



MEMBANGUN PRIVATE CLOUD CLUSTER DENGAN PROXMOX VE

Disusun oleh Kelompok 8

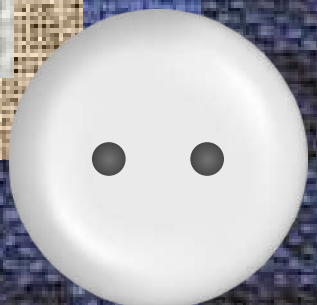
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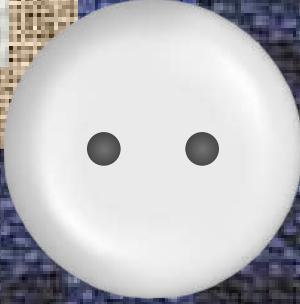
LATAR BELAKANG

Transformasi teknologi informasi telah mendorong organisasi dan institusi pendidikan untuk beralih dari penggunaan server fisik tunggal ke infrastruktur virtual dan cloud. Virtualisasi memungkinkan efisiensi sumber daya, kemudahan manajemen, serta fleksibilitas dalam penyediaan layanan, termasuk kemampuan menjalankan banyak sistem operasi secara terisolasi pada satu perangkat keras. Dengan penerapan cluster dan storage bersama, infrastruktur menjadi lebih scalable dan resilient serta mampu meminimalkan downtime melalui mekanisme failover dan live migration. Proxmox Virtual Environment (Proxmox VE) sebagai platform virtualisasi open-source mendukung cluster multi-node, shared storage, high availability, dan live migration, sehingga sangat relevan digunakan dalam konteks akademik untuk mengintegrasikan teori virtualisasi, cluster, dan manajemen infrastruktur berbasis cloud ke dalam praktik langsung.



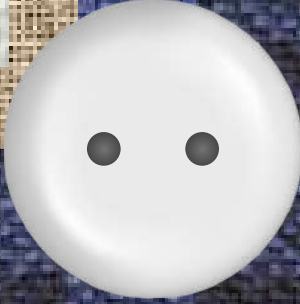


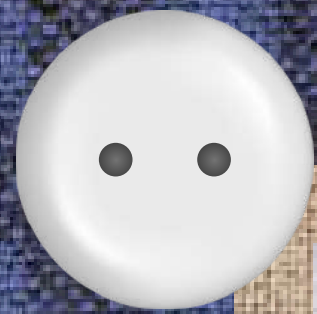
RUMUSAN MASALAH

1. Bagaimana merancang arsitektur private cloud cluster menggunakan Proxmox VE?
 2. Bagaimana melakukan instalasi dan konfigurasi Proxmox VE pada multi-node?
 3. Bagaimana membangun storage bersama berbasis ZFS?
 4. Bagaimana menguji live migration antar-node?
 5. Bagaimana memastikan sistem mendukung high availability dan failover?
- 



TUJUAN

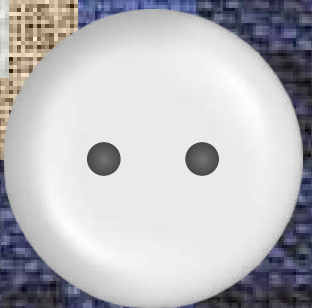
1. Merancang arsitektur private cloud cluster yang stabil dan scalable
 2. Mengonfigurasi Proxmox VE pada lingkungan multi-node
 3. Mengintegrasikan storage bersama berbasis ZFS
 4. Menguji proses live migration VM tanpa downtime
 5. Menguji kestabilan cluster dan mekanisme HA
- 



PROXMOX VE

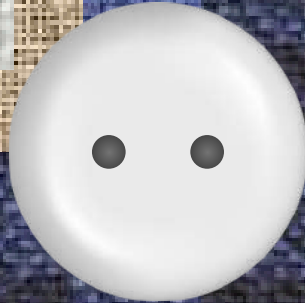
Proxmox VE adalah platform virtualisasi open-source berbasis Debian yang mendukung:

1. KVM untuk virtual machine
2. LXC untuk container
3. Manajemen terpusat berbasis web
4. Cluster multi-node
5. Live migration
6. High Availability (HA)
7. Dukungan storage fleksibel (ZFS, Ceph, NFS, iSCSI)





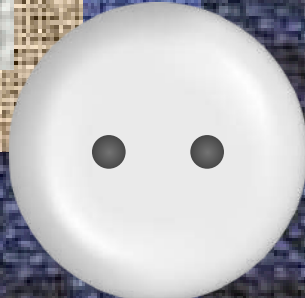
CLUSTER DAN HIGH AVAILABILITY

1. Cluster adalah kumpulan beberapa node yang dikelola sebagai satu sistem
 2. High Availability memastikan layanan tetap berjalan meskipun terjadi kegagalan node
 3. Proxmox VE menggunakan:
 - a. Corosync
 - b. Shared storage
 - c. HA Manager
 4. VM dapat direstart atau dipindahkan otomatis ke node lain
- 



STORAGE BERSAMA (ZFS)

ZFS merupakan filesystem dan volume manager yang:

1. Mendukung snapshot dan integritas data
 2. Cocok untuk cluster kecil hingga menengah
 3. Konfigurasi lebih sederhana dibanding Ceph
 4. Mendukung live migration jika digunakan sebagai shared storage
- 



LIVE MIGRATION

Live migration adalah proses memindahkan VM yang sedang berjalan tanpa mematikan VM.

Kegunaan live migration:

1. Maintenance node
2. Load balancing
3. Failover manual
4. Menghindari downtime layanan

Syarat utama: Menggunakan shared storage





VIRTUALISASI SERVER

Virtualisasi server memungkinkan:

1. Menjalankan banyak OS dalam satu hardware
2. Efisiensi resource
3. Fleksibilitas deployment
4. Mendukung HA dan disaster recovery

Proxmox VE menggunakan:

1. KVM (full virtualization)
 2. LXC (container)
- 



ARSITEKTUR SISTEM


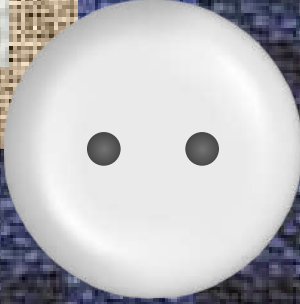
1. Menggunakan 2 node Proxmox VE
2. Shared storage berbasis ZFS
3. Terhubung melalui jaringan lokal (WiFi)
4. Mendukung komunikasi cluster dan live migration

Node:

- Node 1 (Miris) – 192.168.1.45
 - Node 2 (Kel8) – 192.168.1.44
- 



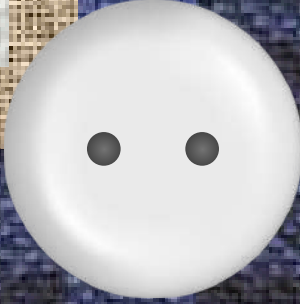
KOMPONEN SISTEM

1. Node Proxmox VE: server virtualisasi
 2. Shared Storage ZFS: menyimpan disk VM
 3. Cluster Network: komunikasi antar-node
 4. HA Manager: menjaga ketersediaan VM
- 
- 



SKEMA PROSES

Seluruh tahapan dilakukan secara bertahap untuk memastikan sistem berjalan stabil dan virtual machine tetap aktif tanpa downtime selama proses migrasi. untuk proses tahapan nya ada pada slide selanjutnya.



INSTLASASI PROXMOX VE

New Virtual Machine

Virtual machine name and operating system

The ISO image is used to install the operating system on the VM.

VM Name

VM Folder

ISO Image


OS Edition

OS

OS Distribution

OS Version

☐ Proceed with Unattended Installation

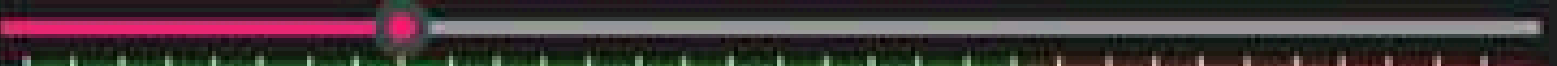


 VirtualBox can't install an OS from the selected ISO. OS cannot be determined, the guest OS will need to be installed manually.

