



SECRET MANAGEMENT

Azure Key Vault



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Kubernetes has "Secret" object which contains sensitive data like key, password, or token. The data save are usually meant for specific pods or container images and this makes the application code to devoid any confidential data. However, this is secret is usually not encrypted by default. Anyone that has access to the API sever data store (etcd) can compromise the data. To deal with this issue, it is recommended to have the secret managed more securely by encrypting the secret and enabling RBAC. Azure key vault was in used in this implementation to store and retrieve digital keys and credentials. Azure Key Vault logging can be enabled to monitor how and who accessed the keys (this was implemented in this project).

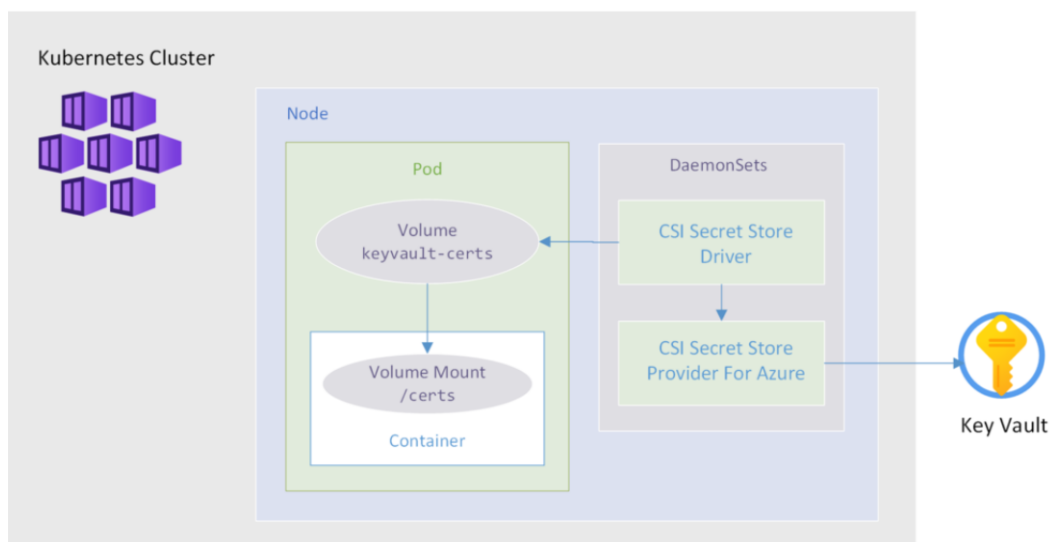


Figure 4.1 Flow from key Vault to a pod and volume mounted on container

Using **pod managed identity** is also an important feature available in Azure cloud. With this feature, a pod can authenticate itself against azure services that support manage identity such as SQL or Storage. Though this was not implemented but it is very vital feature that helps in the resolving issues surrounding stored tokens and keys compromise in cloud. The flow below described how it works.

