KPLABS Course

HashiCorp Certified: Vault Associate

Authentication and Authorization

ISSUED BY

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REPRESENTATIVE

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Module 1: Overview of Vault

1.1 Understanding Authentication

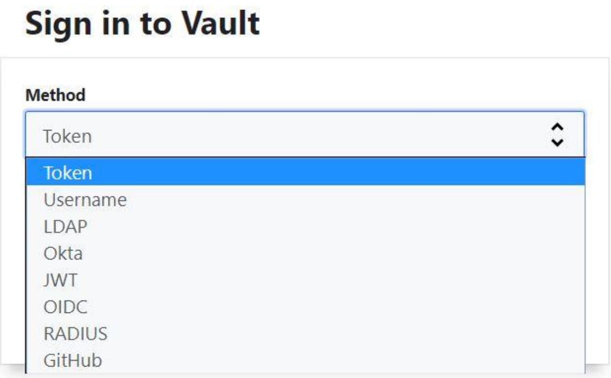
Authentication is the process of recognizing a user's identity

Authentication can be based on various approaches like username/password, tokens, and others.

1.2 Authentication Methods in Vault

There are multiple ways in which we can authenticate in Vault.

Before a client can interact with the Vault, it must authenticate against an auth method.



Sign in to Vault

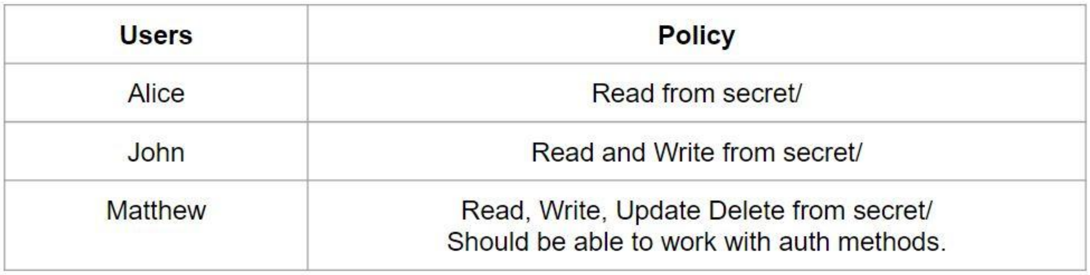
Method

Token

.

Module 2: Vault Policies

Vault Policies determine the level of access a user maintains.

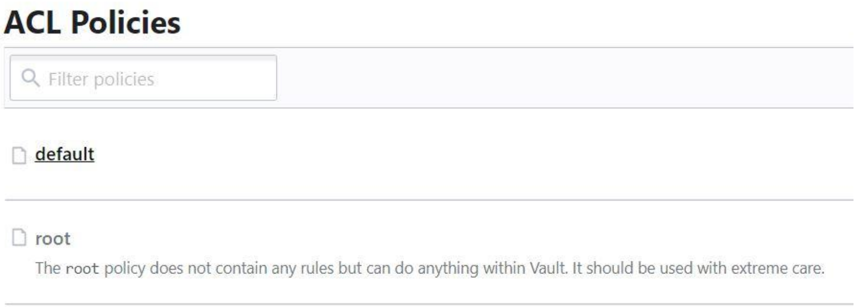


Users	Policy
Alice	Read from secret/
John	Read and Write from secret/
Matthew	Read, Write, Update Delete from secret/ Should be able to work with auth methods.

When you first initialize Vault, the root policy gets created by default. The root policy is a special policy that gives superuser access to everything in Vault.

This allows the superuser to set up the initial policies, auth methods, etc.

In addition, another built-in policy, default, is created. The default policy is attached to all tokens and provides common permissions.



ACL Policies

default

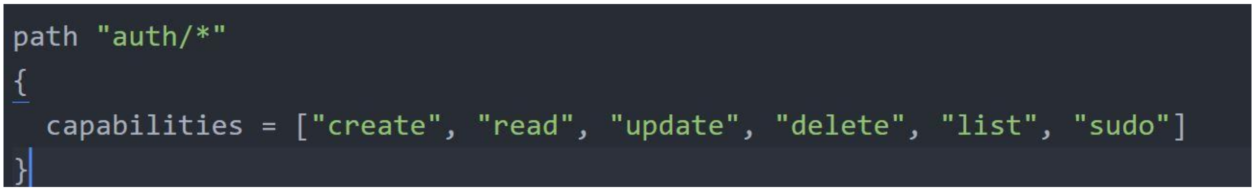
root

The root policy does not contain any rules but can do anything within Vault. It should be used with extreme care.

2.2 Basics of Policy Writing

Policies written in HCL format are often referred to as ACL Policies.

Everything in Vault is path-based, and admins write policies to grant or forbid access to certain paths and operations in Vault.

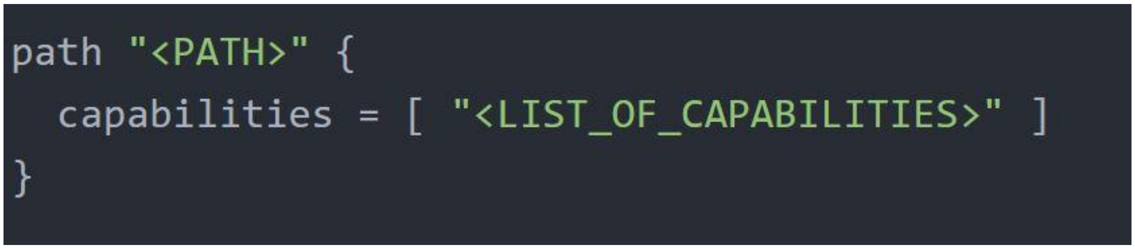


```
path "auth/*"
{
  capabilities = ["create", "read", "update", "delete", "list", "sudo"]
}
```

2.3 Basic Format

An empty policy grants no permission in the system.

