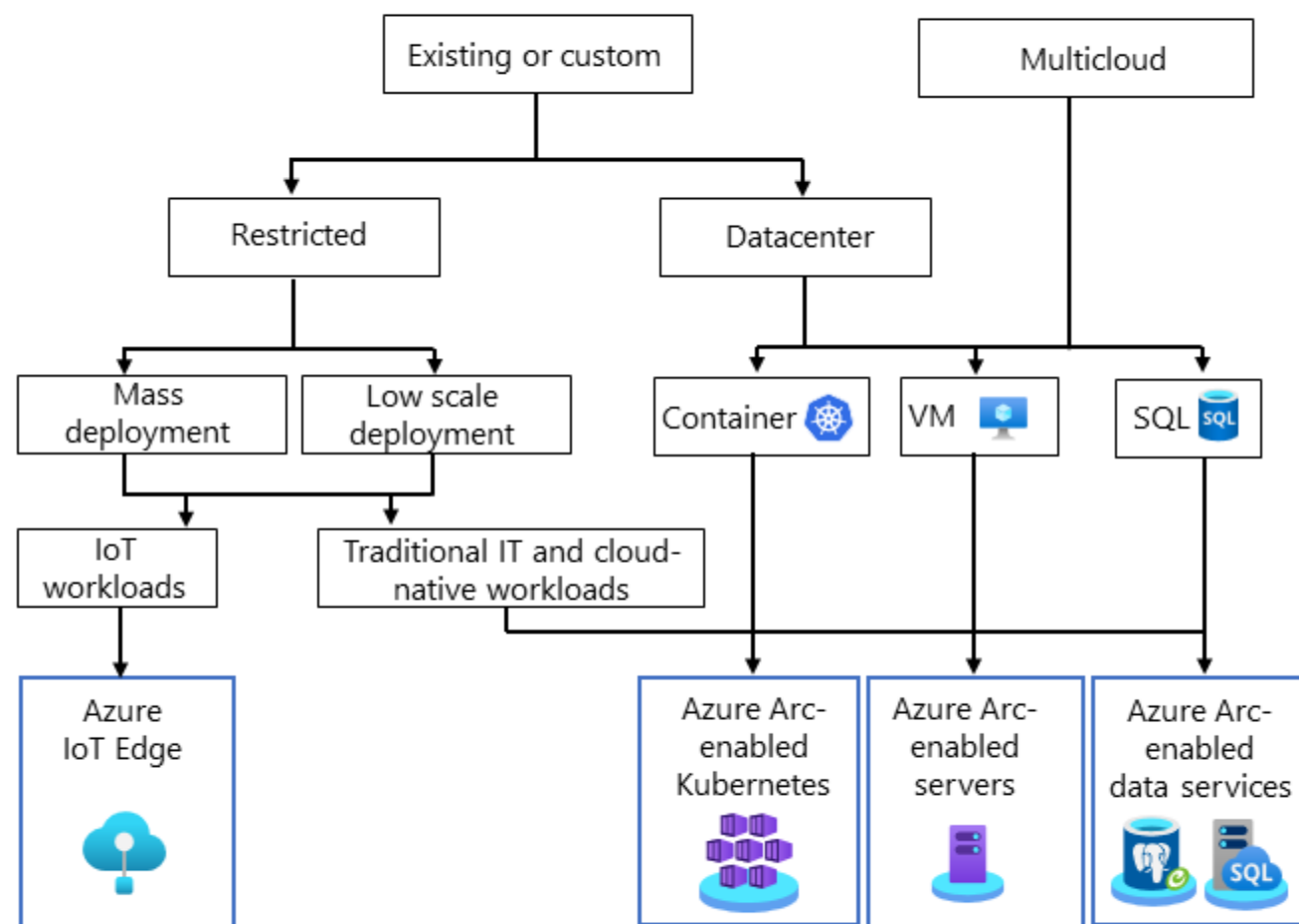
Premier solutions



Validated nodes



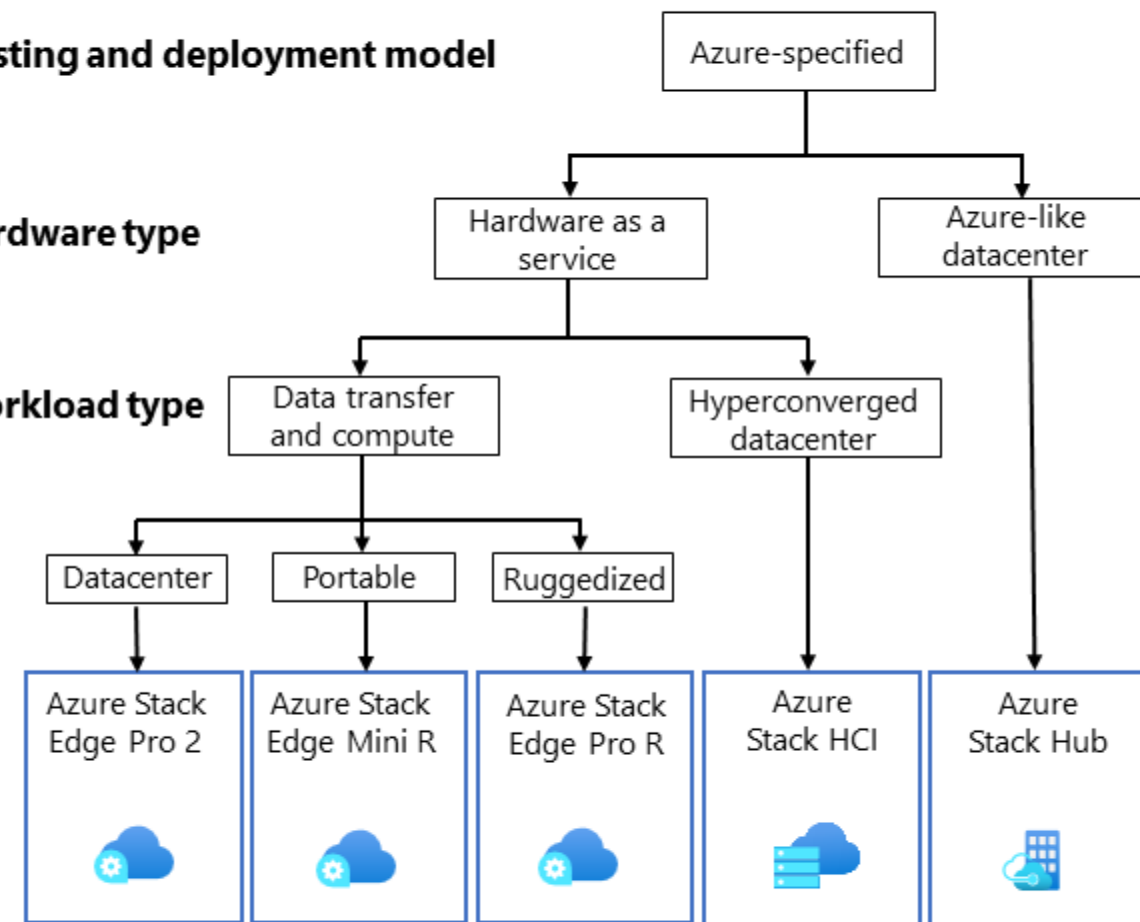
Integrated systems



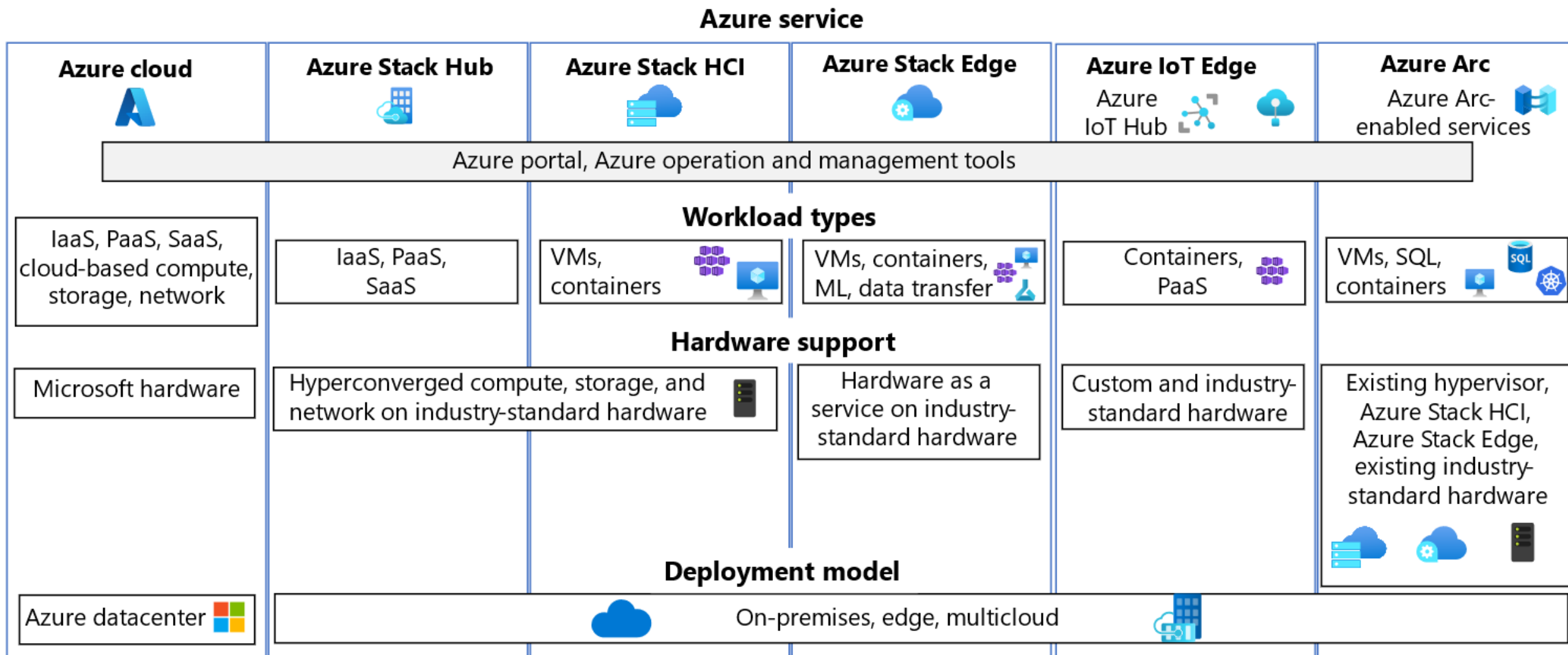
Hosting and deployment model

Hardware type

Workload type



Azure service



#ScottishSummit2024

Azure Arc

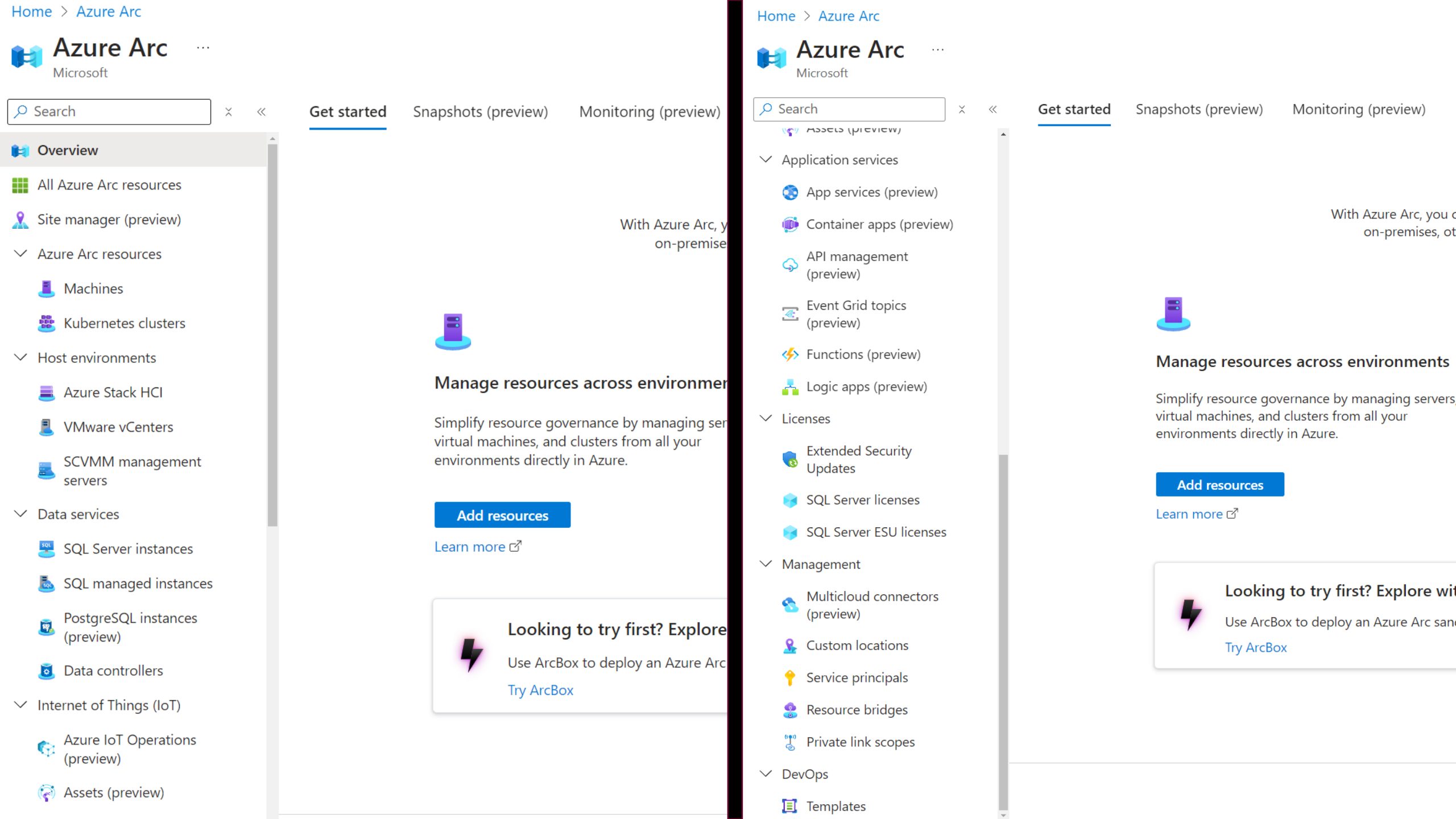


Hybrid



Project infrastructure running outside of Azure into Azure

- Linux and Windows VMs and bare metal servers
- Any CNCF certified Kubernetes distribution
- Microsoft SQL Server





Azure Arc | Kubernetes clusters



Microsoft

 Search



 Add 

 Manage view 















