HashiCorp Vault

Consuming Secrets from HCP Vault

Agenda

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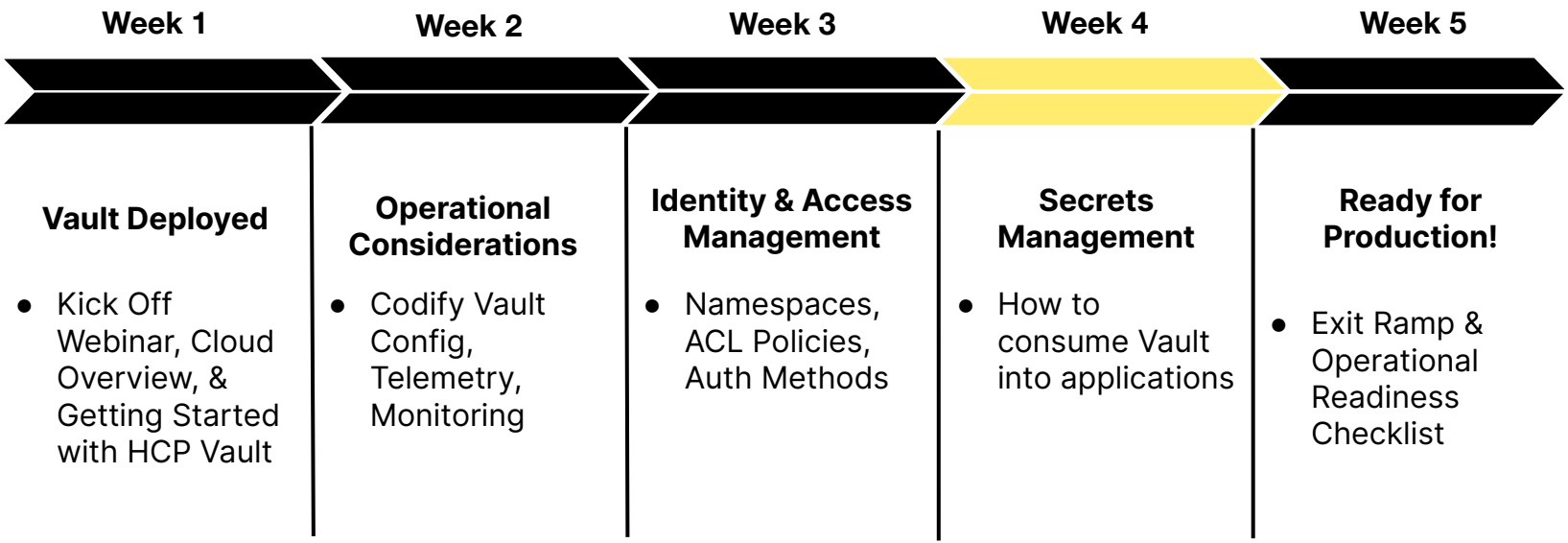
HCP Vault Onboarding Program

A 5 week guided community environment
Assisting customers with onboarding and adoption

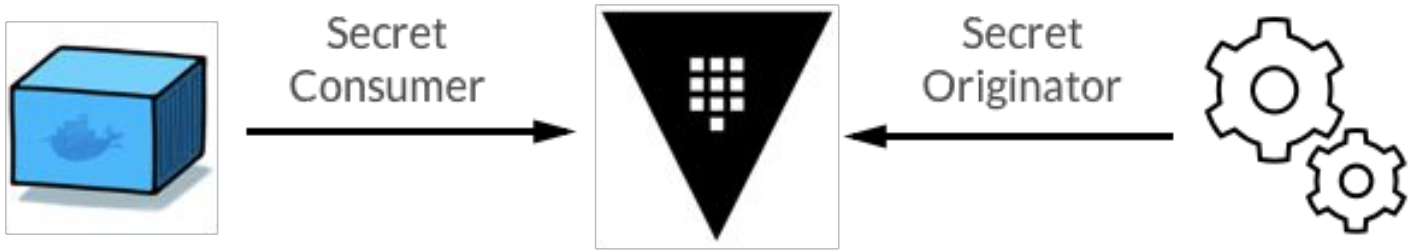


01

Secure Introduction

Secret Originator and Consumer

Successful secure distribution of a secret from an originator to a consumer, allows all subsequent secrets transmitted between them to be authenticated by the trust established by that initial successful transaction



- Tokens are the core method for authentication within Vault
- Every secret consumer (client) must acquire a valid token

Methods for Secure Introduction

Platform Integration

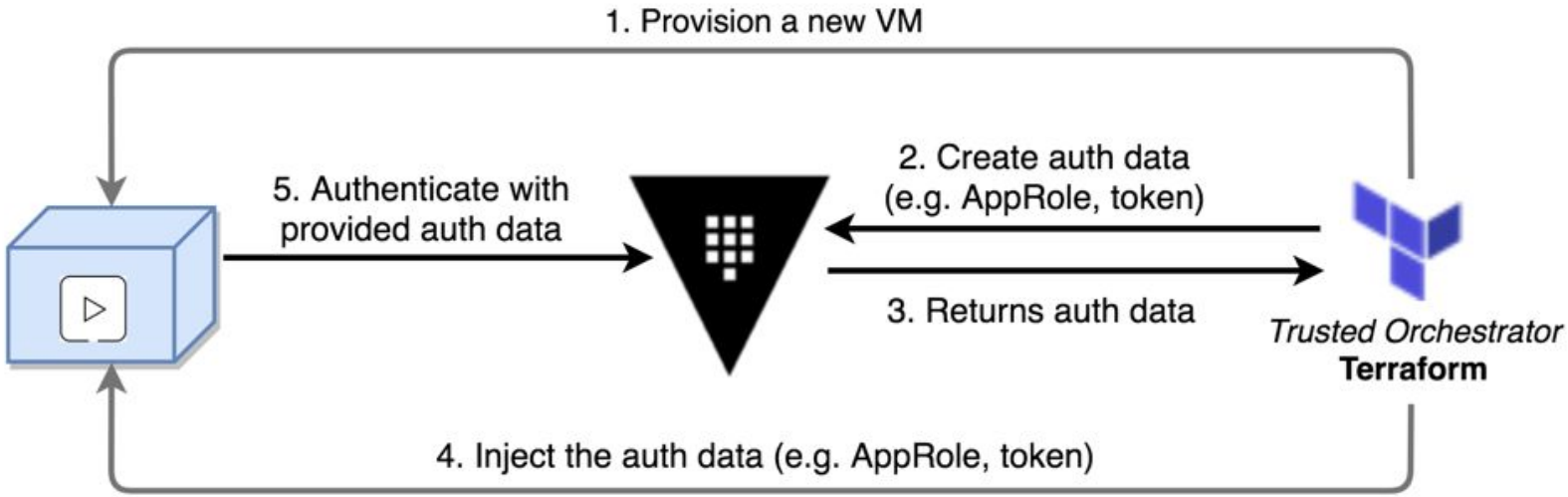
- Vault establishes trust relationship with a trusted platforms (AWS, Azure, GCP)
- The platforms identifier of resources (VMs, containers, etc) is used to authenticate and provide authorization to a Vault token