Therefore ACL policies are defined for each path.



```
path "<PATH>" {
  capabilities = [ "<LIST_OF_CAPABILITIES>" ]
}
```

2.4 Primary Capabilities

Here are some of the important capabilities:

- Create
- Read
- Update
- Delete
- List
- Sudo
- Deny

2.5 Root Protected API Endpoints

Some of the paths are more restrictive and requires a root token or sudo capability in the policy.

Some of these paths are as follows:

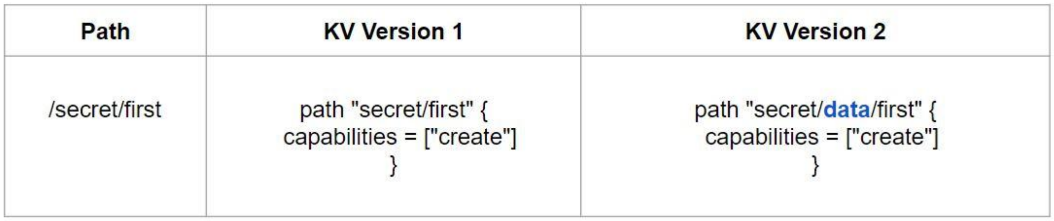
- auth/token/accessors
- auth/token
- sys/audit
- sys/rotate
- sys/seal

Module 3: Vault Policies - Part 2

3.1 ACL Rules Format - KV V2

The version 2 kv store uses a prefixed API, which is different from the version 1 API.

Writing and reading versions are prefixed with the data/ path

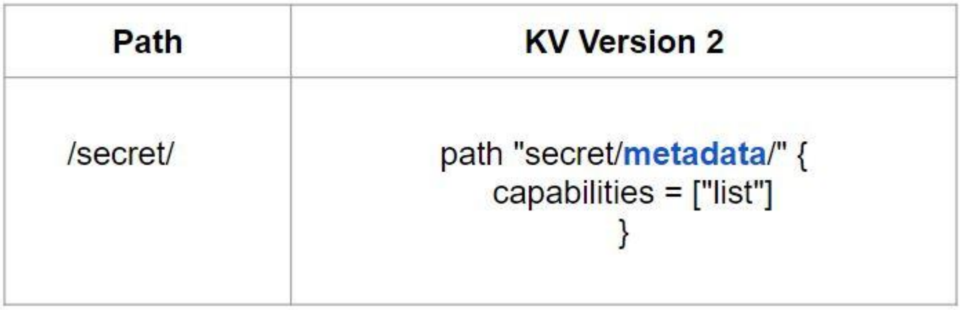


Path	KV Version 1	KV Version 2

/secret/first	path "secret/first" {
	capabilities = ["create"]
	}
		path "secret/**data**/first" {
		capabilities = ["create"]
		}

3.2 Listing Secrets

- The metadata/ endpoint returns a list of key names at the specified location.
- The input must be a folder.
- The values themselves are not accessible via this command.

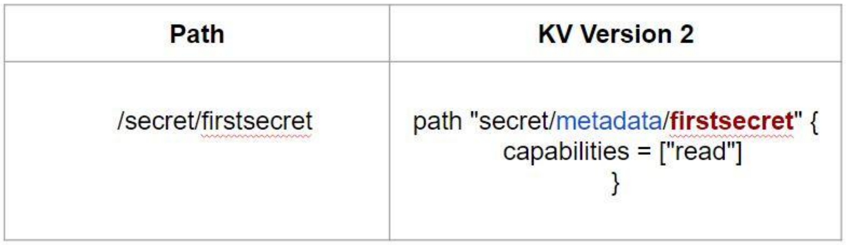


Path	KV Version 2

/secret/	path "secret/**metadata**/" {
	capabilities = ["list"]
	}

3.3 Reading Secret Metadata

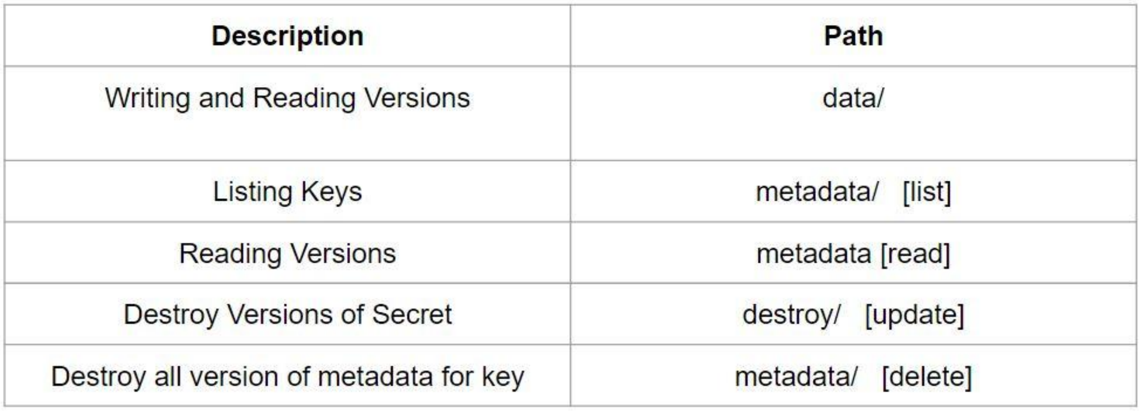
This endpoint retrieves the metadata and versions for the secret at the specified path.



