AKS Security Simplified for Developers

Wolfgang Ofner
Senior Cloud Architect

Agenda

Authentication and Authorization

Entra Workload ID

Private AKS Cluster

Azure Key Vault Provider for Secrets

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Focus on Azure, Kubernetes, and DevOps

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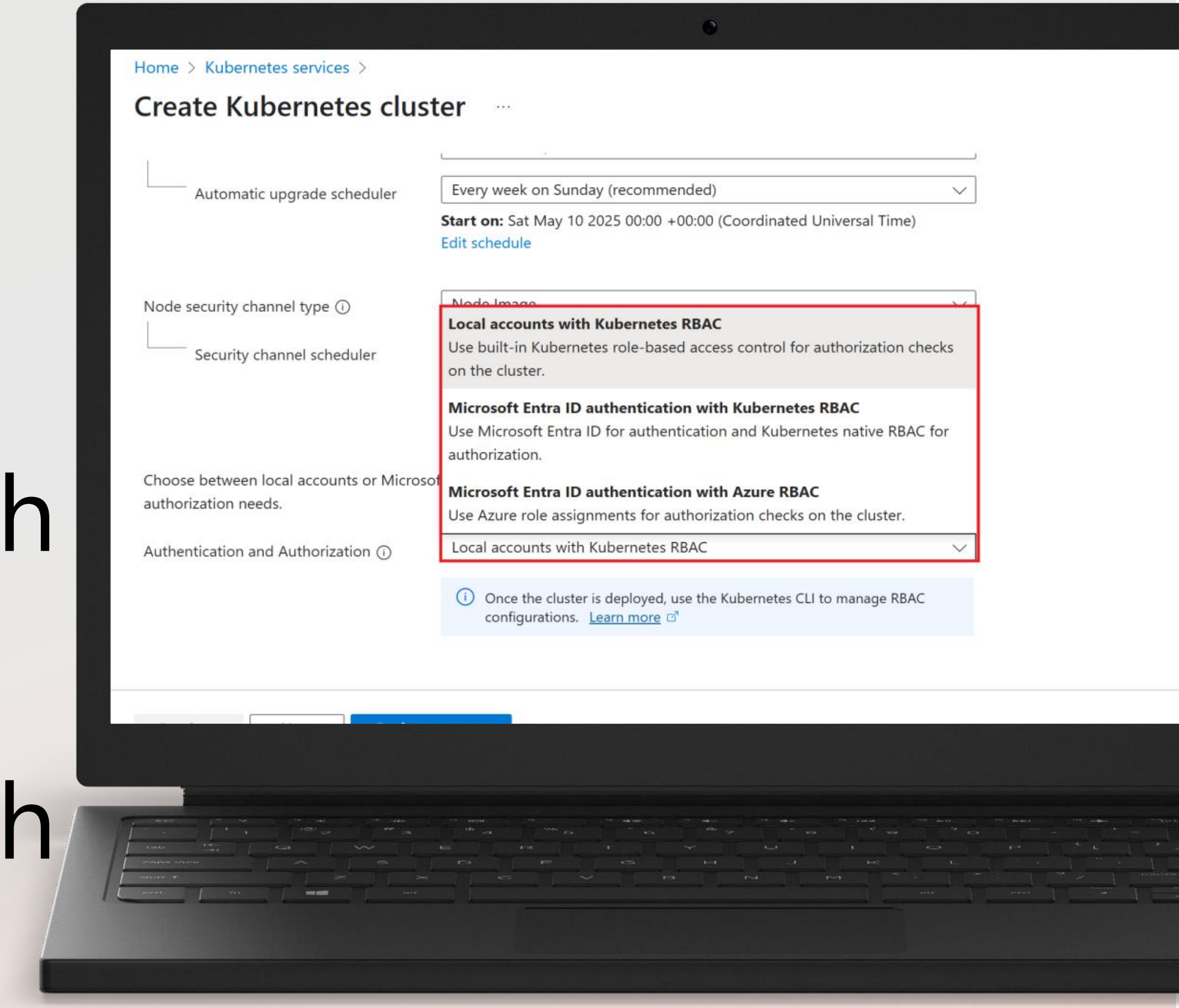
Authentication and Authorization

Authentication

Local Accounts with Kubernetes RBAC

Entra ID Authentication with Kubernetes RBAC

Entra ID Authentication with Azure RBAC



Home > Kubernetes services >

Create Kubernetes cluster ···

Automatic upgrade scheduler: Every week on Sunday (recommended)

Start on: Sat May 10 2025 00:00 +00:00 (Coordinated Universal Time)

Edit schedule

Node security channel type ⓘ

Security channel scheduler

Local accounts with Kubernetes RBAC
Use built-in Kubernetes role-based access control for authorization checks on the cluster.

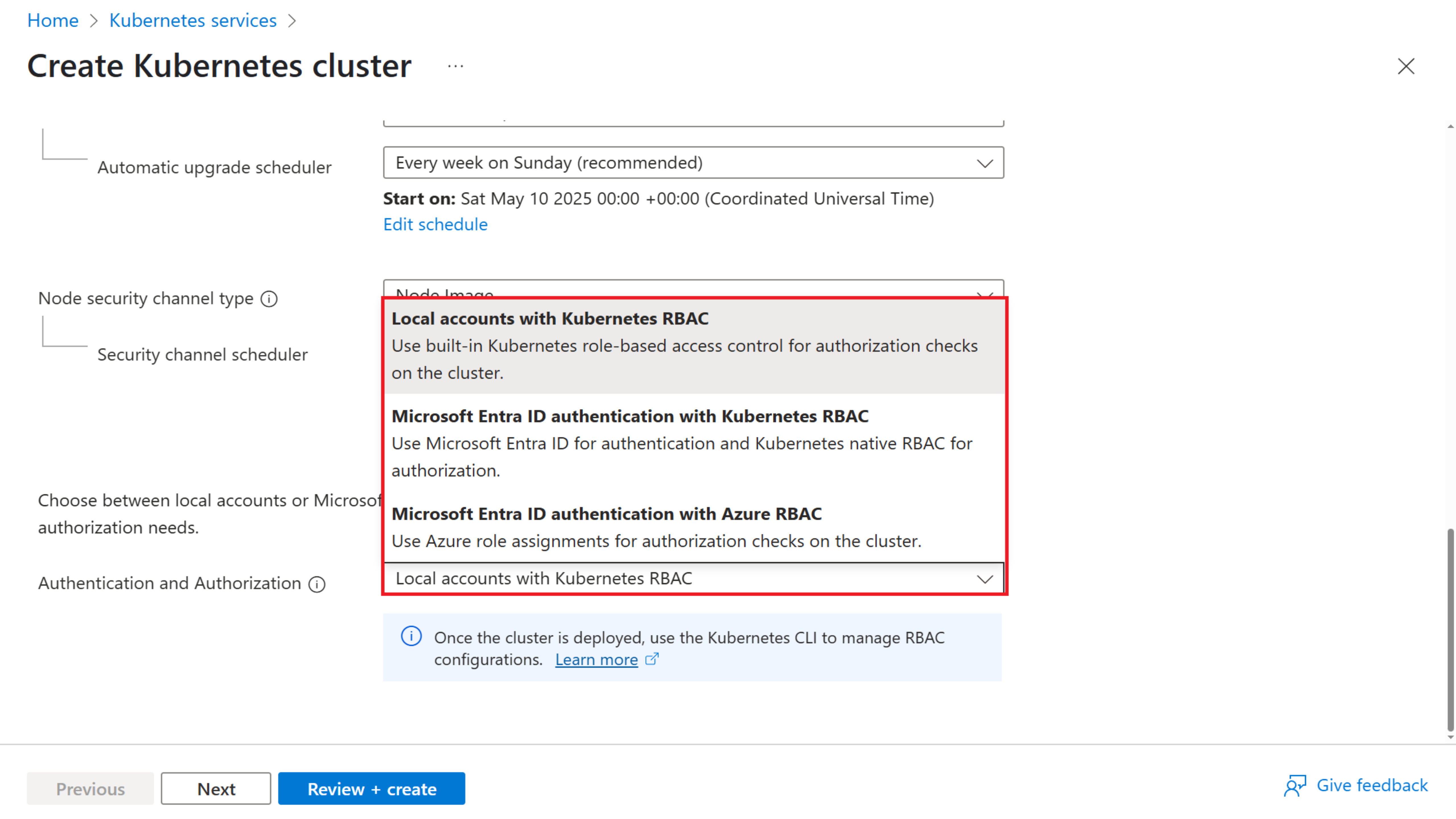
Microsoft Entra ID authentication with Kubernetes RBAC
Use Microsoft Entra ID for authentication and Kubernetes native RBAC for authorization.

Microsoft Entra ID authentication with Azure RBAC
Use Azure role assignments for authorization checks on the cluster.

Choose between local accounts or Microsof authorization needs.

Authentication and Authorization ⓘ: Local accounts with Kubernetes RBAC

ⓘ Once the cluster is deployed, use the Kubernetes CLI to manage RBAC configurations. Learn more



Home > Kubernetes services >

Create Kubernetes cluster ...

Automatic upgrade scheduler: Every week on Sunday (recommended)

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Node security channel type ⓘ: Node Image

Security channel scheduler

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Authentication and Authorization ⓘ: Local accounts with Kubernetes RBAC

ⓘ Once the cluster is deployed, use the Kubernetes CLI to manage RBAC configurations. Learn more

Local Account with Kubernetes RBAC

Local Accounts K8s RBAC

Default authentication mode for AKS

No link between Microsoft Entra and AKS

Use K8s build-in authentication

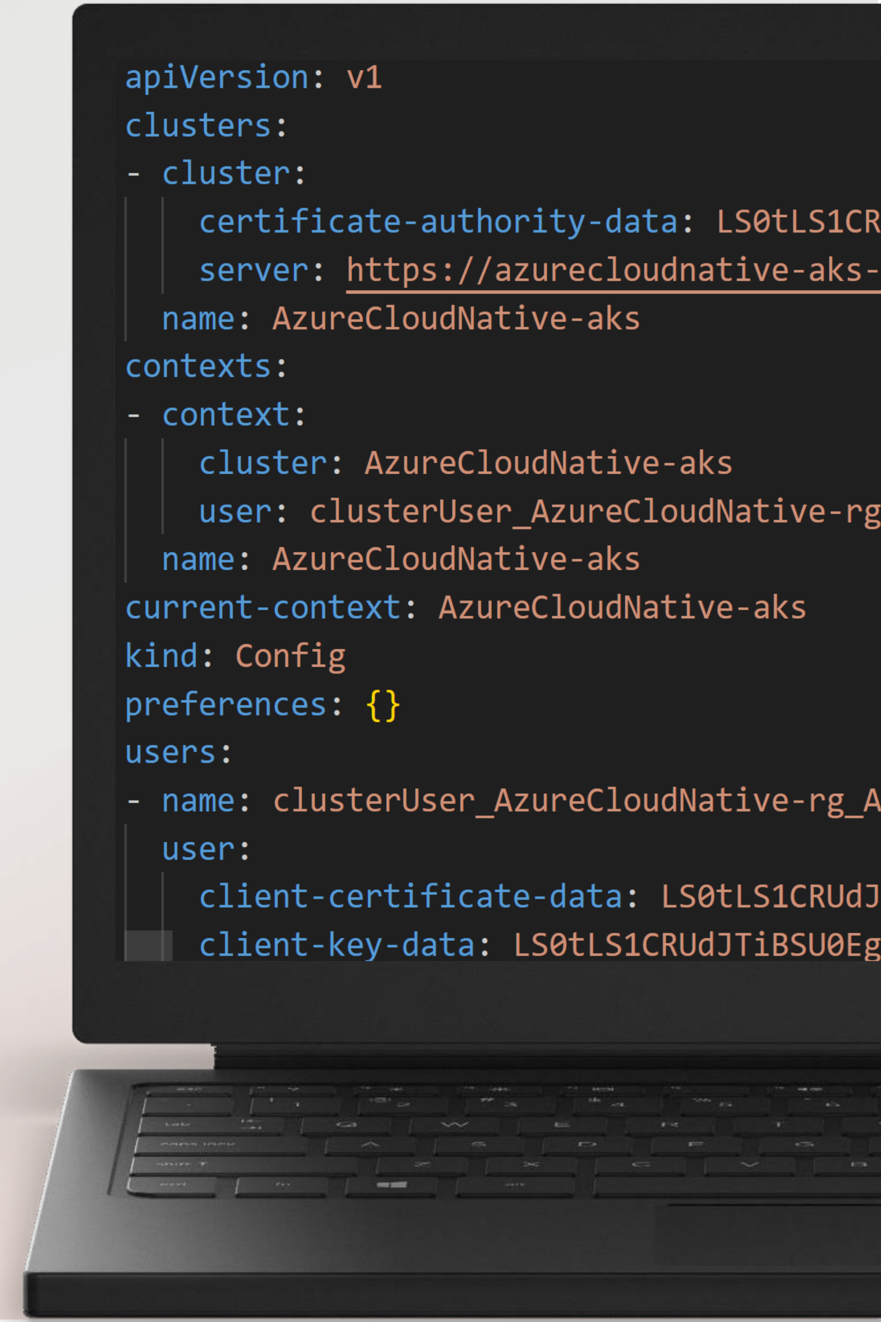
Token is stored unencrypted in .kube config file

