How to Integrate HashiCorp Vault with Jenkins to secure your Secrets

Nandita Sahu · Follow

8 min read · Jun 28, 2022

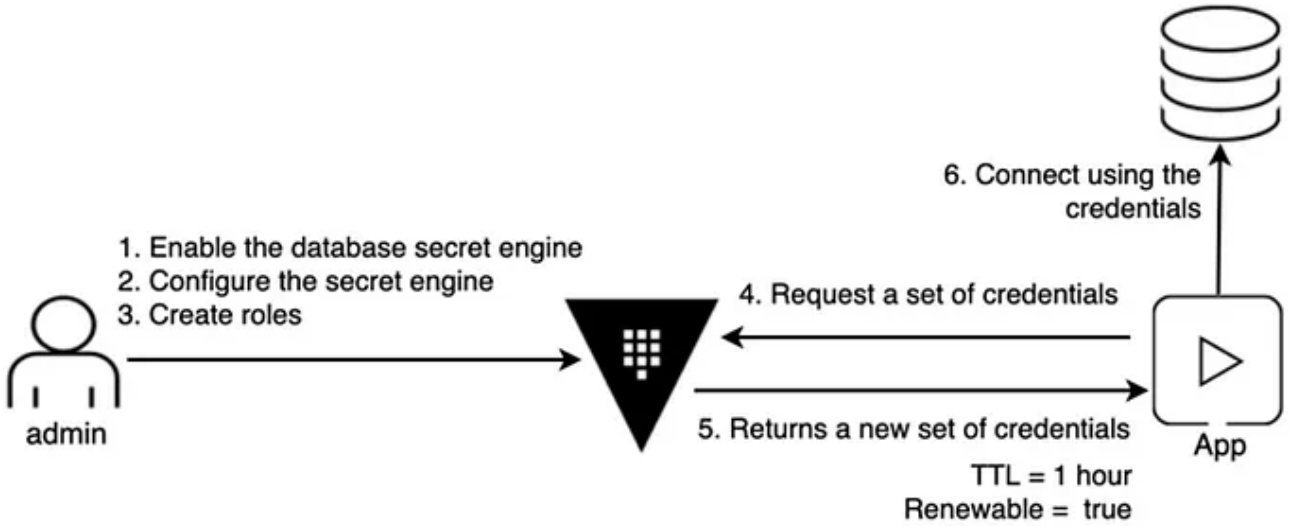
HashiCorp Vault with Jenkins

What is Vault?

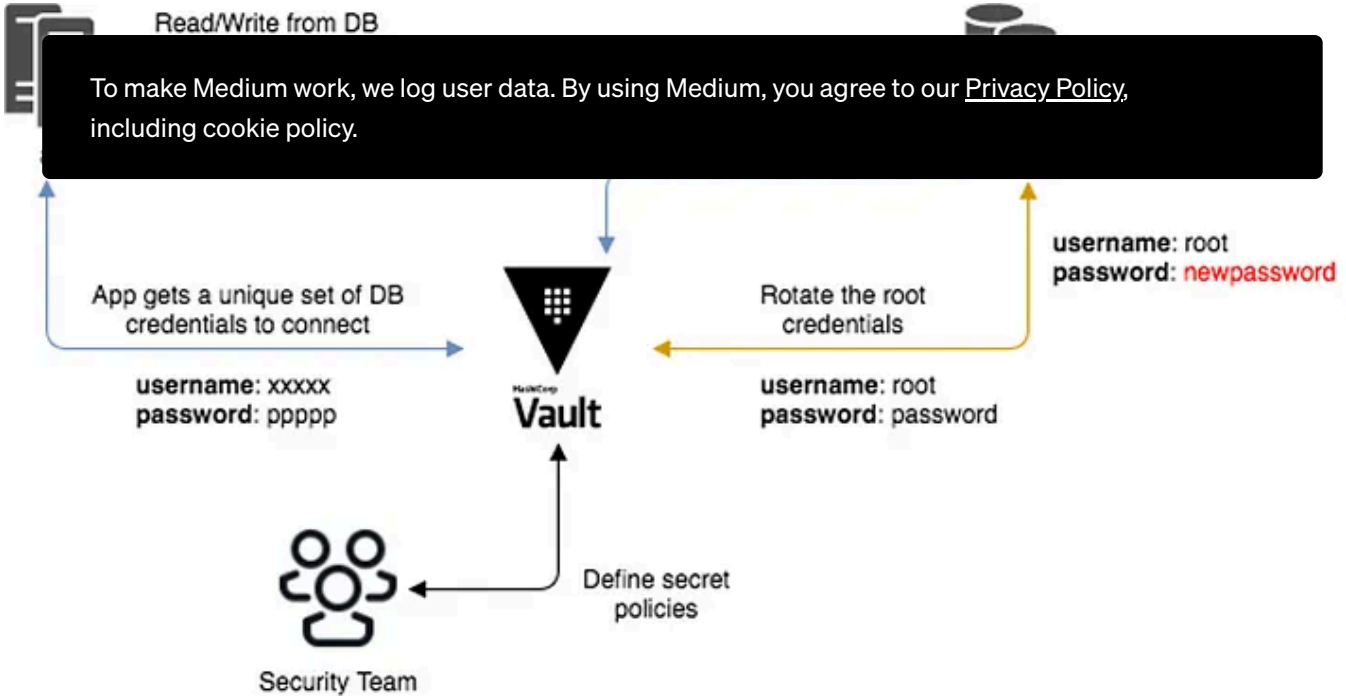
Vault is a tool that enables you to keep your secrets secured and encrypted. It can also do other things like encrypt data for your applications and generate temporary secrets and certificates for users and services. It is a cloud agnostic secret management system and safely store and manage sensitive data in hybrid cloud environment. It use to generate dynamic short-lived credentials or encrypt application data on fly.

There are different types of secrets : Username and Passwords , Certificates , En

Vault Use Cases



Secrets Management



Secrets Management : Centrally store, access and distribute secrets. Vault would be a best way to store sensitive environment variables, database credentials, API keys and many more .

Encryption of Application Data : Vault can be used to encrypt/decrypt data that is stored elsewhere. It allow applications to encrypt their data while still storing it in the primary data store.

Identity Based Access : Authenticate and access different clouds , systems and endpoints using trusted entities.

Vault Server Modes

It

Dev Mode for Development

Prod Mode for QA and Production

Dev Mode :

Initialized and unsealed — The server will be automatically initialized and unsealed. You don't need to use `vault operator unseal`. It is ready for use immediately.

In-memory storage — All data is stored (encrypted) in-memory. Vault server doesn't require any file permissions.

Bound to local address without TLS — The server is listening on `127.0.0.1:8200` (the default server address) *without* TLS.