Trusted Orchestrator

- Existing trusted orchestrator (Terraform, Kubernetes, Chef) has already authenticated to Vault with privileged permissions
- At application deployment orchestrator injects necessary credentials to authenticate to Vault and retrieve a Vault token

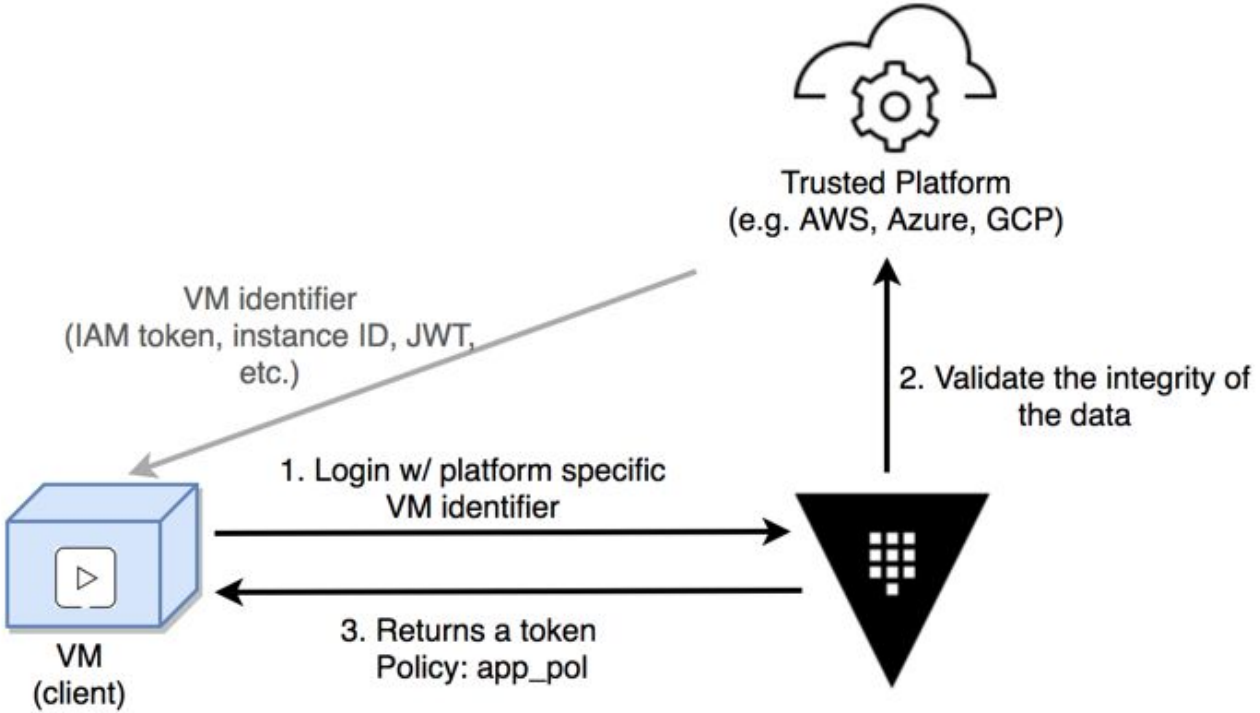
Trusted Orchestrator

Secure introduction in a VM environment



Platform Integration

Secure introduction in a cloud environment



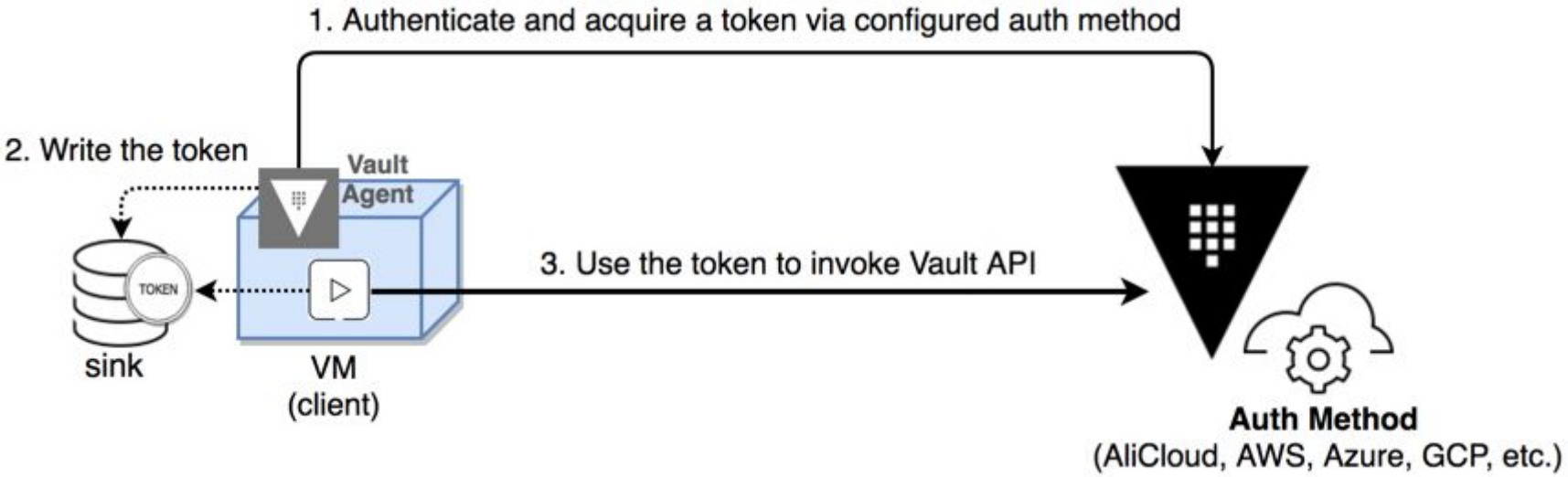
Automating Introduction

Vault Agent is a client daemon which automates the client login workflow and the lifecycle for Vault tokens

- Compatible with both platform integration and trusted orchestrator secure introduction methods
- Included as part of the Vault binary and can be run by starting the binary in agent mode - ***“vault agent -config=<config-file>”***
- After authentication completes a Vault token is written to file sink

Automate Introduction

Vault Agent



Vault Agent Metrics

Metric	Description	Type
`vault.agent.auth.failure`	Number of authentication failures	Counter
`vault.agent.auth.success`	Number of authentication successes	Counter
`vault.agent.proxy.success`	Number of requests successfully proxied	Counter
`vault.agent.proxy.client_error`	Number of request for which Vault returned an error	Counter
`vault.agent.proxy.error`	Number of requests the agent failed to proxy	Counter
`vault.agent.cache.hit`	Number of cache hits	Counter
`vault.agent.cache.miss`	Number of cache misses	Counter

