

# ANSIBLE CONNECTION SECURITY ENHANCING WITH OTP\_SSH

Presenter: Huong Nguyen

Under the guidance of Mentor: Duc Nguyen



# Agenda

1. Key management solution – Harshicorp Vault
2. OTP – SSH with VAULT
3. Implementation & Result

# 1. Key management solution - Hashicorp Vault

What is Vault?

- Secret management service / Secret as a service
- Secured secret storage
- Key rolling

Use Cases

- General Secret Storage
- Data Encryption
- Identity – Based Access
- Key Management



# 1. Key management solution - Harshicorp Vault

Vault key features:

- Secure secret storage
- Dynamic secrets
- Data encryption
- Leasing and renewal
- Revocation

# 1. Key management solution - Harshicorp Vault

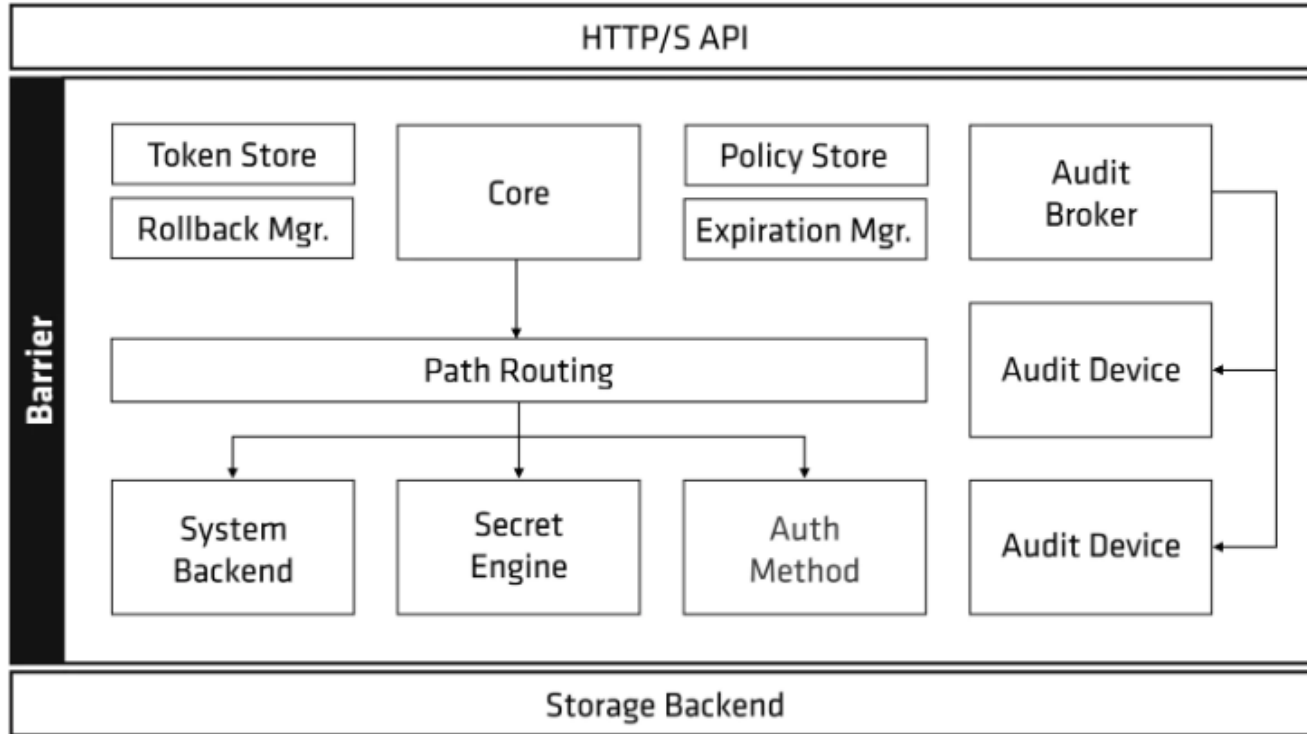


Fig 1.1 Vault architecture

# 1. Key management solution - Harshicorp Vault

Vault initialization concept:

- Share key, Master key, encryption key
- Master key is never stored anywhere
- Vault always starts sealed
- Unsealing requires multiple key shares
- Decryption key is kept in locked memory