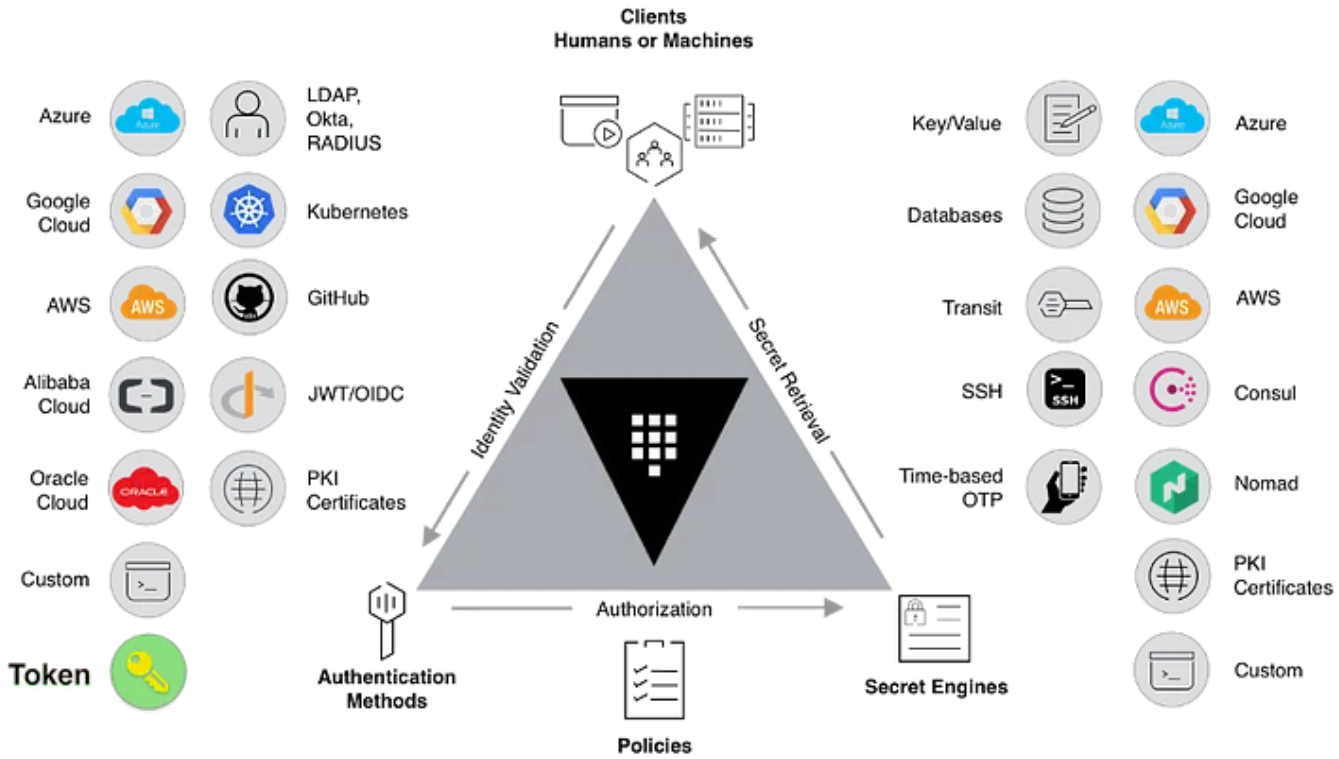
Automatically Authenticated — The server stores your root access token so `vault` CLI access is ready to go. If you are accessing Vault via the API, you'll

need to authenticate using the token printed out.

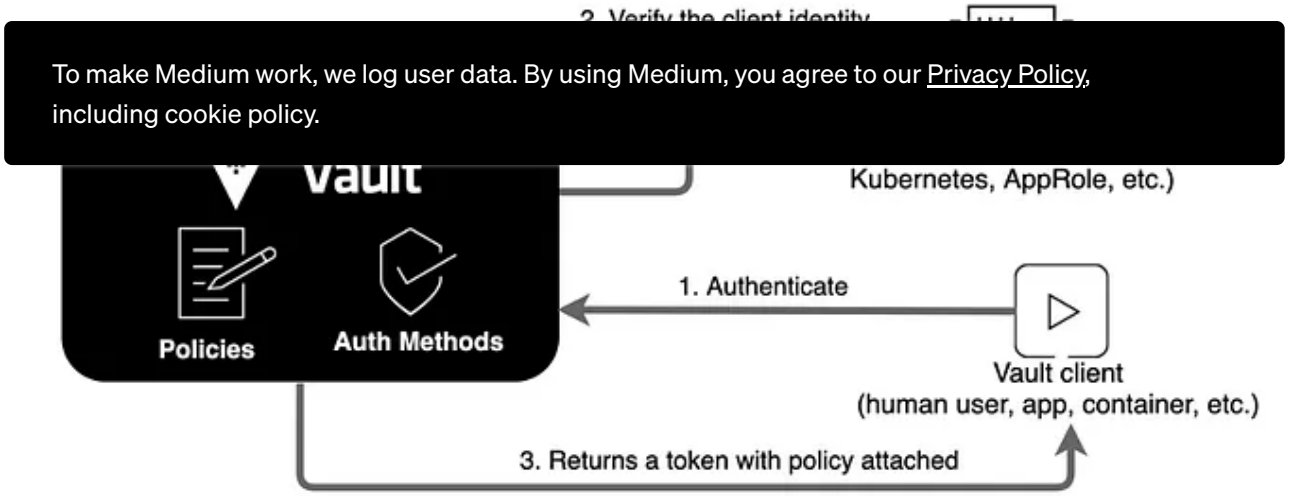
Si

Vault is already unsealed, but if you want to experiment with seal/unseal, then only the single outputted key is required.

Types of Auth Methods



Auth Methods



Workflow of the process

Before a client can interact with Vault, it must authenticate with an auth method to acquire a token. This token has policies attached so that the behaviour of the client can be governed. Auth methods perform authentication to verify the user or machine-supplied information. Some of the supported auth methods are targeted towards users while others are targeted toward machines or apps.

Why Vault instead of Jenkins Credentials ?

Problem with keeping our secret credentials in Jenkins is how pipeline handles credentials. Whenever a pipeline obtains a secret that is scoped, there are no limitations to it on how much and in what ways the pipeline can

use them. This poses a potential security threat considering the pipeline may be

Another problem with Jenkins, its use of encryption methods. There is a static,single common master key and static single common hudson.util.Secret object. Both of these combine to encrypt our credentials. If access to our Jenkins host is compromised, we risk leaking these two keys and thus are credentials will be exposed.

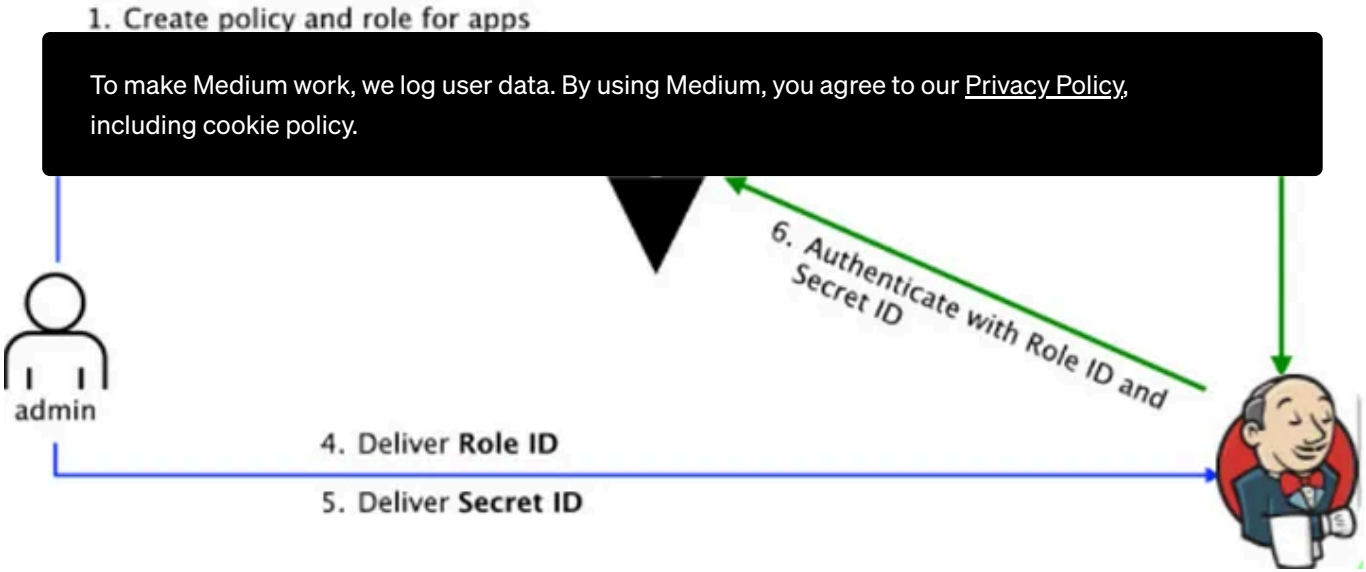
The advantage of using Vault is

· It adds another layer of authentication over Jenkins.