 Refresh

 Export to CSV

 Open query

|


 Assign tags


-  Overview
-  All Azure Arc resources
-  Site manager (preview)
-  Azure Arc resources
-  Machines
-  **Kubernetes clusters**
-  Host environments
-  Azure Stack HCI
-  VMware vCenters
-  SCVMM management servers
-  Data services
-  SQL Server instances
-  SQL managed instances
-  PostgreSQL instances (preview)

Filter for any field...

Subscription equals **all**

Type equals **all**

Resource group equals **all** 

 Add filter

Showing 1 to 3 of 3 records.

No grouping 

 Li

<input type="checkbox"/>	Name 	Type 	Resource group 	Kubernetes version 	Location 
<input type="checkbox"/>	 dev-cluster-testing-arc	Kubernetes - Azure Arc	Testing	1.30.2	Canada Central
<input type="checkbox"/>	 HR-operations	Kubernetes - Azure Arc	HR	1.28.0	Canada Central
<input type="checkbox"/>	 k3s-Arc	Kubernetes - Azure Arc	ArcDemo	1.29.7	Canada Central



k3s-Arc | Namespaces

Kubernetes - Azure Arc



Search



- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Kubernetes resources (preview)

- Namespaces
- Workloads
- Services and ingresses
- Storage
- Configuration

Settings

- Extensions
- Open Service Mesh
- GitOps
- Policies
- Properties
- Locks



Sign in to view your Kubernetes resources.