02

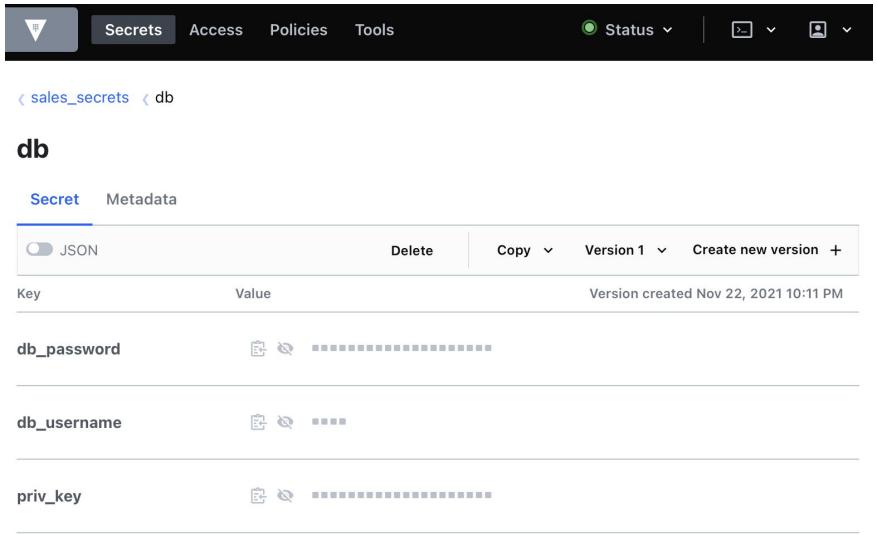
Consuming Secrets

Patterns to Consume Secrets

- UI
- CLI
- HTTP API
- Templating
- Environment Variables
- Client Libraries

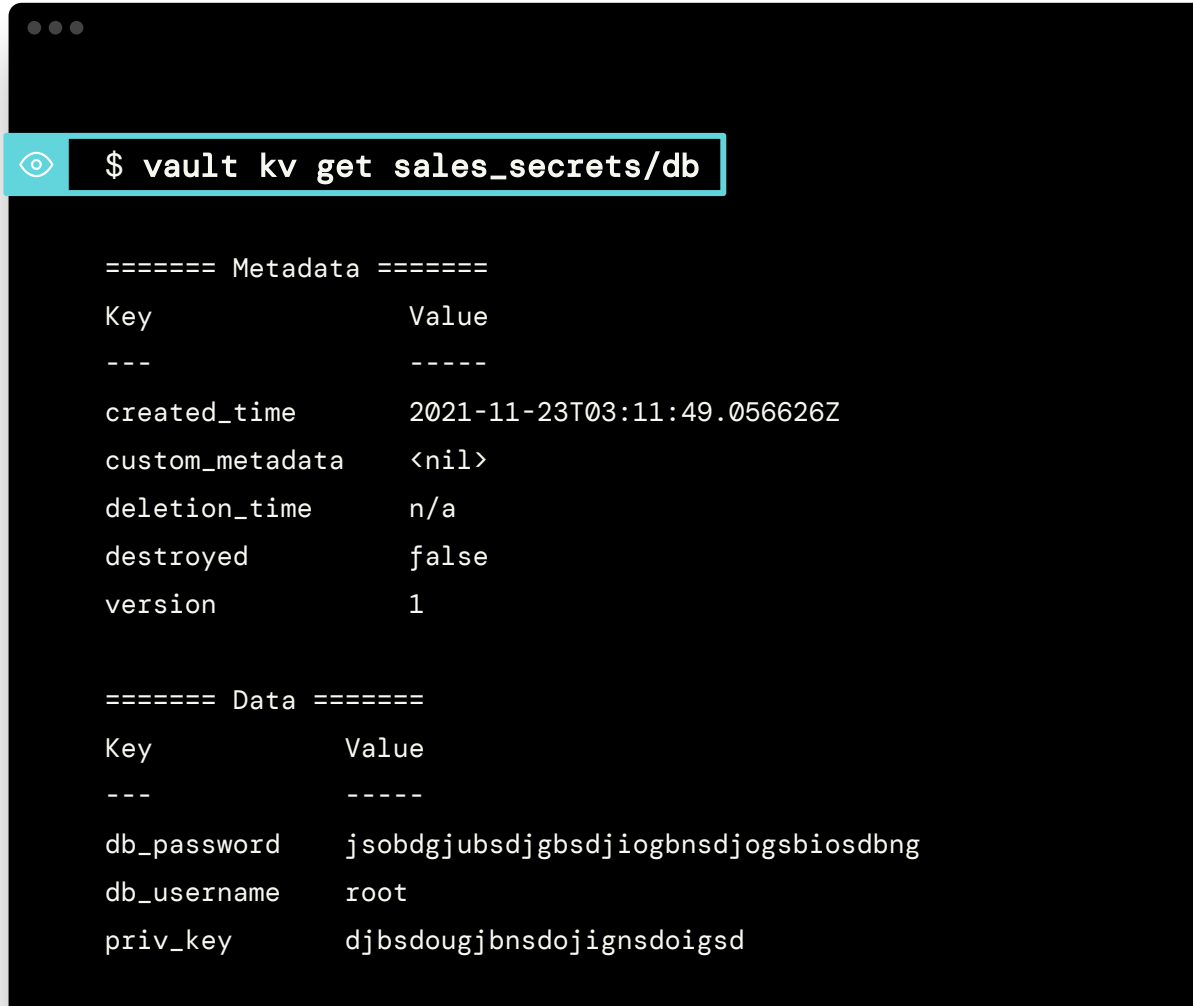
Web UI

- Users can populate and consume secrets without learning CLI or API commands
- Works well for users to consuming secrets
- Can be limiting when secrets need to be consumed at scale or as part of an application configuration