· We can add multiple policies to access the same secret.

· Vault have rotation policy to any of the secrets you create.

· Centrally place to store, access and distribute secrets for organization.



Workflow Diagram of communication between Jenkins and Vault

Installation of Vault (Ubuntu):

sudo apt update && sudo apt install gpg

wget -O- https://apt.releases.hashicorp.com/gpg | gpg — dearmor | sudo tee /usr/share/keyrings/hashicorp-archive-keyring.gpg >/dev/null

gpg — no-default-keyring — keyring /usr/share/keyrings/hashicorp-archive-keyring.gpg –fingerprint

echo “deb [signed-by=/usr/share/keyrings/hashicorp-archive-keyring.gpg] https://apt.releases.hashicorp.com $(lsb_release -cs) main” | sudo tee

/etc/apt/sources.list.d/hashicorp.list

su

Follow the steps for offical Doc

Verifying the Installation

After installing Vault, verify the installation worked by opening a new terminal session and execute command `“vault”`, you should see help output similar to the following:

```
jenkins@devsecops:~$ vault
Us
Co
    write       Write data, configuration, and secrets
    delete      Delete secrets and configuration
    list        List data or secrets
    login       Authenticate locally
    agent       Start a Vault agent
    server      Start a Vault server
    status      Print seal and HA status
    unwrap      Unwrap a wrapped secret

Other commands:
    audit               Interact with audit devices
    auth                Interact with auth methods
    debug               Runs the debug command
    kv                  Interact with Vault's Key-Value storage
    lease               Interact with leases
    monitor             Stream log messages from a Vault server
    namespace           Interact with namespaces
    operator            Perform operator-specific tasks
    path-help           Retrieve API help for paths
    plugin              Interact with Vault plugins and catalog
    policy              Interact with policies
    print               Prints runtime configurations
    secrets             Interact with secrets engines
    ssh                 Initiate an SSH session
    token               Interact with tokens
    version-history     Prints the version history of the target Vault server
```

Starting a Production Vault Server

Create the Vault configuration in the file “vault_`config.hcl`”

```
listener "tcp" {
}


storage "file" {
  path =  "./vault/data"
  node_id = "node1"
}

ui = true
api_addr = "http://localhost:8200"
cluster_addr = "http://127.0.0.1:8201"
disable_mlock = true
```

Configuration File

Within the configuration file, there are two primary configurations:

· **storage:** This is the physical backend that Vault uses for storage.

· **listener:** One or more listeners determine how Vault listens for API re

· **api_addr:** Specifies the address to advertise to route client requests.

· **cluster_addr:** Indicates the address and port to be used for communication between the Vault nodes in a cluster.

Starting the Server

The ./vault/data directory that file storage backend uses must exist.

$ mkdir -p ./vault/data

Set the -config flag to point to the proper path where you saved the configuration above.

If using DEV Mode on EC2 Instance run : vault server -dev -dev-listen-address=”<private ip of ec2>:8082"

If using PROD Mode on EC2 Instance run : vault server -config=vault_config.hcl

Launch a new terminal session, and set VAULT_ADDR environment variable and check the status of the vault.

$ export VAULT_ADDR=’http://127.0.0.1:8200'

$ vault status

```
nansahu@vault-instance:~$ export VAULT_ADDR
```



```
Key                Value
---                -----
Seal Type          shamir
Initialized        false
Sealed             true
Total Shares       0
Threshold          0
Unseal Progress    0/0
Unseal Nonce       n/a
Version            1.11.0
Build Date         2022-06-17T15:48:44Z
Storage Type       file
HA Enabled         false
```

To initialize Vault use vault operator init. This is an unauthenticated request, but it only works on brand new Vaults without existing data:

```
nansahu@vault-instance:/vault_demo$ ls
vault  vault_config.hcl
nansahu@vault-instance:/vault_demo$ sudo vi vault_config.hcl
nansahu@vault-instance:/vault_demo$ vault operator init -key-shares=1 -key-threshold=1
Unseal Key 1:

Initial Root Token:

Vault initialized with 1 key shares and a key threshold of 1. Please securely
distribute the key shares printed above. When the Vault is re-sealed,
restarted, or stopped, you must supply at least 1 of these keys to unseal it
before it can start servicing requests.

Vault does not store the generated root key. Without at least 1 keys to
reconstruct the root key, Vault will remain permanently sealed!

It is possible to generate new unseal keys, provided you have a quorum of
existing unseal keys shares. See "vault operator rekey" for more information.
```

Every initialized Vault server starts in the **sealed** state. From the co it be w to decrypt the data is known as **unsealing** the Vault.

$ export VAULT_TOKEN=<root token>

$ vault operator unseal

```
nansahu@vault-instance:/vault_demo$ export VAULT_TOKEN=
nansahu@vault-instance:/vault_demo$ vault operator unseal
Unseal Key (will be hidden):
Key             Value
---             -----
Seal Type       shamir
Initialized     true
Sealed          false
Total Shares    1
Threshold       1
Version         1.11.0
Build Date      2022-06-17T15:48:44Z
Storage Type    file
Cluster Name    vault-cluster-7a574740
Cluster ID      4e898b55-a892-e6d9-3d56-e031cc1f9c61
HA Enabled      false
```

When the value for `Sealed` changes to `false`, the Vault is unsealed.

Finally, authenticate as the initial root token (it was included in the output wi

$ vault login <root token>

```
nansahu@vault-instance:/vault_demo$ vault login
WARNING! The VAULT_TOKEN environment variable is set! The value of this
variable will take precedence; if this is unwanted please unset VAULT_TOKEN or
update its value accordingly.

Success! You are now authenticated. The token information displayed below
is already stored in the token helper. You do NOT need to run "vault login"
again. Future Vault requests will automatically use this token.

Key                  Value
---                  -----
token                hvs.LtetcYQ8VavGi9tyQ2ATj9UH
token_accessor       aYzCdjidADBjflpBOiqrpgwA
token_duration       ∞
token_renewable      false
token_policies       ["root"]
identity_policies    []
policies             ["root"]
```