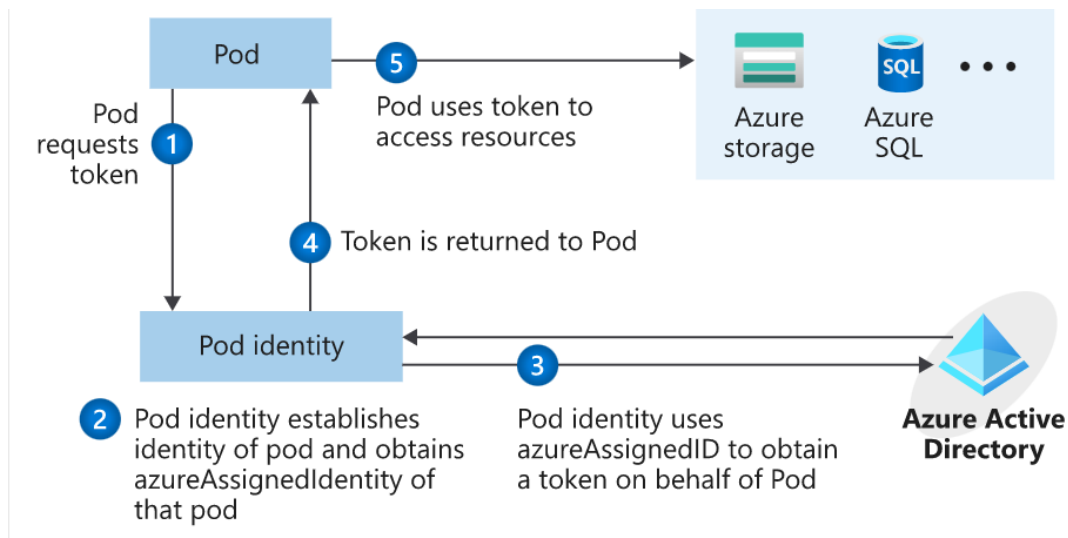


Figure 4. **Error! No text of specified style in document..2** Pod Manage Identity flow (Rhoads, 2021)

Process

Where the passwords and secrets are stored is very important. The secret encoded in base-64 is used when setting up the cluster, the secret can be easily decoded using numerous online tools (Choudhary, 2022).

This was reviewed and Azure key vault was implemented. With this change in configuration, resources can retrieve the secret in the key Vault when needed which has better encryption and more securely saved.

1. Key Vault named **majorProjectVault** was created and then secret was manually created the name was **mysql-password** and the value saved in the vault.

Home > majorProjectVault | Overview > majorProjectVault | Secrets >

Create a secret

Upload options	Manual
Name *	mysql-password
Value *	*****
Content type (optional)	
Set activation date	<input type="checkbox"/>
Set expiration date	<input type="checkbox"/>
Enabled	<input checked="" type="radio"/> Yes <input type="radio"/> No
Tags	0 tags

The screenshot shows the Azure Key Vault 'Secrets' page for 'majorProjectVault'. A notification at the top right states: 'Creating the secret 'mysql-password'. The secret 'mysql-password' has been successfully created.' Below this, a message says: 'The secret 'mysql-password' has been successfully created.' A table lists the secret:

Name	Type	Status	Expiration date
mysql-password		✓ Enabled	

The left sidebar shows navigation options: Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Events, Settings, Keys, Secrets (selected), Certificates, Access policies, Networking, Microsoft Defender for Cloud, Properties, Locks, and Monitoring.

2. Secret Store CSI Driver support was enabled. The function of the CSI driver is for allowing the integration of the Azure keyVault with the AKS cluster. The following commands were run to enable the addons:

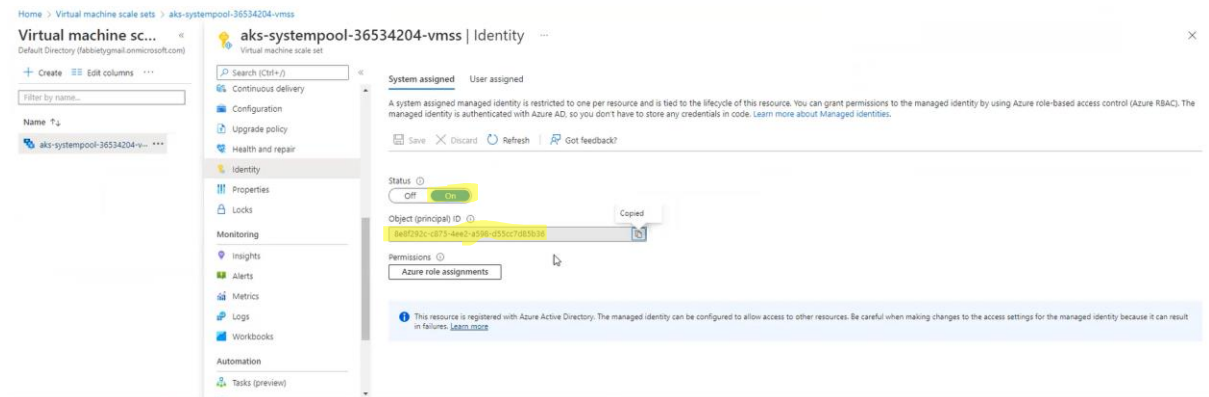
az aks enable-addons --addons azure-keyvault-secrets-provider --name terraform-aks-secure-cluster --resource-group terraform-aks-secure

Verification of the CSI installation captured below.

```
PS /home/fabbiety> kubectl get pods -n kube-system -l 'app in (secrets-store-csi-driver, secrets-store-provider-azure)'
NAME                                READY   STATUS    RESTARTS   AGE
aks-secrets-store-csi-driver-w7l8p   3/3     Running   0           6h9m
aks-secrets-store-provider-azure-sscl 1/1     Running   0           6h9m
PS /home/fabbiety>
```

3. The aim at this point was to provide virtual machine scale set pool which the AKS cluster was using an Identity principal name. This principal name will then be assigned permissions to access the secrets saved in the key Vault.