CLI

Typically used by users for manual secret consumption



HTTP API

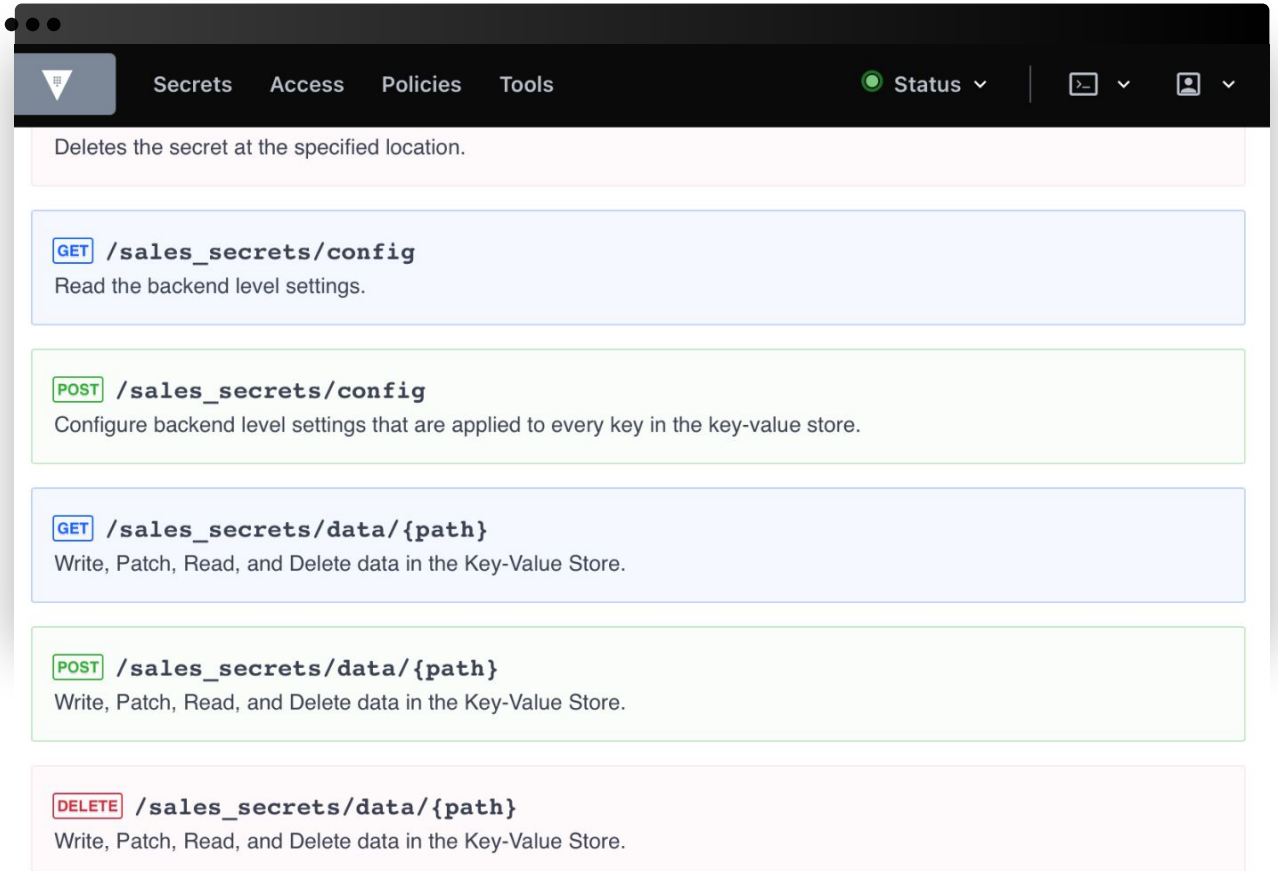
Feature rich API provides full access to Vault and every aspect of Vault can be controlled via this method

```
$ curl --header "X-Vault-Token: $VAULT_TOKEN" \
   --header "X-Vault-Namespace: $VAULT_NAMESPACE" \
   $VAULT_ADDR/v1/secret/data/customer/acme | jq -r ".data"

========== Output ============
{
   "data": {
      "contact_email": "john.smith@acme.com",
      "customer_name": "ACME Inc."
   },
   "metadata": {
    "created_time": "2021-10-29T02:09:32.112647Z",
    "custom_metadata": null,
     "deletion_time": "",
     "destroyed": false,
     "version": 2
   }
}
```

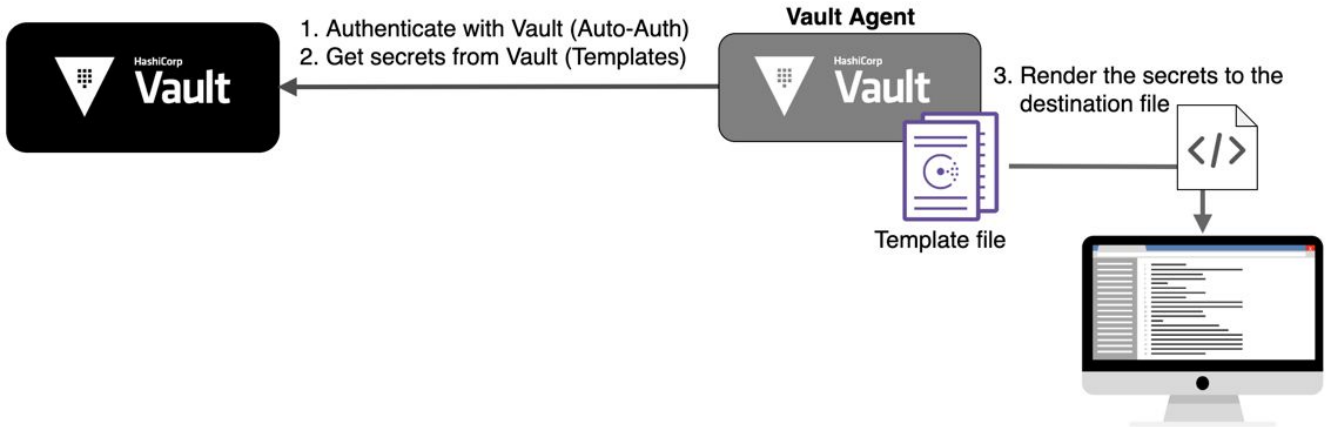
HTTP API Explorer

<VAULT_ADDR>/ui/vault/api-explorer



Vault Agent Templating

- Vault Agent can fully automate the last mile and securely authenticate and retrieve secrets from Vault
- When configured with auto-auth, templating can be configured to retrieve a secret for which the resource has authorization to and template that file to a sink
- Template files are written using the Consul Template markup language



Vault Agent Templating

Example Template

```
$ cat customer.tmpl

{{ with secret "secret/data/customers/acme" }}
Organization: {{ .Data.data.organization }}
ID: {{ .Data.data.customer_id }}
Contact: {{ .Data.data.contact_email }}
{{ end }}

$ cat customer.txt

Organization: ACME Inc.
ID: ABXX2398YZPIE7391
Contact: james@acme.com
```

envconsul

A subprocess which dynamically populates environment variables with secrets read from Vault making them available to applications

```
#!/usr/bin/env bash

cat <<EOT
My connection info is:
username: "${DATABASE_CREDS_READONLY_USERNAME}"
password: "${DATABASE_CREDS_READONLY_PASSWORD}"
database: "my-app"
EOT

$ VAULT_TOKEN=<token> envconsul -upcase -secret
database/creds/readonly ./app.sh

My connection info is:
username:
"v-token-readonly-ww1tq33s7z5uprpxxy68-1527631219"
password: "A1a-u54wut0v605qwz95"
database: "my-app"
```

Go Client Library

[Reference Documentation]

```
// get secret
  secret, err := client.Logical().Read("kv-v2/data/creds")
  if err != nil {
      return "", fmt.Errorf("unable to read secret: %w", err)
  }
  data, ok := secret.Data["data"].(map[string]interface{})
  if !ok {
      return "", fmt.Errorf("data type assertion failed: %T %#v",
secret.Data["data"], secret.Data["data"])
  }
  // data map can contain more than one key-value pair,
  // in this case we're just grabbing one of them
  key := "password"
  value, ok := data[key].(string)
  if !ok {
      return "", fmt.Errorf("value type assertion failed: %T %#v",
data[key], data[key])
  }
```

03

Third-Party Integrations

Ecosystem

- A broad ecosystem of frameworks and tooling have been created to help support integrations between third party tools and services
- These frameworks and tooling can ease the burden on your end users to integrate and consume secrets from Vault