Go to <IP Address>:8200 — → Shows the UI of the HashiCorp Vault Page

AppRole Authentication Method

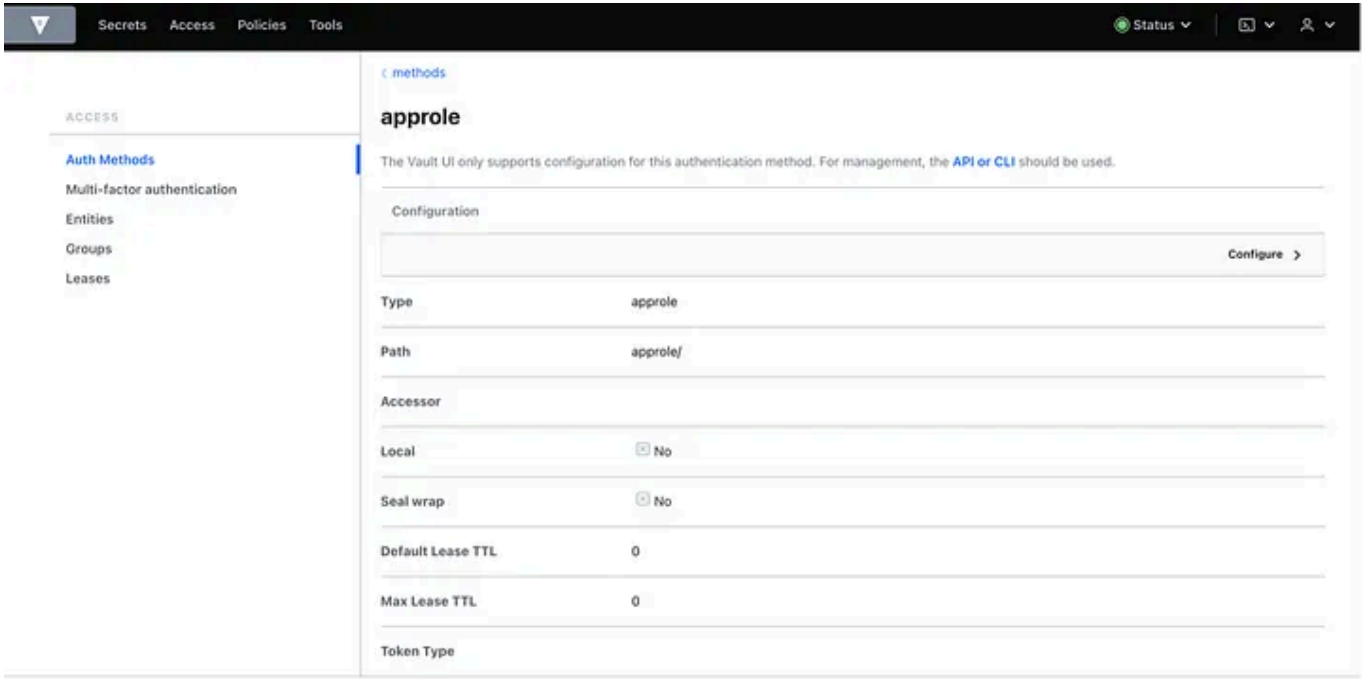
An “AppRole” represents a set of Vault policies and login constraints that must be met to receive a token with those policies. An AppRole can be created for a particular machine, or even a particular user on that machine, or a service spread across machines.

Enable the AppRole auth method:

$ v

Create a named role:

$ vault write auth/approle/role/jenkins-role token_num_uses=0 secret_id_num_uses=0 policies=”jenkins”



token_num_uses: If the token issued by your approle needs the ability to create child tokens, you will need to set token_num_uses to 0.

secret_id_num_uses=0: Creating unlimited secrets

policies: Creating policy with the name of “Jenkins”

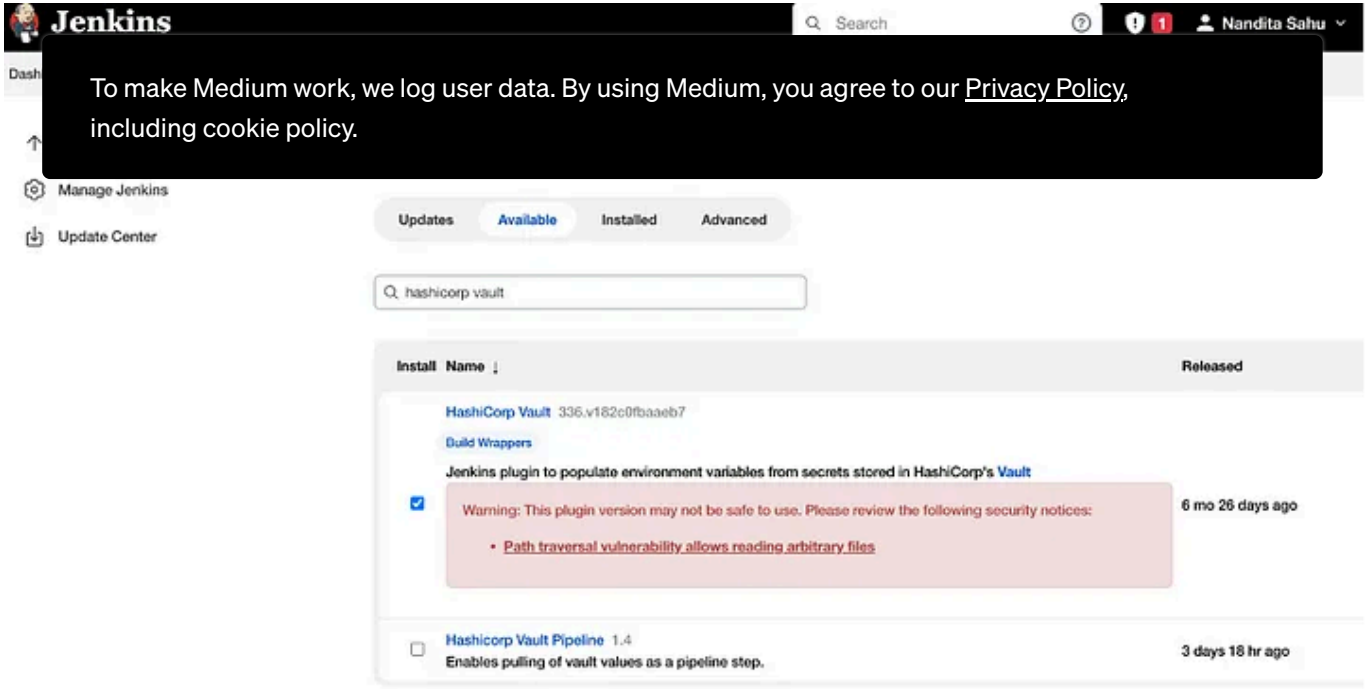
Fetch the RoleID of the AppRole:

$ vault read auth/approle/role/jenkins-role/role-id

Get a SecretID issued against the AppRole:

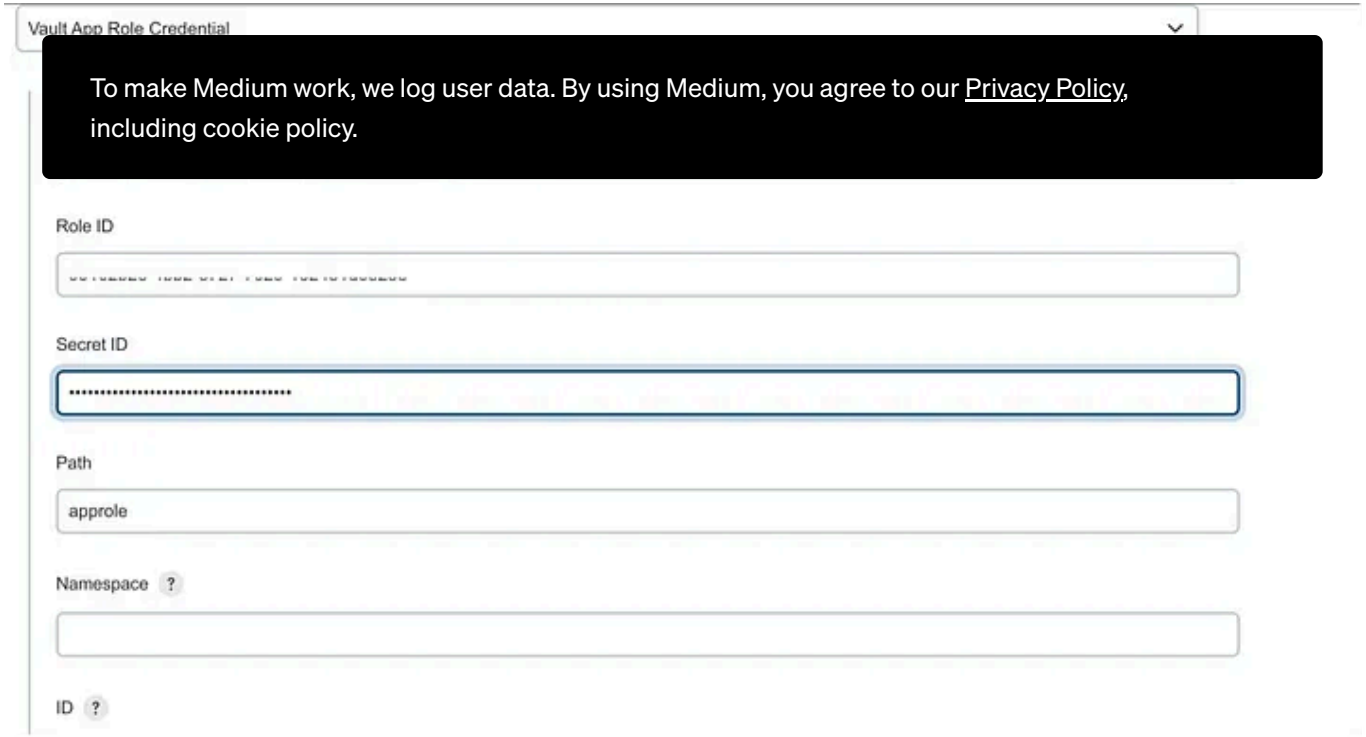
$ vault write -f auth/approle/role/jenkins-role/secret-id