Local Accounts K8s RBAC

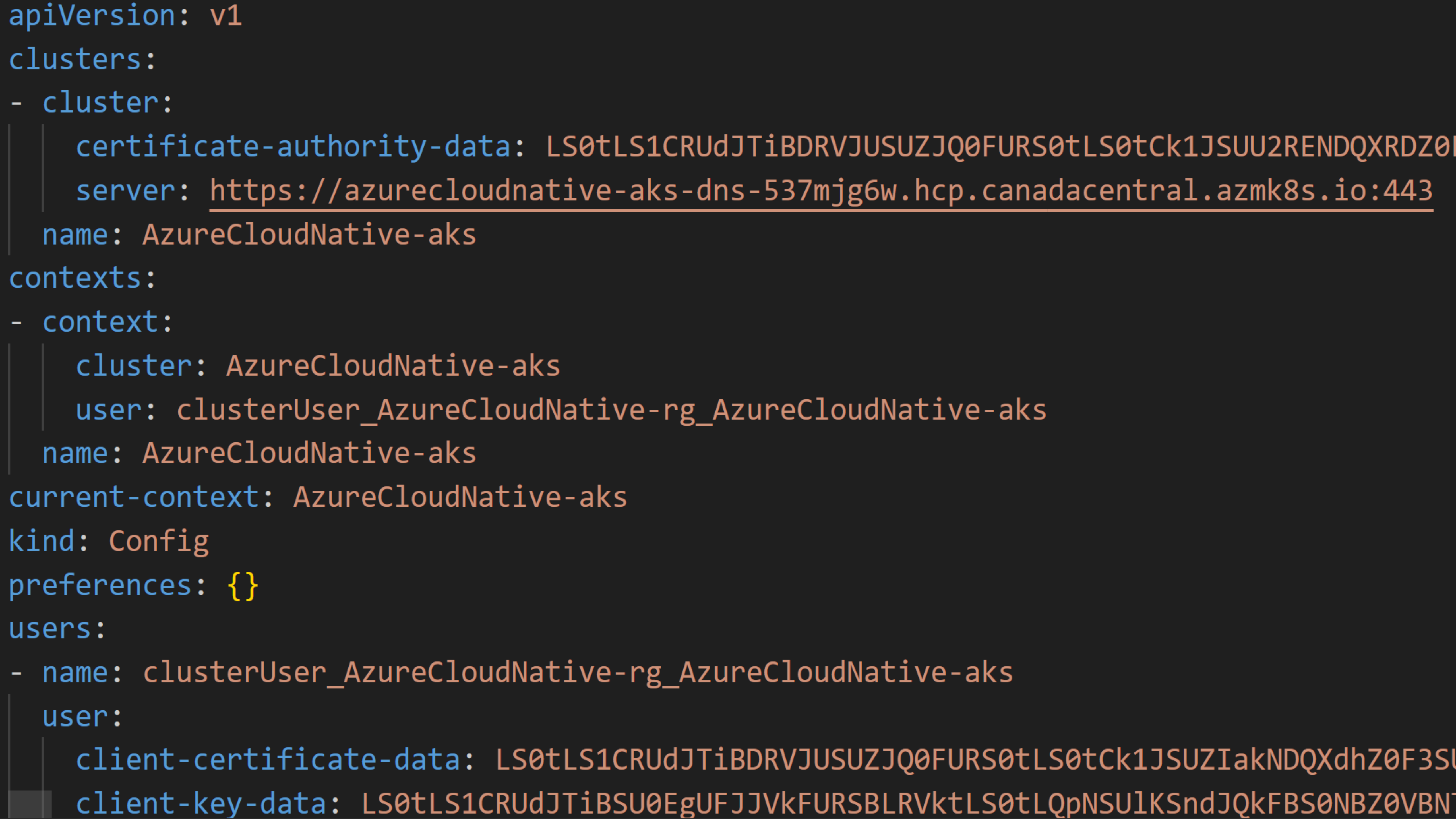
Only recommended when non of the users are in Entra

User management can become very challenging

Local accounts should be disabled for better security



```
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: LS0tLS1CR
    server: https://azurecloudnative-aks-
  name: AzureCloudNative-aks
contexts:
- context:
    cluster: AzureCloudNative-aks
    user: clusterUser_AzureCloudNative-rg
  name: AzureCloudNative-aks
current-context: AzureCloudNative-aks
kind: Config
preferences: {}
users:
- name: clusterUser_AzureCloudNative-rg_A
  user:
    client-certificate-data: LS0tLS1CRUdJ
    client-key-data: LS0tLS1CRUdJTiBSU0Eg
```



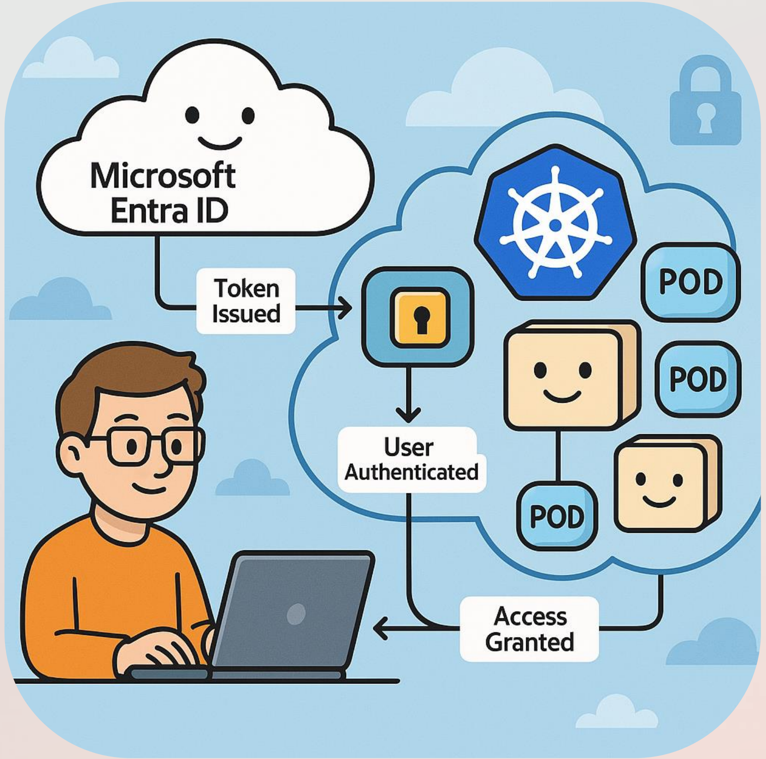
```yaml
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUU2RENDQXRDZ0
    server: https://azurecloudnative-aks-dns-537mjg6w.hcp.canadacentral.azmk8s.io:443
  name: AzureCloudNative-aks
contexts:
- context:
    cluster: AzureCloudNative-aks
    user: clusterUser_AzureCloudNative-rg_AzureCloudNative-aks
  name: AzureCloudNative-aks
current-context: AzureCloudNative-aks
kind: Config
preferences: {}
users:
- name: clusterUser_AzureCloudNative-rg_AzureCloudNative-aks
  user:
    client-certificate-data: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUZIakNDQXdhZ0F3S
    client-key-data: LS0tLS1CRUdJTiBSU0EgUFJJVkFURSBLRVktLS0tLQpNSUlKSndJQkFBS0NBZ0VBN
```

Entra ID Authentication with Kubernetes RBAC

Entra ID with K8s RBAC

Authentication via Microsoft Entra

Authorization via K8s RBAC



Entra ID with K8s RBAC

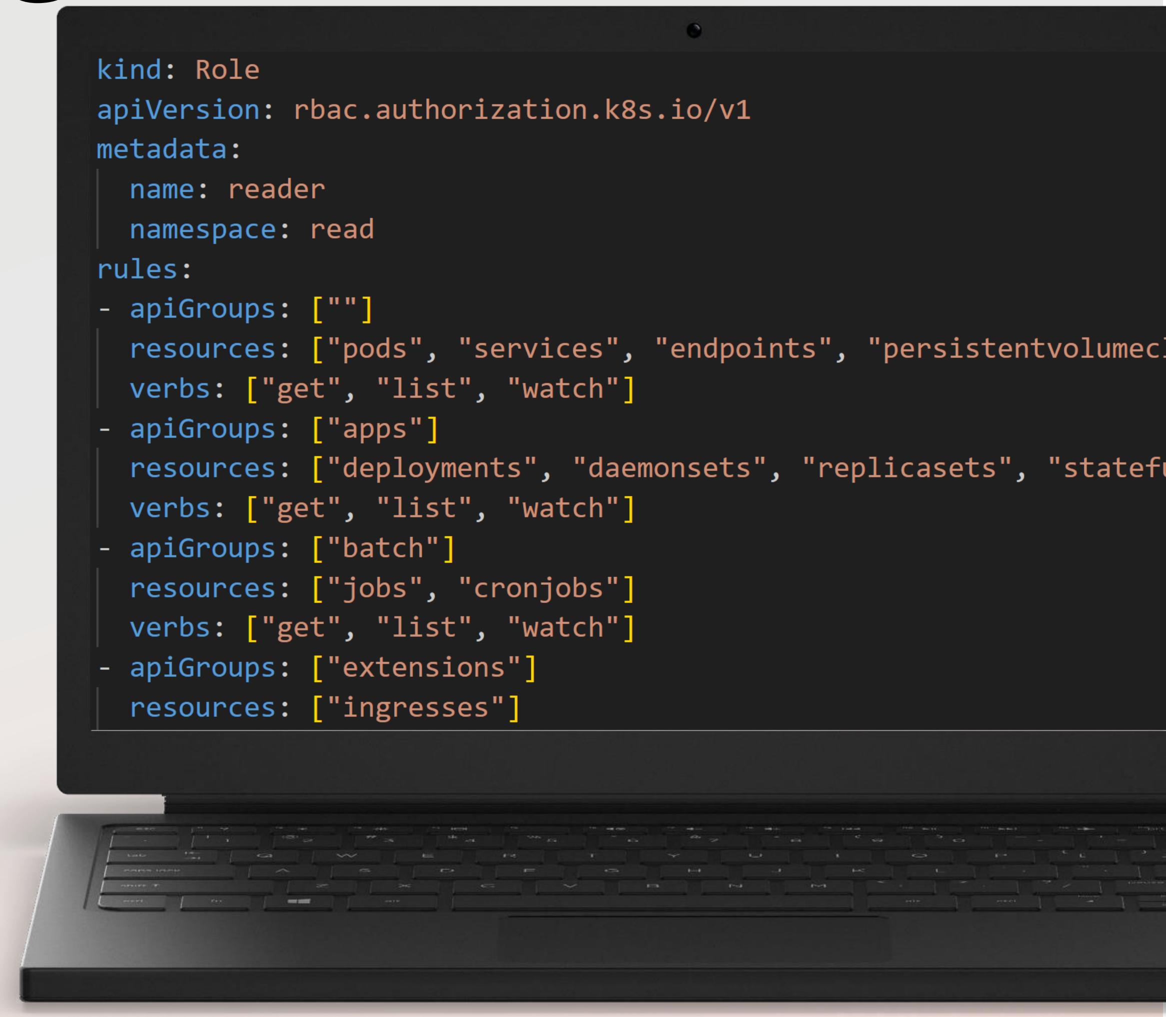
Admin creates role bindings between K8s role and Entra user or group

Entra user or group needs “Azure Kubernetes Cluster User” role to download .kube config