The image below captured the identity enabled and the principal object name.



4. To grant the identity permissions that enable it to read and view key vault contents, the below two images shows the process.

Home > majorProjectVault | Access policies >

Add access policy

Add access policy

Configure from template (optional) Secret Management ▼

Key permissions 0 selected ▼

Secret permissions 7 selected ▼

Certificate permissions 0 selected ▼

Select principal *

aks-systempool-36534204-vmss
Object ID: 8e8f292c-c875-4ee2-a598-d55cc7d85b36

Authorized application ⓘ None selected



Home > majorProjectVault

majorProjectVault | Access policies

Key vault

Search (Ctrl+F)

Save Discard Refresh

Please click the 'Save' button to commit your changes.

☐ Azure Resource Manager for template deployment ⓘ
☐ Azure Disk Encryption for volume encryption ⓘ

Permission model ☒ Vault access policy ☐ Azure role-based access control ⓘ

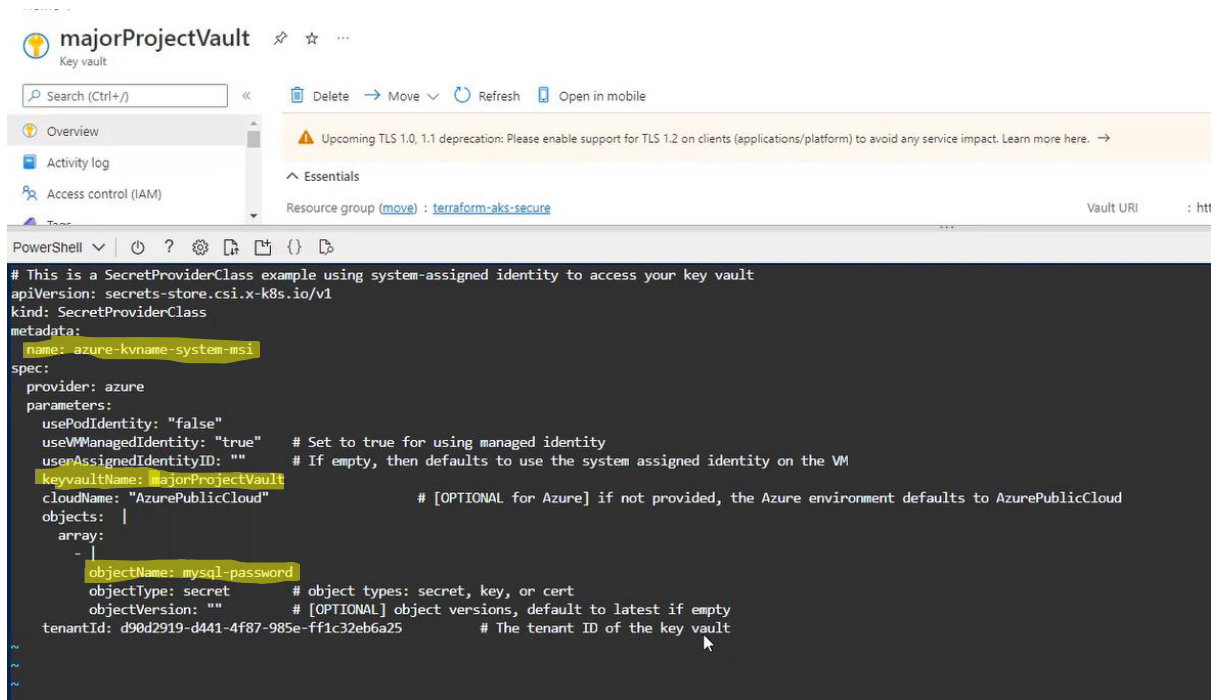
+ Add Access Policy

Current Access Policies

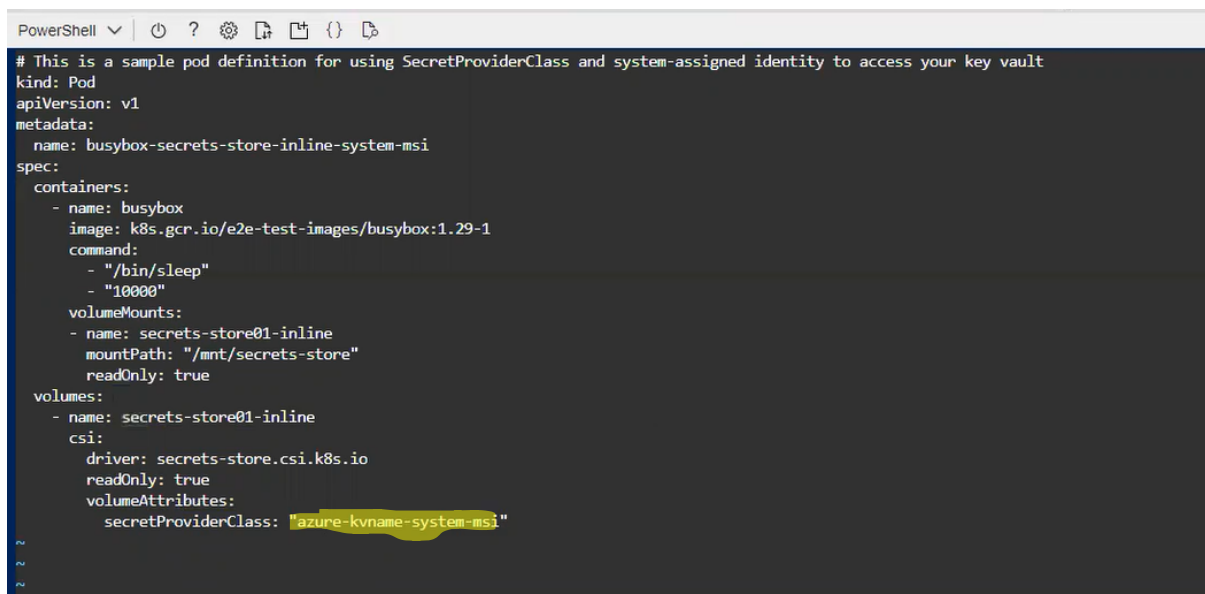
Name	Email	Key Permissions	Secret Permissions	Certificate Permissions	Action
APPLICATION					
aks-systempool-365342...		0 selected	7 selected	0 selected	Delete
USER					
31521140-0070-462f-98...	fabbiety_gmail.com#EXT...	12 selected	7 selected	15 selected	Delete

5. For the secret to actually get access, Secret Provider Class had to be explicitly defined. This presents the name of the secrets that need to be imported from the particular key Vault. The yaml file was created and thereafter applied to the target cluster using this command