PENGATURAN ALOKASI CPU

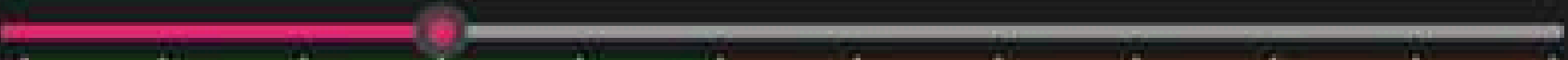


New Virtual Machine

Specify virtual hardware

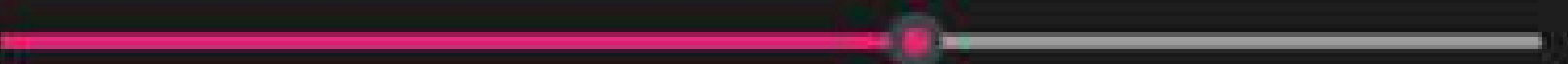
Specify the VM's hardware. Resources allocated to the VM will not be available to the host when the VM is running.

Base Memory  4096 MB  

4 MB 16384 MB

Number of CPUs  4  

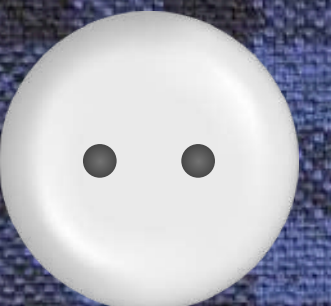
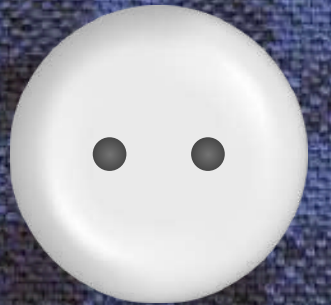
1 CPU 12 CPUs

