Enhancing Ceph Security
Encrypting OSDs With Hashicorp Vault Integration

Naufal Gholib Shiddiq
Cloud Engineer @Btech

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Agenda

1. Pengenalan
2. Ceph Encryption
3. Integrasi Ceph dengan HashiCorp Vault
4. Tantangan dan Limitasi
5. Rekomendasi dan Best Practice

Pengenalan

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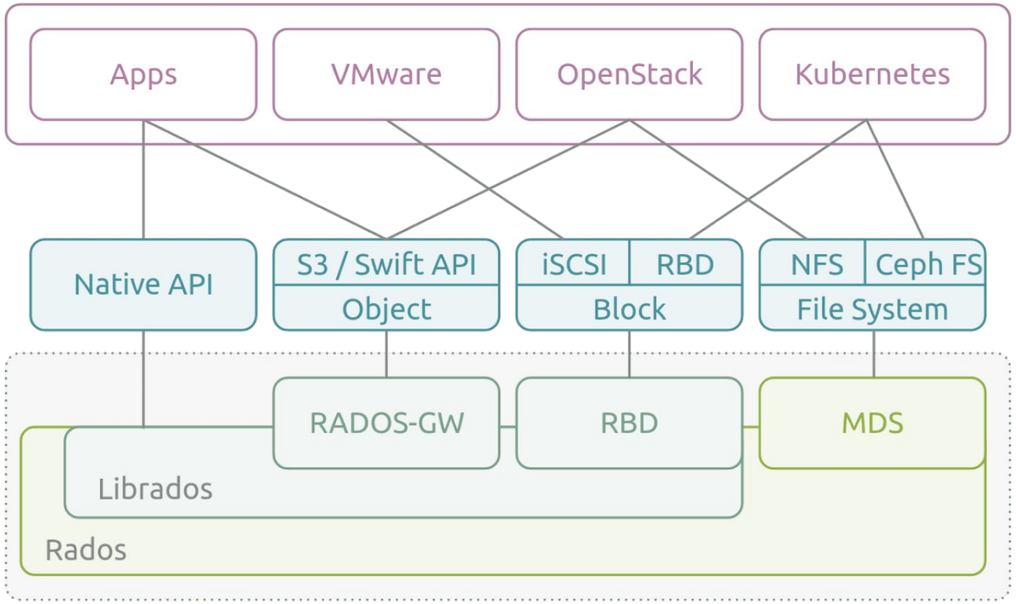


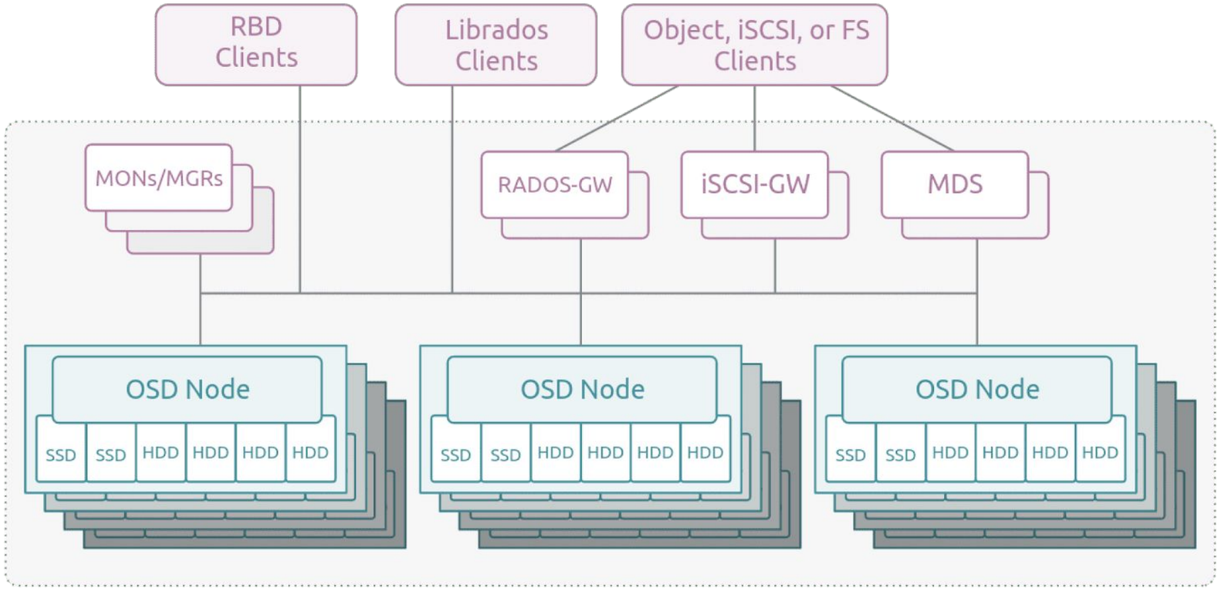
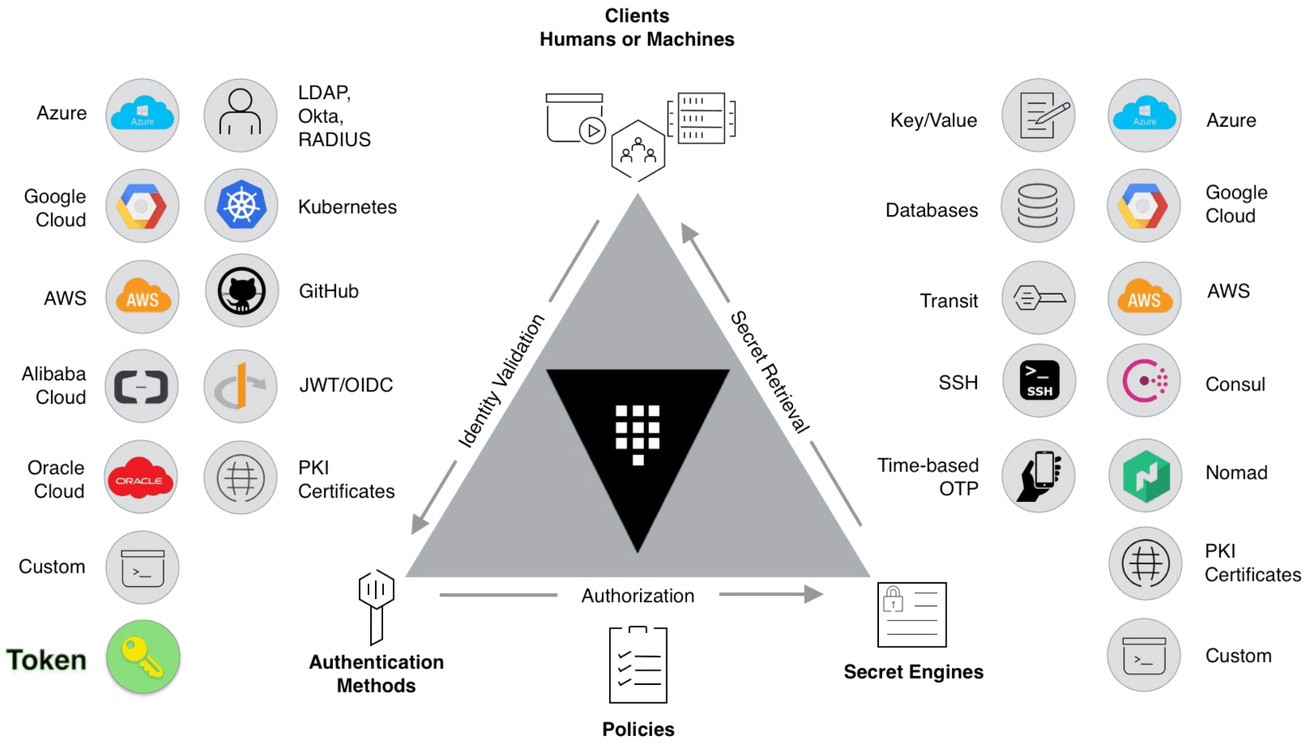