Path	KV Version 2

/secret/firstsecret	path "secret/metadata/**firstsecret**" {
	capabilities = ["read"]
	}

3.4 Summarizing the Path



Description	Path
Writing and Reading Versions	data/
Listing Keys	metadata/ [list]
Reading Versions	metadata [read]
Destroy Versions of Secret	destroy/ [update]
Destroy all version of metadata for key	metadata/ [delete]

Module 4: AppRole Auth Method

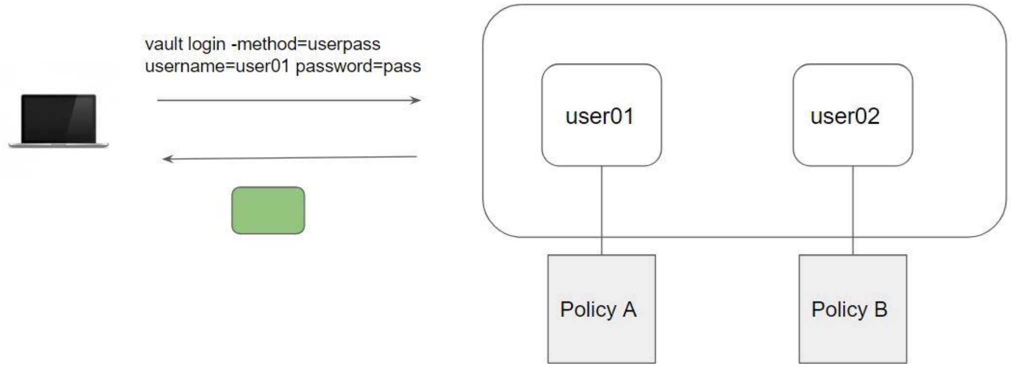
4.1 Overview of the Basics

Before a client can interact with Vault, it must authenticate against an auth method.

Some of the supported auth methods are targeted towards human users while others are targeted toward machines or apps.

Upon authentication, a token is generated

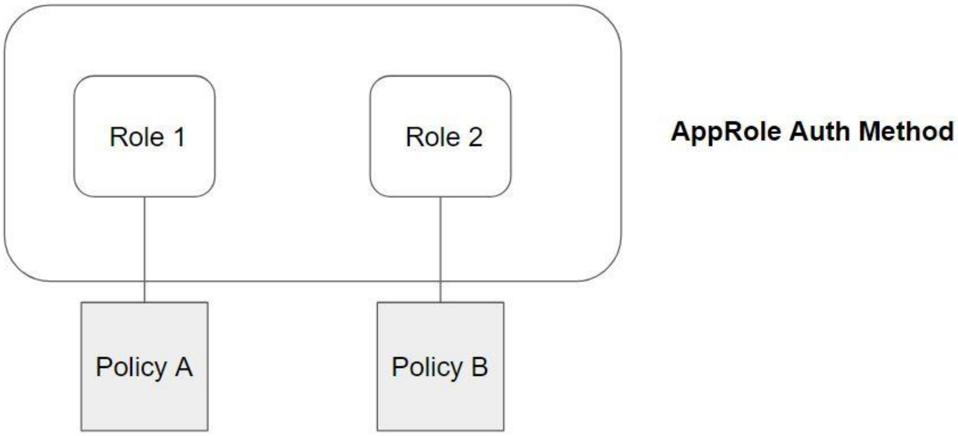
The token may have attached policy, which is mapped at authentication time.



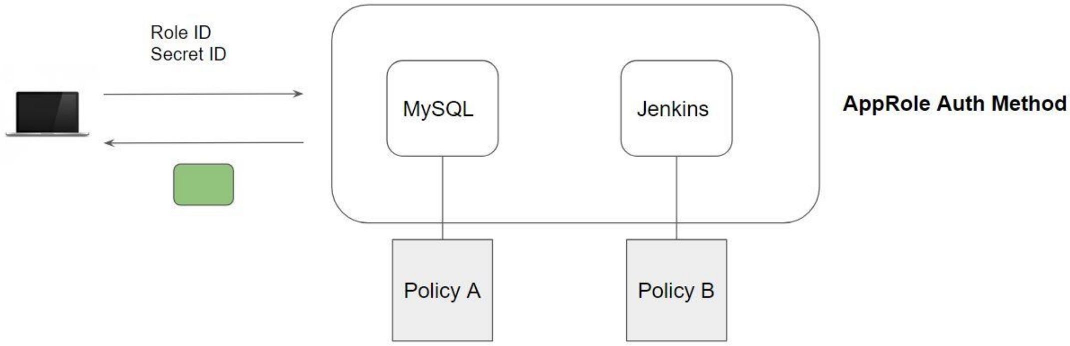
```
vault login -method=userpass
username=user01 password=pass
```