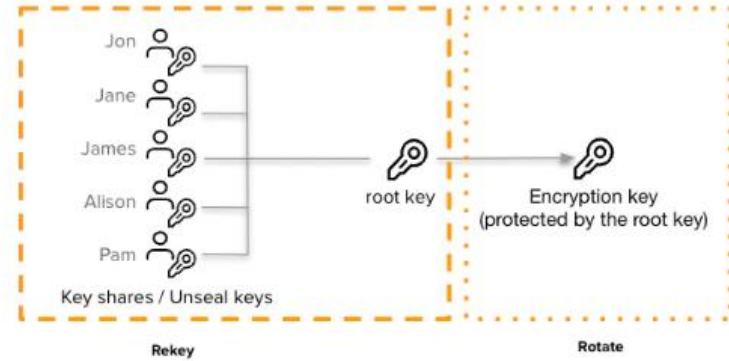


Fig 1.2 Shamir's secret sharing

# 1. Key management solution - Harshicorp Vault

## 1.1 Secret Engine :

- Store, generate, encrypt data.
- Lifecycle: enable, disable, move, tune
- Types of SE: Active Directory, AliCloud, AWS, Azure, Consul, Cubbyhole, Databases, GC, SSH, OpenLDAP...

# 1. Key management solution - Harshicorp Vault

## 1.2 Auth Method :

- Perform authentication and are responsible for assigning identity and a set of policies to a user.
- Types of AM: AppRole, AliCloud, AWS, Azure, Github, TLS cert, Tokens, Username & Password...



# 1. Key management solution - Harshicorp Vault

## 1.3 Audit Device :

- Collectively keep a detailed log of all requests and response to Vault
- Audit log contains every authenticated interaction with Vault, including errors.
- Types of AD: File audit device, syslog audit device, socket

## 2. OTP - SSH with Vault

### 2.1 SSH secret engine

- Providing secure authentication and authorization for access to machines via the SSH protocol
- Managing access to machine infrastructure, providing several ways to issue SSH credentials
- Supporting 3 modes: Signed SSH certificates, One - time SSH Passwords, Dynamic SSH keys.

## 2. OTP - SSH with Vault

Action	Method	Path
Create/ Update role	POST	/ssh/keys/:name
Delete key	DELETE	/ssh/keys/:name
Create role	POST	/ssh/roles/:name
Read role	GET	/ssh/roles/:name
Delete role	DELETE	/ssh/roles/:name
Generate SSH Credentials	POST	/ssh/creds/:name
Verify SSH OTP	POST	/ssh/verify