Image Source

Apa itu Ceph?

Ceph adalah open-source distributed storage platform yang di design untuk mengintegrasikan object, block, dan file storage ke dalam satu kesatuan sistem yang terpadu.

Apa itu HashiCorp Vault?



HashiCorp Vault adalah alat open-source untuk secrets management, seperti kata sandi, API Key, Certificate, dan data sensitif lainnya, secara aman dalam infrastruktur IT.

Image Source

Kenapa Perlu Encryption?

1. Untuk organisasi yang menyimpan sensitive data
2. Compliance-driven industries (healthcare, finance, government)
3. Multi-tenant environments dengan shared infrastructure
4. Cloud deployments dengan third-party management
5. International organizations dengan cross-border data flows

Ceph Encryption

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Ceph Encryption

1. Native Ceph Way
2. Charmhub Ceph
3. Manual Ceph & Vault Integration

Native Ceph Way

1. Ceph menyediakan enkripsi native untuk OSD menggunakan LUKS
2. Menggunakan *ceph-volume xxx --dmcrypt* untuk membuat encrypted OSD
3. Encryption key disimpan di Ceph Monitor dalam bentuk lockbox keyring
4. Encryption key di lockbox hanya dapat diakses oleh OSD dengan ID dan UUID yang sesuai
5. OSD untuk mengambil kunci secara aman saat boot untuk decrypt

Charmhub Ceph

Kita bisa dengan mudah mengaktifkan ceph osd encryption dengan native ceph encryption ataupun vault backend pada charmhub dengan konfigurasi berikut

```
ceph-osd:
  osd-encrypt: True
  osd-encrypt-keymanager: vault # use this to integrate with vault
```

Manual Ceph & Vault Integration

1. Fokus bahasan materi kali ini
2. Terinspirasi dari Ceph Charmhub
3. Mencoba mengimitasi apa yang dilakukan Ceph Charmhub
4. Fokus utama **untuk pembelajaran**
5. Pada akhirnya bisa diterapkan secara lebih luas dan works juga di luar Ceph Environment

Kenapa pakai vault?

1. Centralize system untuk semua encryption keys dan multi platform
2. Keys terpisah dari storage infrastructure
3. Possible untuk automated secret lifecycle management
4. Comprehensive logging dan monitoring capabilities
5. Designed untuk enterprise scale
6. Compliance requirements