kubectl apply -f secretproviderclass.yaml



6. Finally, to create the secret in the kubernetes, a pod that mounted a volume using CSI and referenced the created Secret Provider Class was created.



```

PS /home/fabbiety> kubectl apply -f pod.yaml
pod/busybox-secrets-store-inline-system-msi created
PS /home/fabbiety> kubectl get po
NAME                                READY   STATUS    RESTARTS   AGE
busybox-secrets-store-inline-system-msi 1/1     Running   0           4s
PS /home/fabbiety> kubectl exec busybox-secrets-store-inline -- ls /mnt/secrets-store/
Error from server (NotFound): pods "busybox-secrets-store-inline" not found
PS /home/fabbiety> 

```

Validating the secrets from the created pod

```

PS /home/fabbiety> kubectl exec busybox-secrets-store-inline-system-msi -- ls /mnt/secrets-store/
mysql-password
PS /home/fabbiety> kubectl exec busybox-secrets-store-inline-system-msi -- cat /mnt/secrets-store/mysql-password
Password@123
PS /home/fabbiety> 

```

This is the recommended way of managing secrets in AKS cluster (and cloud in general) with all values stored in key vault. The content of the vault can be key or certificate or as seen in the demonstration above, secrets. Only specific secret in a specific key vault can be accessed after permission is expressly given. The whole management of the public and private keys are done by the platform provider.