Table 2.1 SSH secret engine API

## 2. OTP - SSH with Vault

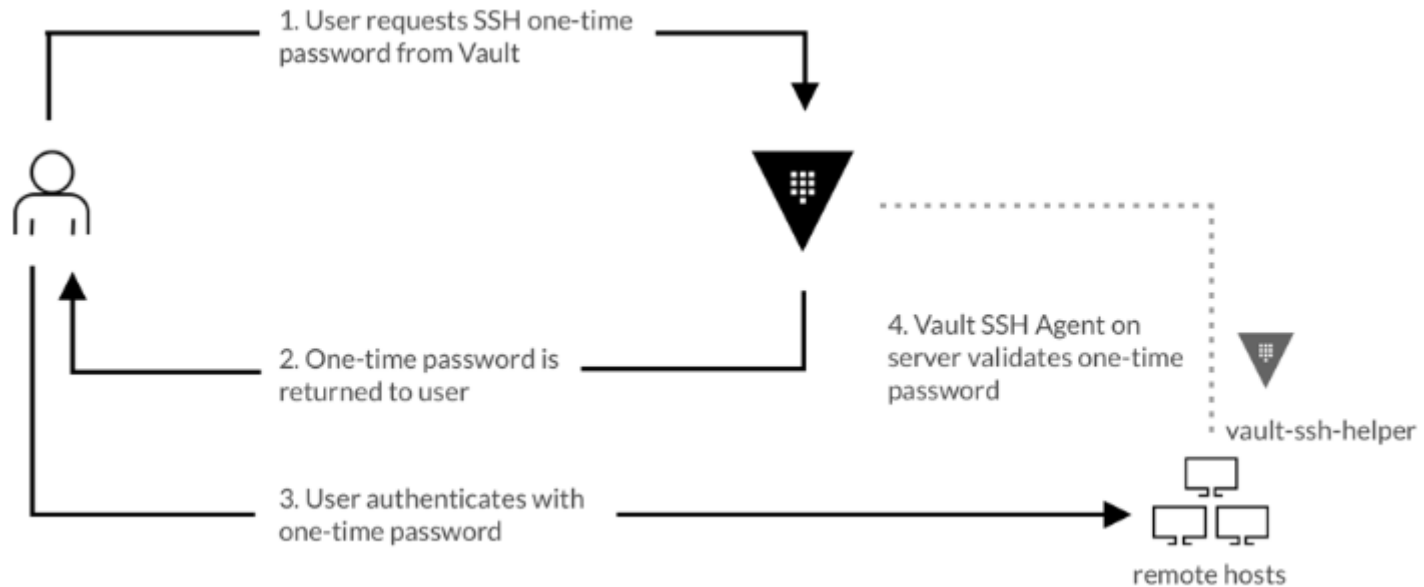


Fig 2.1 Workflow of mode: OTP - SSH with Vault

## 2. OTP - SSH with Vault

Vault - ssh - helper:

- A counterpart to HashiCorp Vault's SSH backend.
- Allows a machine to consume One-Time-Passwords (OTP)  
→ created by Vault servers
- Install Vault - ssh - helper in remote host.
- Vault-ssh-helper's binary is run as an external command using `pam_exec.so`

## 2. OTP - SSH with Vault

### Vault - ssh - helper usage

Option	Description
Verify - only	Verifies that vault - ssh - helper is install correctly and is able to communicate with Vault
config	The path to the configuration file.
dev	Vault - ssh - helper communicates with Vault with TLS disable.