Integrasi Ceph dengan Vault

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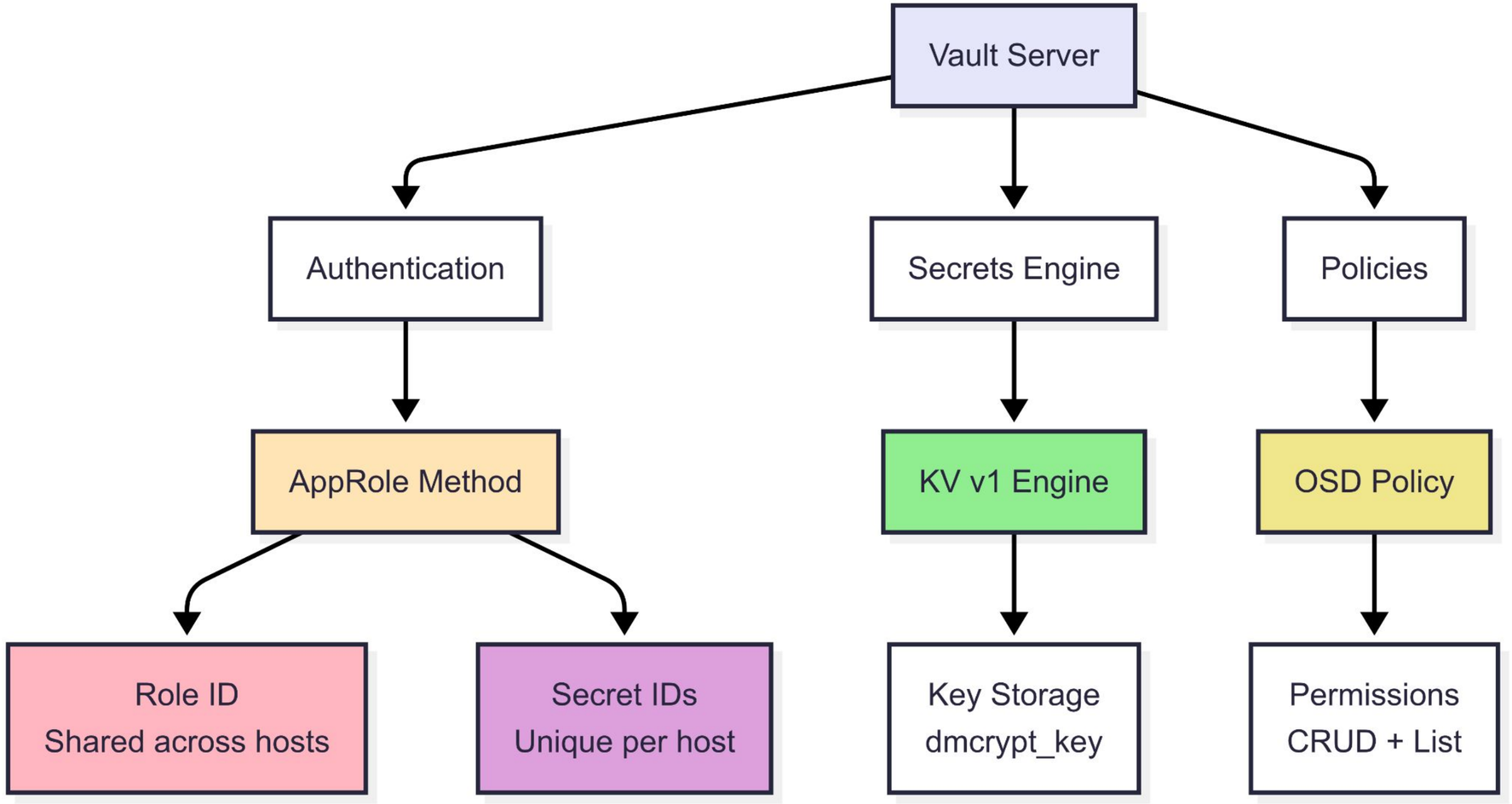
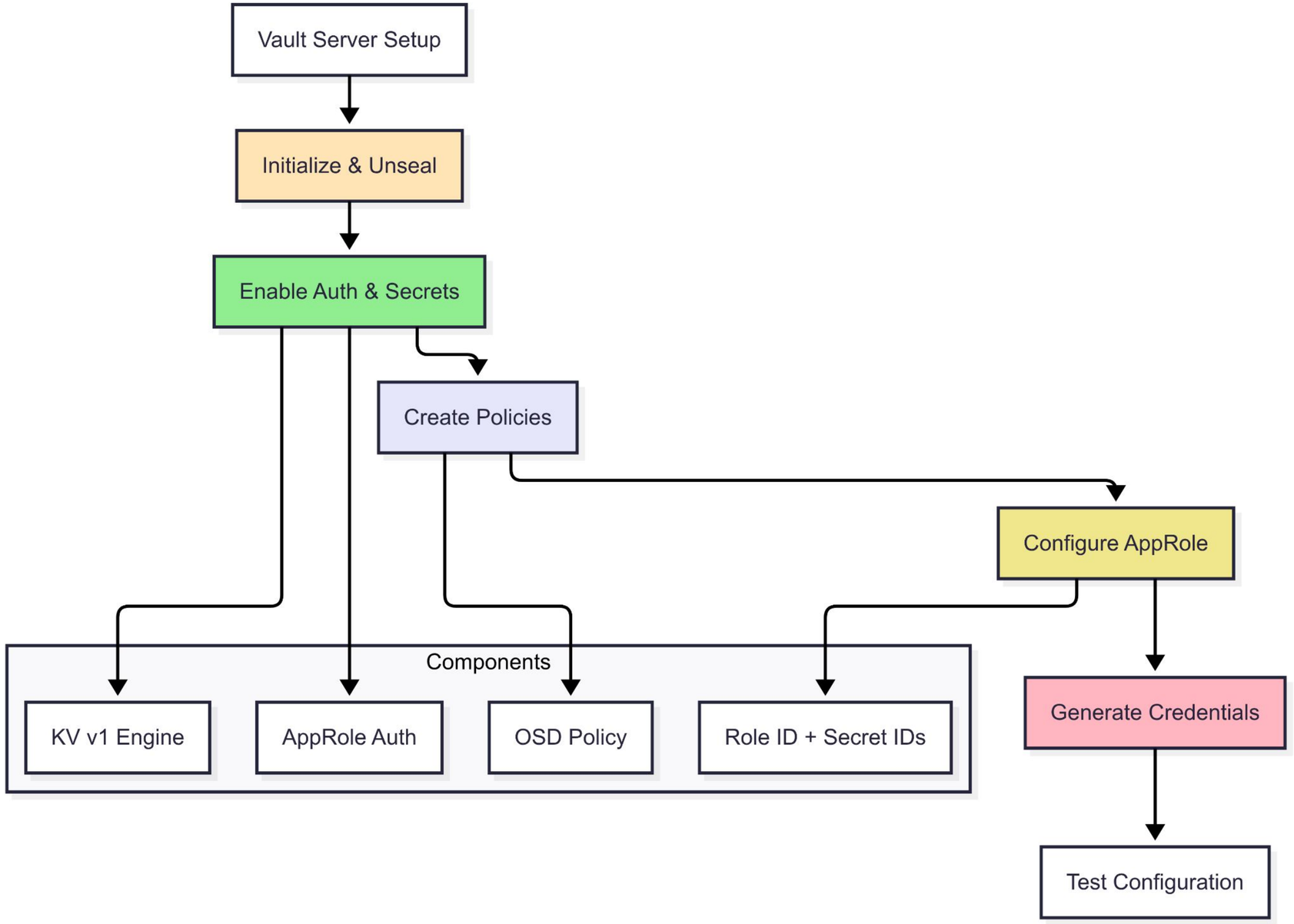
Integrate Ceph with Vault