Entra ID with K8s RBAC

Easier user management than local accounts

Choose this option to have a "portable" cluster



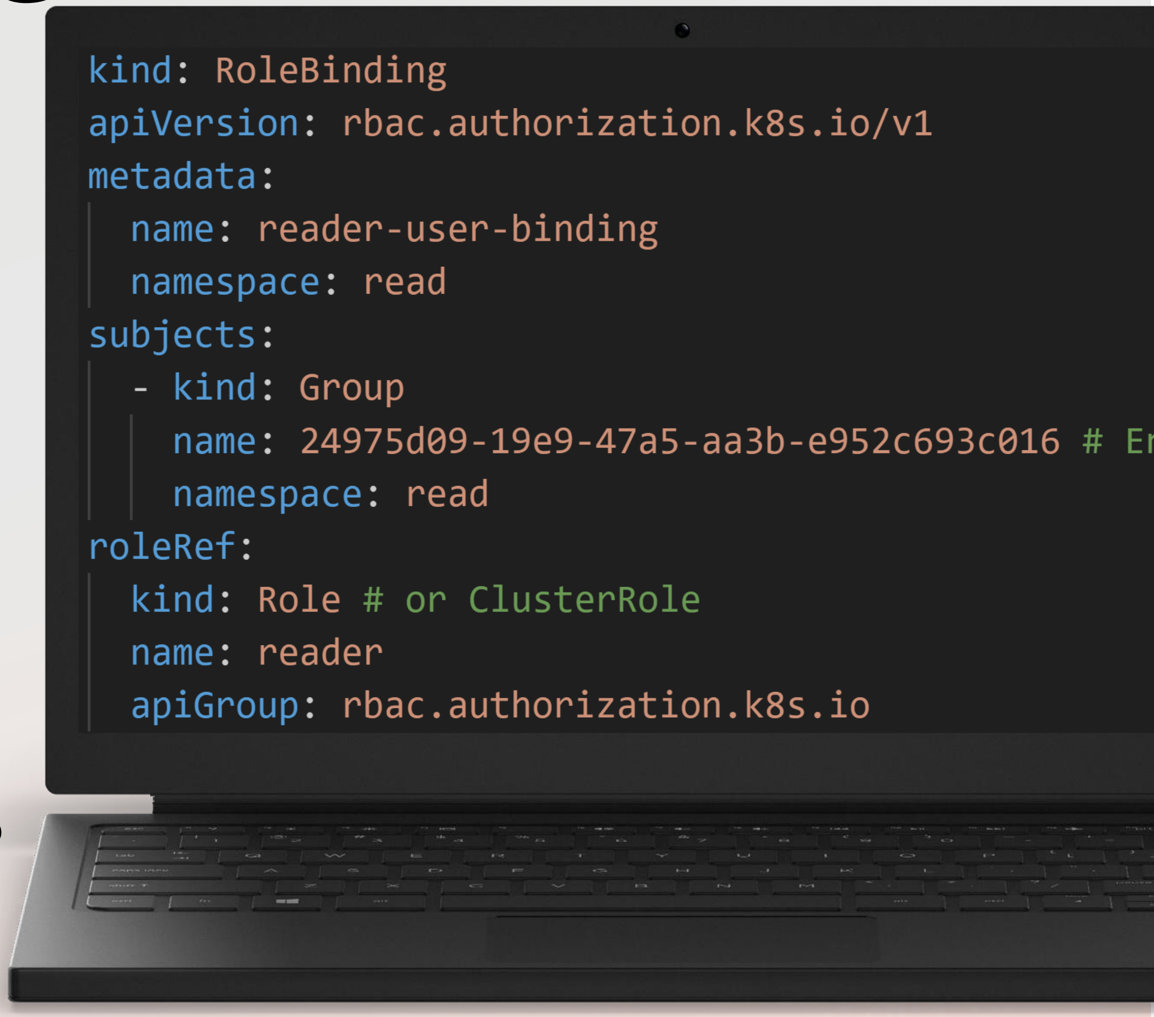
```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: reader
  namespace: read
rules:
- apiGroups: [""]
  resources: ["pods", "services", "endpoints", "persistentvolumec
  verbs: ["get", "list", "watch"]
- apiGroups: ["apps"]
  resources: ["deployments", "daemonsets", "replicasets", "statef
  verbs: ["get", "list", "watch"]
- apiGroups: ["batch"]
  resources: ["jobs", "cronjobs"]
  verbs: ["get", "list", "watch"]
- apiGroups: ["extensions"]
  resources: ["ingresses"]
```

Entra ID with K8s RBAC

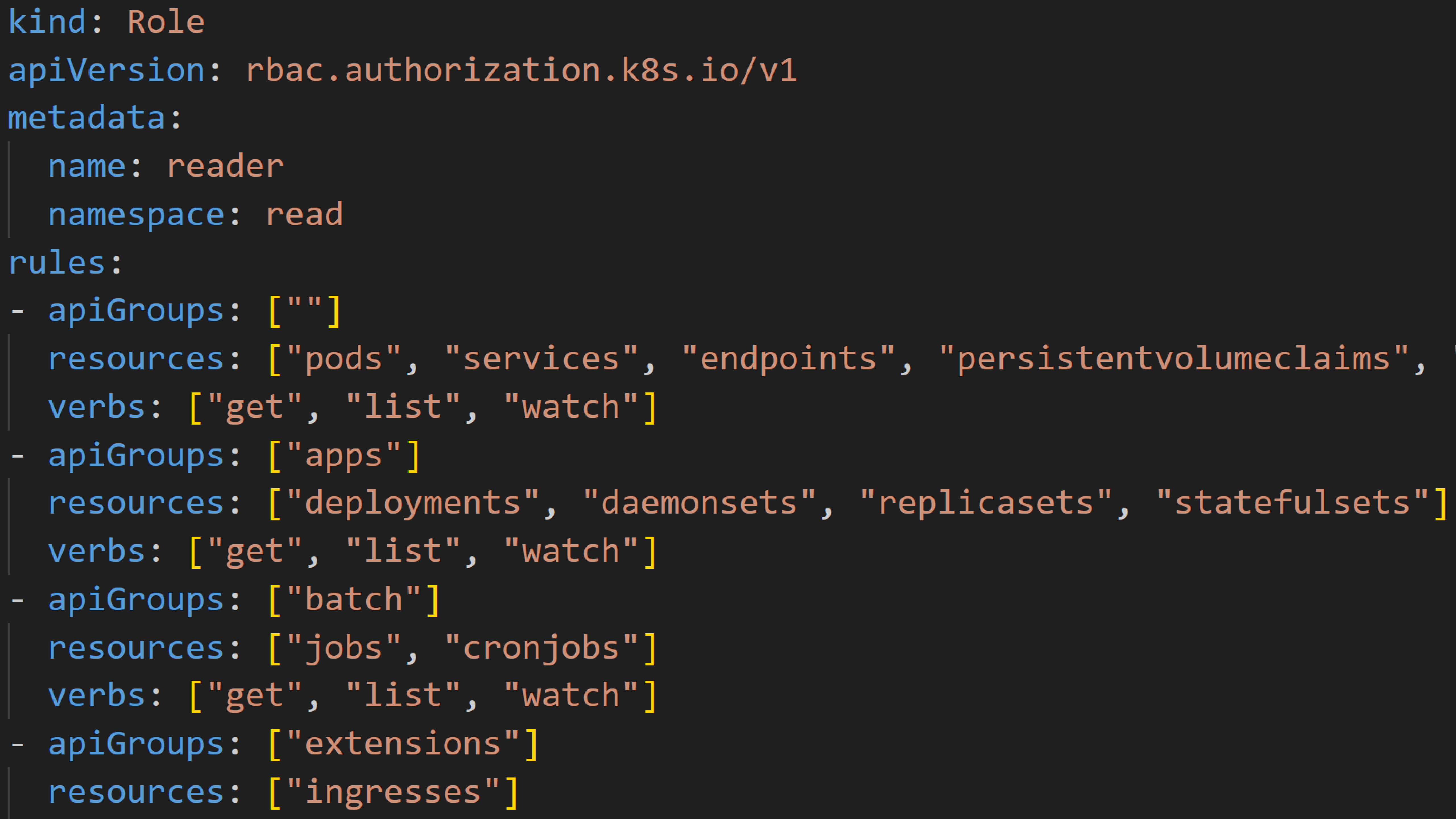
Auditing access to the cluster can be cumbersome

Access can be given to Entra users and groups

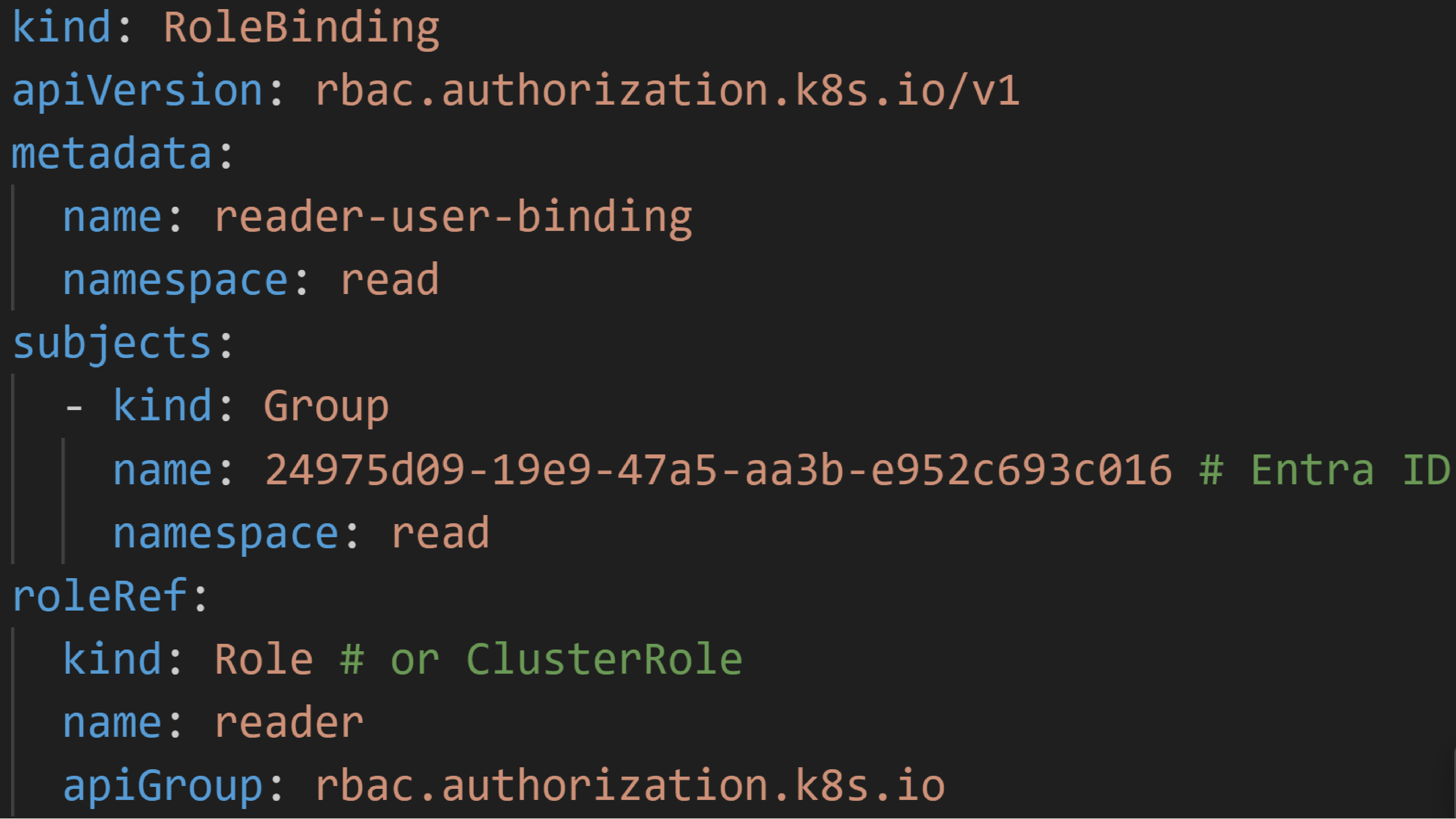
Management with Entra IDs



```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: reader-user-binding
  namespace: read
subjects:
  - kind: Group
    name: 24975d09-19e9-47a5-aa3b-e952c693c016 # Er
    namespace: read
roleRef:
  kind: Role # or ClusterRole
  name: reader
  apiGroup: rbac.authorization.k8s.io
```

