Unleashing the Potential of Hybrid Cloud:

Streamlining Multi-Cloud Management and on-Premises Integration

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Agenda



Introduction to Hybrid Cloud



Azure Arc and Kubernetes



Integrating On-Premises with Cloud



Real-World Projects



Conclusion



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

Azure Stack Edge

Azure Stack Hub

Azure Stack HCI

Azure Arc

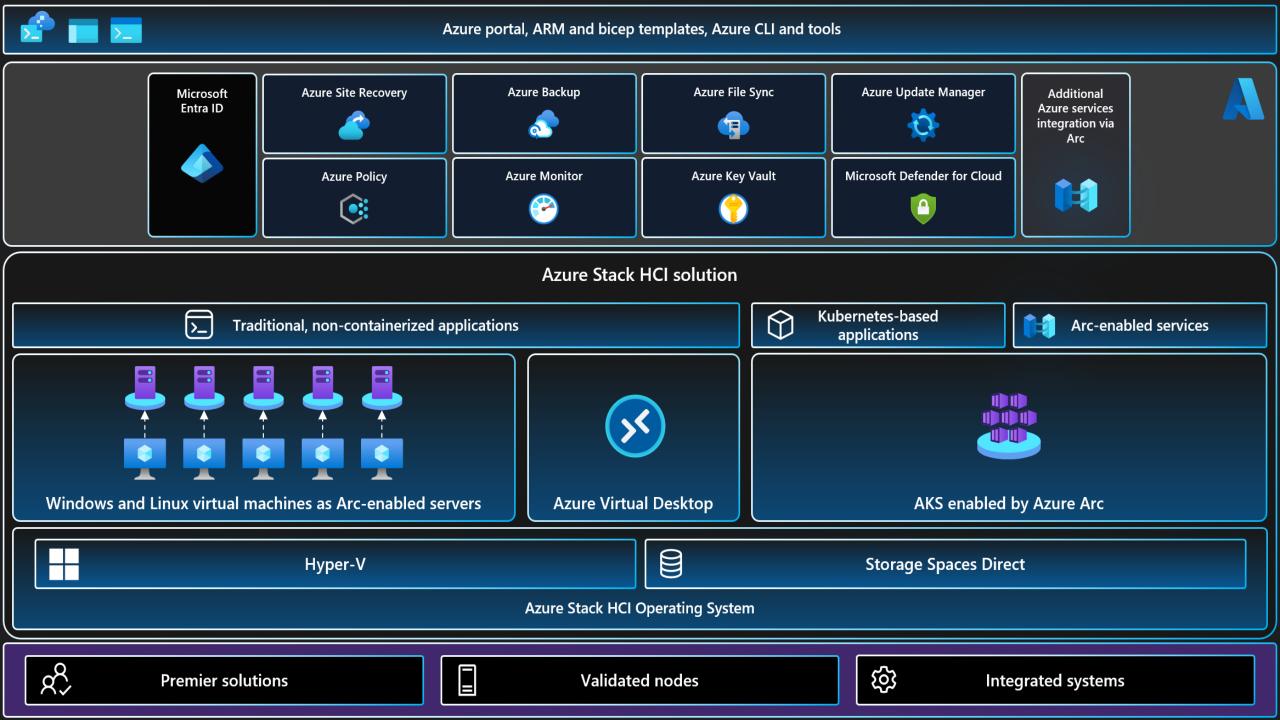
Azure Stack HCI

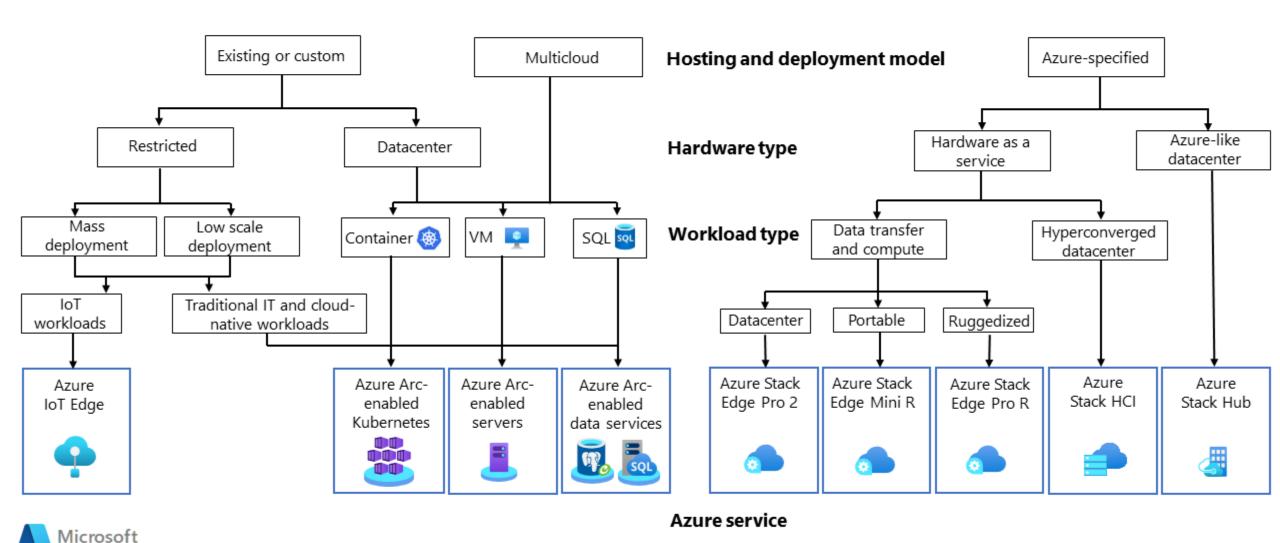
Azure Stack HCI OS is an operating system based on Windows Server