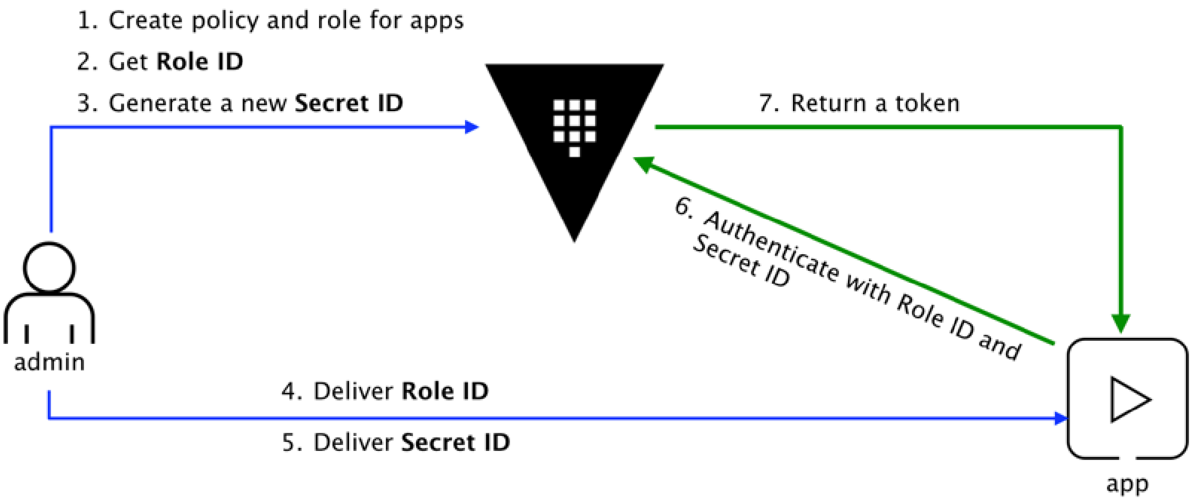
4.2 Overview of AppRole Method

The AppRole auth method allows multiple “roles” to be defined corresponding to different applications, each with different levels of access.



The following diagram represents the high-level overview of the working of the AppRole method.




1. Create policy and role for apps
2. Get **Role ID**
3. Generate a new **Secret ID**
7. Return a token
6. Authenticate with Role ID and Secret ID
admin
4. Deliver **Role ID**
5. Deliver **Secret ID**
app

4.3 Important Pointers

The AppRole auth method was specifically designed to be used by machines and applications but uses a similar authentication method that a human might use.

You can look at Role ID as a “username” and the Secret ID as a “password” allowing machines to authenticate to Vault.

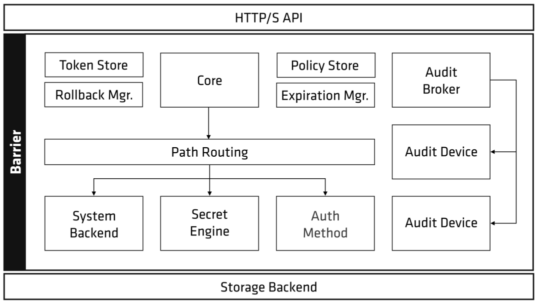
Module 5: HTTP API with Vault

5.1 Overview of HTTP APIs

All of Vault's capabilities are accessible via the HTTP API

Most calls from the CLI actually invoke the HTTP API.

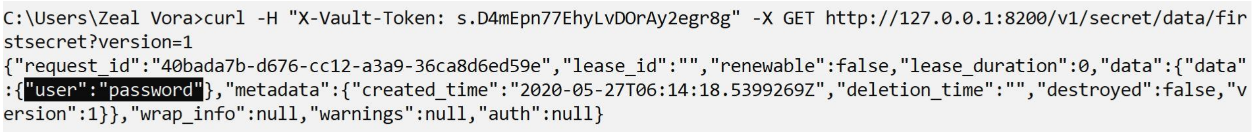
Some of the Vault features are not available via the CLI and can only be accessed via the HTTP API.



5.2 Authenticating with CURL

With the help of curl, we can send a request to the Vault and can get the appropriate response.

To perform an operation, you need to make use of the client token. The client token can be set with the X-Vault-Token HTTP header within the request.



```
C:\Users\Zeal Vora>curl -H "X-Vault-Token: s.D4mEpn77EhyLvDOrAy2egr8g" -X GET http://127.0.0.1:8200/v1/secret/data/fir
stsecret?version=1
{"request_id":"40bada7b-d676-cc12-a3a9-36ca8d6ed59e","lease_id":"","renewable":false,"lease_duration":0,"data":{"data"
:{"user":"password"},"metadata":{"created_time":"2020-05-27T06:14:18.5399269Z","deletion_time":"","destroyed":false,"v
ersion":1}},"wrap_info":null,"warnings":null,"auth":null}
```

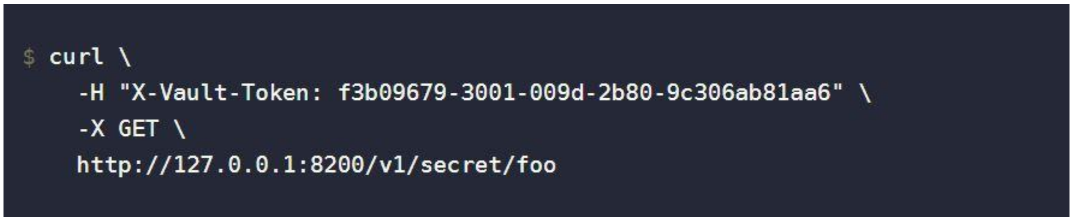
5.3 HTTP APIs Endpoints

All API routes are prefixed with /v1/.

With few documented exceptions, all request body data and response data from Vault is via JSON.