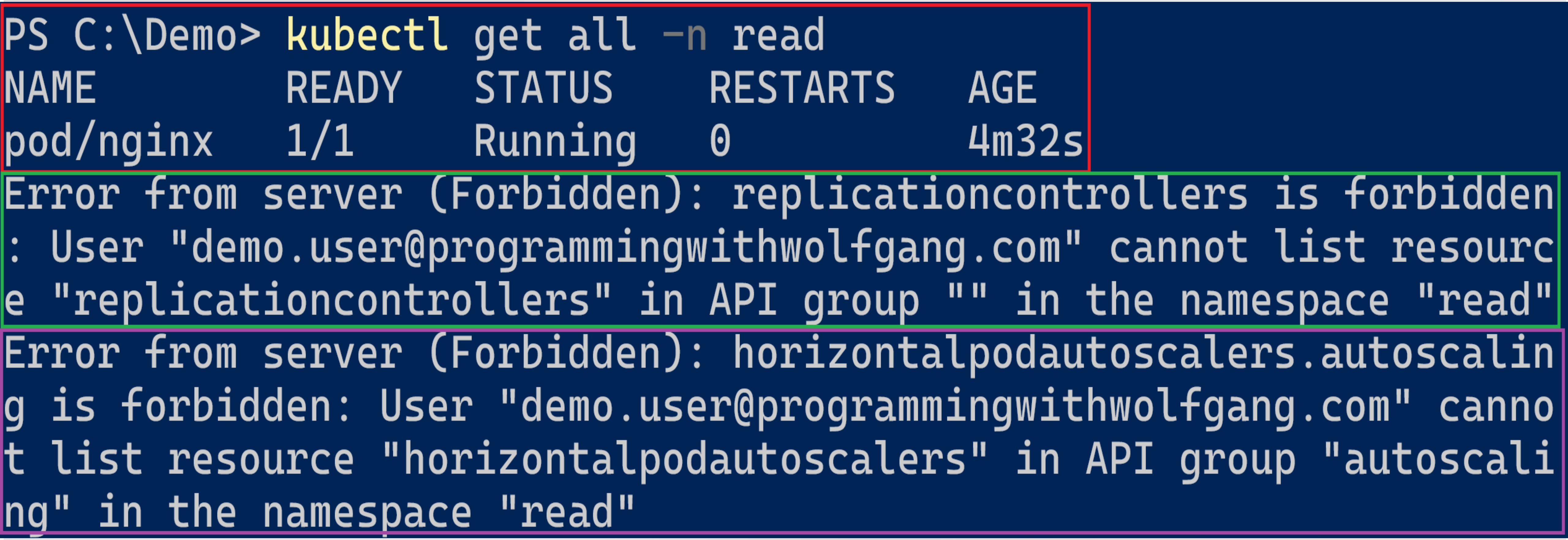


```yaml
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: reader
  namespace: read
rules:
- apiGroups: [""]
  resources: ["pods", "services", "endpoints", "persistentvolumeclaims", "
  verbs: ["get", "list", "watch"]
- apiGroups: ["apps"]
  resources: ["deployments", "daemonsets", "replicasets", "statefulsets"]
  verbs: ["get", "list", "watch"]
- apiGroups: ["batch"]
  resources: ["jobs", "cronjobs"]
  verbs: ["get", "list", "watch"]
- apiGroups: ["extensions"]
  resources: ["ingresses"]
```



```yaml
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: reader-user-binding
  namespace: read
subjects:
  - kind: Group
    name: 24975d09-19e9-47a5-aa3b-e952c693c016 # Entra ID
    namespace: read
roleRef:
  kind: Role # or ClusterRole
  name: reader
  apiGroup: rbac.authorization.k8s.io
```

Entra ID with K8s RBAC



```
PS C:\Demo> kubectl get all -n read
NAME         READY   STATUS    RESTARTS   AGE
pod/nginx    1/1     Running   0          4m32s
Error from server (Forbidden): replicationcontrollers is forbidden
: User "demo.user@programmingwithwolfgang.com" cannot list resourc
e "replicationcontrollers" in API group "" in the namespace "read"
Error from server (Forbidden): horizontalpodautoscalers.autoscalin
g is forbidden: User "demo.user@programmingwithwolfgang.com" canno
t list resource "horizontalpodautoscalers" in API group "autoscali
ng" in the namespace "read"
```

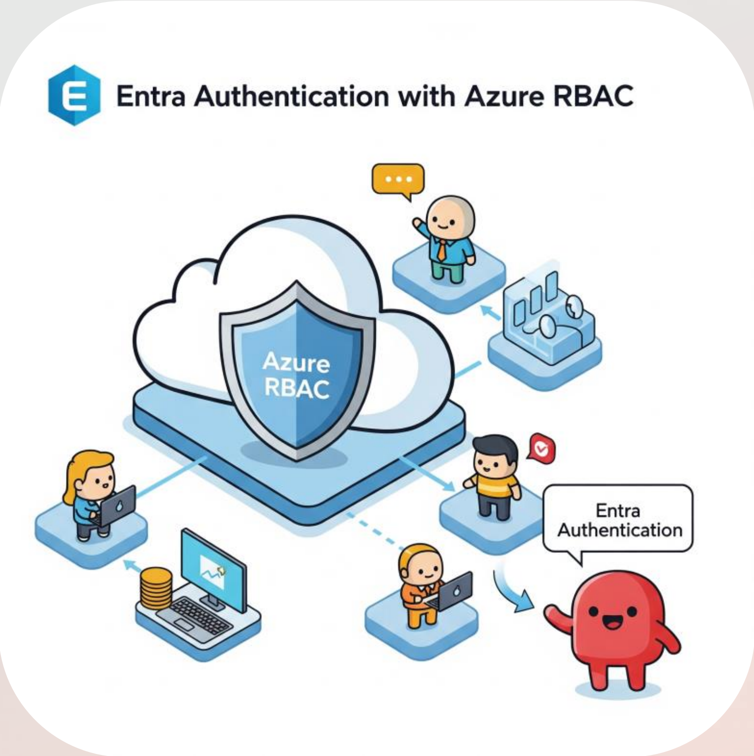
Entra ID Authentication with Azure RBAC

Entra Authentication with Azure RBAC

Manage access to the cluster with Azure only

Use Azure RBAC roles to manage permissions inside AKS

Recommended way to manage AKS cluster

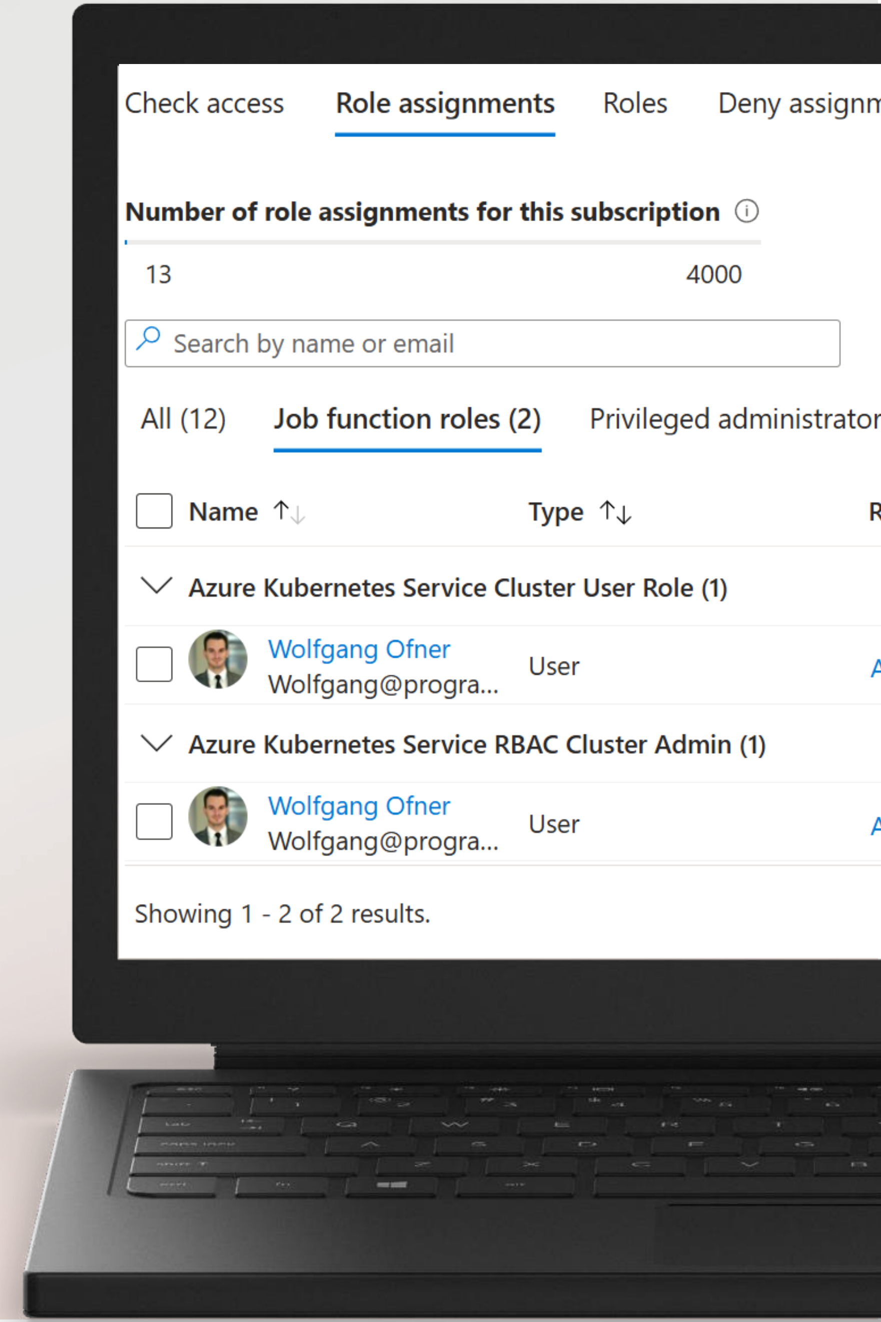


Entra Authentication with Azure RBAC

"Azure Kubernetes Service Cluster User Role" to download config

Assign built-in or custom roles

Namespace specific permissions can only be assigned via Azure CLI



Check access | Role assignments | Roles | Deny assignm

Number of role assignments for this subscription ⓘ

13 4000

Search by name or email

All (12) | Job function roles (2) | Privileged administrator

□	Name ↑↓	Type ↑↓	R
	Azure Kubernetes Service Cluster User Role (1)		
□	Wolfgang Ofner Wolfgang@progra...	User	A
	Azure Kubernetes Service RBAC Cluster Admin (1)		
□	Wolfgang Ofner Wolfgang@progra...	User	A

Showing 1 - 2 of 2 results.