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

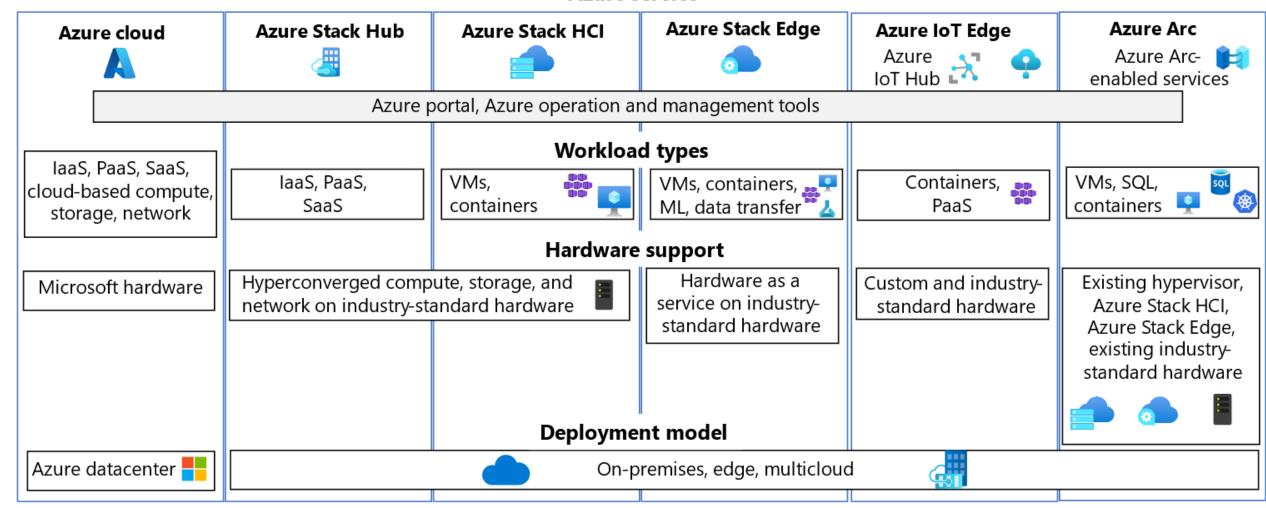
Each cluster consists of 1 to 16 physical servers

Often used in disconnected scenarios





Azure service





Azure Arc

Azure Arc Overview

Project infrastructure running outside of Azure into Azure

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



X





- Azure Arc virtual machines (preview)
- Azure Stack HCI
- Kubernetes clusters
- VMware vCenters
- SCVMM management servers

Data services

- SQL Server instances
- PostgreSQL (preview)
- SQL managed instances

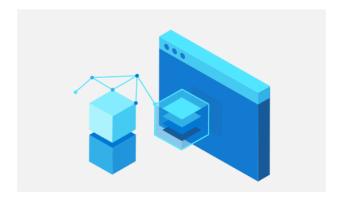
Application Services

- API management (preview)
- App services (preview)
- Event Grid topics (preview)
- Functions (preview)
- Azure IoT Operations (preview)
- Logic apps (preview)

Get started Infrastructure Services Learn more

See and manage all your on-prem infrastructure, anywhere. It's free to get started.

With Azure Arc, you can manage your infrastructure in all your environments, including on-premises, other public clouds, and edge devices. There's no charge to start, just add your infrastructure and enjoy the views. Learn more



Get hands-on with ArcBox

Use ArcBox to deploy an Azure Arc sandbox in less than an hour. Learn more \Box ¹



Add your infrastructure for free

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Deploy Azure services

Use Azure Arc to deploy Azure services on your infrastructure. Learn more ♂

Try ArcBox

Add

Deploy

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Manage infrastructure as it was running in Azure

- Update Management
- Configuration Management
- Microsoft Cloud Defender

Azure Arc-enabled Kubernetes

Install Azure Arc extensions to manage the cluster

- Azure Monitor
- GitOps with Flux
- Azure Policy
- Azure Key Vault Secrets Provider

Securely access cluster without opening inbound ports

Azure Arc Installation Prerequisites

Azure CLI Arc extension

curl -sL https://aka.ms/InstallAzureCLIDeb | sudo bash az extension add --name connectedk8s