Table 2.2 Vault - ssh - helper usage

## 2. OTP - SSH with Vault

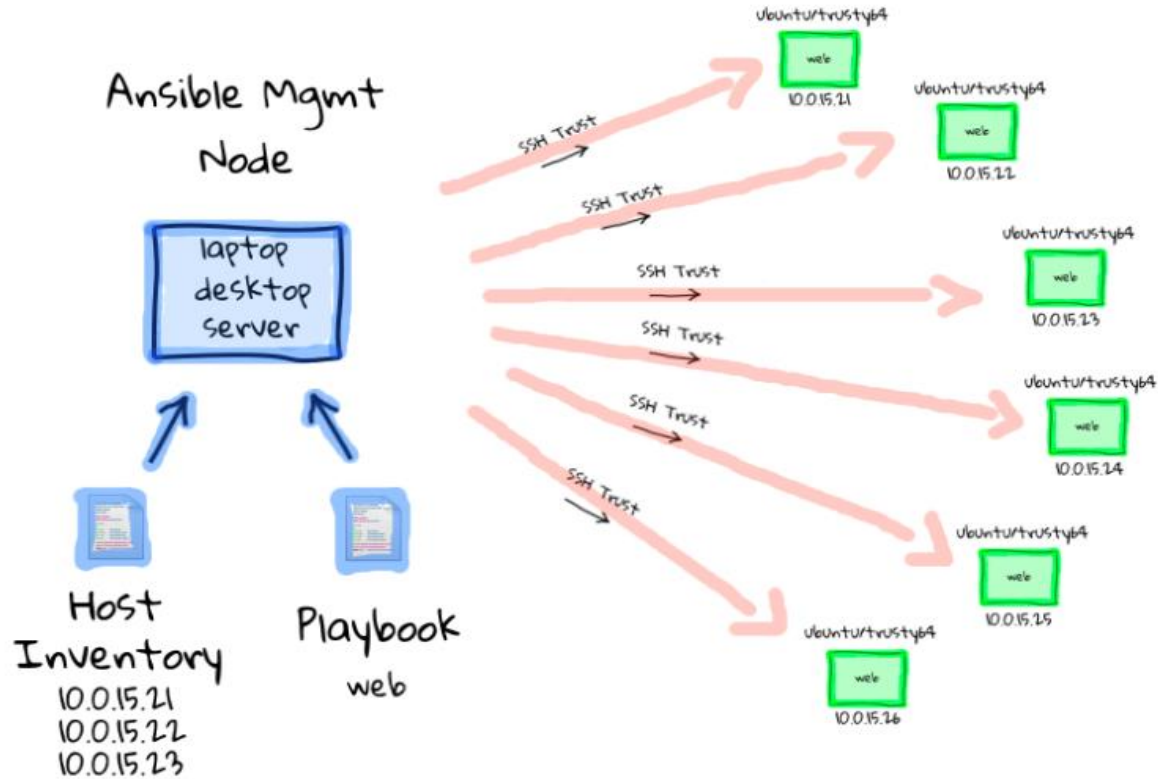
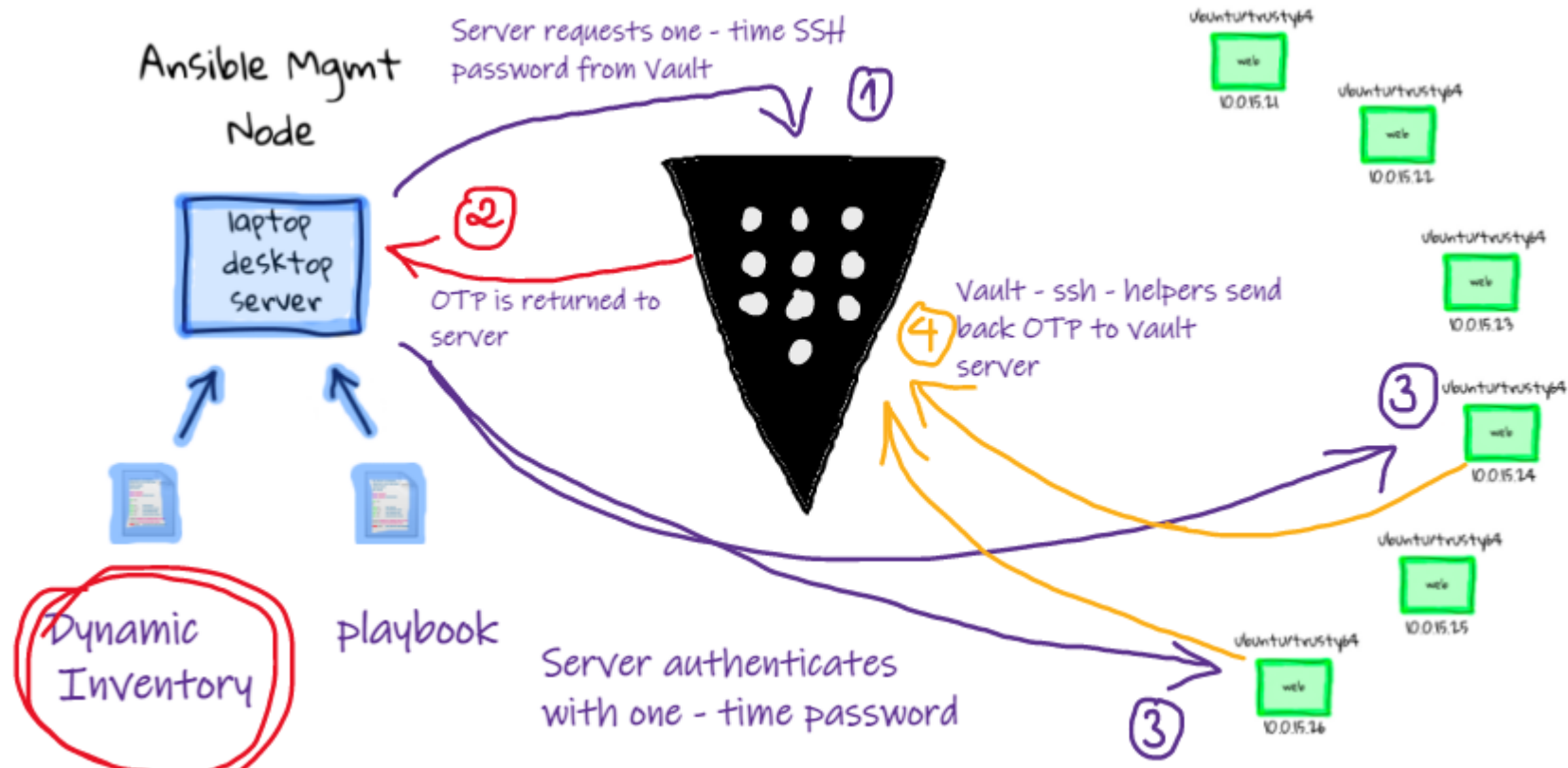