Considerations

Support

- HashiCorp is unable to provide technical support for third party frameworks and tooling
- HashiCorp Support Engineering can support teams from a Vault perspective, any issues with the framework or tooling will need to be raised with the creator of those frameworks or tooling

Enterprise Capabilities

- HashiCorp has established partnerships with a number of partners who have created tooling and framework that support enterprise capabilities (ex. namespaces)
- If the tooling or framework that is being used does not support enterprise capabilities, please have the creators reach out to HashiCorp to assist with supporting enterprise capabilities

Java Applications

Spring Cloud Vault client libraries

[Spring Cloud Vault Java Application Demo]

```java
@Configuration
@RestController
public class Application {

 @Value("${config.name}")
 String name = "World";

 @RequestMapping("/")
 public String home() {
   return "Hello " + name;
 }

 public static void main(String[] args) {
   SpringApplication.run(Application.class, args);
 }
}
```

Vault C# Client

Integrate with your .Net Applications

[Using HashiCorp Vault C# Client with .NET Core]

```
public VaultConfigurationProvider(VaultOptions config)
{
        _config = config;
        var vaultClientSettings = new VaultClientSettings(
            _config.Address,
            new AppRoleAuthMethodInfo(_config.Role,
                                      _config.Secret)
        );
        _client = new VaultClient(vaultClientSettings);
}

public class VaultOptions
{
      public string Address { get; set; }
      public string Role { get; set; }
      public string Secret { get; set; }
      public string MountPath { get; set; }
      public string SecretType { get; set; }
}
```

Ruby Plugin

Integrate with Ruby on Rails Applications

[Vault Rails]

```ruby
class Person < ActiveRecord::Base
 include Vault::EncryptedModel
 vault_attribute :ssn
end

class AddEncryptedSSNToPerson < ActiveRecord::Migration
 add_column :persons, :ssn_encrypted, :string
end

person = Person.new
person.ssn = "123-45-6789"
person.save #=> true
person.ssn_encrypted #=> "vault:v0:EE3EV8P5hyo9h..."
```

Pipeline Integration

Github Actions

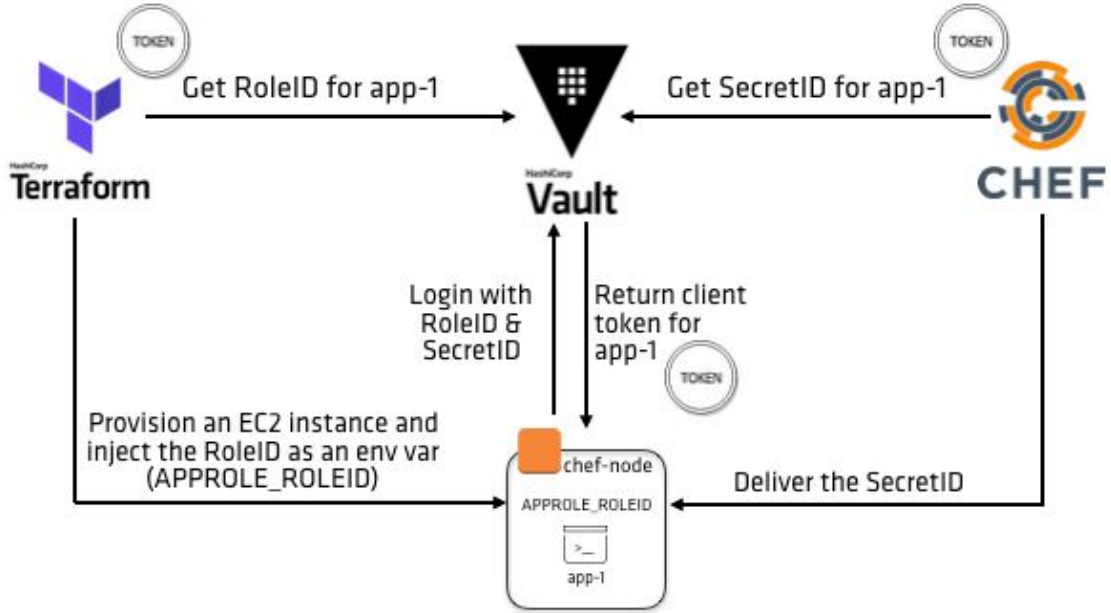
[Github Actions : Vault Secrets]

```
jobs:
   build:
       # ...
       steps:
           # ...
           - name: Import Secrets
             uses: hashicorp/vault-action@v2.3.1
             with:
               url: https://vault.mycompany.com:8200
               token: ${{ secrets.VaultToken }}
               caCertificate: ${{ secrets.VAULTCA }}
               secrets: |
                   secret/data/ci/aws accessKey |
AWS_ACCESS_KEY_ID ;
                   secret/data/ci/aws secretKey |
AWS_SECRET_ACCESS_KEY ;
                   secret/data/ci npm_token
```

Pipeline Integration

Chef

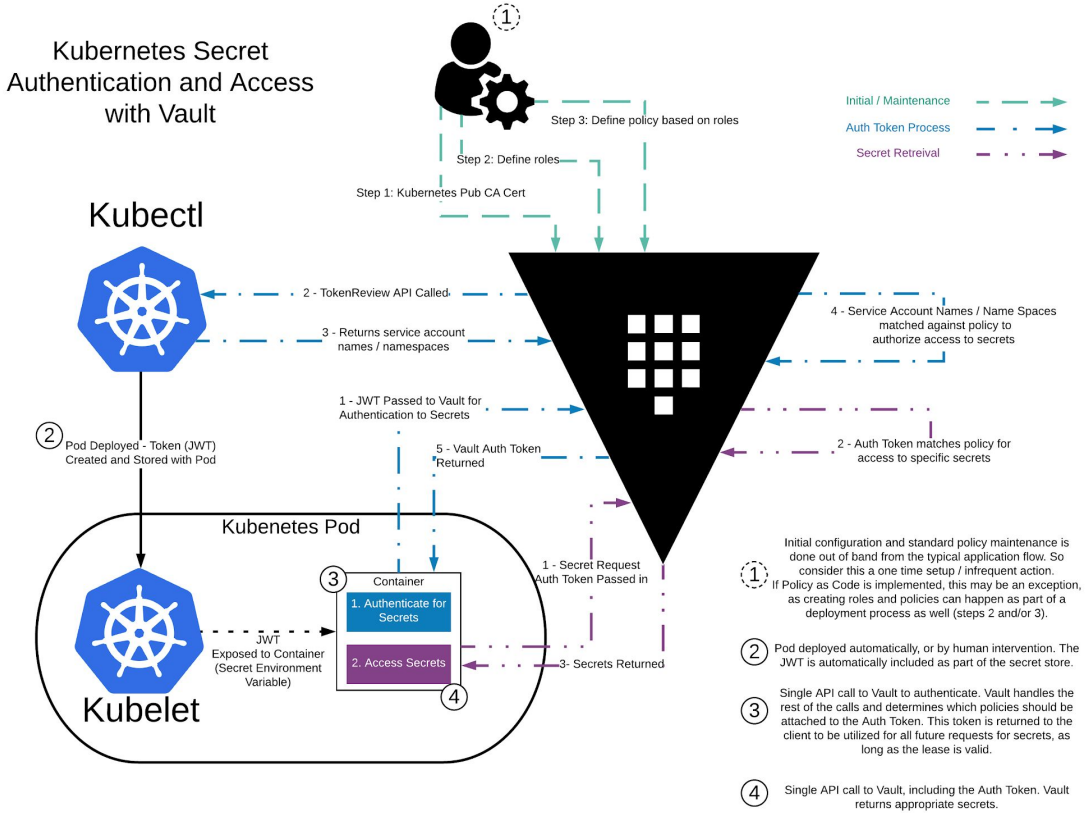
[AppRole With Terraform & Chef | Vault]