Azure Arc Installation Prerequisites

Azure CLI Arc extension
Register Azure Provider

↑ root@Office: /home/wolfgang ×

```
root@Office:/home/wolfgang# az provider register --namespace Microsoft.Kubernetes
root@Office:/home/wolfgang# az provider register --namespace Microsoft.KubernetesConfiguration
root@Office:/home/wolfgang# az provider register --namespace Microsoft.ExtendedLocation
```

Azure Arc Installation Prerequisites

Register Azure Provider

```
↑ root@Office: /home/wolfgang ×
root@Office:/home/wolfgang# az provider show -n Microsoft.Kubernetes -o table
                      RegistrationPolicy
                                             RegistrationState
Namespace
Microsoft.Kubernetes RegistrationRequired
                                            Registered
root@Office:/home/wolfgang# az provider show -n Microsoft.KubernetesConfiguration -o table
                                    RegistrationPolicy
Namespace
                                                           RegistrationState
Microsoft.KubernetesConfiguration RegistrationRequired Registered
root@Office:/home/wolfgang# az provider show -n Microsoft.ExtendedLocation -o table
                             RegistrationPolicy
                                                   RegistrationState
Namespace
Microsoft.ExtendedLocation
                            RegistrationRequired
                                                   Registered
```

Azure Arc Installation

Install with Azure CLI



root@Office:/home/wolfgang# az connectedk8s connect --name k3s-arc --resource-group ArcDemo This operation might take a while...

Azure Arc Installation

Install with Azure CLI

Applications are installed in the azure-arc namespace

Azure Arc Applications

PS C:\Users\Wolfgang> kubectl get pods -n azu	ıre-arc			
NAME	READY	STATUS	RESTARTS	AGE
cluster-metadata-operator-5dcbb5d97b-k2pwb	2/2	Running	0	14m
clusterconnect-agent-5776f946d9-jchl4	3/3	Running	0	14m
clusteridentityoperator-bf596c845-h8s7s	2/2	Running	0	14m
config-agent-6cd59d5896-d4tvx	2/2	Running	0	14m
controller-manager-59bcd87698-m8jj9	2/2	Running	0	14m
extension-events-collector-55c95b8c4d-m8l5d	2/2	Running	0	14m
extension-manager-75d47f499f-62twm	3/3	Running	0	14m
flux-logs-agent-7d7dc6754f-l24tq	1/1	Running	0	14m
kube-aad-proxy-775476dd6d-bpdld	2/2	Running	0	14m
metrics-agent-595bcfdc9-4jpkg	2/2	Running	0	14m
resource-sync-agent-c9559b855-bggcp	2/2	Running	0	14m

Azure Arc in the Azure Portal

"Single pane of glass"

Manage outside infrastructure within Azure



X





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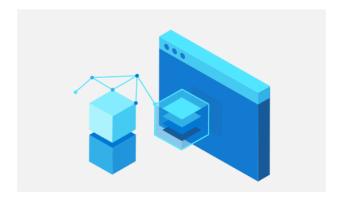
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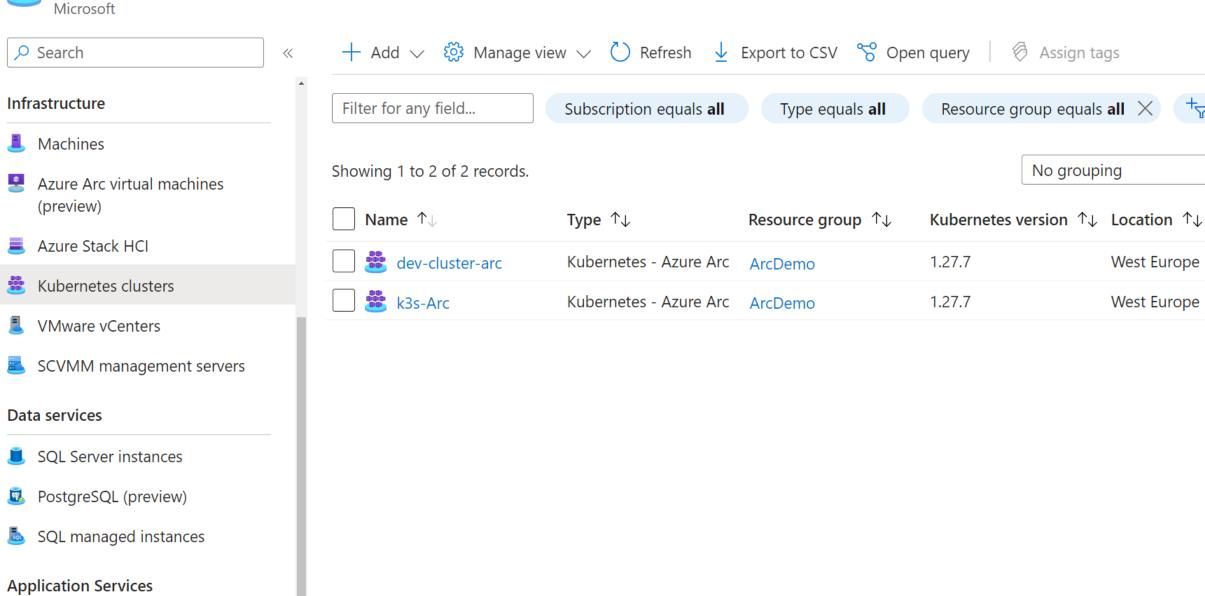
Add