Fig 2.2 Previous Ansible architecture

## 2. OTP - SSH with Vault





# 3. Implementation & Result

## 3.1 Start Vault

- Access to Vault server

```
$ vault server -dev -dev-root-token-id root -dev-listen-address <copied-address>:8200
```

- Enable SSH secret engine

```
$ vault secrets enable ssh  
Success! Enabled the ssh secrets engine at: ssh/
```

- Create a role

```
$ vault write ssh/roles/otp_key_role \  
  key_type=otp \  
  default_user=vagrant \  
  cidr_list=0.0.0.0/0
```

# 3. Implementation & Result

## 3.1 Start Vault

- Create policy to allow access to the SSH OTP role and then attach the policy to an authentication method.

```
$ tee test.hcl <<EOF
# To list SSH secrets paths
path "ssh/*" {
  capabilities = [ "list" ]
}
# To use the configured SSH secrets engine otp_key_role role
path "ssh/creds/otp_key_role" {
  capabilities = ["create", "read", "update"]
}
EOF
```

# 3. Implementation & Result

## 3.2 Config remote hosts

- Install and config Vault - ssh - helper

```
$ sudo tee /etc/vault-ssh-helper.d/config.hcl <<EOF
vault_addr = "$VAULT_EXTERNAL_ADDR"
tls_skip_verify = false
ssh_mount_point = "ssh"
allowed_roles = "*"
EOF
```

- Modify PAM sshd configuration and sshd configuration

# 3. Implementation & Result

## 3.3 Server gets OTP and implements SSH

- Get OTP via API

```
1
2 #!/bin/bash
3 VAULT_ADDR='http://10.61.131.188:8200'
4 UBUNTU_TOKEN=$(curl --silent --request POST --data '{"password": "training"}' $VAULT_ADDR/v1/auth/userpass/login/ubuntu | jq -r '.auth | .client_token')
5 TOKEN1=$(curl --silent --header "X-Vault-Token: $UBUNTU_TOKEN" --request POST --data '{"ip": "'10.61.131.188'"}' $VAULT_ADDR/v1/ssh/creds/otp_key_role | jq -r .data.key)
6 #TOKEN2=$(curl --silent --header "X-Vault-Token: $UBUNTU_TOKEN" --request POST --data '{"ip": "'10.0.0.1'"}' $VAULT_ADDR/v1/ssh/creds/otp_key_role | jq -r .data.key)
```