Disk Size  10,00 GB

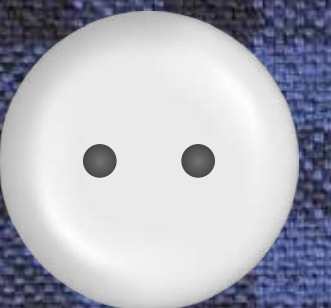
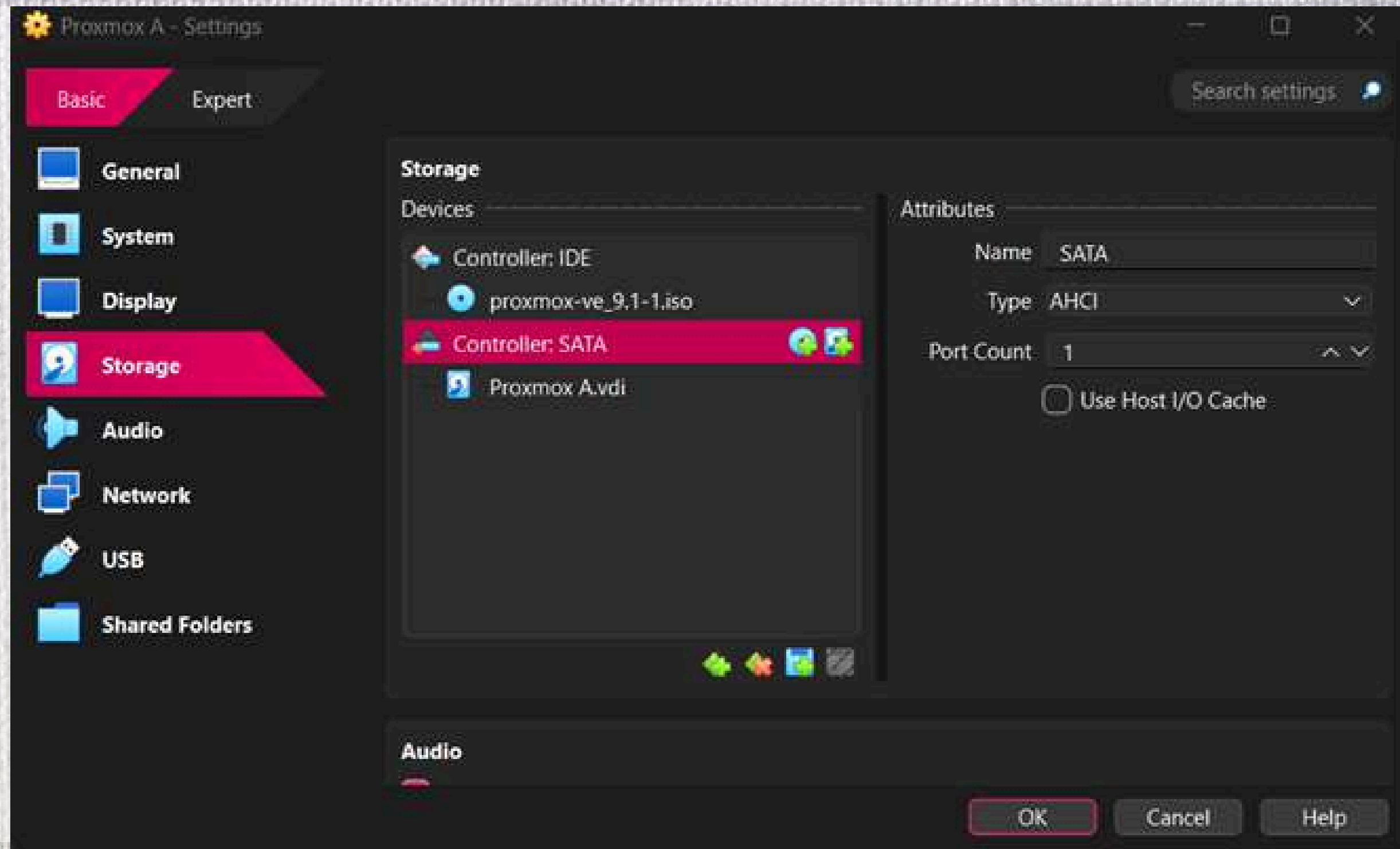
4,00 MB 2,00 TB