Entra Workload Identitiy

Entra Workload Identity

Azure resource can have identities

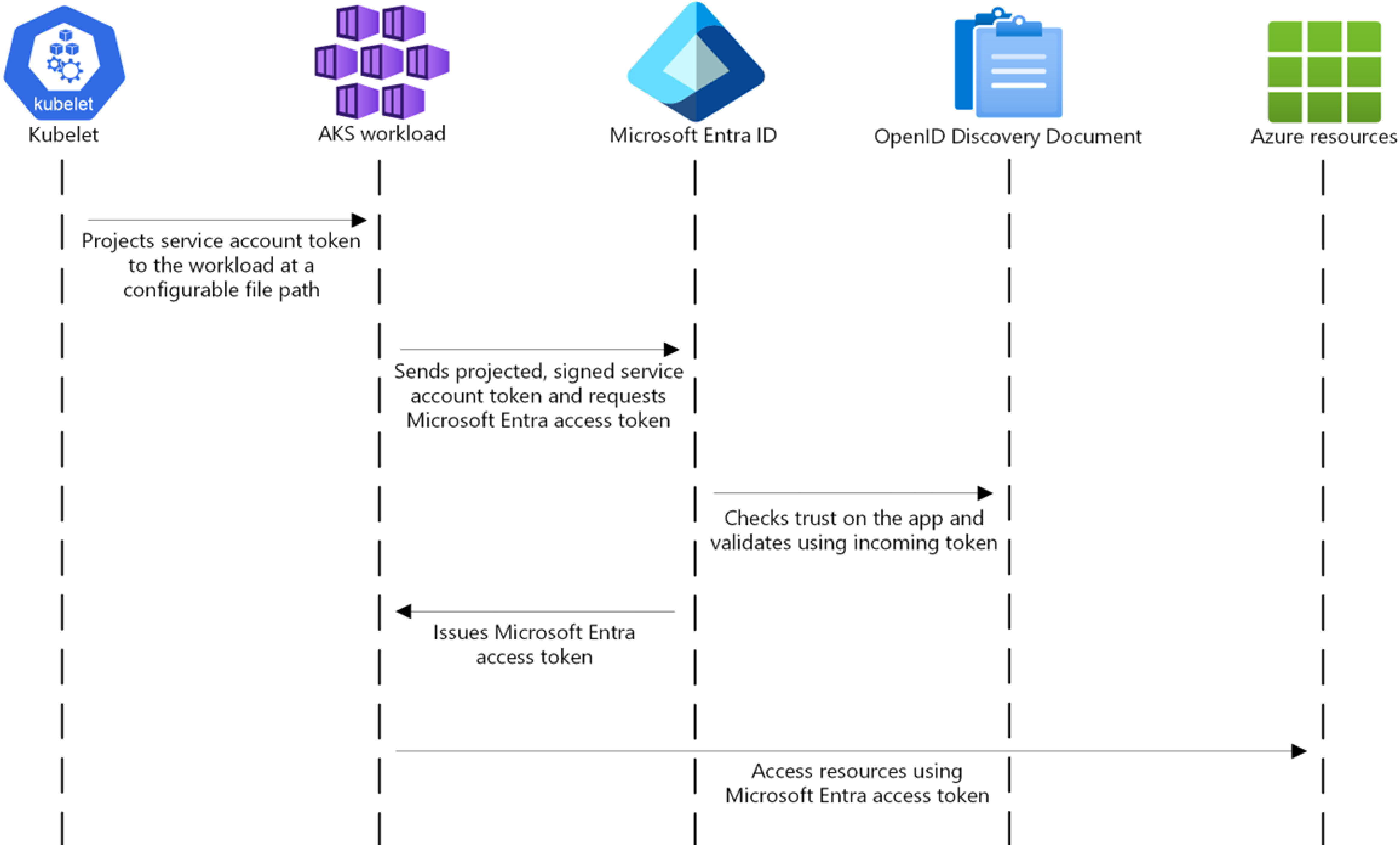
Always use identities over username and password

AKS identity is not assigned to the pods

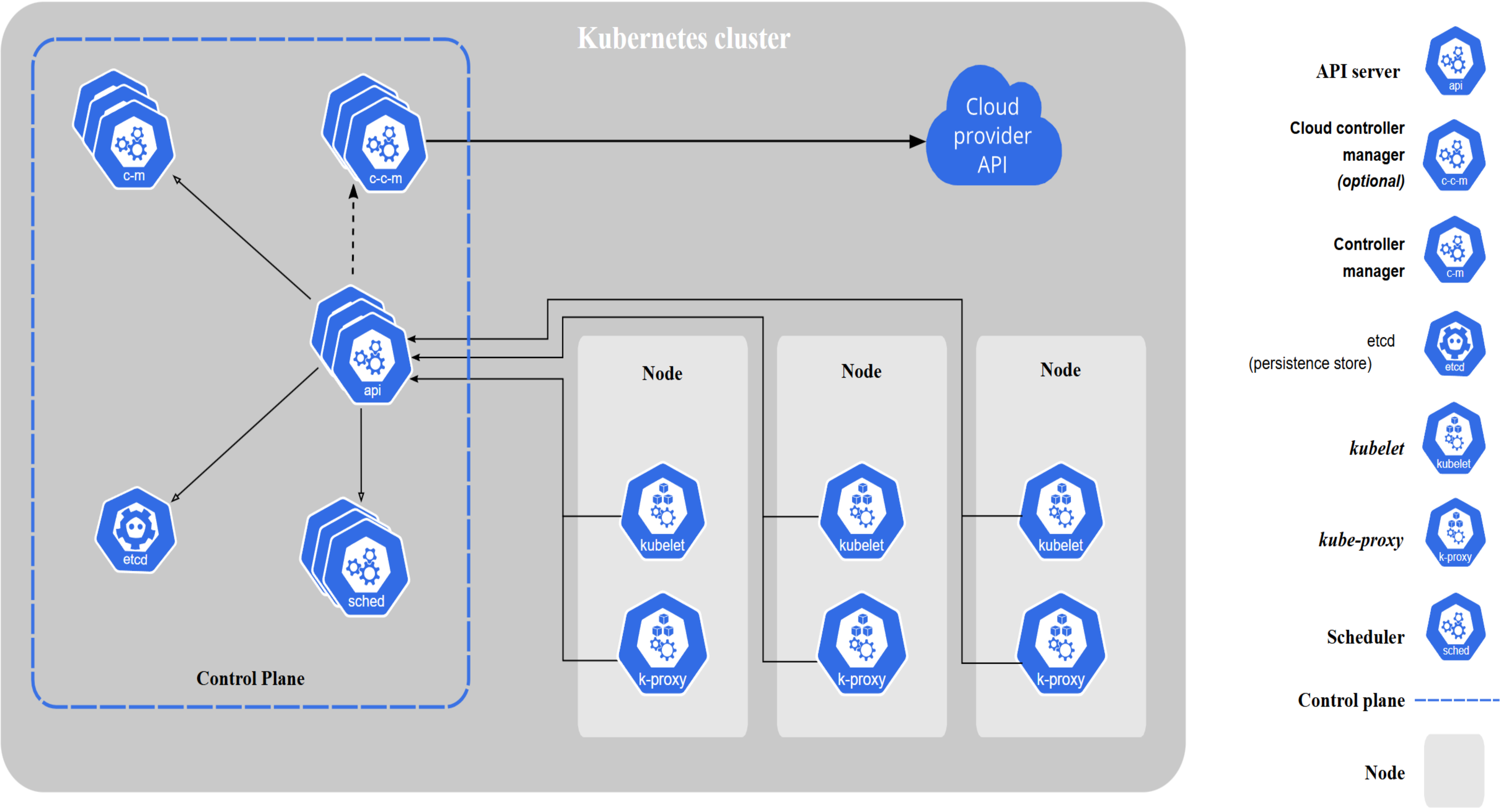
Entra Workload Identity

Entra Workload Identity gives a pod an identity

- Pods can access Azure resources with this identity
- azure.workload.identity/use=true label needed on pod
- OIDC Issuer must be enabled for the AKS cluster


kubelet
Kubelet
AKS workload
Microsoft Entra ID
OpenID Discovery Document
Azure resources
Projects service account token to the workload at a configurable file path
Sends projected, signed service account token and requests Microsoft Entra access token
Checks trust on the app and validates using incoming token
Issues Microsoft Entra access token
Access resources using Microsoft Entra access token

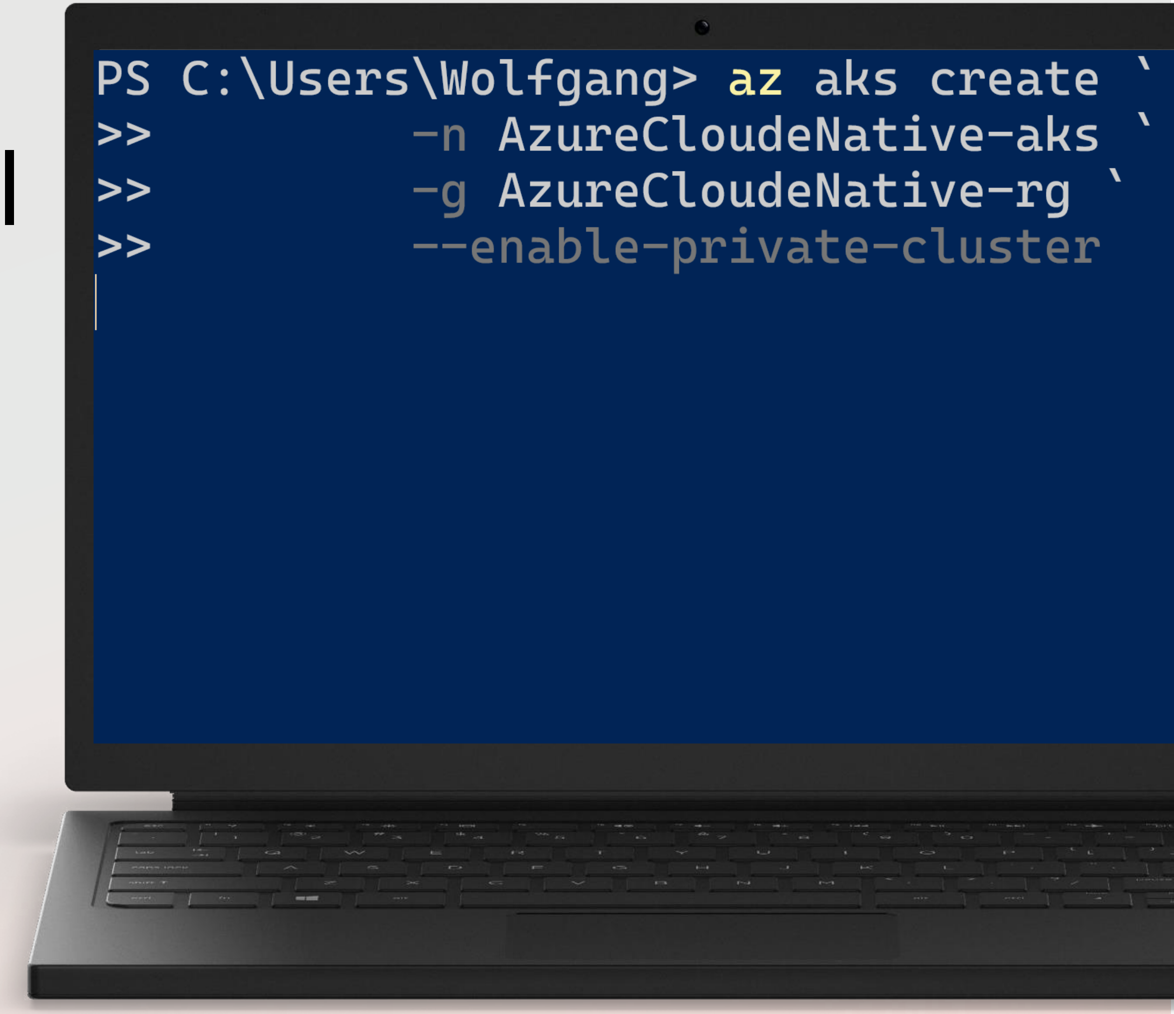
Private AKS Cluster


Kubernetes cluster
c-m
c-c-m
Cloud provider API
api
etcd
sched
Control Plane
Node
Node
Node
kubelet
kubelet
kubelet
k-proxy
k-proxy
k-proxy
API server
api
Cloud controller manager (optional)
c-c-m
Controller manager
c-m
etcd (persistence store)
etcd
kubelet
kubelet
kube-proxy
k-proxy
Scheduler
sched
Control plane
Node