- Using Script plugin to generate dynamic inventory

# 3. Implementation & Result

## 3.3 Result

```
huong@py: ~/ansible_otp_ssh_connection
2022-09-20T16:13:18.679+0700 [INFO] identity: entities restored
2022-09-20T16:13:18.679+0700 [INFO] identity: groups restored
2022-09-20T16:13:18.679+0700 [INFO] expiration: lease restore complete
2022-09-20T16:13:18.679+0700 [INFO] core: post-unseal setup complete
2022-09-20T16:13:18.679+0700 [INFO] core: vault is unsealed
2022-09-20T16:13:18.683+0700 [INFO] expiration: revoked lease: lease_id=a
uth/token/root/h40ff2aa8936e742ce1e475c5eeb014ff16bf314c15441ce0be52bc8d68
414f74
2022-09-20T16:13:18.691+0700 [INFO] core: successful mount: namespace=""
path=secret/ type=kv
2022-09-20T16:13:18.691+0700 [INFO] secrets.kv.kv_68ad9f21: collecting ke
ys to upgrade
2022-09-20T16:13:18.705+0700 [INFO] secrets.kv.kv_68ad9f21: done collecti
ng keys: num_keys=1
2022-09-20T16:13:18.705+0700 [INFO] secrets.kv.kv_68ad9f21: upgrading key
s finished
WARNING! dev mode is enabled! In this mode, Vault runs entirely in-memory
and starts unsealed with a single unseal key. The root token is already
authenticated to the CLI, so you can immediately begin using Vault.

You may need to set the following environment variable:

$ export VAULT_ADDR='http://10.208.182.77:8200'

The unseal key and root token are displayed below in case you want to
seal/unseal the Vault or re-authenticate.

Unseal Key: ipCeK4C08za1qivnSTMj13G8xGgQ9+ysgYRveOLS3qk=
Root Token: root

Development mode should NOT be used in production installations!

2022-09-20T16:13:55.652+0700 [INFO] core: successful mount: namespace=""
path=ssh/ type=ssh
2022-09-20T16:13:55.733+0700 [INFO] core: enabled credential backend: pat
h=userpass/ type=userpass

huong@py: ~/ansible_otp_ssh_connection$ bash start_vault.
bash: start_vault.: No such file or directory
huong@py:~/ansible_otp_ssh_connection$ bash start_vault.sh
{
  "key_type": "otp",
  "default_user": "huong",
  "cidr_list": "10.208.180.0/22"
}
{
  "policy": "path \"ssh/creds/otp_key_role\" {\n capabilities = [ \"create
\", \"read\", \"update\", \"list\" ]\n }"
}
hello
huong@py:~/ansible_otp_ssh_connection$
```

# 3. Implementation & Result

## 3.3 Result

```
huong@py:~/ansible_otp_ssh_connection$ /home/huong/ansible_otp_ssh_connection/otp_generate.py --list
{
  "_meta": {
    "hostvars": {
      "huong": {
        "ansible_host": "10.208.182.77",
        "ansible_ssh_pass": "5f5c8493-1526-092c-e5a8-0b80528671bf"
      }
    }
  },
  "all": {
    "children": [
      "ungrouped"
    ]
  },
  "ungrouped": {
    "hosts": [
      "huong"
    ]
  }
}
huong@py:~/ansible_otp_ssh_connection$ /home/huong/ansible_otp_ssh_connection/otp_generate.py --list
{
  "_meta": {
    "hostvars": {
      "huong": {
        "ansible_host": "10.208.182.77",
        "ansible_ssh_pass": "33e97fce-cfc1-e991-e2c5-6720238c3c73"
      }
    }
  },
  "all": {
    "children": [
      "ungrouped"
    ]
  }
}
```

### 3. Implementation & Result

```
huong@py:~/ansible_otp_ssh_connection$ /home/huong/ansible_otp_ssh_connection/otp_generate.py --list
{
  "_meta": {
    "hostvars": {
      "huong": {
        "ansible_host": "10.208.182.77",
        "ansible_ssh_pass": "3cfc509e-c5b0-7344-da7c-be03df366e81"
      }
    }
  },
  "all": {
    "children": [
      "ungrouped"
    ]
  },
  "ungrouped": {
    "hosts": [
      "huong"
    ]
  }
}
huong@py:~/ansible_otp_ssh_connection$ ansible --inventory otp_generate.py all -m ping
huong | SUCCESS => {
  "ansible_facts": {
    "discovered_interpreter_python": "/usr/bin/python3"
  },
  "changed": false,
  "ping": "pong"
}
huong@py:~/ansible_otp_ssh_connection$
```

# References

- [One-Time SSH Passwords \(OTP\) - SSH - Secrets Engines | Vault | HashiCorp Developer](#)
- [Secure Shell: How Does SSH Work \(slashroot.in\)](#)
- [SSH - Secrets Engines | Vault | HashiCorp Developer](#)
- [hashicorp/vault-ssh-helper: Vault SSH Agent is used to enable one time keys and passwords \(github.com\)](#)
- [ansible/ansible.md at master · HaManhDong/ansible \(github.com\)](#)
- [Inventory plugins — Ansible Documentation](#)
- [How to write a Python script to create dynamic Ansible inventories | Enable Sysadmin \(redhat.com\)](#)





# THANKS!

## Any questions?

You can find me at:  
@huongnt499  
huong.set@gmail.com