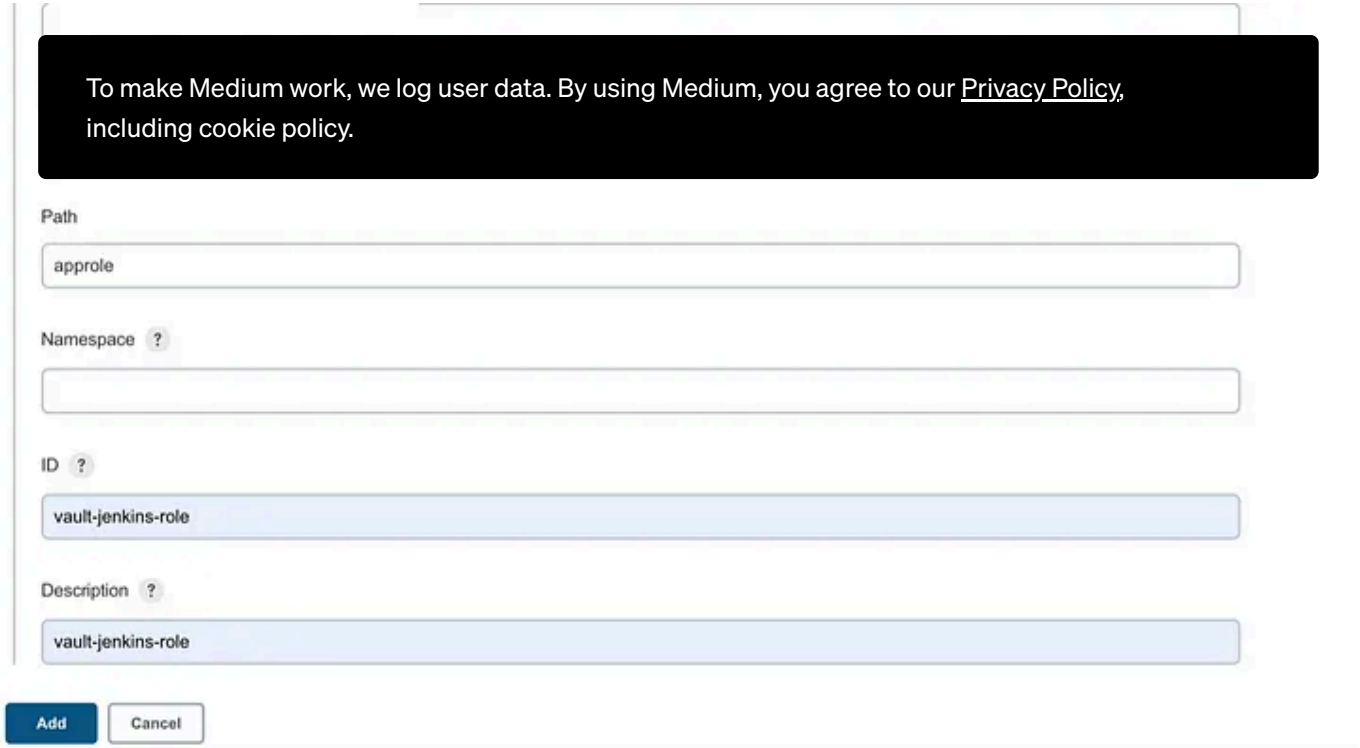
Install Vault Plugin & Integrate vault with Jenkins:



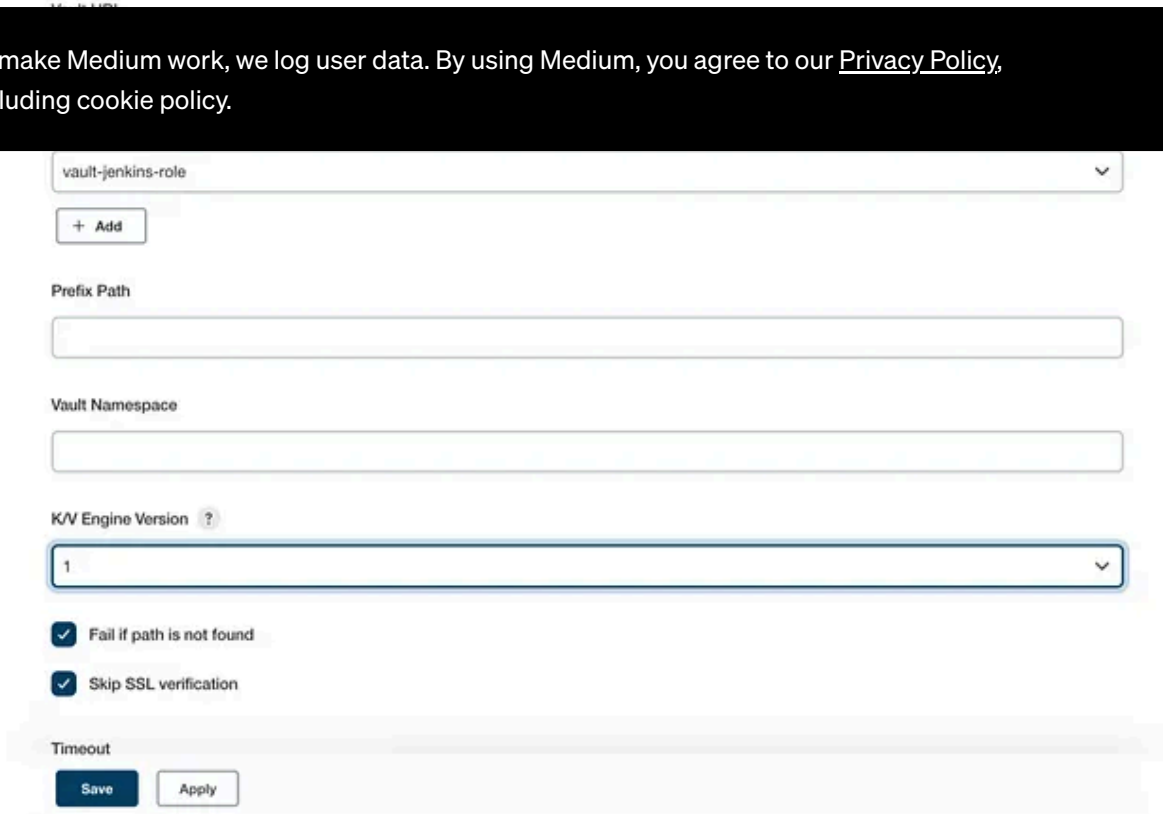
After installing the plugin, Navigate to Manage Credentials and add credentials and select credential type as **Vault AppRole Credentials** and fill out the **role ID, Secret ID, path and ID** as generic name to identify and click on Add.

The Role ID and Secret ID are ones which we got in the upper slide.





Vault plugin configure in Jenkins



Fill “Vault URL” (URL where Vault UI is accessible), “Vault Credential” (where we add the credentials mentioned in Jenkins for approle as vault-jenkins-role) .Click on advance settings to disable the ssl certification. (As we have not used SSL Certificates in demo).