Deploy

Home > Azure Arc

API management (preview)





+ Add filter

West Europe

West Europe



Kubernetes - Azure Arc





Activity log

Access control (IAM)

Tags

X Diagnose and solve problems

Kubernetes resources (preview)

Namespaces

Workloads

Region 2 Services and ingresses

Storage

Configuration

Settings

Extensions

Open Service Mesh

37 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 * (i)
Sign in

Azure Arc Extensions

Azure Arc extensions

Bring Azure Services to your Kubernetes cluster

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

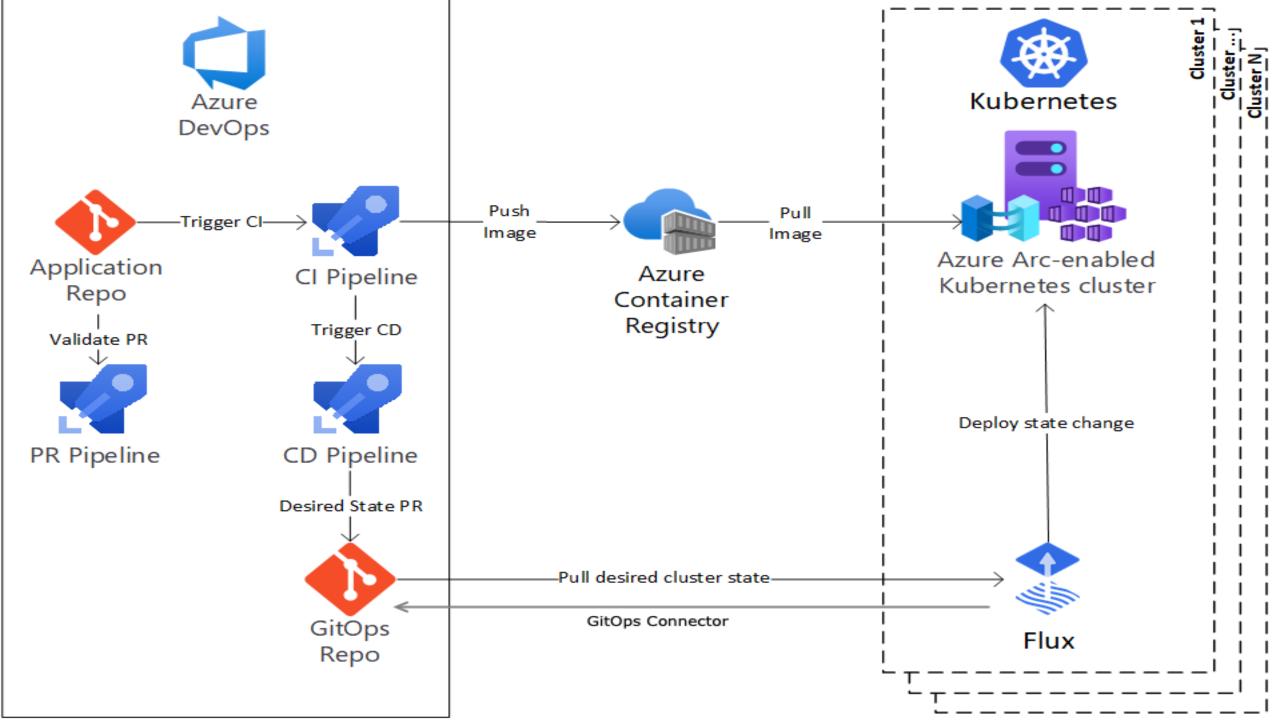
Git Ops Extension

Uses Flux as GitOps agent

Can be installed via Azure CLI or Azure Portal

2 repositories

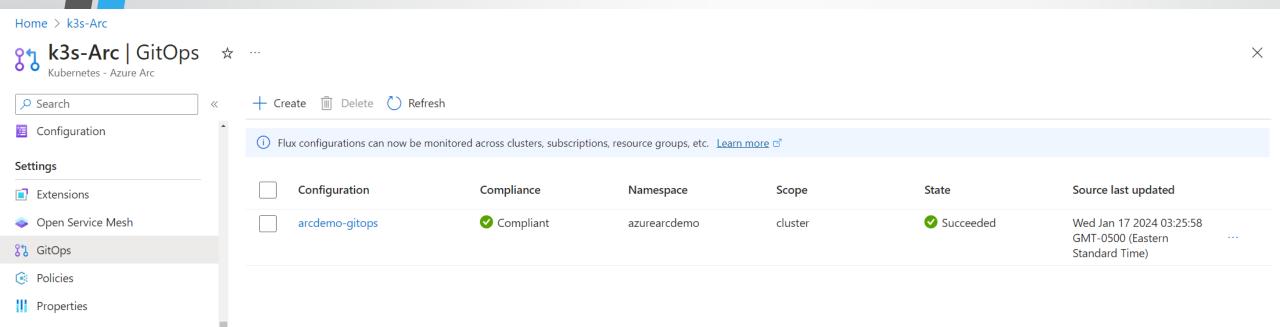
- Application repository
- Configuration repository