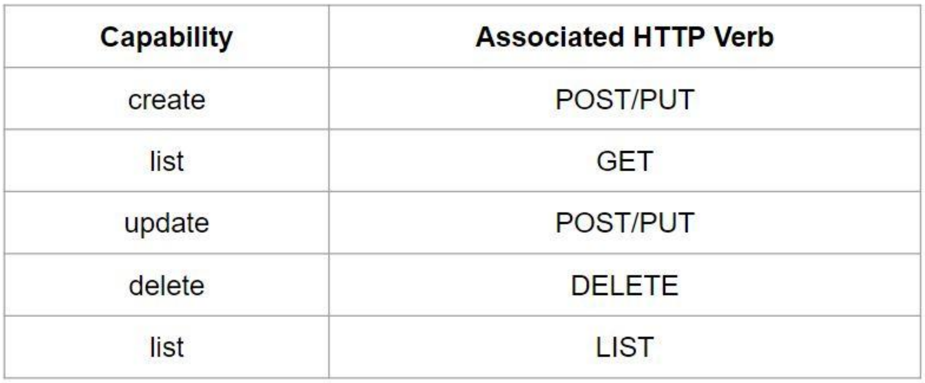
/v1/secret/foo

This maps to secret/foo where foo is the key in the secret/ mount



```
$ curl \
    -H "X-Vault-Token: f3b09679-3001-009d-2b80-9c306ab81aa6" \
    -X GET \
    http://127.0.0.1:8200/v1/secret/foo
```

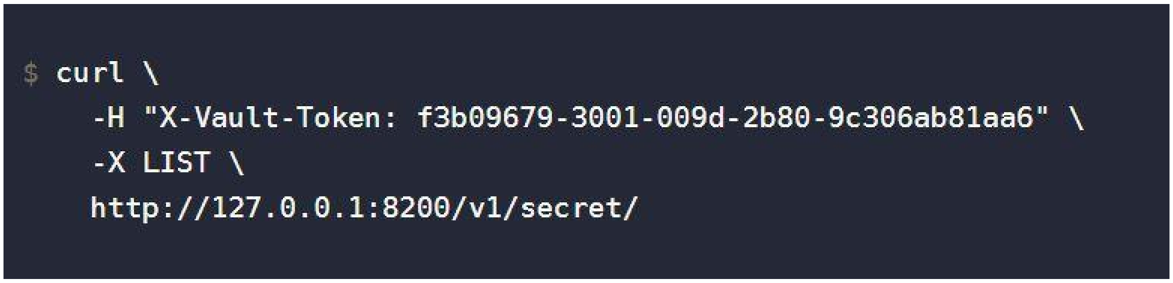
5.4 HTTP Verbs to Capability Mapping



Capability	Associated HTTP Verb
create	POST/PUT
list	GET
update	POST/PUT
delete	DELETE
list	LIST

5.5 List Operations

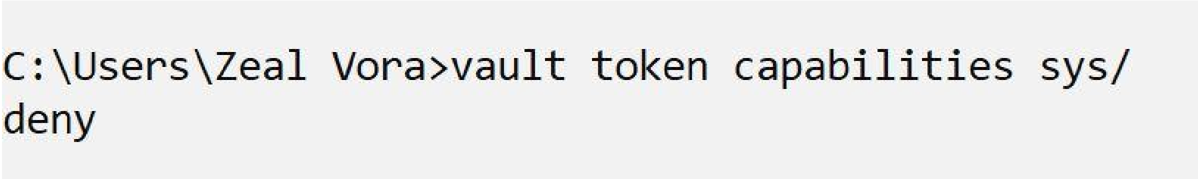
For listing related aspects, like vault secrets list, you can either issue a GET with the query parameter list=true, or you can use the LIST HTTP verb.



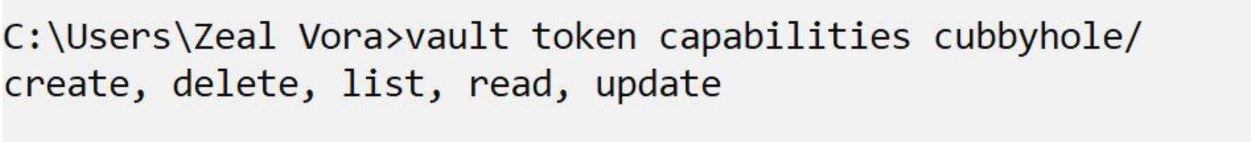
```
$ curl \
    -H "X-Vault-Token: f3b09679-3001-009d-2b80-9c306ab81aa6" \
    -X LIST \
    http://127.0.0.1:8200/v1/secret/
```

Module 6: Token Capabilities

The token capabilities command fetches the capabilities of a token for a given path.



```
C:\Users\Zeal Vora>vault token capabilities sys/
deny
```



```
C:\Users\Zeal Vora>vault token capabilities cubbyhole/
create, delete, list, read, update
```

If a TOKEN is provided as an argument, the "/sys/capabilities" endpoint and permission is used.

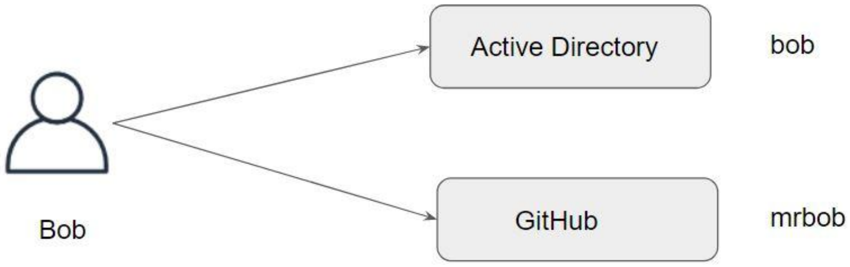
If no TOKEN is provided, the "/sys/capabilities-self" endpoint and permission is used with the locally authenticated token.

Module 7: Entities and Aliases

7.1 Authentication for Multiple Users

Vault supports multiple authentication methods and also allows enabling the same type of authentication method on different mount paths.