A service account bearer token is required to view the Kubernetes resources on this cluster. This can be created using kubectl while connected to your cluster via CLI. [Learn how to create a service account bearer token](#)

Service account bearer token * ⓘ

Sign in

#ScottishSummit2024

Azure Arc Extensions



Azure Arc extensions



Bring Azure Services to your Kubernetes cluster

- GitOps for deployments
- Azure Monitor
- Azure Key Vault Secrets Provider

Git Ops Extension



Uses Flux as GitOps agent

Can be installed via Azure CLI or Azure Portal

2 repositories

- Application repository
- Configuration repository



Azure
DevOps



Trigger CI



CI Pipeline

Push
Image



Azure
Container
Registry

Pull
Image



Kubernetes



Azure Arc-enabled
Kubernetes cluster

Deploy state change



Flux

Pull desired cluster state

GitOps Connector

Application
Repo

Validate PR



PR Pipeline

Trigger CD



CD Pipeline

Desired State PR



GitOps
Repo

Cluster 1

Cluster ...j

Cluster N

Git Ops Extension Installation



Single Azure CLI command to configure and install GitOps operator

Git Ops Extension Installation



```
PS C:\Users\Wolfgang> az k8s-configuration flux create `
>> --cluster-name k3s-Arc `
>> --resource-group ArcDemo `
>> --name arcdemo-gitops `
>> --namespace azurearcdemo `
>> --cluster-type connectedClusters `
>> --scope cluster `
>> --https-user wolfgang@programmingwithwolfgang.com `
>> --https-key 7ubfok7viuepij24pymxblsekhyjcdjxbsqgcczyplso6sv3x5a `
>> --url https://dev.azure.com/ProgrammingWithWolfgang/AzureArcDemo/_git/AzureArcDemoGitOps `
>> --branch master `
>> --kustomization name=app path=./AzureArcDemo prune=true
D:\a\_work\1\s\build_scripts\windows\artifacts\cli\Lib\site-packages\cryptography\hazmat\backends\openssll
/backend.py:27: UserWarning: You are using cryptography on a 32-bit Python on a 64-bit Windows Operating
System. Cryptography will be significantly faster if you switch to using a 64-bit Python.
'Microsoft.Flux' extension not found on the cluster, installing it now. This may take a few minutes...
```

Git Ops Deployment



Home > k3s-Arc

 **k3s-Arc | GitOps** ☆ ...
Kubernetes - Azure Arc



 Create  Delete  Refresh

 Configuration

Settings


 Extensions




 Open Service Mesh

 GitOps

 Policies

 Properties

 Flux configurations can now be monitored across clusters, subscriptions, resource groups, etc. [Learn more](#) 



<input type="checkbox"/>	Configuration	Compliance	Namespace	Scope	State	Source last updated
<input type="checkbox"/>	arcdemo-gitops	 Compliant	azurearcdemo	cluster	 Succeeded	Wed Jan 17 2024 03:25:58 GMT-0500 (Eastern Standard Time) 

#ScottishSummit2024

Git Ops Deployment



[Home](#) > [k3s-Arc | GitOps](#) >

 **k3s-Arc/arcdemo-gitops**   ...
GitOps configuration



 Search



Delete




Refresh



Give feedback


 Overview

 Configuration objects

 Source

 Kustomizations

Status

Compliance state	 Compliant
Configuration objects	3 objects
Installation status	Succeeded
Source last sync commit	master@sha1:4ad385bd016dc352ecc0839505f22794c2...
Source last updated	2024-01-17, 3:25:58 a.m.
Status last updated	2024-01-17, 3:47:01 a.m.

Properties

Namespace	azurearcdemo
Scope	cluster
Type	Flux v2
Kustomizations	1 Kustomizations

Source

Source kind	GitRepository
Repository URL	https://dev.azure.com/ProgrammingWithWolfgang/Az...
Repository reference type	Branch
Branch	master
Repository public key	---
Sync interval	1 mins
Sync timeout	1 mins

#ScottishSummit2024

Git Ops Deployment



```
PS C:\Users\Wolfgang> kubectl get pods -n azurearcdemo
```

NAME	READY	STATUS	RESTARTS	AGE
azurearcdemo-64fbd7fcfc-4v6qr	1/1	Running	0	28m

GitOps Repository



Kustomize file referencing all release files

GitOps Repository



```
apiVersion: kustomize.config.k8s.io/v1
kind: Kustomization
resources:
- HelmRelease.yaml
```

GitOps Repository



Kustomize file referencing all release files

HelmRelease YAML file containing information about the Helm chart

apiVersion: helm.toolkit.fluxcd.io/v2beta1

kind: HelmRelease

metadata:

name: azurearcdemo

namespace: azurearcdemo

annotations:

clusterconfig.azure.com/use-managed-source: "true"

spec:

interval: 1m

releaseName: azurearcdemo

chart:

spec:

chart: ./AzureArcDemo/charts/azurearcdemo

GitOps Pipeline



CD Pipeline reads newest tag from Azure Container Registry

Replace tag in values.yaml file

Commit changes to master branch

GitOps Agent sees changes and applies them to the K8s cluster

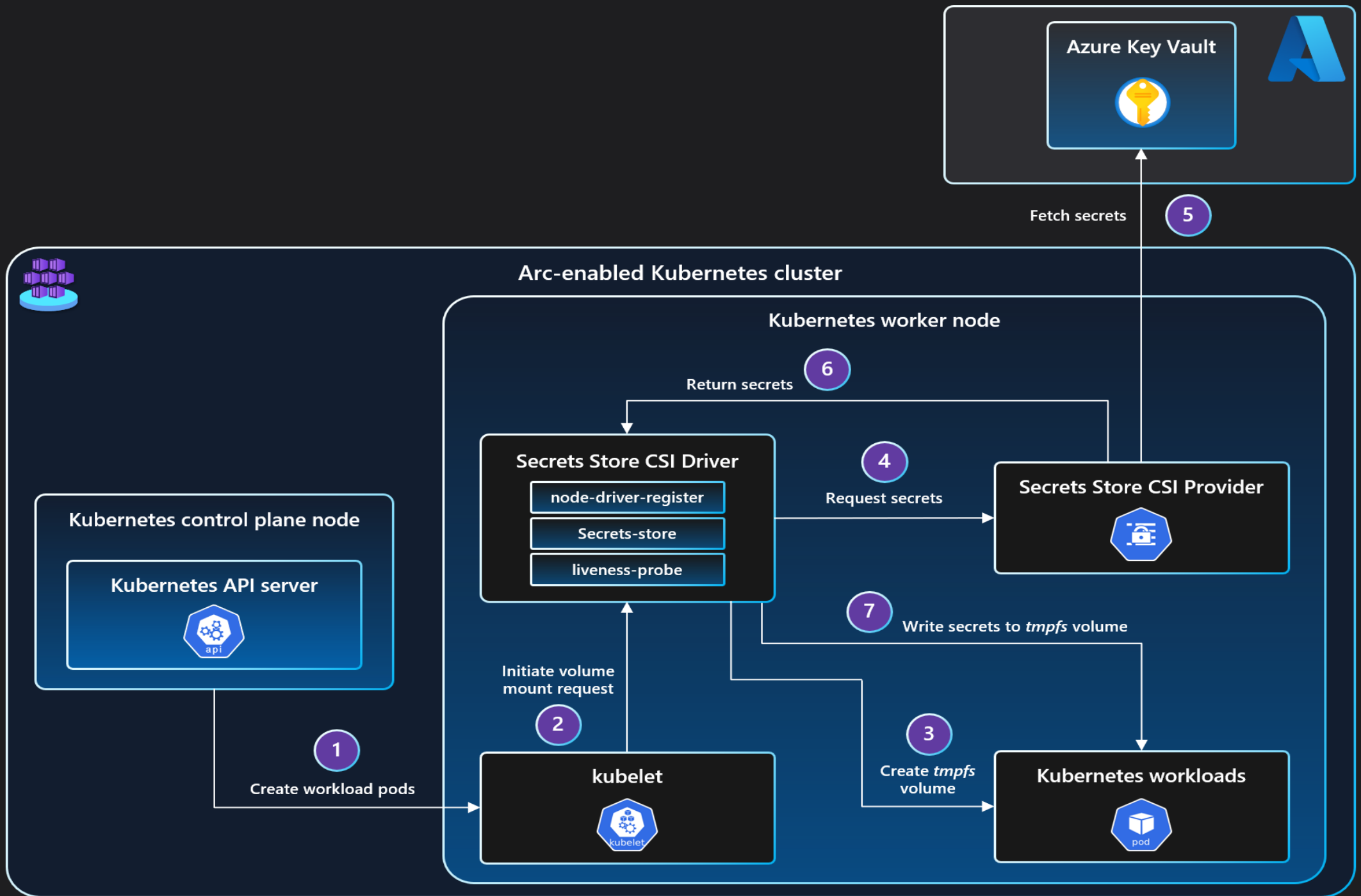
Azure Key Vault Secrets Provider Extension



Mount secrets from Azure Key Vault into Kubernetes

Secrets are retrieved using gRPC

Get all advantages from Azure Key Vault



Azure Monitor Extension



Azure Monitor agent is installed in its own namespace
Agent sends information to Log Analytics Workspace

Azure Monitor:

- Dashboards
- Alerting
- Container Insights

Search (Ctrl+/) << Refresh View All Clusters Recommended alerts (Preview) View Workbooks ? Help Feedback

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Security (preview)

Kubernetes resources (preview)

Namespaces

Workloads

Services and ingresses

Storage

Configuration

Settings

Extensions

GitOps (preview)

Policies

Properties

Locks

Monitoring

Insights

Alerts

Metrics

Logs

Time range = Last 30 minutes

+ Add Filter

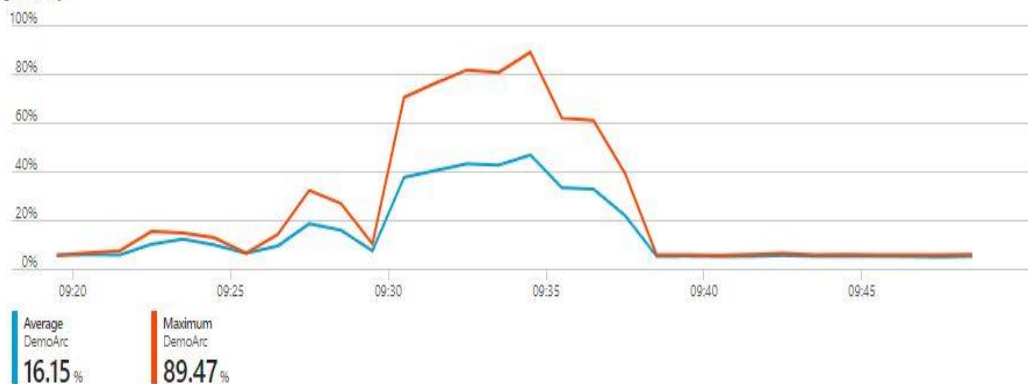
What's new Cluster Reports Nodes Controllers Containers

Node CPU Utilization %

Percentage of Total capacity

Avg Min 50th 90th 95th Max

1m granularity

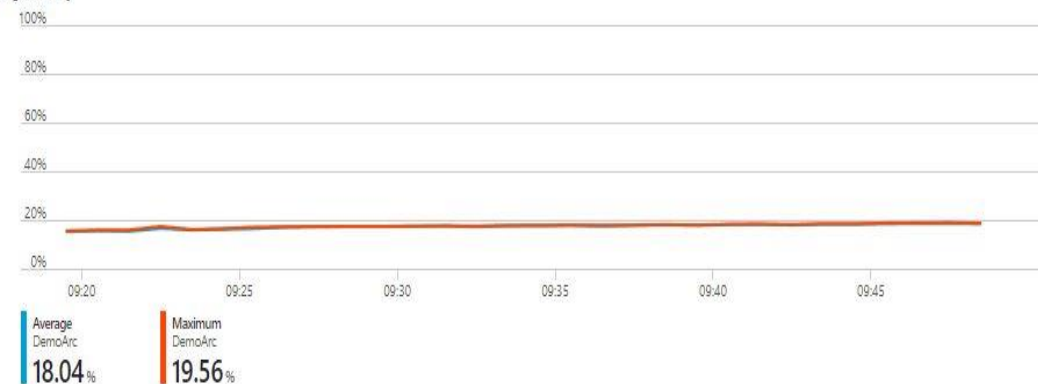


Node Memory Utilization %

Percentage of Total capacity (memory rss)