1. Install dan Setting Vault
2. Install dan Setting Vaultlocker
3. Membuat Encrypted Ceph OSD

1. Install dan Setting Vault



1. Install dan Setting Vault



2. Install dan Setting Vaultlocker

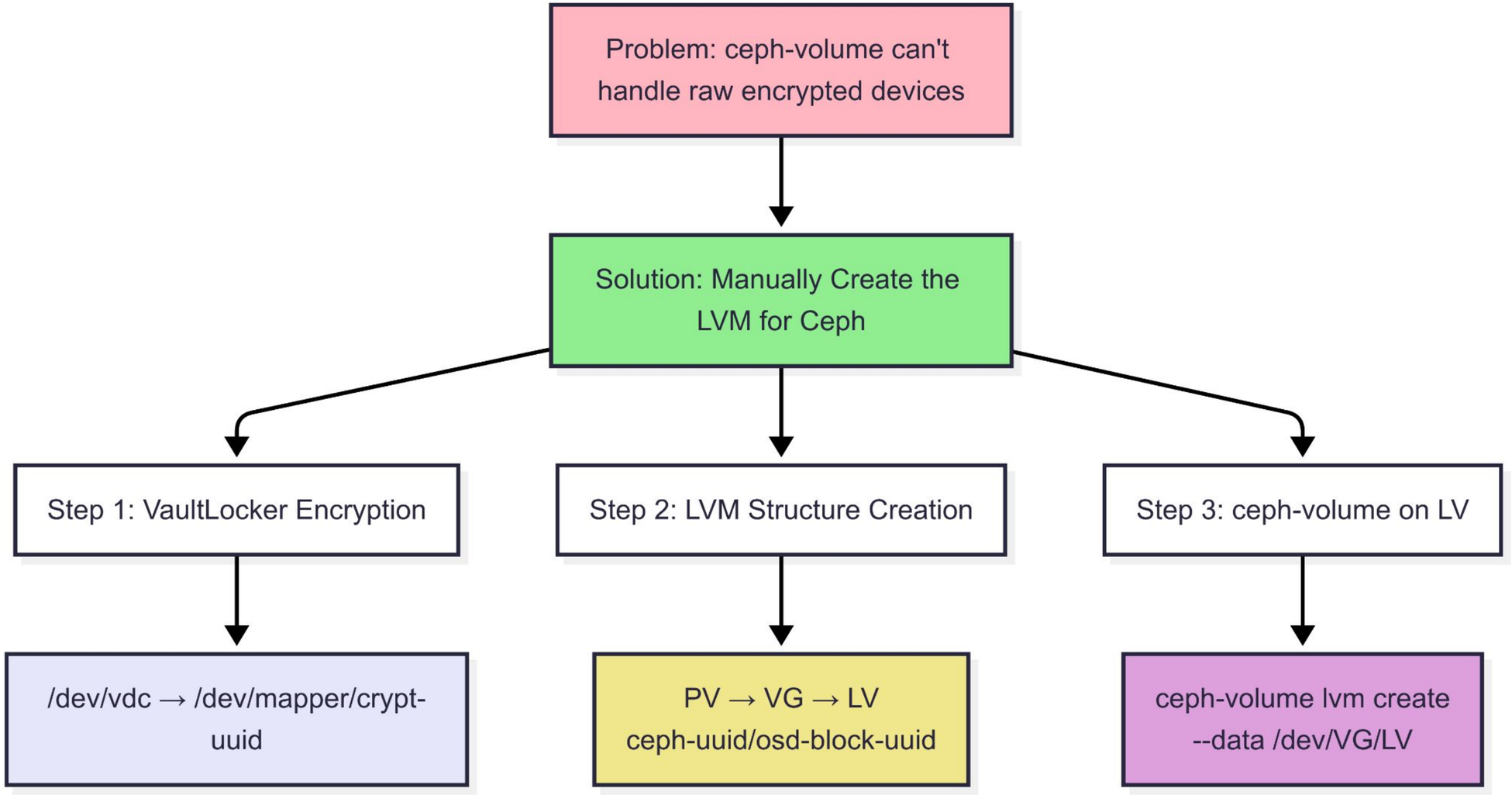
```
# you can install directly via apt
sudo apt install vaultlocker

# edit according to your env
cat /etc/vaultlocker/vaultlocker.conf
[vault]
url = http://192.168.10.14:8200
approle = 8529a1f8-28b2-f1d5-f93a-48ea66985ff1
secret_id = f62033b7-997d-630b-ab6b-2987aaf4c8a3
backend = vaultlocker
```