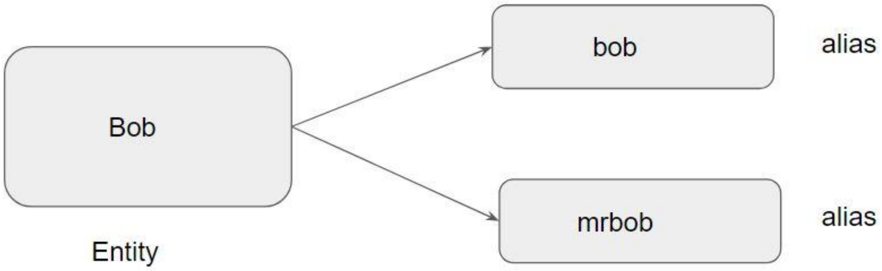
Each Vault client may have multiple accounts with various identity providers that are enabled on the Vault server.

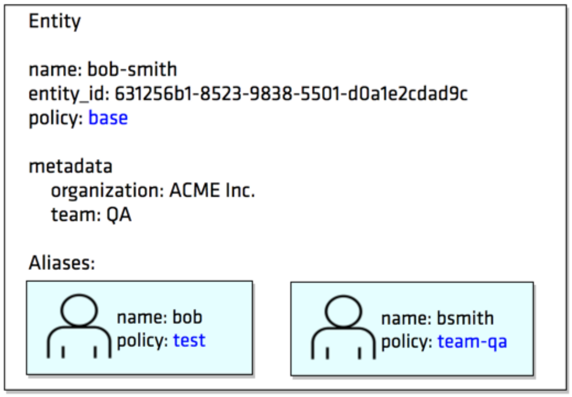


7.2 Entity and Alias

An entity can be created with the name of Bob.

Create an alias that represents each of the accounts and associate them as an entity member.





Entity

name: bob-smith
entity_id: 631256b1-8523-9838-5501-d0a1e2cdad9c
policy: base

metadata
    organization: ACME Inc.
    team: QA

Aliases:

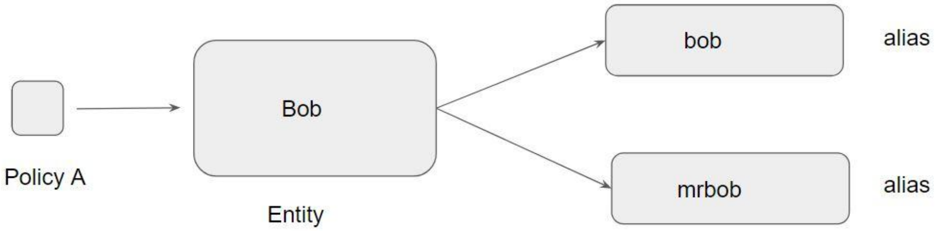
name: bob
policy: test

name: bsmith
policy: team-qa

7.3 Overview of Policies at Entities

We can set policies on the entity level and both the accounts can inherit.

Create an alias that represents each of the accounts and associate them as an entity member.



7.4 Identity Secret Engine

The Identity secrets engine maintains the clients who are recognized by Vault.

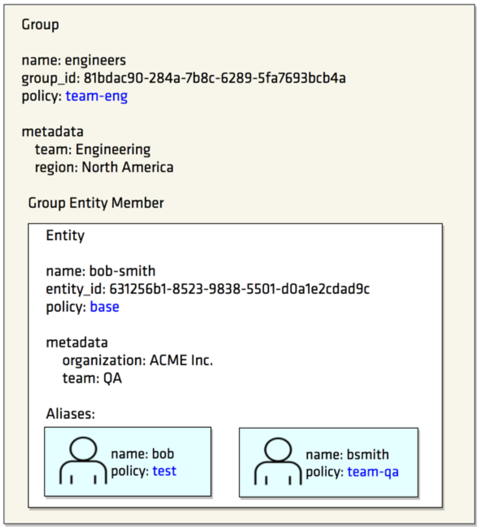
Each client is internally termed as an Entity. An entity can have multiple Aliases

This secret engine will be mounted by default. This secret engine cannot be disabled or moved.

Module 8: Identity Groups

A group can contain multiple entities as its members.

Policies set on the group is granted to all members of the group.



```
Group

name: engineers
group_id: 81bdac90-284a-7b8c-6289-5fa7693bcb4a
policy: team-eng

metadata
  team: Engineering
  region: North America

 Group Entity Member

 Entity

 name: bob-smith
 entity_id: 631256b1-8523-9838-5501-d0a1e2cdad9c
 policy: base

 metadata
   organization: ACME Inc.
   team: QA

 Aliases:

   name: bob          name: bsmith
   policy: test       policy: team-qa
```

By default, Vault creates an internal group.

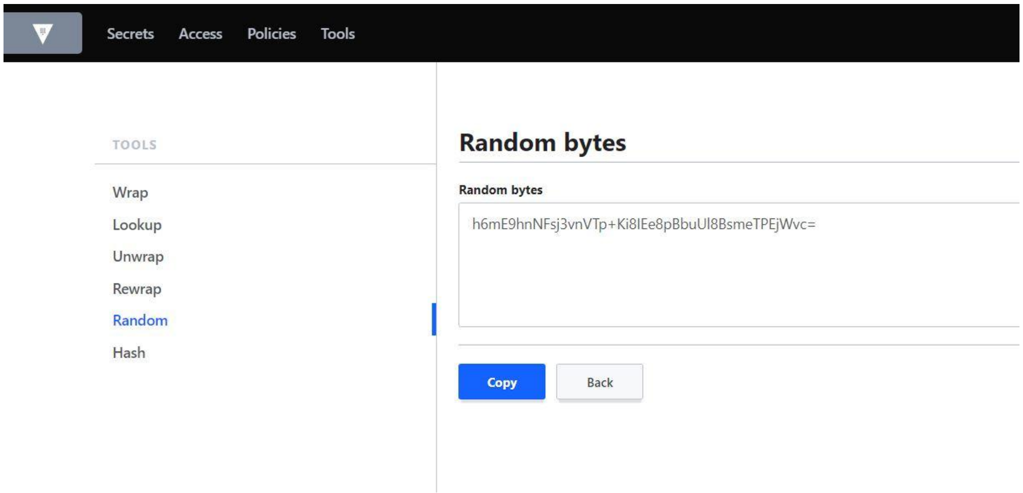
Many organizations already have groups defined within their external identity providers like Active Directory.