Avg Min 50th 90th 95th Max

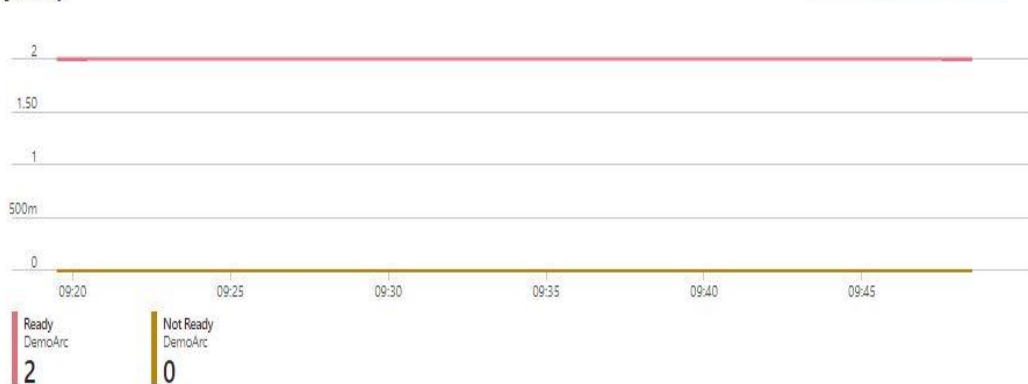
1m granularity



Node Count

1m granularity

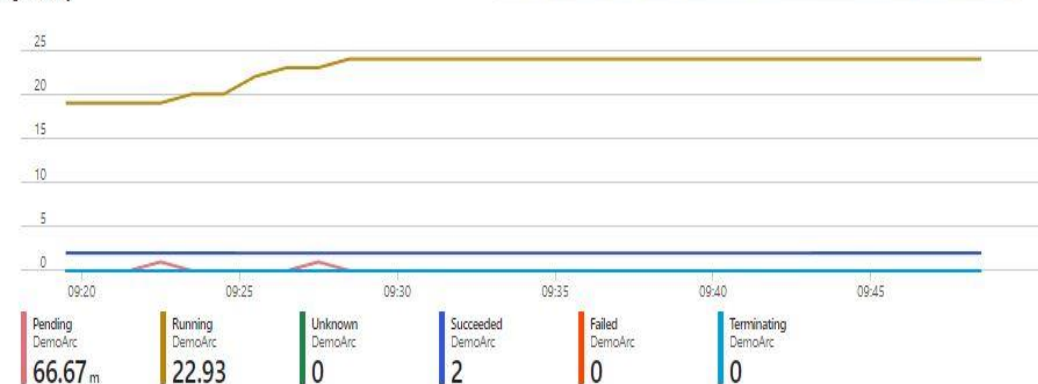
Total Ready Not Ready



Active Pod Count

1m granularity

Total Pending Running Unknown Succeeded Failed Terminating



Search (Ctrl+/) << Refresh View All Clusters Recommended alerts (Preview) View Workbooks ? Help Feedback

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Security (preview)

Kubernetes resources (preview)

Namespaces

Workloads

Services and ingresses

Storage

Configuration

Settings

Extensions

GitOps (preview)

Policies

Properties

Locks

Monitoring

Insights

Alerts

Metrics

Logs

Time range = Last 30 minutes

+ Add Filter

What's new Cluster Reports Nodes Controllers Containers

Node CPU Utilization %

Percentage of Total capacity

Avg Min 50th 90th 95th Max

1m granularity

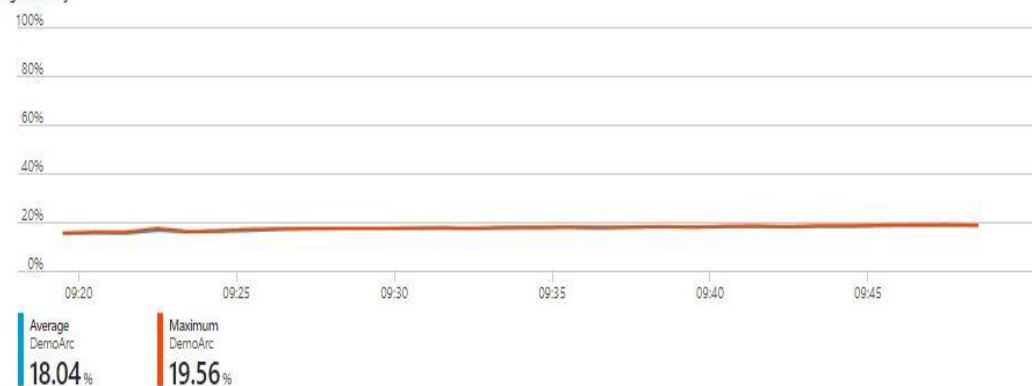


Node Memory Utilization %

Percentage of Total capacity (memory rss)