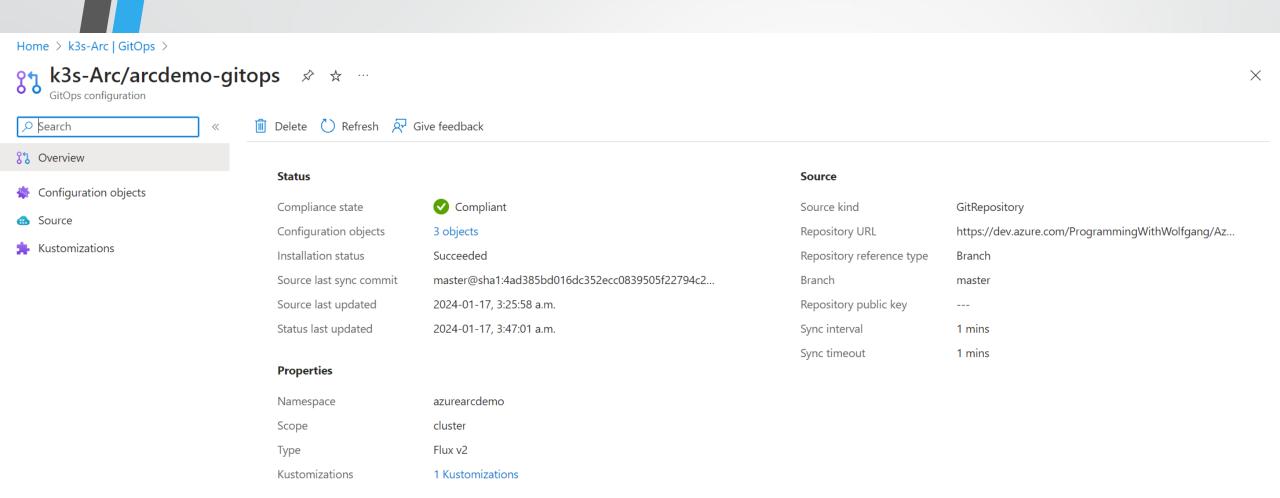


Single Azure CLI command to configure and install GitOps operator

```
>> --cluster-name k3s-Arc '
>> --resource-group ArcDemo '
>> --name arcdemo-gitops `
>> --namespace azurearcdemo '
>> --cluster-type connectedClusters '
>> --scope cluster '
>> --https-user wolfgang@programmingwithwolfgang.com '
>> --https-key 7ubfok7viuepij24pymxblsekhyjcdjxbsqgcczyplsuo6sv3x5a `
>> --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/openssl
/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...
```

PS C:\Users\Wolfgang> az k8s-configuration flux create `





GitOps 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

Tag can be set manually when starting the pipeline

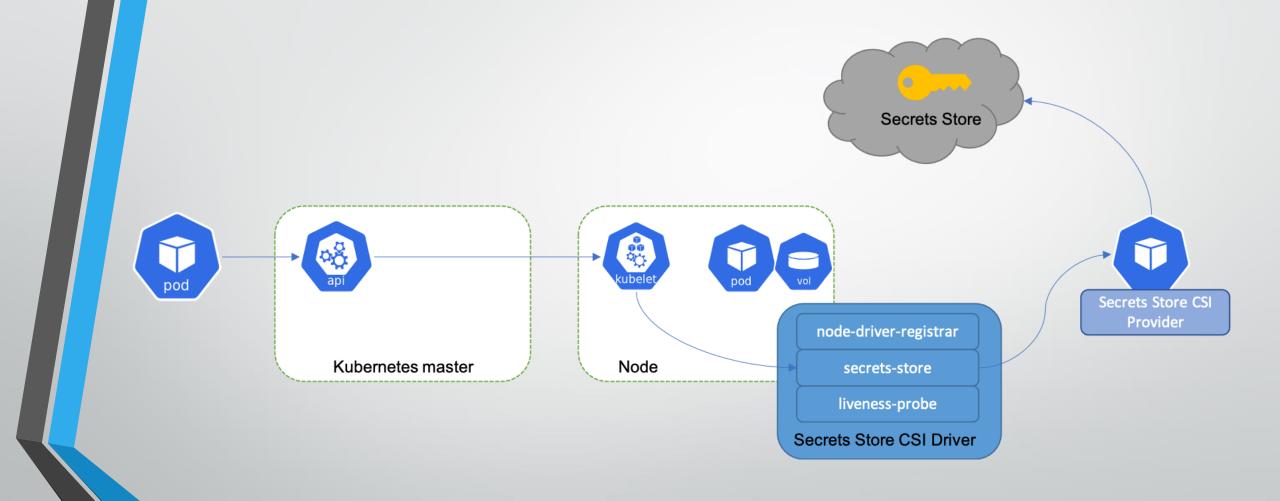
Azure Key Vault Secrets Provider Extension