04

Kubernetes

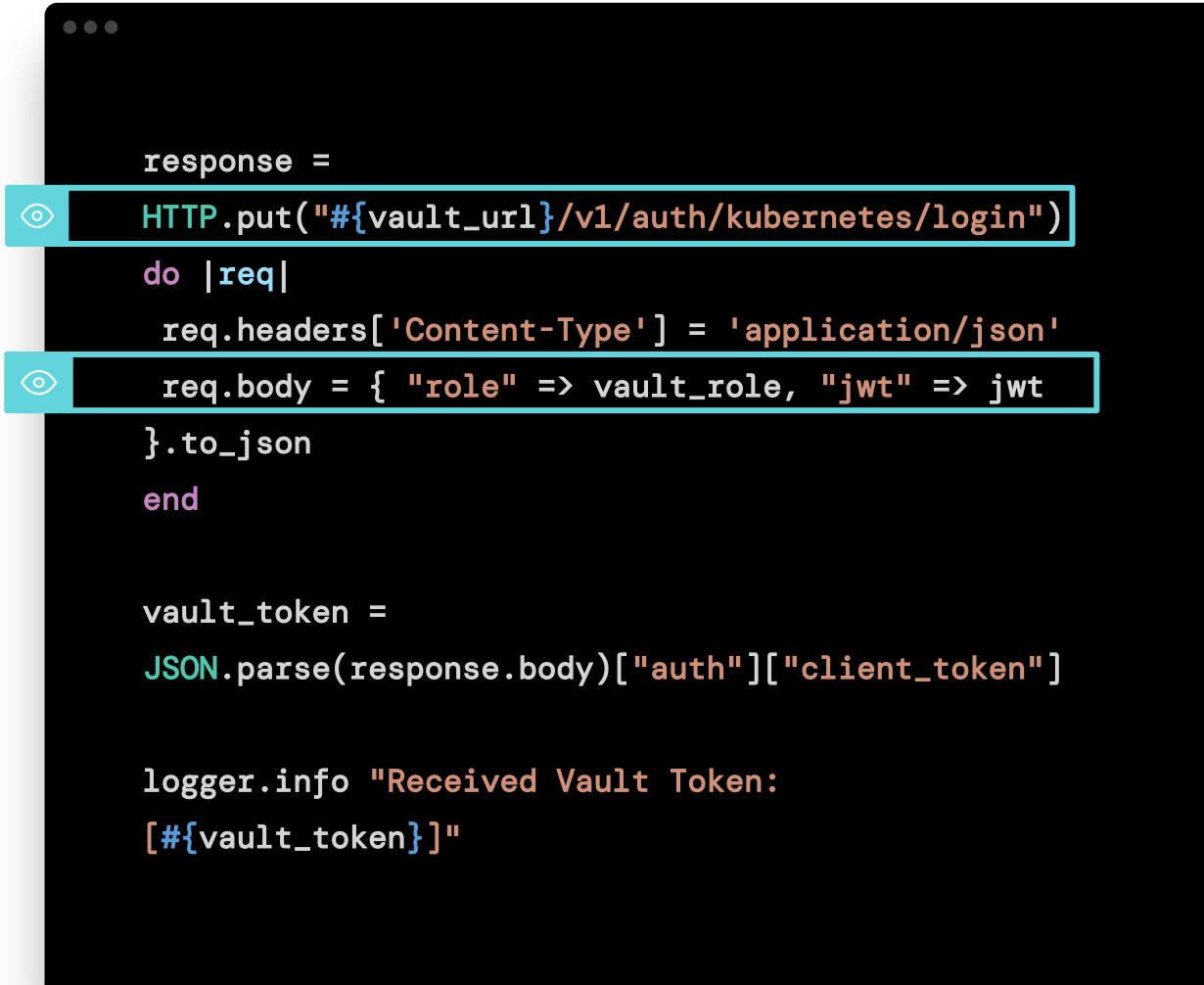
Kubernetes Auth Flow



Application Pod Definition

```
apiVersion: v1
kind: Pod
...
spec:
 serviceAccountName: k8s-service-acct
 containers:
   - name: app
     image: burtlo/exampleapp-ruby:k8s
   env:
       - name: VAULT_ADDR
       - value:
"http://vault.default.svc.cluster.local:8200"
       - name: VAULT_ROLE
       - value: "internal-app"
```

Example App Code Changes



```
response =
HTTP.put("#{vault_url}/v1/auth/kubernetes/login")
do |req|
 req.headers['Content-Type'] = 'application/json'
 req.body = { "role" => vault_role, "jwt" => jwt
}.to_json
end

vault_token =
JSON.parse(response.body)["auth"]["client_token"]

logger.info "Received Vault Token:
[#{vault_token}]"
```

05

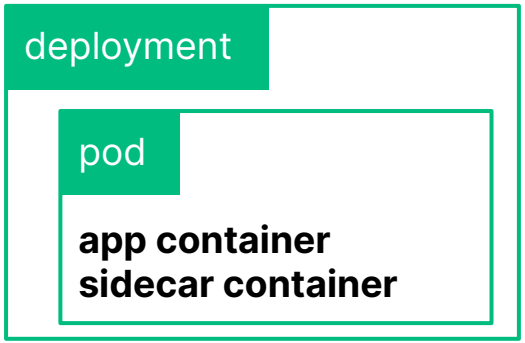
Vault Agent Injector

Sidecar Pattern

Vault unaware pods would offload the authentication and secret retrieval to a dedicated container appended to every deployment/pod