Avg Min 50th 90th 95th Max

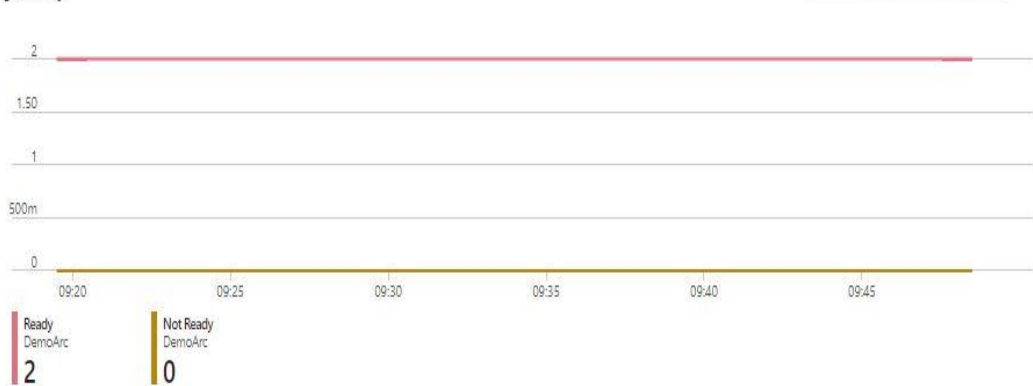
1m granularity



Node Count

1m granularity

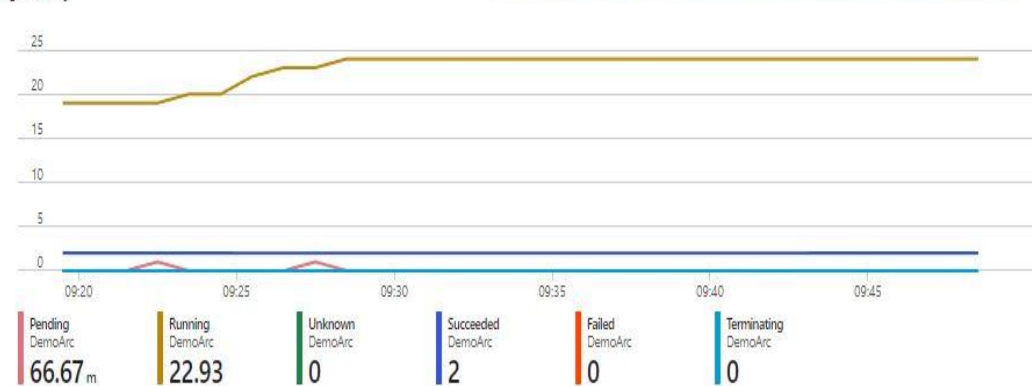
Total Ready Not Ready



Active Pod Count

1m granularity

Total Pending Running Unknown Succeeded Failed Terminating



«  Refresh

 View All Clusters

 Recommended alerts (Preview)

 View Workbooks

 Help

 Feedback

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems
- Security (preview)

Kubernetes resources (preview)

- Namespaces
- Workloads
- Services and ingresses
- Storage
- Configuration

Settings

- Extensions
- GitOps (preview)
- Policies

- Properties
- Locks

Monitoring

- Insights
- Alerts

Time range = Last 30 minutes

+ Add Filter

What's new Cluster Reports Nodes Controllers Containers

Metric: CPU Usage (millicores)

Min Avg 50th 90th 95th Max

Name	Status	95th % ↓	95th	Pod	Node	Restarts	UpTime	Trend 95th % (1 bar = 1m)
 customerapi	✓ Ok	91%	1810 mc	customerapi-5d5f8d96c5-v8nt7	master	0	25 mins	
 mqtt	✓ Ok	64%	322 mc	mqtt-58b75468c-zcnzx	master	0	27 mins	
 kube-aad-proxy	✓ Ok	17%	17 mc	kube-aad-proxy-8564d4dd5d-qqcby	worker1	0	54 mins	
 omsagent	✓ Ok	7%	10 mc	omsagent-727fd	worker1	0	31 mins	
 omsagent	✓ Ok	4%	6 mc	omsagent-4pftj	master	0	32 mins	
 fluent-bit	✓ Ok	4%	0.8 mc	config-agent-69dcdb554d-7swhm	worker1	0	57 mins	
 fluent-bit	✓ Ok	4%	0.8 mc	cluster-metadata-operator-9945b897c-nxcwr	worker1	0	57 mins	
 cluster-metadata-operator	✓ Ok	4%	2 mc	cluster-metadata-operator-9945b897c-nxcwr	worker1	0	58 mins	
 fluent-bit	✓ Ok	3%	0.7 mc	controller-manager-5494575977-rfc6g	worker1	0	57 mins	
 flux-logs-agent	✓ Ok	3%	1 mc	flux-logs-agent-86cf4f7b7d-55fld	worker1	0	58 mins	
 fluent-bit	✓ Ok	3%	0.6 mc	extension-manager-7dc84fb6d7-sfznl	worker1	0	57 mins	
 resource-sync-agent	✓ Ok	3%	1 mc	resource-sync-agent-56f777f6b6-7zj9n	worker1	0	58 mins	

#ScottishSummit2024

Azure Arc Services



Azure Arc Services



Azure Arc-enabled infrastructure

- Azure Arc-enabled servers
- Azure Arc-enabled Kubernetes
- Azure Stack HCI

Azure Arc Services



Azure Arc-enabled services

- Azure App Service
- Azure Logic Apps
- Azure Event Grid
- Azure Functions
- Azure API Management
- Azure Container Apps