Private AKS Cluster

Disable public access to API

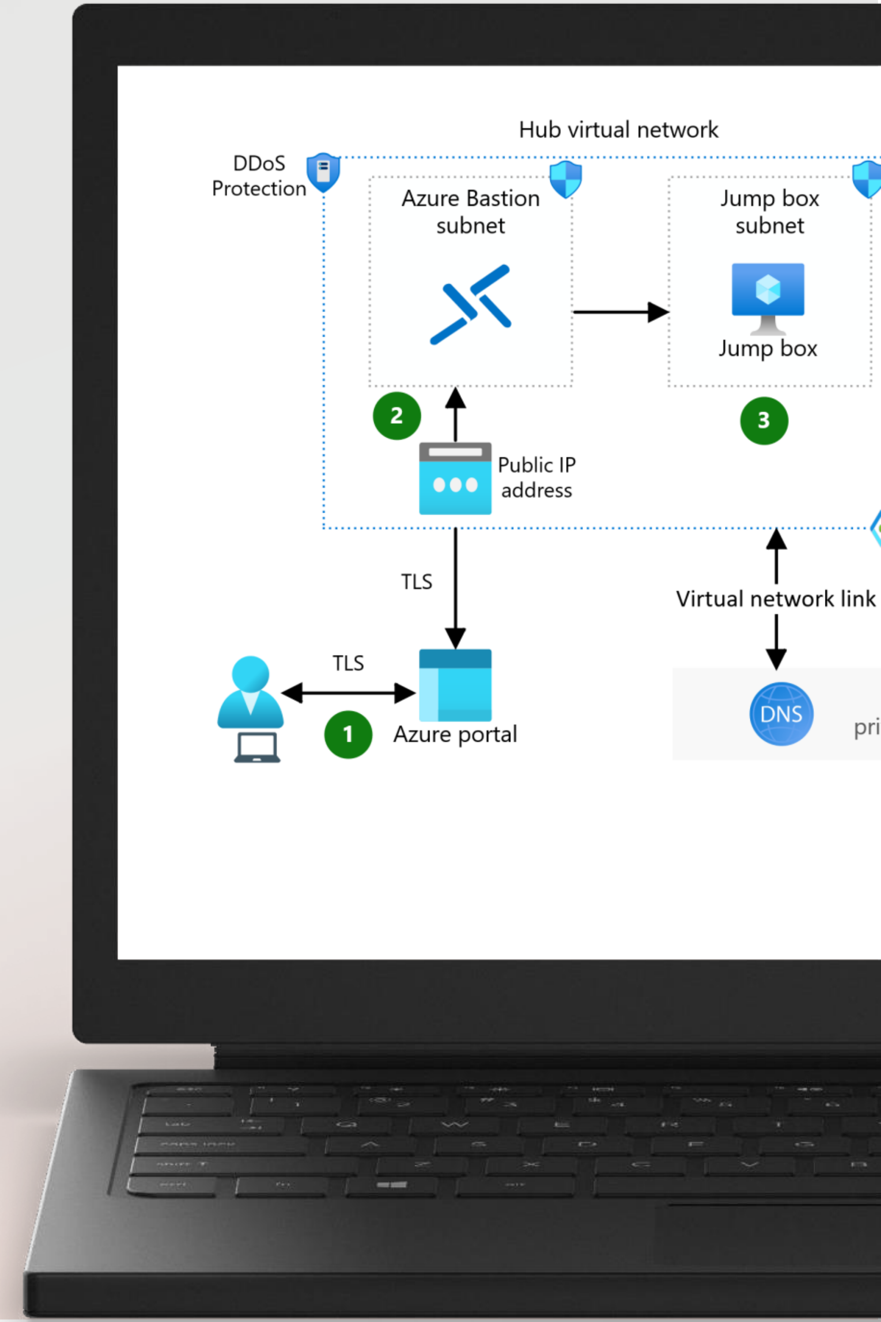
Communication between Worker and Master nodes over a private connection

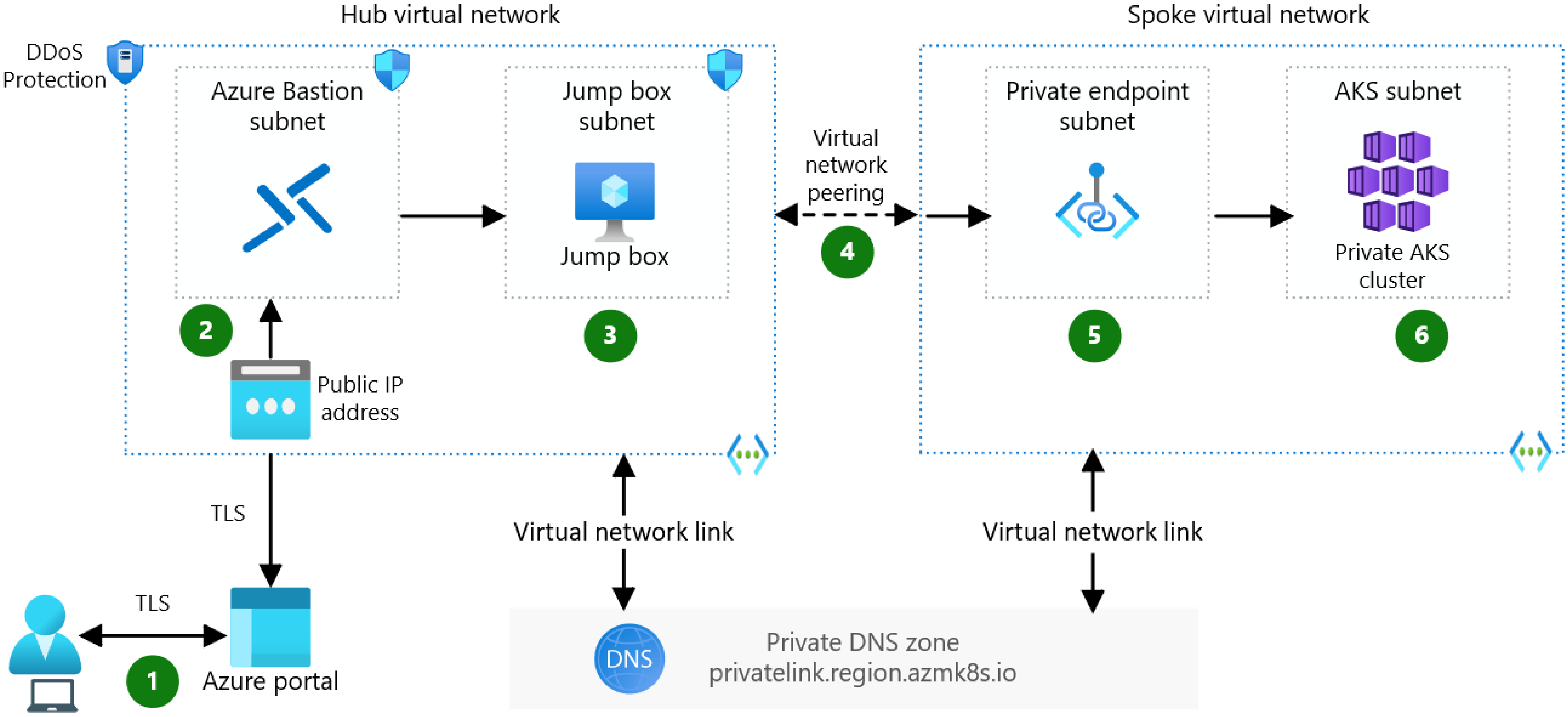


```
PS C:\Users\Wolfgang> az aks create `
>>          -n AzureCloudeNative-aks `
>>          -g AzureCloudeNative-rg `
>>          --enable-private-cluster
```

Private AKS Cluster

Use Azure Bastion and a Jump box



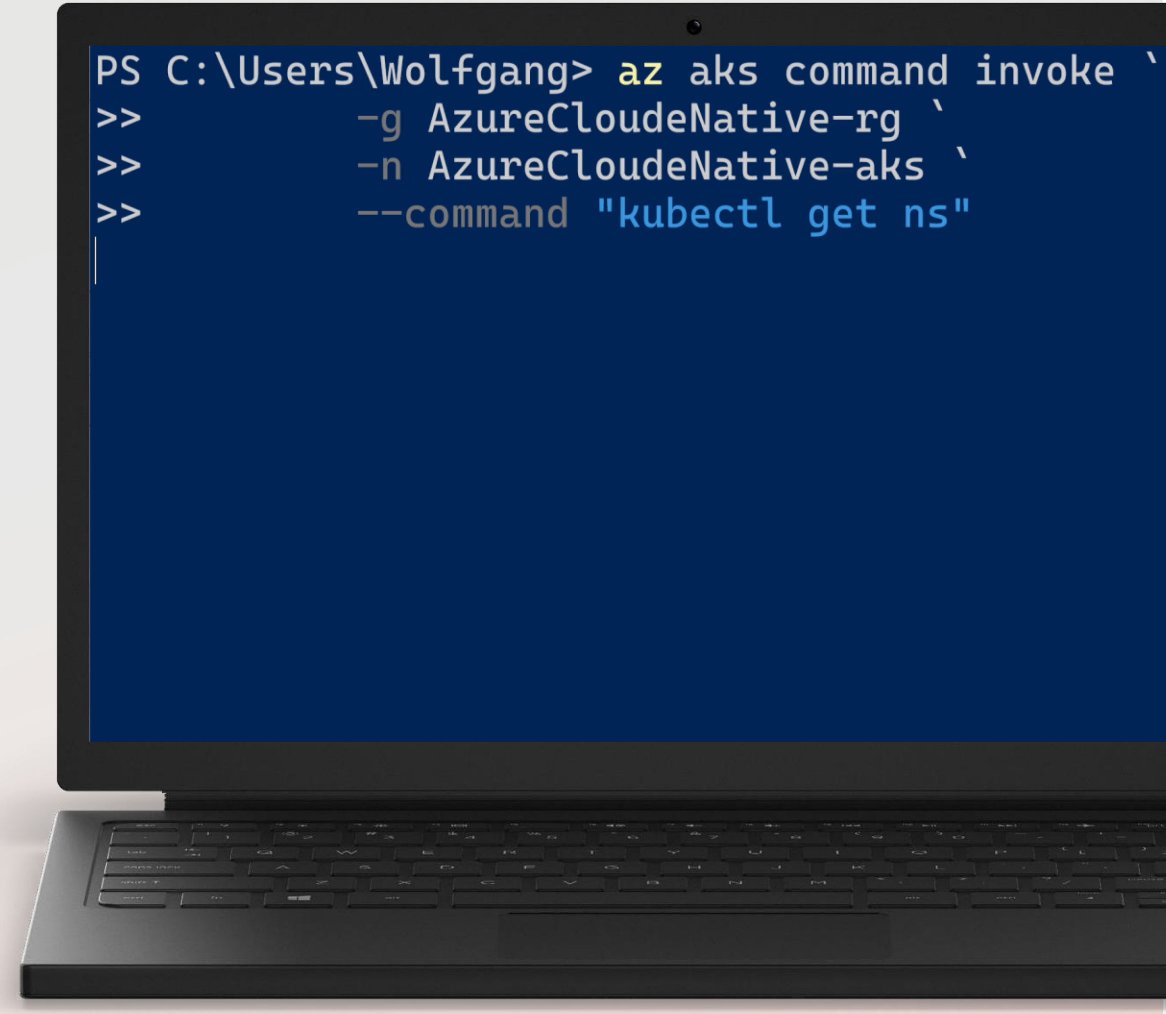

Hub virtual network
Spoke virtual network
DDoS Protection
Azure Bastion subnet
Jump box subnet
Jump box
Virtual network peering
Private endpoint subnet
AKS subnet
Private AKS cluster
2
3
4
5
6
Public IP address
TLS
TLS
1
Azure portal
Virtual network link
Virtual network link
DNS
Private DNS zone
privatelink.region.azmk8s.io