Kita bisa install langsung Vaultlocker melalui APT dan tinggal sesuaikan file config nya

3. Membuat Encrypted Ceph OSD

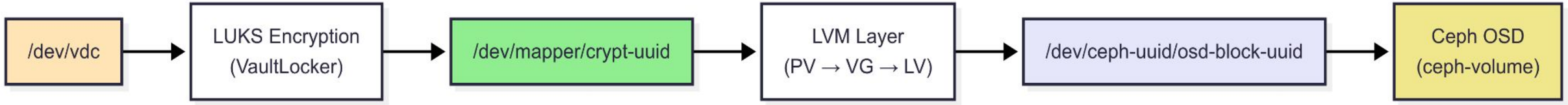
```
root@na-host3:~# lsblk
NAME                                                                                  MAJ:MIN RM   SIZE RO TYPE  MOUNTPOINTS
loop0                                                                                   7:0    0  50.9M  1 loop  /snap/snapd/24718
loop1                                                                                   7:1    0  73.9M  1 loop  /snap/core22/2010
loop2                                                                                   7:2    0 204.7M  1 loop  /snap/vault/2399
loop3                                                                                   7:3    0   100M  0 loop
└crypt-9f8c3e19-2dde-46e3-9633-92f21b33a89b                                           252:1    0    84M  0 crypt
loop4                                                                                   7:4    0  49.3M  1 loop  /snap/snapd/24792
loop5                                                                                   7:5    0  73.9M  1 loop  /snap/core22/2045
sr0                                                                                    11:0    1   366K  0 rom
vda                                                                                   253:0    0    50G  0 disk
├vda1                                                                                 253:1    0    49G  0 part  /
├vda14                                                                                253:14   0     4M  0 part
├vda15                                                                                253:15   0   106M  0 part  /boot/efi
└vda16                                                                                259:0    0   913M  0 part  /boot
vdb                                                                                   253:16   0    50G  0 disk
└ceph--a48e1f82--83c5--4b17--80c6--799a4f91f4ed-osd--block--ca4b4916--9bef--4025--9c7b--bcf953568131 252:0    0    50G  0 lvm
vdc                                                                                   253:32   0    50G  0 disk
vdd                                                                                   253:48   0    50G  0 disk
root@na-host3:~# ceph-volume lvm create --data /dev/mapper/crypt-9f8c3e19-2dde-46e3-9633-92f21b33a89b
Running command: /usr/bin/ceph-authtool --gen-print-key
Running command: /usr/bin/ceph-authtool --gen-print-key
Running command: /usr/bin/ceph --cluster ceph --name client.bootstrap-osd --keyring /var/lib/ceph/bootstrap-osd/ceph.keyring -i - osd new ec06d352-465c-473c-9109-61c59fc8295f
--> Was unable to complete a new OSD, will rollback changes
Running command: /usr/bin/ceph --cluster ceph --name client.bootstrap-osd --keyring /var/lib/ceph/bootstrap-osd/ceph.keyring osd purge-new osd.5 --yes-i-really-mean-it
 stderr: purged osd.5
-->  RuntimeError: Unable to find any LV for zapping OSD: 5
root@na-host3:~#
```