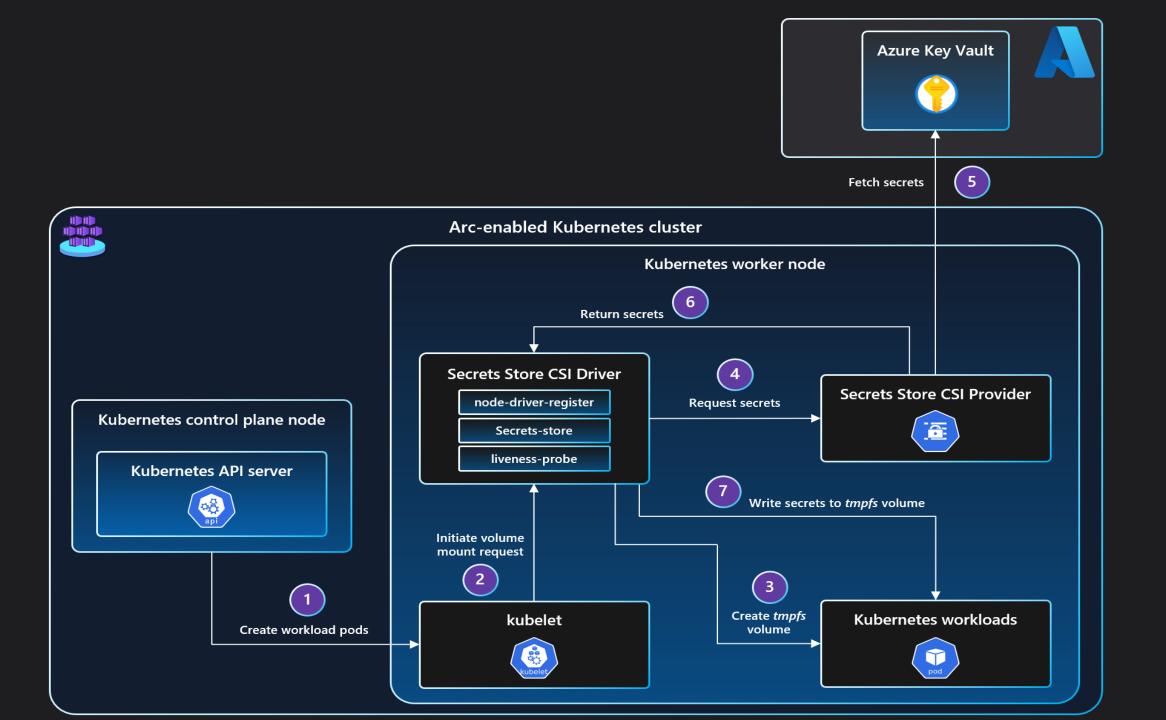
Mount secrets from Azure Key Vault into Kubernetes