☐ Use EFI

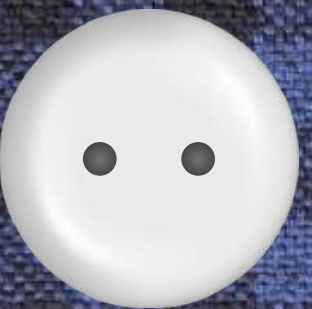
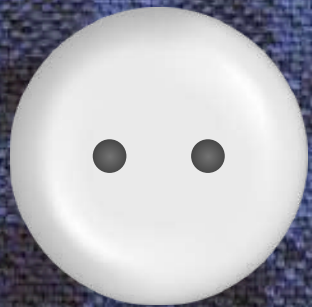
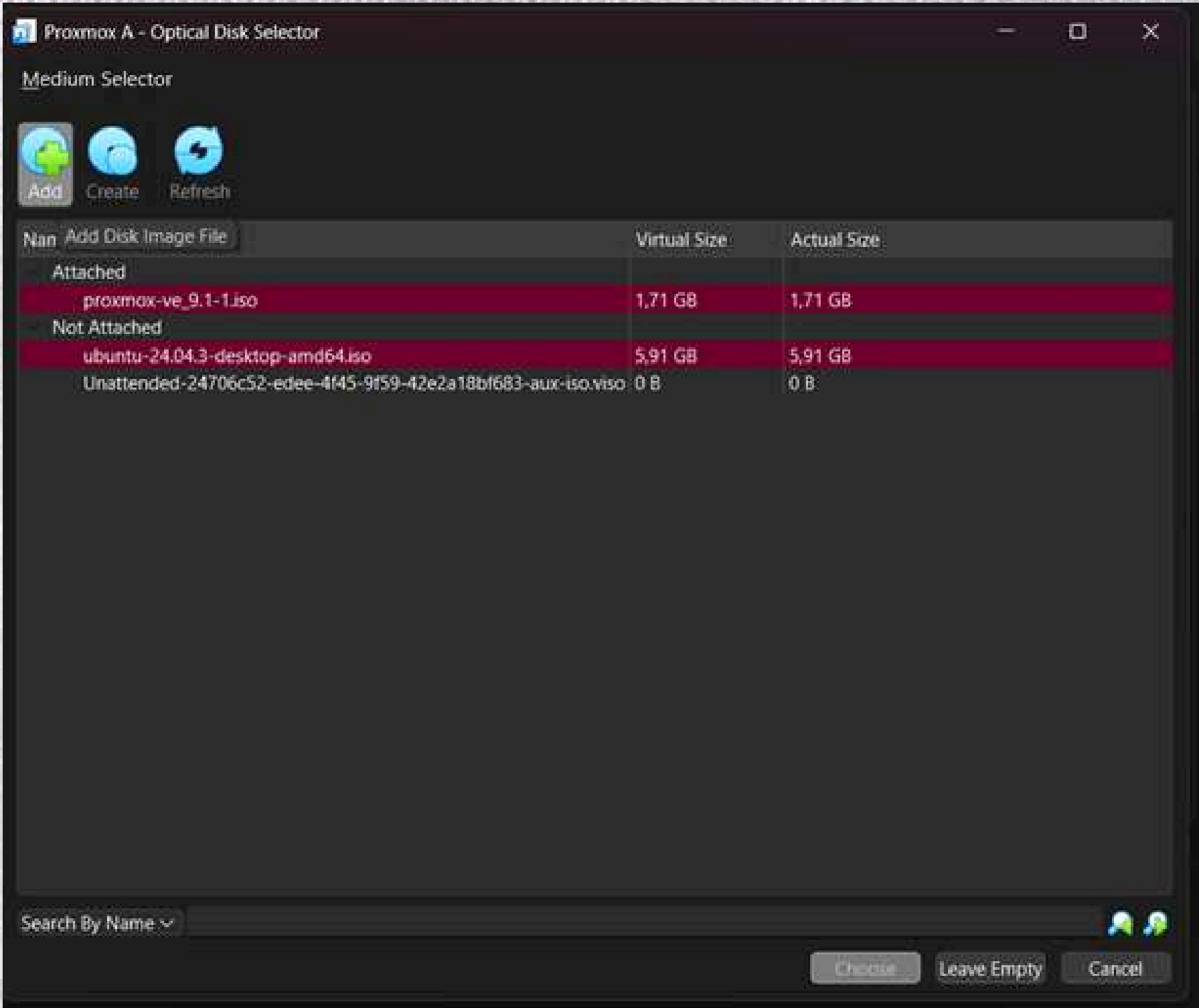
Help Back Next Cancel