3. Membuat Encrypted Ceph OSD

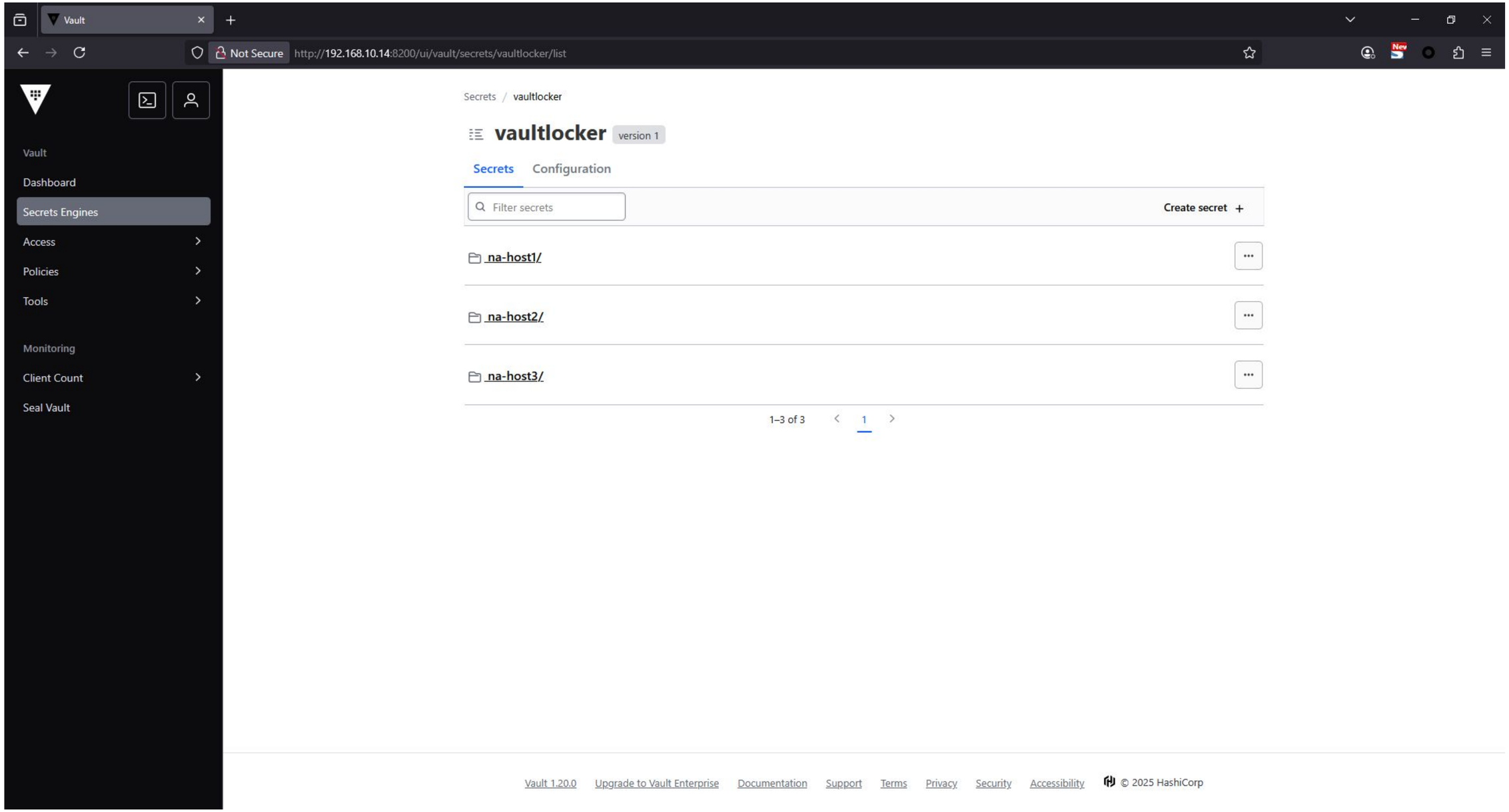


3. Membuat Encrypted Ceph OSD

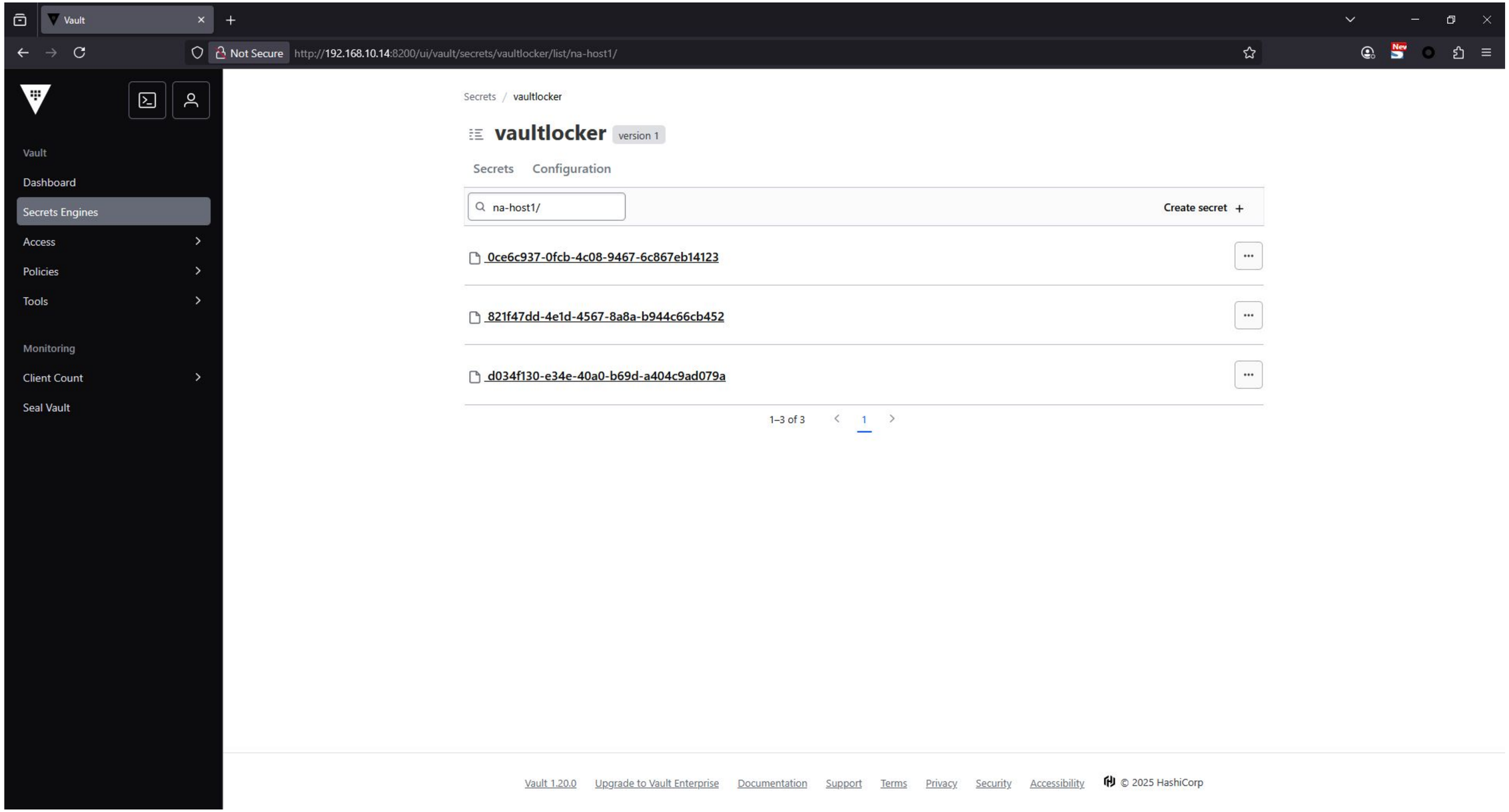
```
root@na-host1:~# lsblk | head -15
NAME                                                                                                  MAJ:MIN RM   SIZE RO TYPE
loop0                                                                                                   7:0    0  49.3M  1 loop
loop1                                                                                                   7:1    0  73.9M  1 loop
loop2                                                                                                   7:2    0 204.7M  1 loop
sr0                                                                                                    11:0    1   366K  0 rom
vda                                                                                                   253:0    0    50G  0 disk
├─vda1                                                                                                253:1    0    49G  0 part
├─vda14                                                                                               253:14   0     4M  0 part
├─vda15                                                                                               253:15   0   106M  0 part
└─vda16                                                                                               259:0    0   913M  0 part
vdb                                                                                                   253:16   0    50G  0 disk