External Groups allows to link Vault with the external identity provider (auth provider) and attach appropriate policies to the group.

Module 9: Tools in Vault

Vault contains a certain set of tools that will allow us to achieve a specific function.

These are also available in the /sys/tools endpoint



Random bytes

Random bytes: h6mE9hnNFsj3vnVTp+Ki8IEe8pBbuUI8BsmeTPEjWvc=

Endpoints	Description
/sys/tools/random/164	Generate 164 bytes of random value.
/sys/tools/hash/sha2-512	Hash input data based on SHA2

Module 10: Vault Auto Complete

Vault Auto-Complete feature allows automatic completion for flags, subcommands, and arguments.

Manual Command	With Auto-Complete
vault operator seal	vault op [TAB] se [TAB] → vault operator seal

Be sure to restart your shell after installing autocompletion!

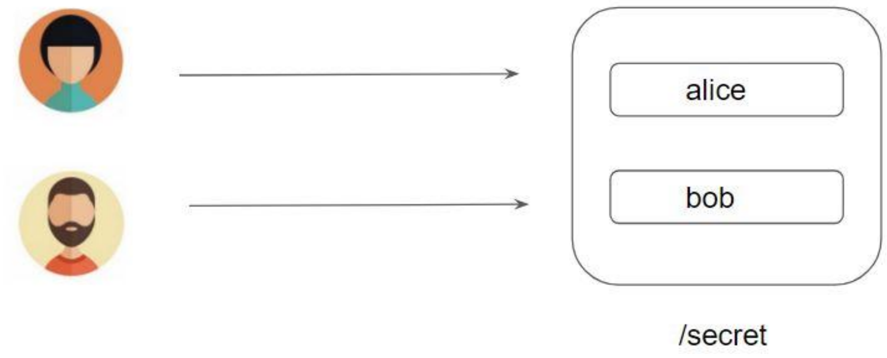
Module 11: Path Templating

11.1 Understanding the Challenge

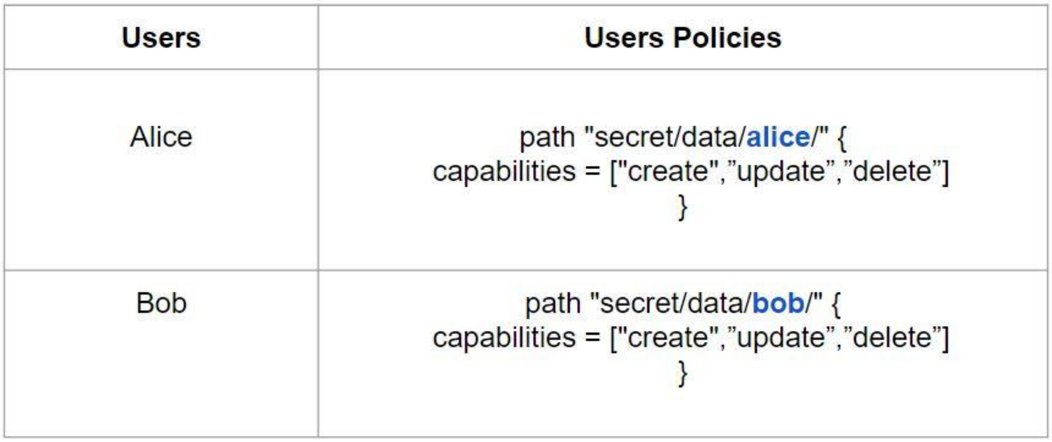
Let’s assume that /secret has two prefix:

- /secret/alice
- /secret/bob

Each user should only be able to access their own data.



Each user will need to have a different policy.



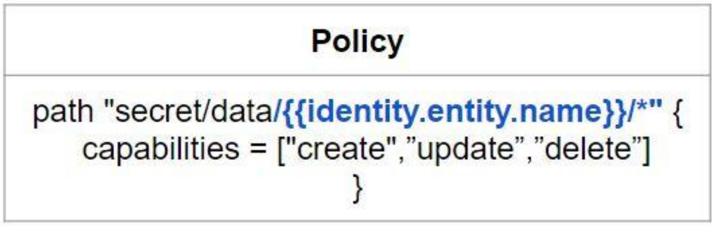
Users	Users Policies

Alice	path "secret/data/**alice**/" {
	capabilities = ["create",”update”,”delete”]
	}

Bob	path "secret/data/**bob**/" {
	capabilities = ["create",”update”,”delete”]
	}