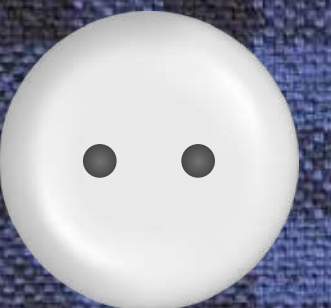
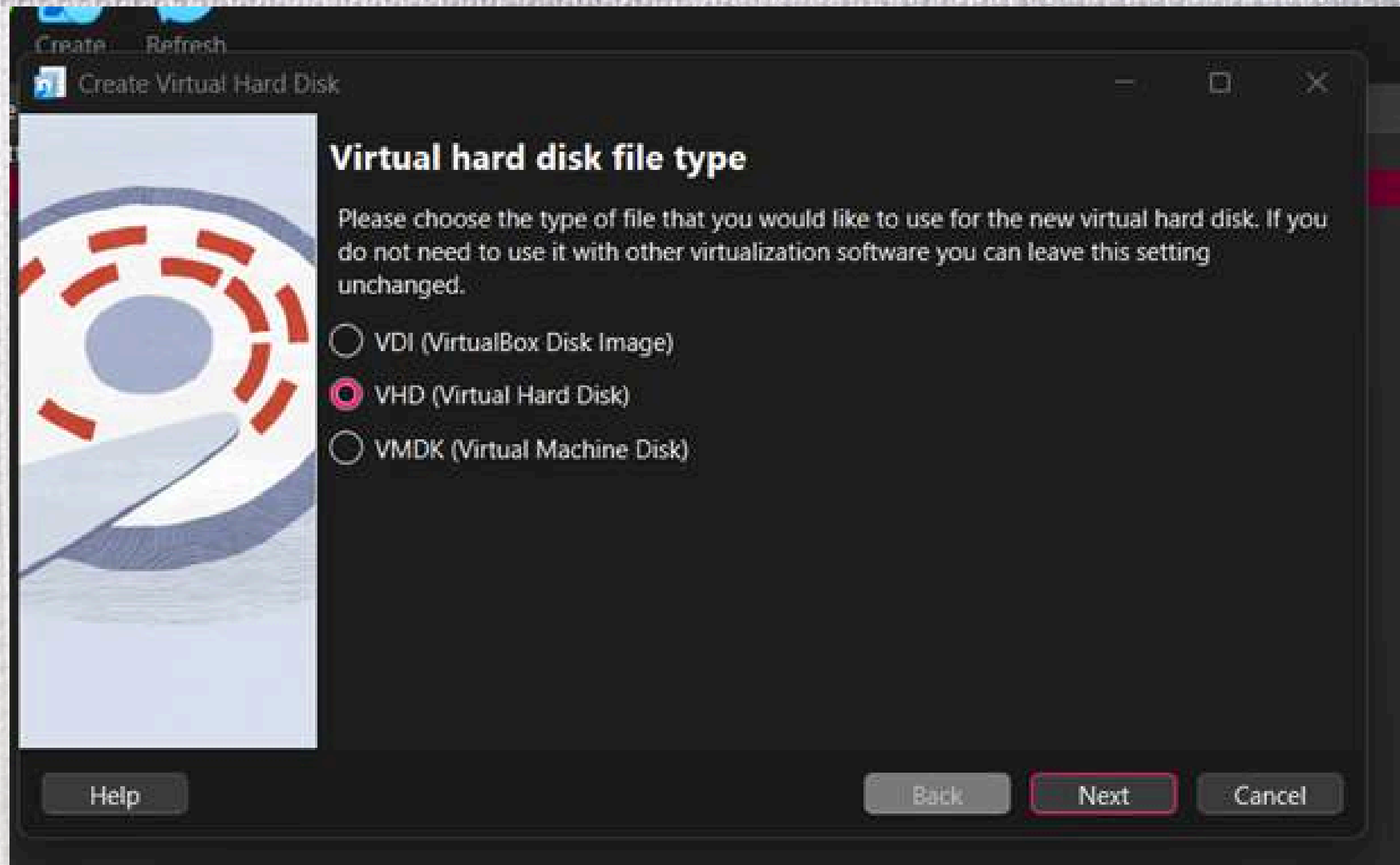
KONFIGURASI STORAGE PADA CONTROLLER SATA