└─ceph--a7fbf7d0--87a1--4e93--a311--a0ea7b54f53c-osd--block--7351cbf5--d967--44d3--b6bd--def4b7bf1f7b   252:0    0    50G  0 lvm
vdc                                                                                                   253:32   0    50G  0 disk
└─crypt-d034f130-e34e-40a0-b69d-a404c9ad079a                                                          252:1    0    50G  0 crypt
  └─ceph--d034f130--e34e--40a0--b69d--a404c9ad079a-osd--block--d034f130--e34e--40a0--b69d--a404c9ad079a 252:2    0    50G  0 lvm
root@na-host1:~# pvs
  PV                                            VG                                        Fmt  Attr PSize   PFree
  /dev/mapper/crypt-d034f130-e34e-40a0-b69d-a404c9ad079a ceph-d034f130-e34e-40a0-b69d-a404c9ad079a lvm2 a--   49.98g    0
  /dev/vdb                                      ceph-a7fbf7d0-87a1-4e93-a311-a0ea7b54f53c lvm2 a--  <50.00g    0
  /dev/vdd                                      ceph-e45f0e46-df01-4c65-8ef4-e62e30a93d58 lvm2 a--  <50.00g    0
root@na-host1:~# lvs
  LV                                        VG                                        Attr       LSize   Pool Origin Data%  Me
  osd-block-7351cbf5-d967-44d3-b6bd-def4b7bf1f7b ceph-a7fbf7d0-87a1-4e93-a311-a0ea7b54f53c -wi-ao---- <50.00g
  osd-block-d034f130-e34e-40a0-b69d-a404c9ad079a ceph-d034f130-e34e-40a0-b69d-a404c9ad079a -wi-ao----  49.98g
  osd-block-acbcd6ec-df75-4e06-8c4a-925b613941ea ceph-e45f0e46-df01-4c65-8ef4-e62e30a93d58 -wi-ao---- <50.00g
root@na-host1:~#
```