Private AKS Cluster

Use Azure Bastion and a Jump box

Wrap command with “az aks command invoke” command

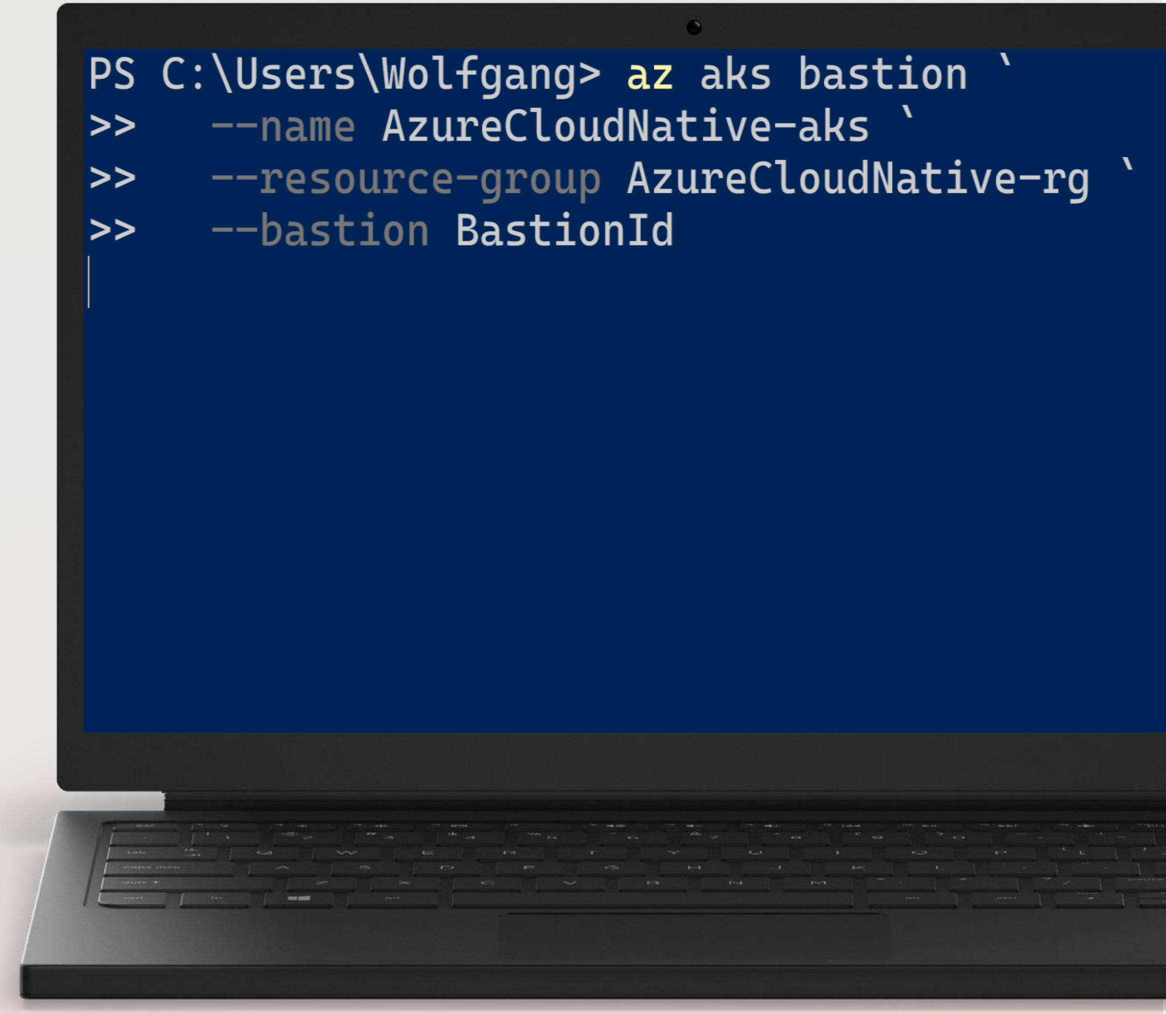
VPN/ExpressRoute connection



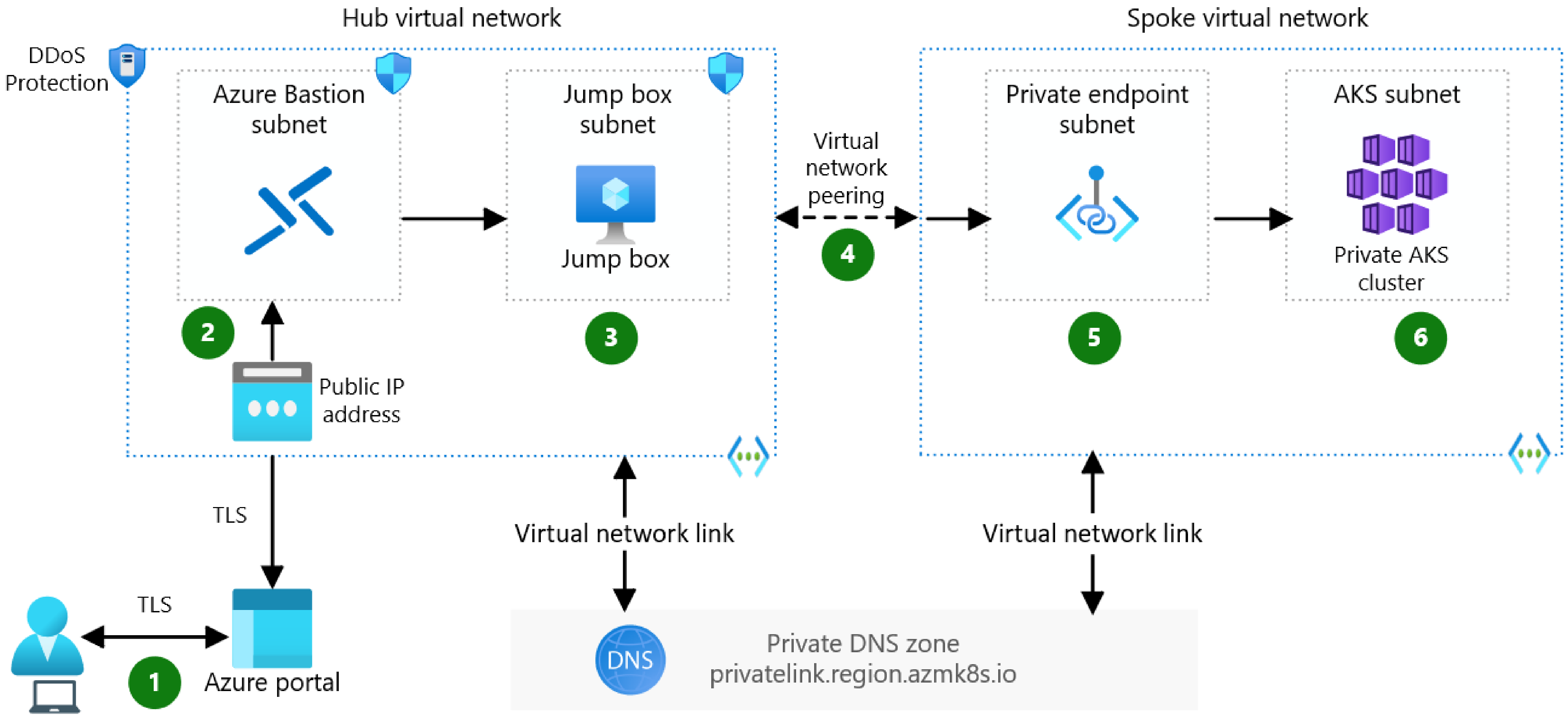
```
PS C:\Users\Wolfgang> az aks command invoke `
>>          -g AzureCloudeNative-rg `
>>          -n AzureCloudeNative-aks `
>>          --command "kubectl get ns"
```

Private AKS Cluster

New feature to access AKS through Azure Bastion



```
PS C:\Users\Wolfgang> az aks bastion `
>>    --name AzureCloudNative-aks `
>>    --resource-group AzureCloudNative-rg `
>>    --bastion BastionId
```


Hub virtual network
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DDoS Protection
Azure Bastion subnet
Jump box subnet
Jump box
Virtual network peering
Private endpoint subnet
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Private AKS cluster
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Virtual network link
Virtual network link
DNS
Private DNS zone
privatelink.region.azmk8s.io
1
2
3
4
5
6