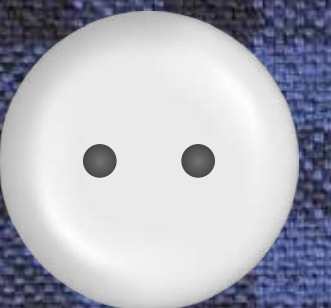
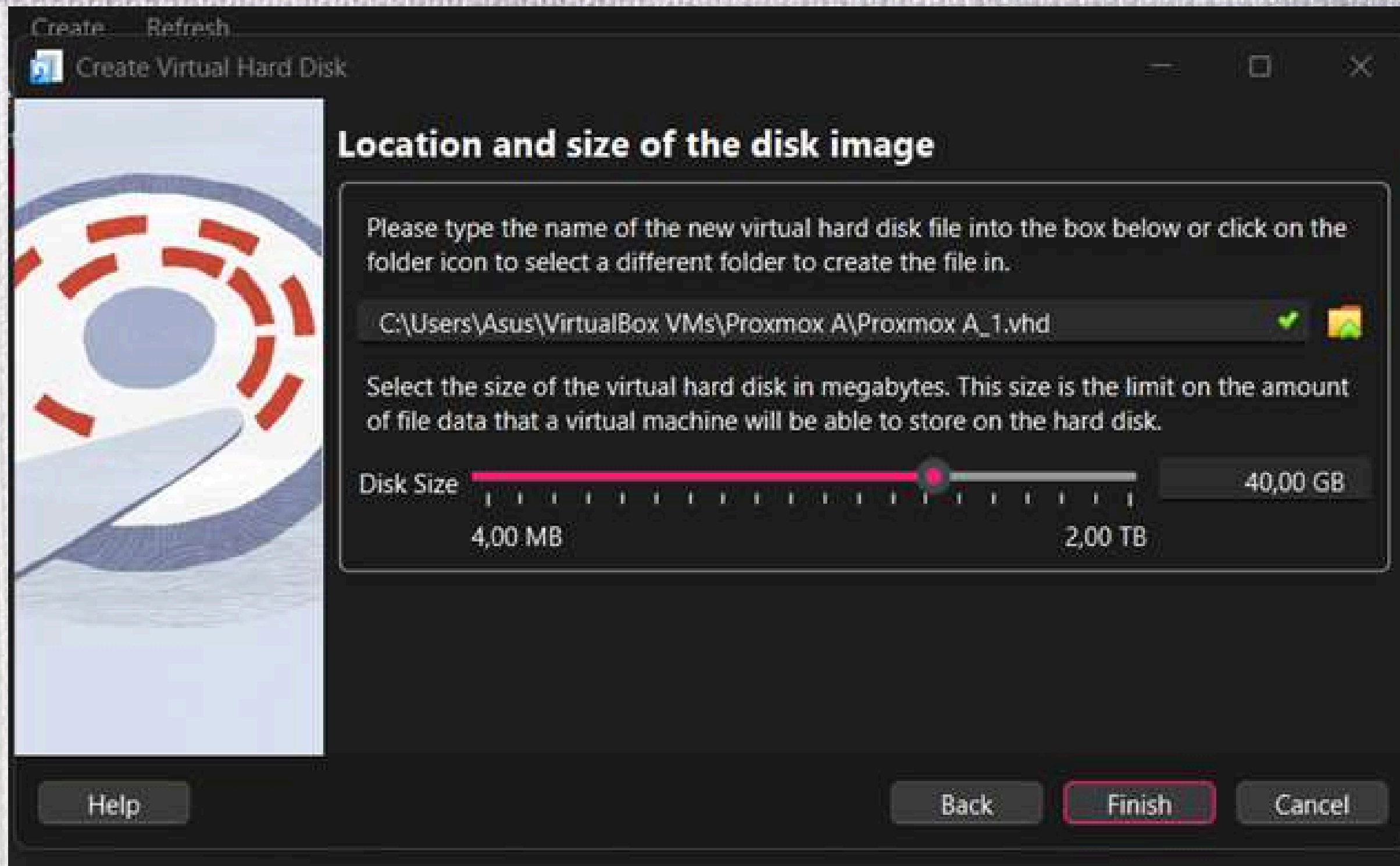
PENAMBAHAN MEDIA PENYIMPANAN VIRTUAL