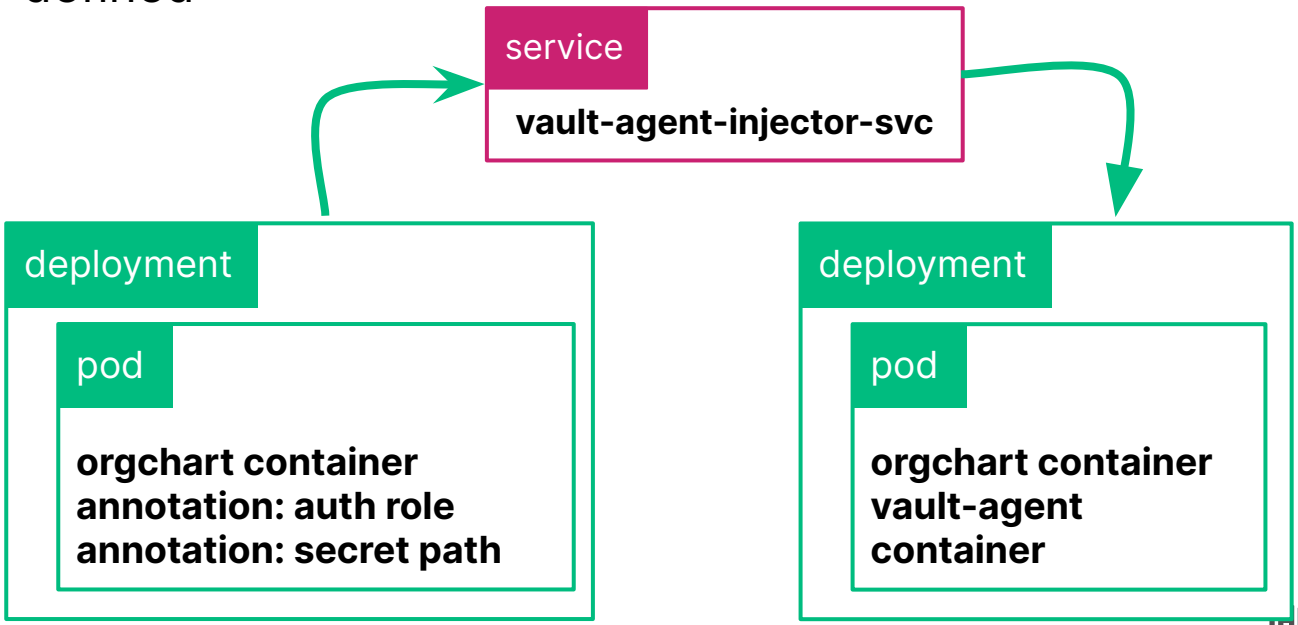
Sidecar container needs:

- Vault address
- Vault authentication role
- Vault secret path



Sidecar Pattern

Registers a Mutating Webhook Configuration that takes action when pod/deployment annotations are defined



Install Agent Injector

```
> helm repo add hashicorp
https://helm.releases.hashicorp.com
"hashicorp" has been added to your repositories

> helm search repo hashicorp/vault
NAME            CHART VERSION   APP VERSION
DESCRIPTION
hashicorp/vault 0.18.0          1.9.0
Official HashiCorp Vault Chart

> helm install vault hashicorp/vault \
--set="injector.enabled=true"
```

Agent Annotations

```
spec:
 template:
   metadata:
     annotations:
       vault.hashicorp.com/agent-inject: "true"
       vault.hashicorp.com/role: "internal-app"
       vault.hashicorp.com/agent-inject-secret-database-config.txt:
"internal/data/database/config"
```

View the Secret

```
> kubectl exec orgchart --container orgchart \
    -- cat /vault/secrets/database-config.txt

data: map[password:db-secret-password
username:db-readonly-user]
metadata:
map[created_time:2019-12-20T18:17:50.930264759Z
deletion_time: destroyed:false version:2]
```

06

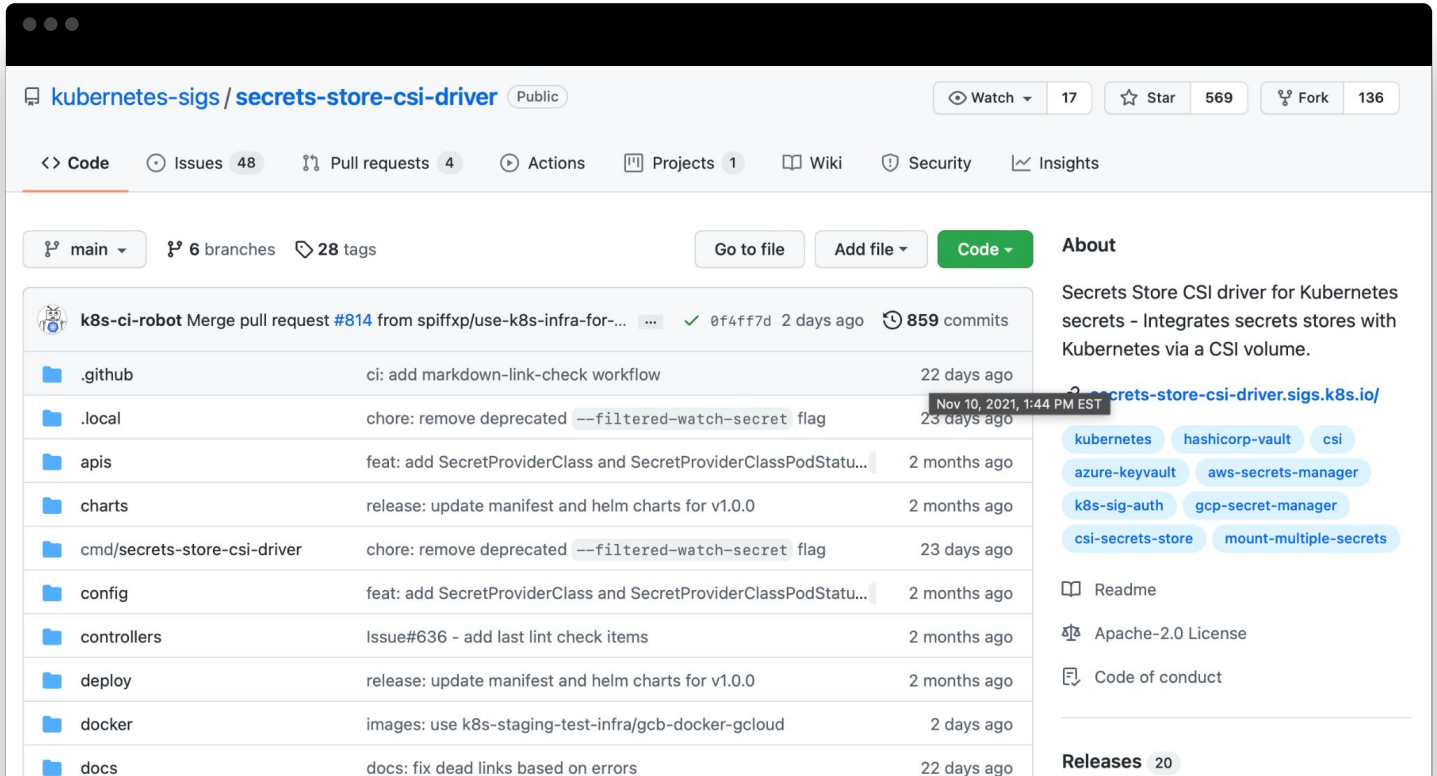
Container Storage Interface

Overview

- Secrets Store CSI driver for Kubernetes secrets - Integrates secrets stores with Kubernetes via a Container Storage Interface (CSI) volume
- The Secrets Store CSI driver allows Kubernetes to mount multiple secrets, keys, and certs stored in enterprise-grade external secrets stores into their pods as a volume
- Once the Volume is attached, the data is mounted into the container's file system

Secrets Store CSI Driver

[CSI Driver]