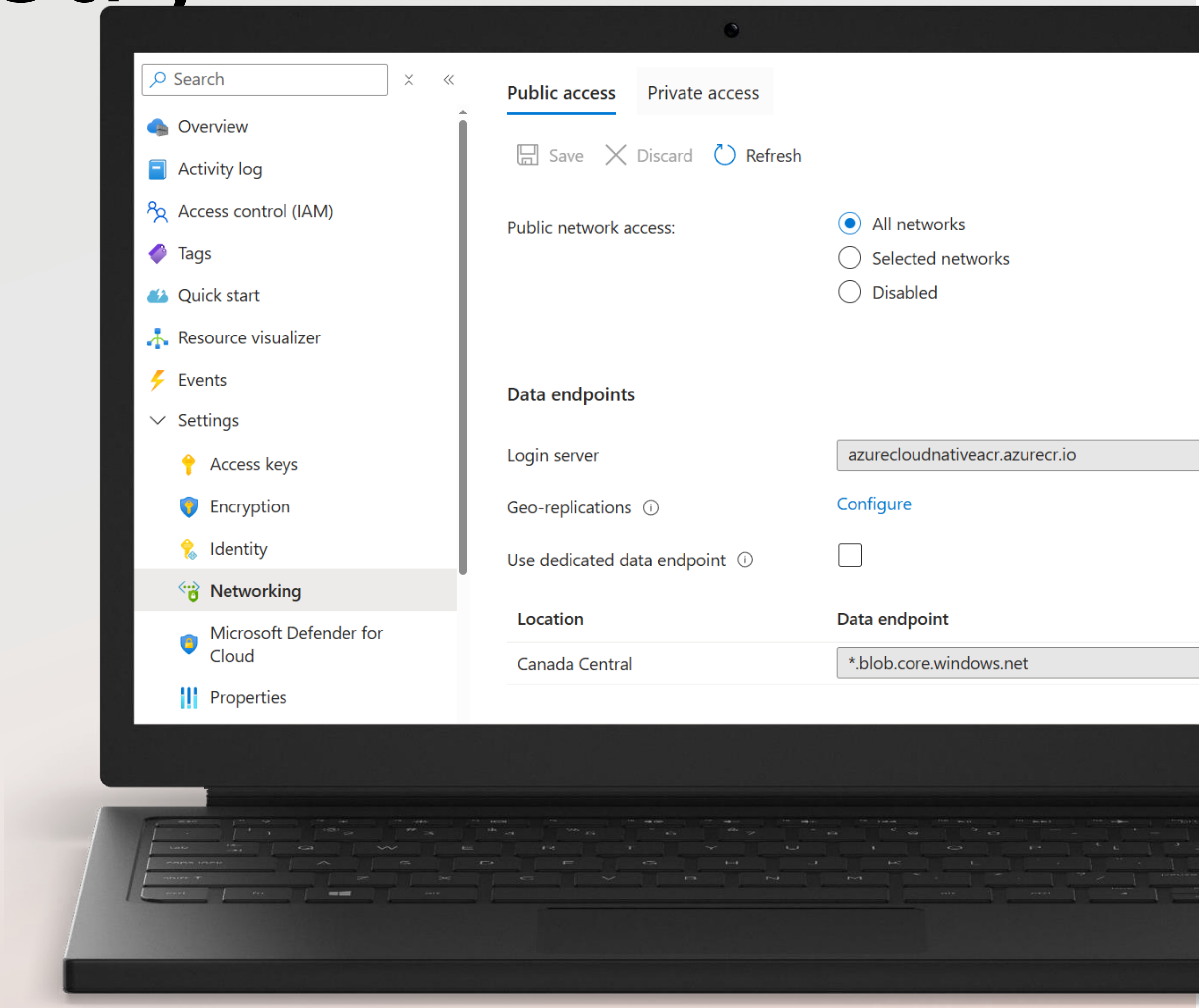
Private
Azure Container Registry

Azure Container Registry

Store images in private registry

Keep everything private

AKS should download images over private connection



Public network access: ● All networks ○ Selected networks ○ Disabled

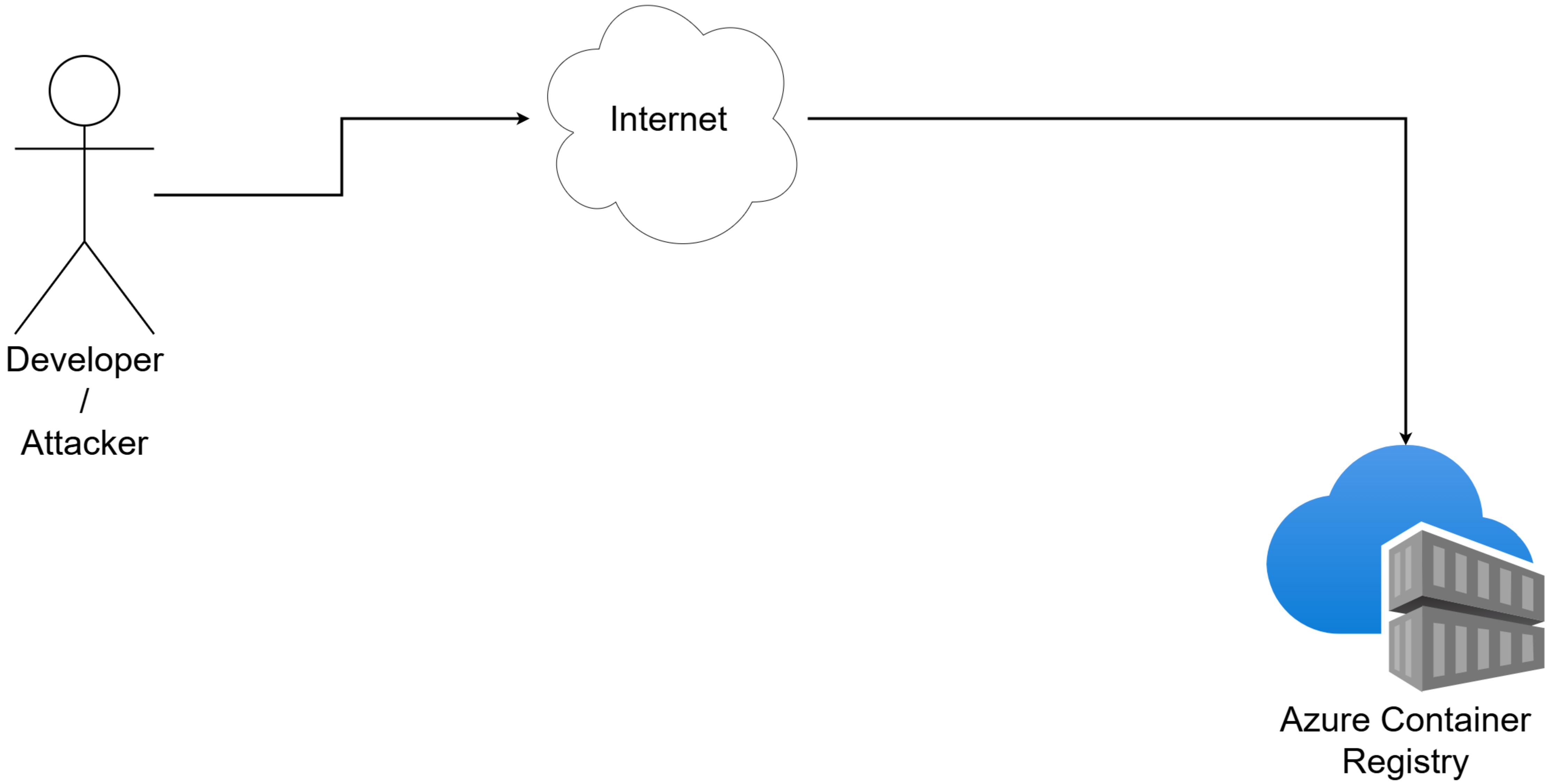
Data endpoints

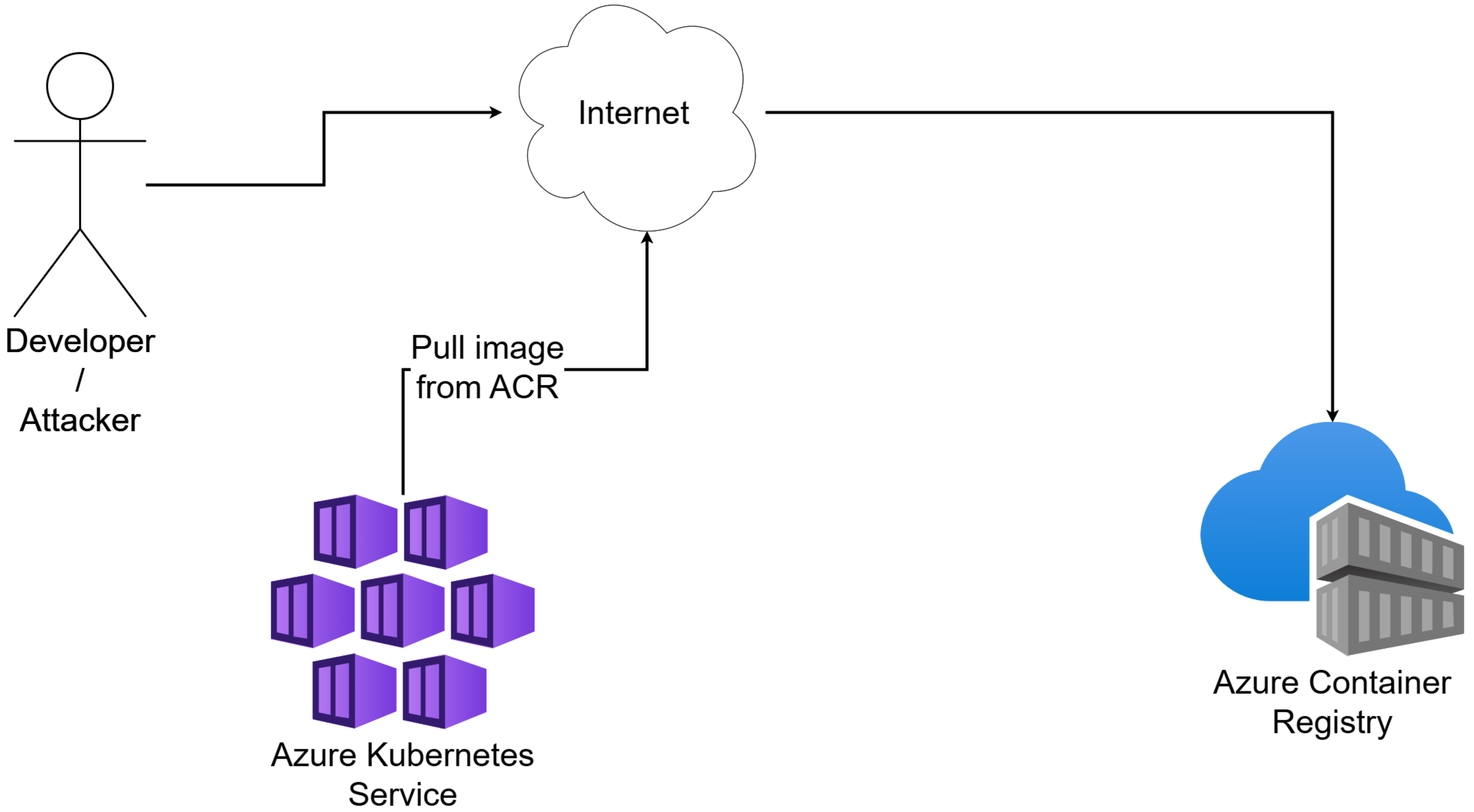
Login server: azurecloudnativeacr.azurecr.io

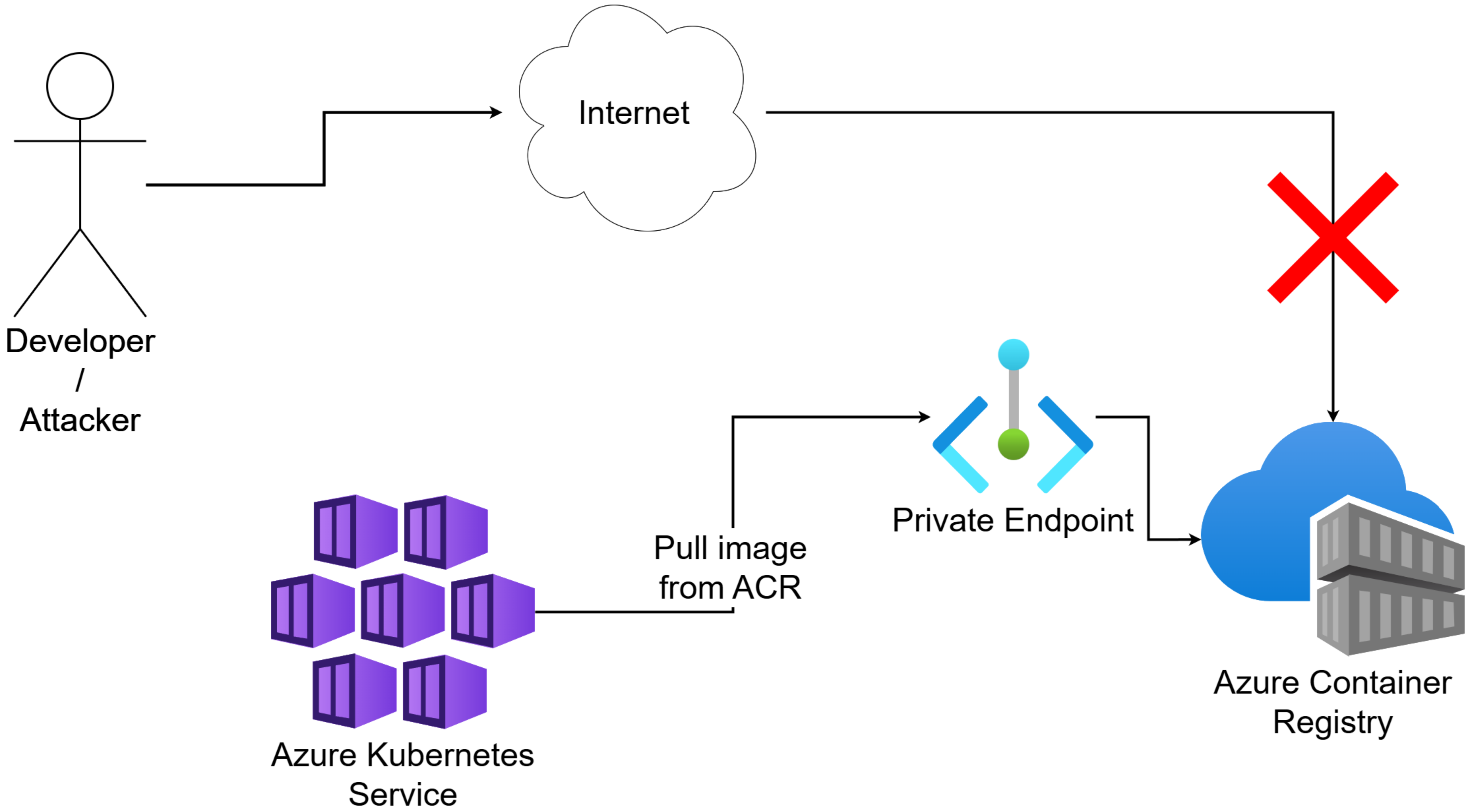
Geo-replications ⓘ Configure

Use dedicated data endpoint ⓘ □

Location	Data endpoint
Canada Central	*.blob.core.windows.net


Developer
/
Attacker
Internet
Azure Container
Registry


Internet
Developer
/
Attacker
Pull image
from ACR
Azure Kubernetes
Service
Azure Container
Registry


Internet
Developer
/
Attacker
Private Endpoint
Pull image
from ACR
Azure Kubernetes
Service
Azure Container
Registry

Azure Container Registry

No changes for pull operation necessary

Private DNS-Zone resolves public FQDN

Build agent needs to push images over private endpoint

Azure Key Vault Provider for Secrets Store CSI Driver

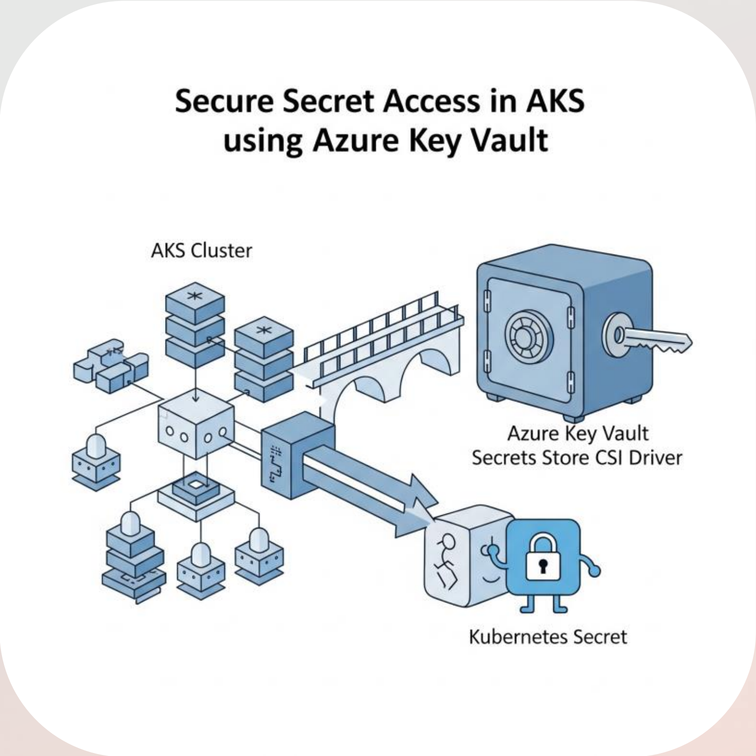
KV Secrets Store Provider

Mount secrets, keys, and certificates to pods

Auto-rotate secrets

Sync Azure Key Vault with Kubernetes secrets

Separation of concerns


Secure Secret Access in AKS using Azure Key Vault
AKS Cluster
Azure Key Vault Secrets Store CSI Driver
Kubernetes Secret

Further Security Topics

Further Security Topics

Use Azure Linux as your node OS

Disable SSH access

Disable local accounts

Install the Azure Policy addon

Microsoft Defender for Containers

Setup your cluster using AKS Automatic

Further Security Topics

Only run signed images

Validate image integrity

Limit the pod privileges

Set the security context

Reduce the pod capabilities

Configure seccom (secure computing)

AKS Security Simplified for Developers

Wolfgang Ofner
Senior Cloud Architect