Create Secrets in Vault

Enable Secrets where path = “secrets” and it will using key value pair

$ vault secrets enable -path=secrets kv

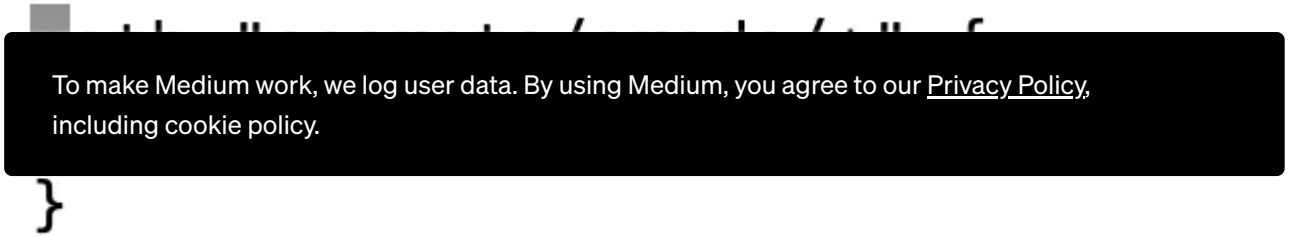
W

secret and value as jenkins123

$ `vault write secrets/creds/my-secret-text secret=jenkins123`

We now create a policy to give permission to approle to retrieve secrets

$ vi jenkins-policy.hcl

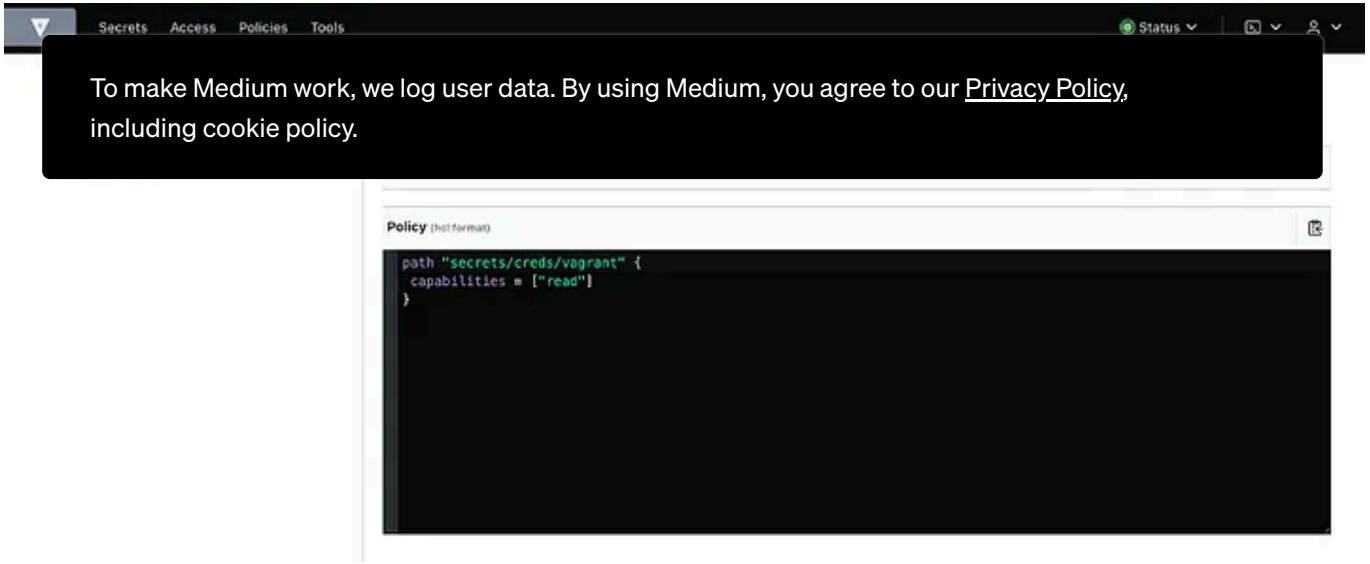


Policy for approle

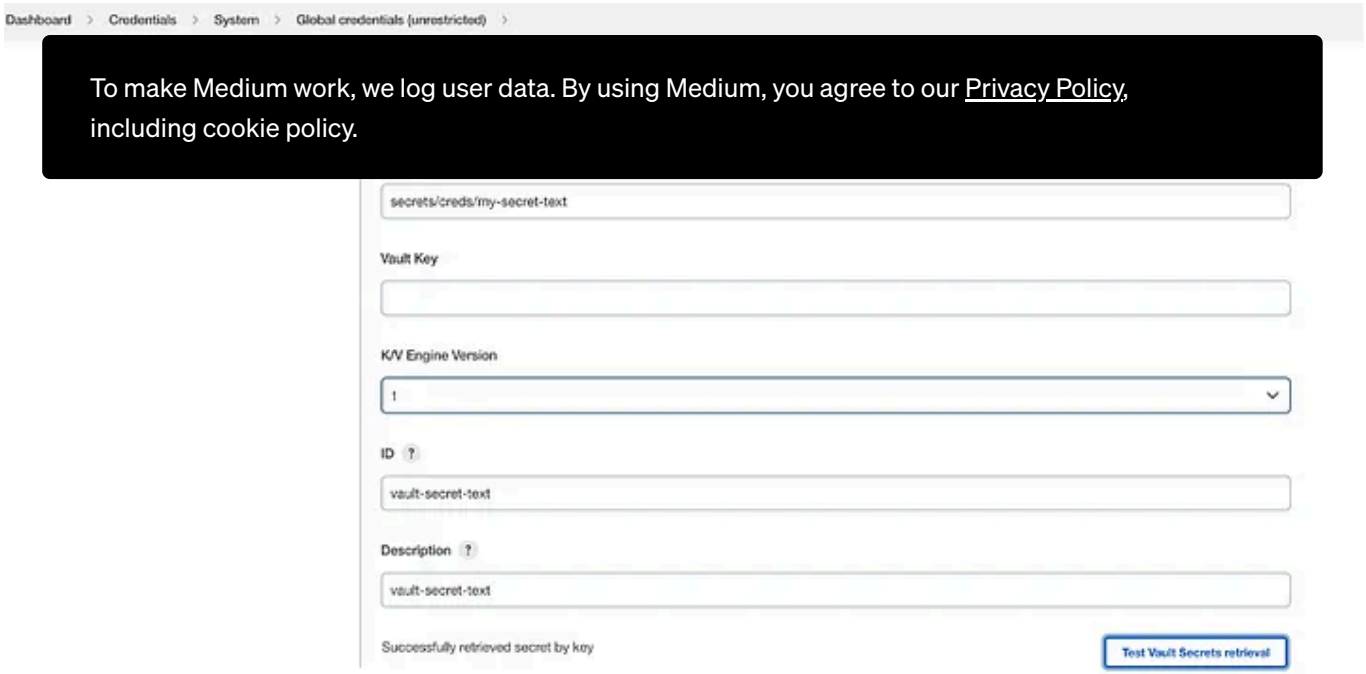
This policy is giving read secrets permission to approle , those secrets which are stored in the path “secrets/creds/*” (In vault)