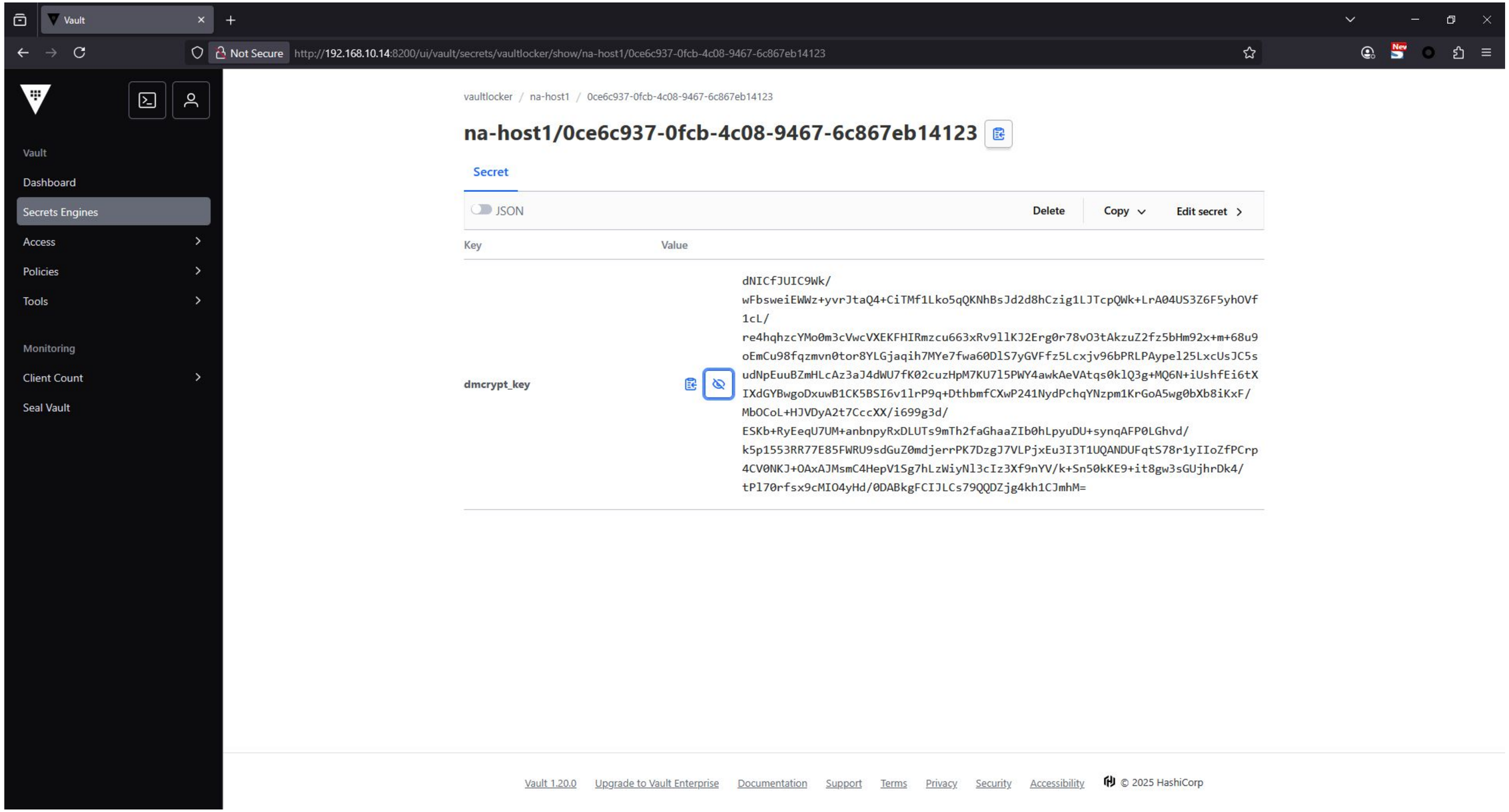
3. Membuat Encrypted Ceph OSD



3. Membuat Encrypted Ceph OSD



3. Membuat Encrypted Ceph OSD



Tantangan dan Limitasi

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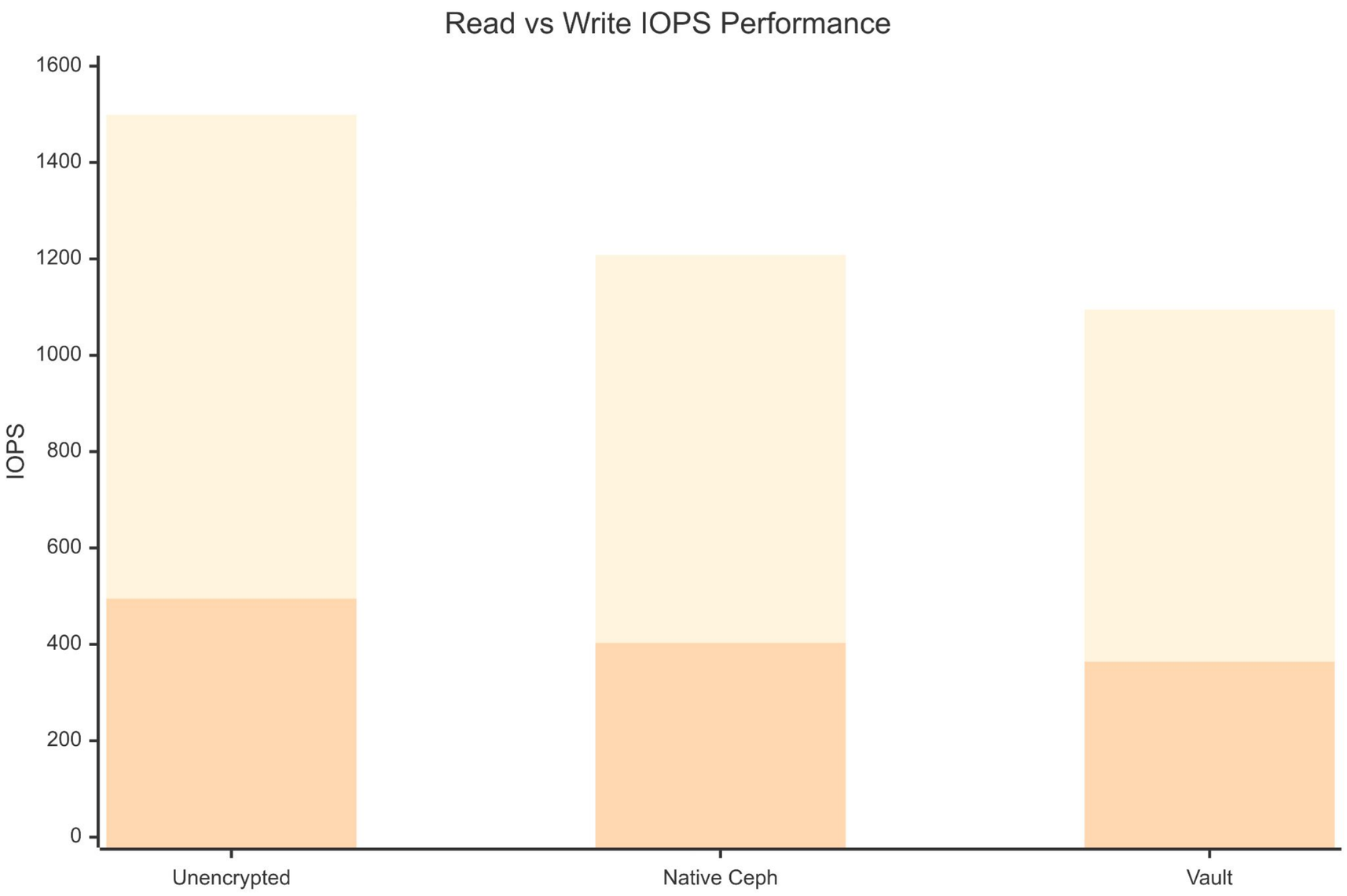
Tantangan dan Limitasi

1. IOPS menurun secara significant
2. Integrasi manual butuh banyak effort

Tantangan dan Limitasi



Key Findings

1. **Native Ceph Encryption Impact:**
   - **~19-20% performance reduction** compared to unencrypted
2. **Vault Encryption Impact:**
   - **~27% performance reduction** compared to unencrypted
   - **~9% additional reduction** compared to Native Ceph

Rekomendasi & Best Practice

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Rekomendasi & Best Practice

1. Deploy HashiCorp Vault secara highly available (HA)
2. Aktifkan file audit logging
3. Buat Vault Policy dan Approle yang berbeda untuk setiap host
4. Buat config Approle lebih strict
5. Setup Secret ID rotation

THANK YOU

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