Secrets are retrieved using gRPC

Get all advantages from Azure Key Vault

Azure Key Vault Secrets Provider Extension



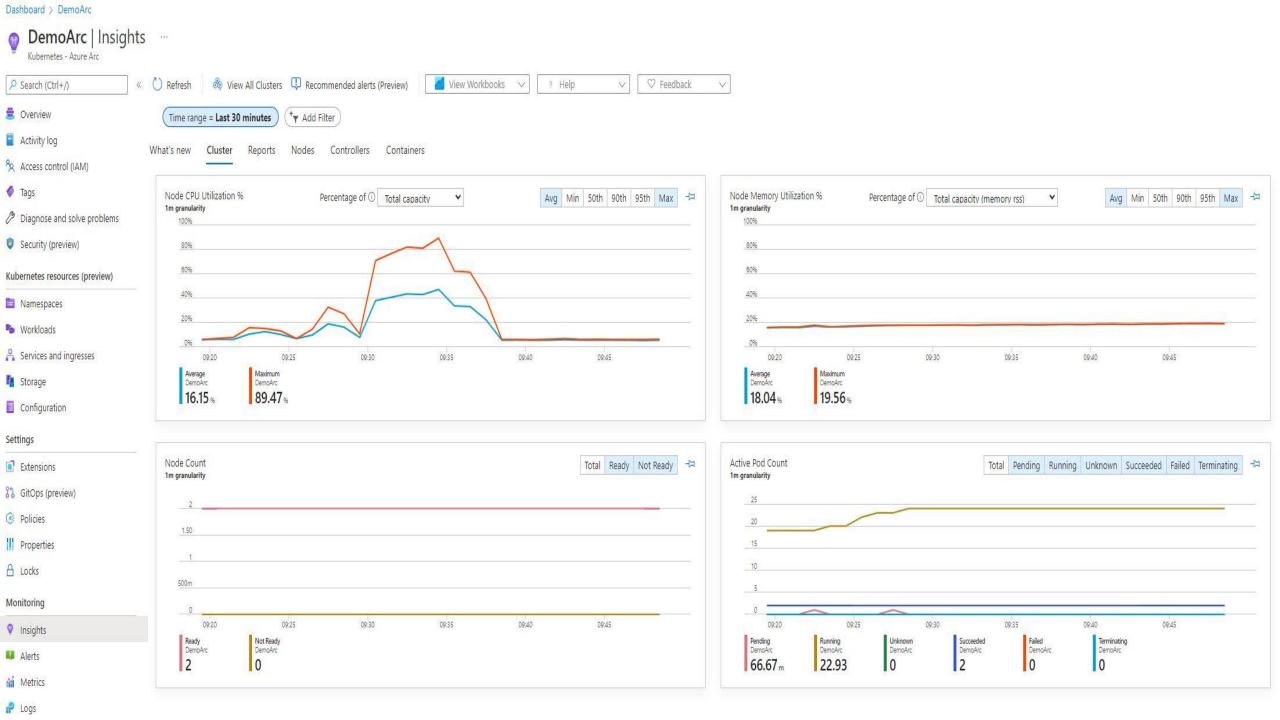


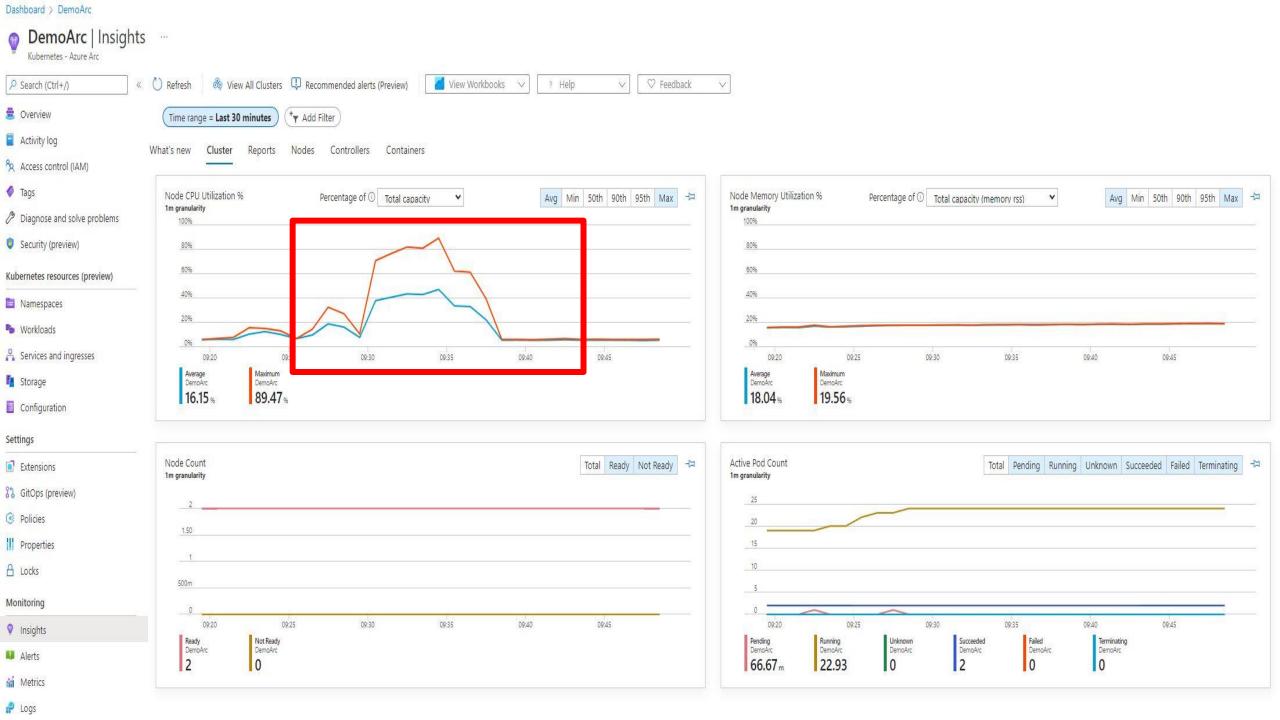
Azure Monitor Extension

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

Azure Monitor:

- Dashboards
- Alerting
- Container Insights





Dashboard > DemoArc DemoArc | Insights Kubernetes - Azure Arc View Workbooks ♡ Feedback View All Clusters Recommended alerts (Preview) P Search (Ctrl+/) ? Help Overview Time range = Last 30 minutes +▼ Add Filter Activity log What's new Cluster Nodes Controllers Containers Reports Access control (IAM) Search by name... Metric: CPU Usage (millicores) ✔ Min Avg 50th 90th 95th Max Tags Diagnose and solve problems Name 95th % 1 95th Pod Node UpTime Trend 95th % (1 bar = 1m) Security (preview) Status Restarts Kubernetes resources (preview) customerapi Ok 91% 1810 mc customerapi-5d5f8d96c5-v8nt7 0 master 25 mins Namespaces mqtt Ok 64% mqtt-58b75468c-zcnzx 27 mins 322 mc 0 master Workloads Ok Ok kube-aad-proxy 17% 17 mc kube-aad-proxy-8564d4dd5d-ggcbg worker1 0 54 mins Rervices and ingresses ** Ok omsagent 7% 10 mc omsagent-727fd worker1 0 31 mins Storage Configuration Ok omsagent 4% 6 mc omsagent-4pftj master 0 32 mins Settings O Ok fluent-bit config-agent-69dcdb554d-7swhm 0 4% 0.8 mc worker1 57 mins Extensions fluent-bit O Ok 57 mins 0 4% 0.8 mc cluster-metadata-operator-9945b897c-nxcwr worker1 33 GitOps (preview) O Ok cluster-metadata-operator cluster-metadata-operator-9945b897c-nxcwr worker1 4% 2 mc 0 58 mins Policies | Properties fluent-bit Ok controller-manager-5494575977-rfc6g worker1 3% 0.7 mc 0 57 mins A Locks Ok flux-logs-agent 3% flux-logs-agent-86cf4f7b7d-55fld worker1 1 mc 0 58 mins Monitoring Ok Ok fluent-bit 3% extension-manager-7dc84fb6d7-sfznl worker1 0 0.6 mc 57 mins Insights O Ok resource-sync-agent-56f777f6b6-7zj9n resource-sync-agent 3% 1 mc worker1 0 58 mins Alerts

Azure Arc-enabled infrastructure

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

Azure Arc-enabled services

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

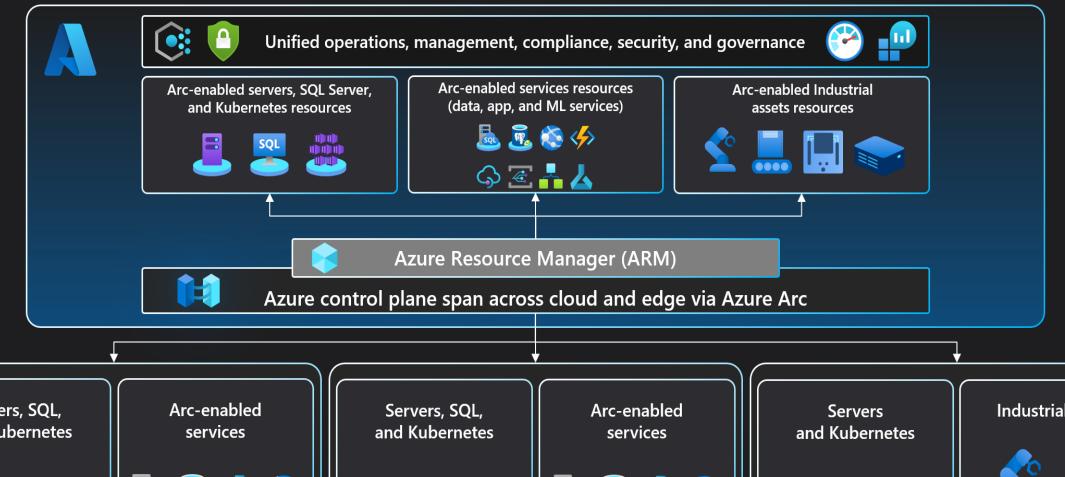
Azure Arc-enabled data services

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

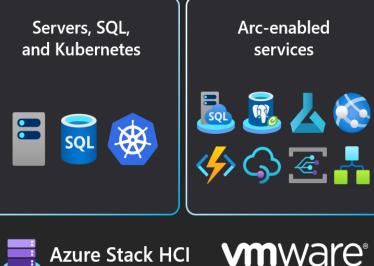
Azure Arc-enabled services run inside a Kubernetes cluster

Bring Azure services to your on-prem datacenter

Developers can continue using their tools









Real-World Projects

Real-World Projects

Project "Autonomous Ropeway System"

Project "Smart Machine Factory"



Project "Autonomous Ropeway System"

Ropeway vehicle comes out of the garage automatically

Saves costs due to better usage of resources and less wear and tear

Routing possible -> ropeway vehicle can find its way

Running 24/7 with minimum human interaction

Challenges

Use existing hardware

No inbound traffic allowed

- No connection from Azure DevOps
- No possibility to use cloud services to manage the infrastructure
- How to authenticate users?
- No VPN or ExpressRoute allowed



Smart Machine Factory

Run Azure Stack HCI AKS in factories around the globe Use Azure Arc to manage AKS cluster

- Azure Monitor for monitoring and alerting
- GitOps for deployments without access to the factory
- Microsoft Entra integration for user authentication

Run additional service in AKS such as managed PostgreSQL

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

Possibly the most powerful Azure service Major focus from Microsoft

Deep technical knowledge required

Can be buggy

Documentation needs improvement

Resources

Slides

Azure Arc Series – Blog Posts

Azure Arc - Youtube Playlist

Azure Arc Documentation

Azure Stack HCI

Flux CD







A&D

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