$ `vault policy write jenkins jenkins-policy.hcl`

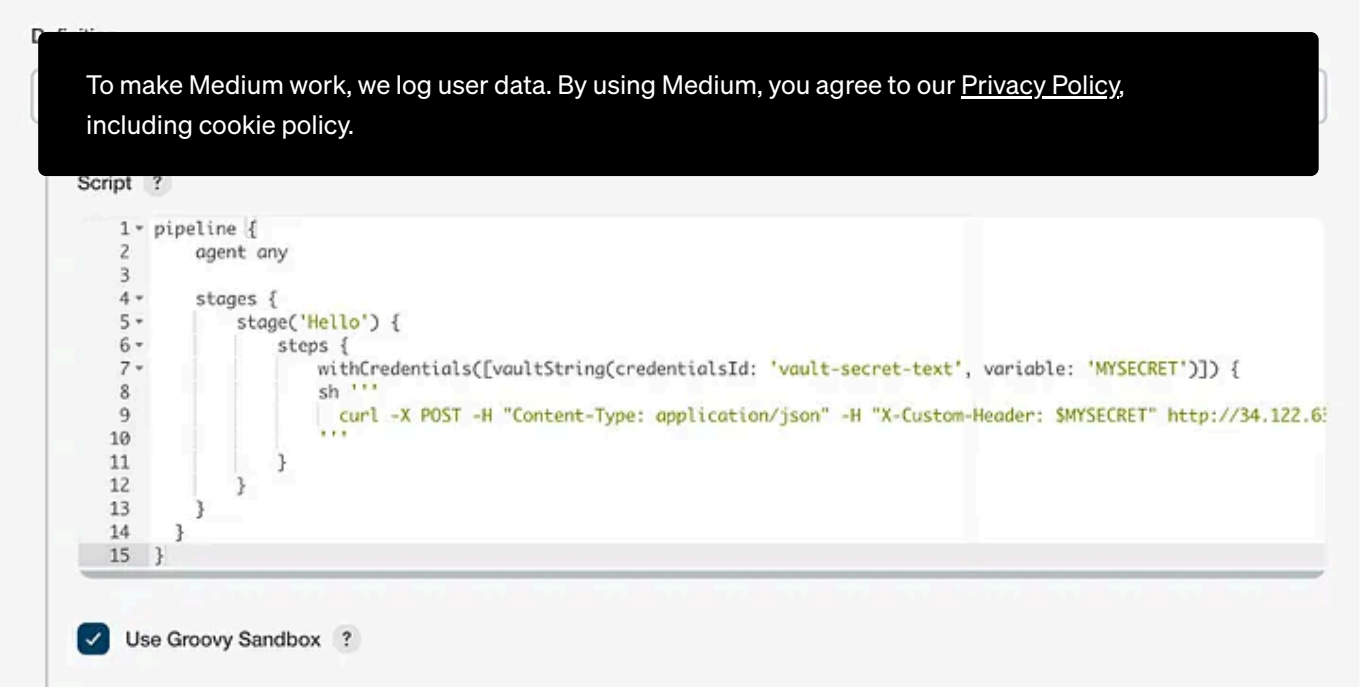
`Create a policy named “jenkins” and use “jenkins-policy.hcl” as its content`



Navigate to Manage Credentials and add credentials and select credential type as **Vault Secret Text Credentials** and fill “**Path** of the Secrets stored in Vault “ and ID **.**

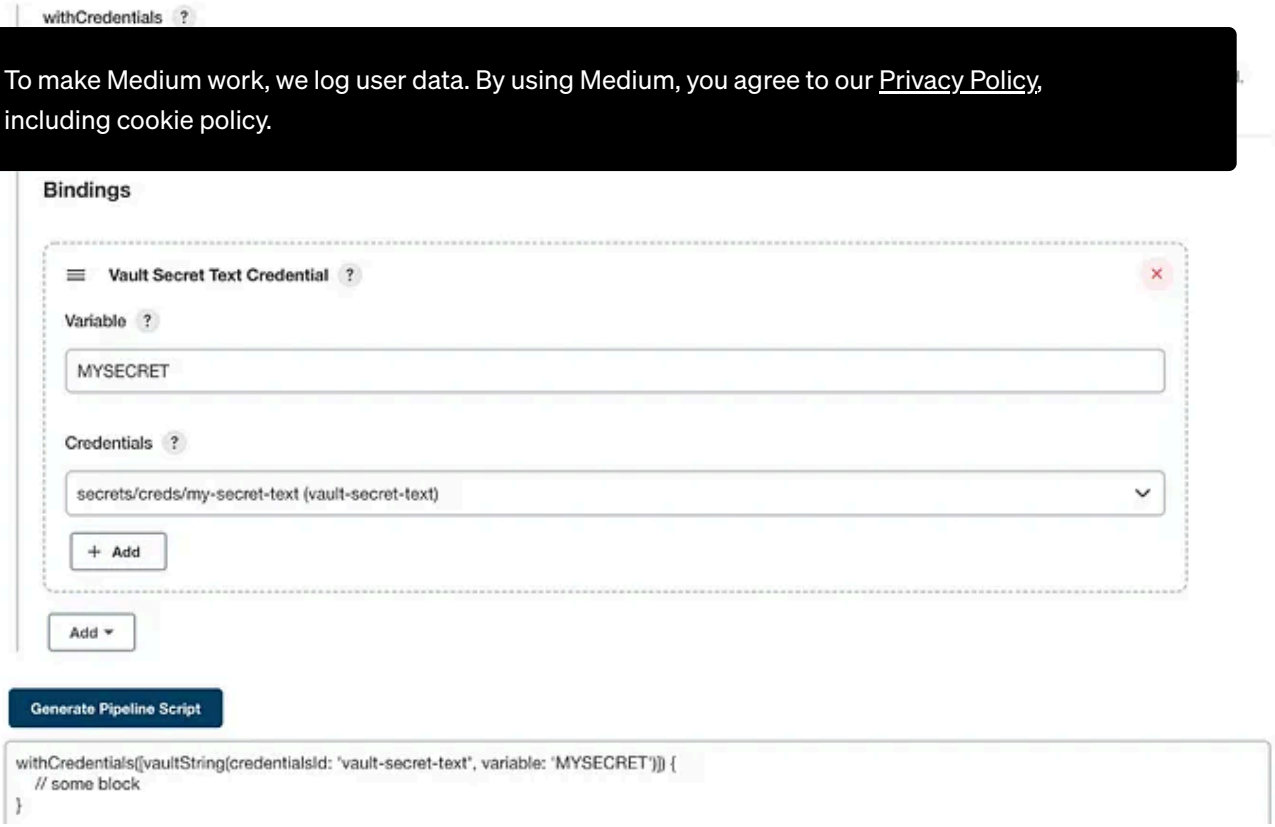


Create a Declarative Jenkins Pipeline



Declarative Jenkins Pipeline

Here , we are using withCredentials function . We are using '**credentialsId**' : Id of the secrets(my-secret-text) which we have declared in Jenkins Configure Credentials and '**variable**' as '**MYSECRET**' : which we will be using in jenkins pipeline referring to the ID of the secrets created in Jenkins.



Output of the Jenkins Declarative Pipeline :