Azure Arc Services



Azure Arc-enabled data services

- Azure SQL Managed Instance
- PostgreSQL Hyperscale
- Azure Machine Learning

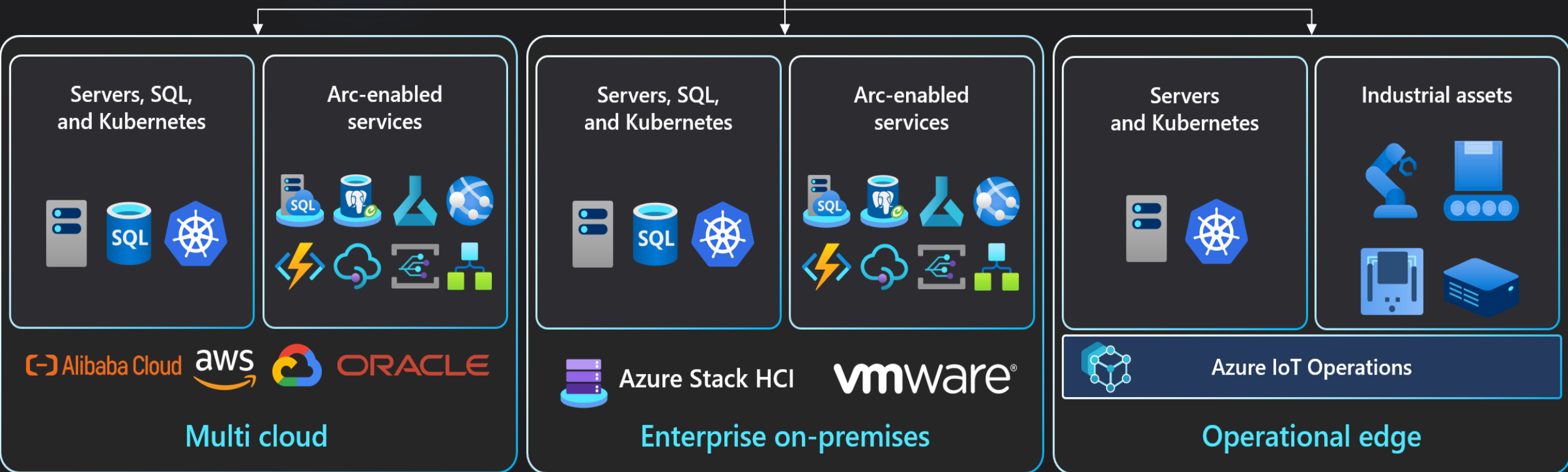
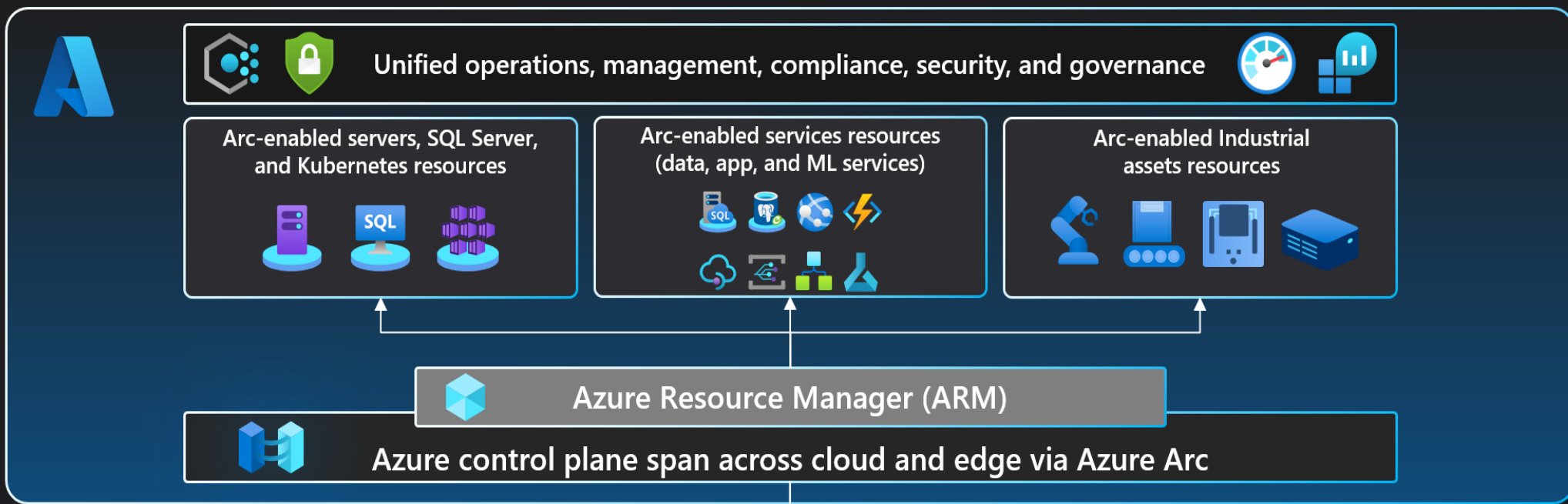
Azure Arc Services



Azure Arc-enabled services run inside a Kubernetes cluster

Bring Azure services to your on-prem datacenter

Developers can continue using their tools



#ScottishSummit2024

Hybrid Cloud Conclusion



Hybrid Cloud Conclusion



Powerful tool to combine on-premises requirements with cloud services

Manage on-premises infrastructure from the cloud

- Data never leaves your datacenter
- Combine cloud services with low latency

Broad technical knowledge necessary

Too many applications to talk about them in just one hour

Azure Arc Conclusion



Proof of concept was successful

Powerful service

Major focus from Microsoft

Broad IT-knowledge needed

Services can be a bit buggy

Documentation sometimes complicated

Resources



- [Azure Arc Series – Blog Posts](#)
- [Azure Arc - Youtube Playlist](#)
- [Azure Arc Documentation](#)
- [Azure Stack HCI](#)
- [Flux CD](#)

#ScottishSummit2024

Q&A



Thank You to our Sponsors...



Platinum Sponsor

Capgemini 

Gold Sponsors

resco

WGW

dox42[®]
automate your documents
integrate your data

 Kerv Digital

#ScottishSummit2024

Thank You to our Sponsors...



With Thanks



#ScottishSummit2024

Multi-Cloud Management and On-Premises Integration

Wolfgang Ofner