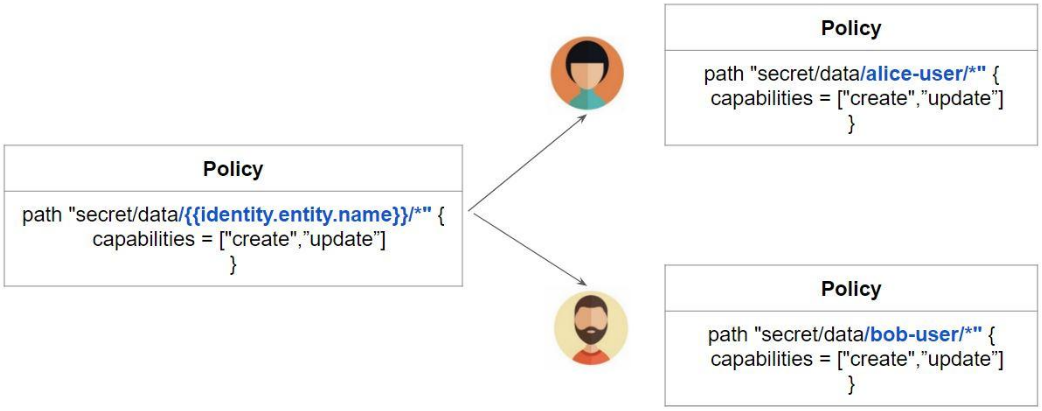
11.2 Overview of Path Templating

Path Templating allows variable replacement based on information of the entity.



Policy

```
path "secret/data/{{identity.entity.name}}/*" {
  capabilities = ["create",”update”,”delete”]
}
```



Policy

```
path "secret/data/{{identity.entity.name}}/*" {
  capabilities = ["create",”update”]
}
```

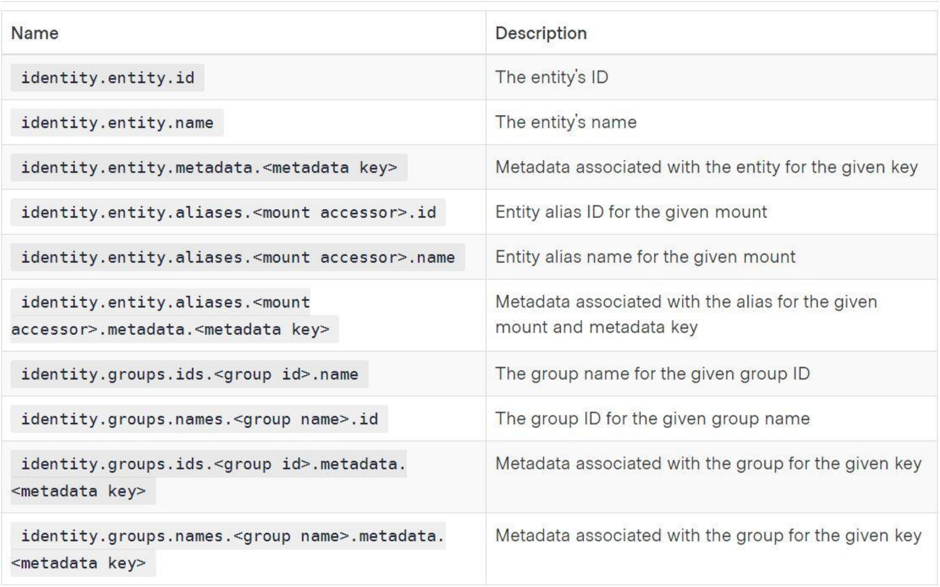
Policy

```
path "secret/data/alice-user/*" {
  capabilities = ["create",”update”]
}
```

Policy

```
path "secret/data/bob-user/*" {
  capabilities = ["create",”update”]
}
```

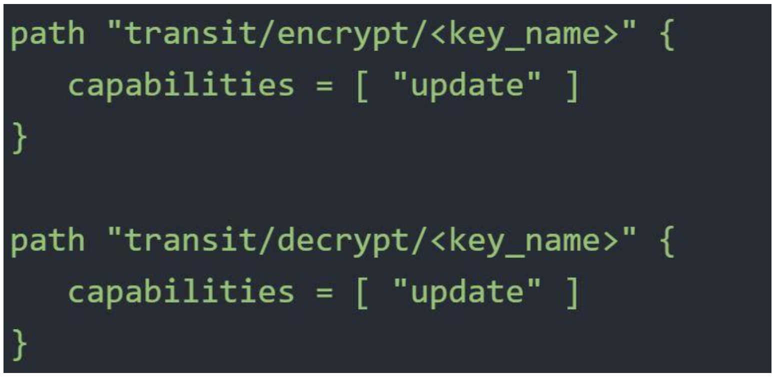
11.3 Supported Parameters



Name	Description
`identity.entity.id`	The entity's ID
`identity.entity.name`	The entity's name
`identity.entity.metadata.<metadata key>`	Metadata associated with the entity for the given key
`identity.entity.aliases.<mount accessor>.id`	Entity alias ID for the given mount
`identity.entity.aliases.<mount accessor>.name`	Entity alias name for the given mount
`identity.entity.aliases.<mount accessor>.metadata.<metadata key>`	Metadata associated with the alias for the given mount and metadata key
`identity.groups.ids.<group id>.name`	The group name for the given group ID
`identity.groups.names.<group name>.id`	The group ID for the given group name
`identity.groups.ids.<group id>.metadata.<metadata key>`	Metadata associated with the group for the given key
`identity.groups.names.<group name>.metadata.<metadata key>`	Metadata associated with the group for the given key

Module 12: Vault Policies - Transit Engine

For the vault clients to be able to perform the encrypt and decrypt operations, there are two important policy rules that need to be added.



```
path "transit/encrypt/<key_name>" {
   capabilities = [ "update" ]
}

path "transit/decrypt/<key_name>" {
   capabilities = [ "update" ]
}
```