Install Container Storage Interface

```
> helm repo add hashicorp
https://helm.releases.hashicorp.com
"hashicorp" has been added to your repositories

> helm search repo hashicorp/vault
NAME            CHART VERSION   APP VERSION
DESCRIPTION
hashicorp/vault 0.18.0          1.9.0
Official HashiCorp Vault Chart

> helm install vault hashicorp/vault \
 --set "injector.enabled=false" \
 --set "csi.enabled=true" \
 --set
"injector.externalVaultAddr=http://addr:8200"
```

Install Secrets Store CSI Driver

```
> helm repo add secrets-store-csi-driver \
https://raw.githubusercontent.com/kubernetes-sigs/
secrets-store-csi-driver/master/charts
...

> helm install csi
secrets-store-csi-driver/secrets-store-csi-driver
...
```

Define SecretProviderClass

```yaml
apiVersion: secrets-store.csi.x-k8s.io/v1alpha1
kind: SecretProviderClass
metadata:
name: vault-database
spec:
 provider: vault
 parameters:
   vaultAddress: "http://vault.default.svc.cluster.local:8200"
   roleName: "internal-app"
   objects: |
     - objectName: "db-password"
       secretPath: "internal/data/database/config"
       secretKey: "password"
```

Define a Pod with a Volume

```yaml
spec:
 containers:
 - image: nginx
   name: webapp
   volumeMounts:
   - name: secrets-store-inline
     mountPath: "/mnt/secrets-store"
     readOnly: true
 volumes:
   - name: secrets-store-inline
     csi:
       driver: secrets-store.csi.k8s.io
       readOnly: true
       volumeAttributes:
         secretProviderClass: "vault-database"
```

Pattern Comparison

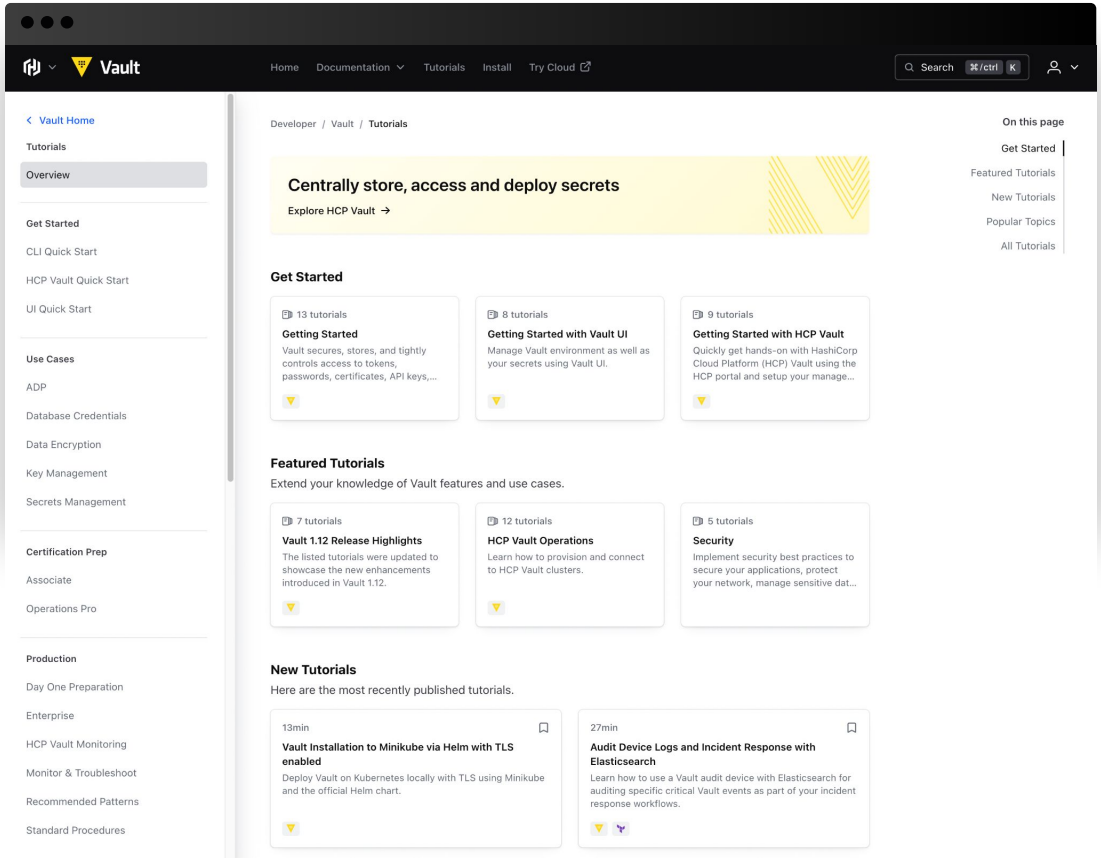
[Kubernetes Vault Integration via Sidecar Agent Injector vs. CSI Provider]

	Agent Sidecar	CSI
Secret projection	Shared Memory Volume Environment Variable	Ephemeral Disk Environment Variables Kubernetes Secrets
Secret scope	Global	Global
Secret types	All Secret Engines (Static & Dynamic)	All Secret Engines (Static & Dynamic)
Secret templating	Yes	No
Secret size limit	No Limit (both storage types)	No Limit (both storage types)
Secret definitions	CLI / API / UI	CLI / API / UI
Encryption	Yes (at rest & in-transit)	Yes (at rest & in-transit)
Secret rotation	Yes	No
Secret caching	Yes	No
Auditability	Yes	Yes
Deployment method	1 Shared K8s Cluster Service + 1 Sidecar Container Per Application Pod	Daemonset
Vault agent support	Yes	No
Helm support	Yes	Yes

Next Steps

Tutorials

Step-by-step guides to accelerate deployment of Vault



https://developer.hashicorp.com/vault/tutorials

Resources

- Vault API Explorer
- Vault Agent
- Vault Agent Templates
- Vault Agent Metrics
- Consul Template & Envconsul with Vault
- Secure Introduction of Vault Clients
- Vault AWS Lambda Extension
- Collection of sample code using Vault client libraries (C#, Go, Ruby, Python, Java)

Need Additional Help?

Customer Success

Contact our Customer Success Management team with any questions. We will help coordinate the right resources for you to get your questions answered

customer.success@hashicorp.com

Technical Support

Something not working quite right? Engage with HashiCorp Technical Support by opening a ticket for your issue at

support.hashicorp.com

Discuss

Engage with the HashiCorp Cloud community including HashiCorp Architects and Engineers

discuss.hashicorp.com

Upcoming Webinar

Program Closing

Asynchronous content sent to your inbox that includes some useful resources to validate production readiness and ensure operational best practices for your HCP Vault clusters

Action Items

- Share to customer.success@hashicorp.com
  - Authorized technical contacts for support
  - Stakeholders contact information (name and email addresses)
- Assess how teams or applications will access Vault
- Plan how your organization will internally share patterns and best practices for utilizing secrets from Vault

Q&A

Thank you

customer.success@hashicorp.com

www.hashicorp.com/customer-success