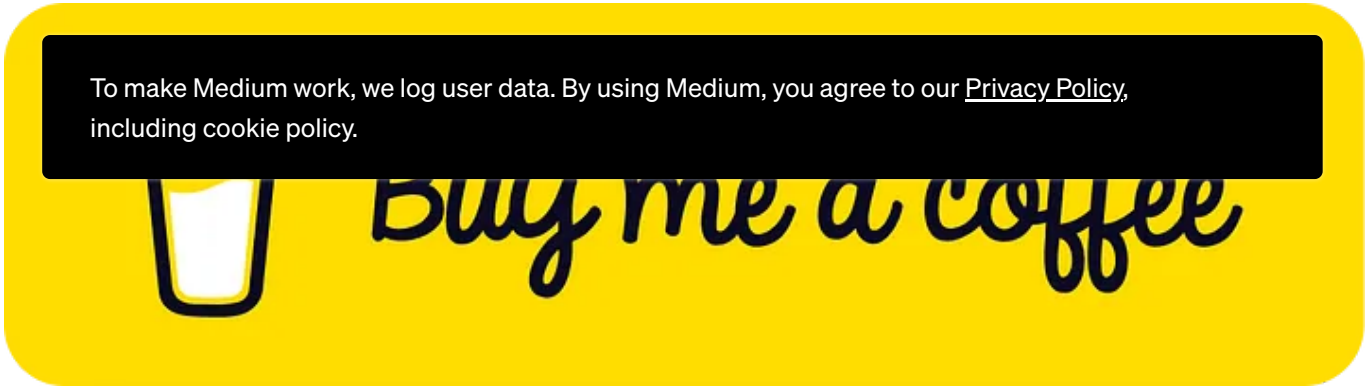
```
Started by user Nandita Sahu
[Pipeline] stage
[Pipeline] { (Hello)
[Pipeline] withCredentials
Masking supported pattern matches of $MYSECRET
[Pipeline] {
[Pipeline] sh
+ curl -X POST -H Content-Type: application/json -H X-Custom-Header: ****
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed

  0     0    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0
100   549  100   549    0     0  68625      0 --:--:-- --:--:-- --:--:--  134k
<html>
<head>
<meta http-equiv="Content-Type" content="text/html;charset=ISO-8859-1"/>
<title>Error 403 No valid crumb was included in the request</title>
</head>
<body><h2>HTTP ERROR 403 No valid crumb was included in the request</h2>
<table>
<tr><th>URI:</th><td>/</td></tr>
<tr><th>STATUS:</th><td>403</td></tr>
<tr><th>MESSAGE:</th><td>No valid crumb was included in the request</td></tr>
<tr><th>SERVLET:</th><td>Stapler</td></tr>
</table>
<hr/><a href="https://eclipse.org/jetty">Powered by Jetty:// 9.4.45.v20220203</a><hr/>

</body>
</html>
```

Output of Jenkins Job

If you like my article , Buy me a coffee :)



For more references , go through the below videos and links

https://gist.github.com/darinpope/4e46fad6d823ae249dec625bff3a2d82

Vault Jenkins Pipeline Jenkins Approle Secrets

Written by Nandita Sahu

Follow

1.4K Followers

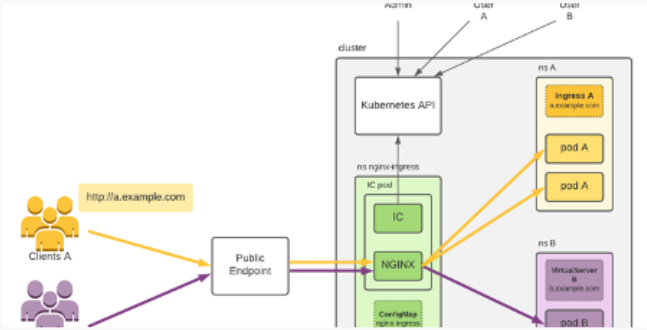
I am quick learner and always love to explore new tools and technologies. You can buy me a coffee :) https://www.buymeacoffee.com/NanditaSahu

More from Nandita Sahu

Nandita Sahu

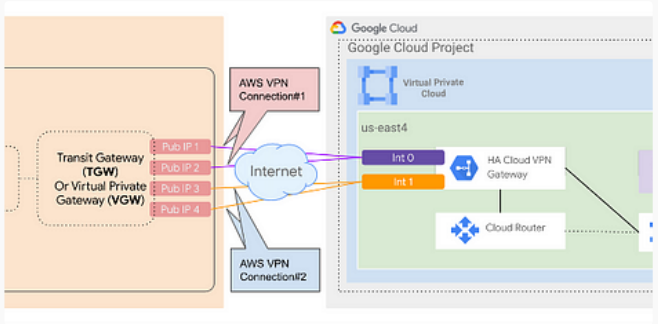
Terraformer—Generate Terraform Files from Existing Infrastructure

What is Terraformer?



Nandita Sahu

“Securing Your EKS Cluster: A Step-by-Step Guide to...



Nandita Sahu

How to define Dependencies between modules in Terragrunt

In this article , you will get an idea about how to define dependency blocks in Terragrunt...

Jan 4, 2023 20 4

Nandita Sahu

HA VPN connections between GCP and AWS

In this article, you will get a brief idea about how to create highly available VPN...

Oct 23, 2022 109 2

See all from Nandita Sahu

Recommended from Medium

Kevin

HashiCorp Vault—common use commands

a list of commonly used CLI commands for interacting with Vault

May 17 20

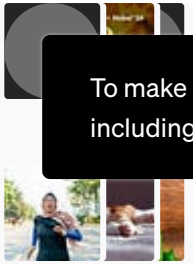
Khalid isyaku

CICD Pipeline with Jenkins, Sonar and Docker

Project Introduction:

Oct 5

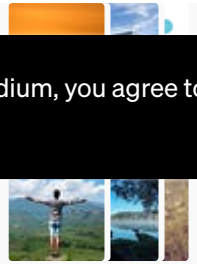
Lists



Staff Picks

Self-Improvement 101

20 stories · 2912 saves



Stories to Help You Level-Up

Productivity 101

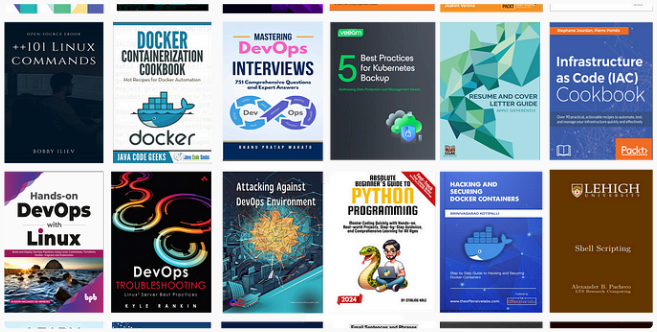
20 stories · 2467 saves

Bernardin Houessou

DevSecOps dotnet pipeline : (Bitbucket, Jenkins, SonarQube,...

DevSecOps : .Net , Jenkins, Sonarqube, Checkmarx, Owasp, Docker, K8s, Trivy

Apr 26 4

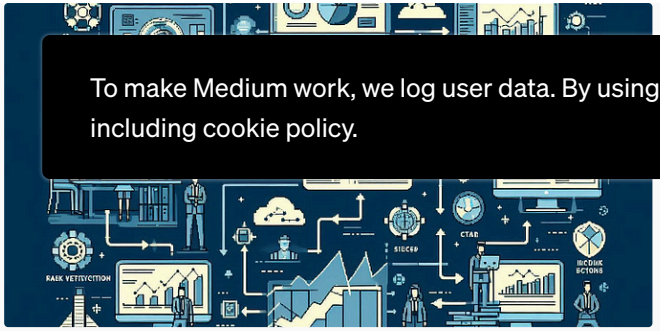


Cumhur Akkaya

DevOps and Cloud Resources 2024 (PDF Books)

I updated DevOps and Cloud resources. I added 51 new documents. In this article;🔎 ...

Sep 17 101 1

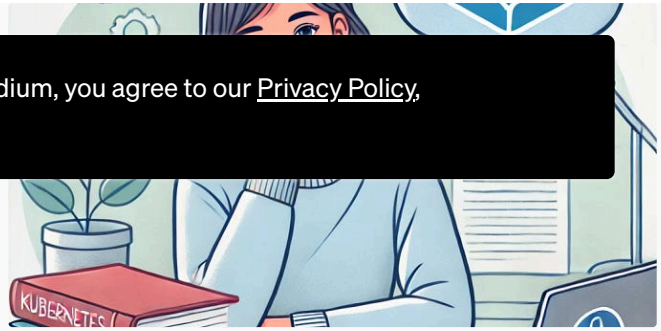


Harpreet Singh Kalsi

Monitoring and DevSecOps with COTS and Custom Software

Recently I have had conversations in my professional setting wherein the points were...

May 31 18



DevOpsDynamo

Conquer the CKA Exam! 5 Realistic Kubernetes Scenarios Every...

👉 if you're not a Medium member, read this story for free, here.

Oct 8 14 1

See more recommendations