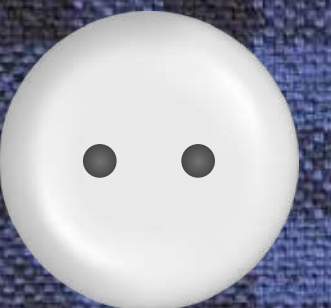
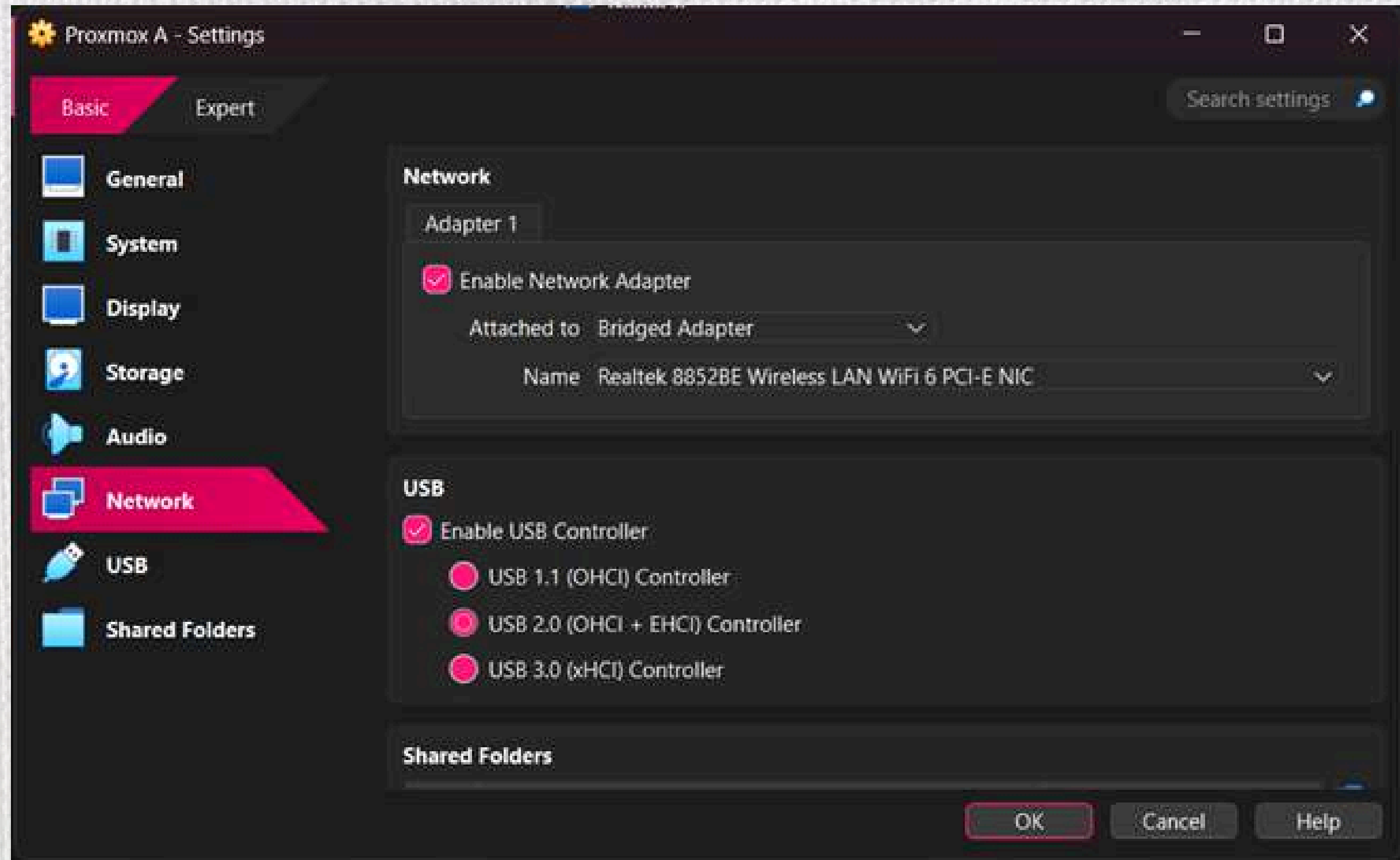
PEMILIHAN JENIS VIRTUAL HARD DISK SEBAGAI MEDIA MIGRASI



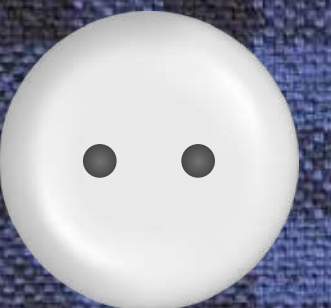
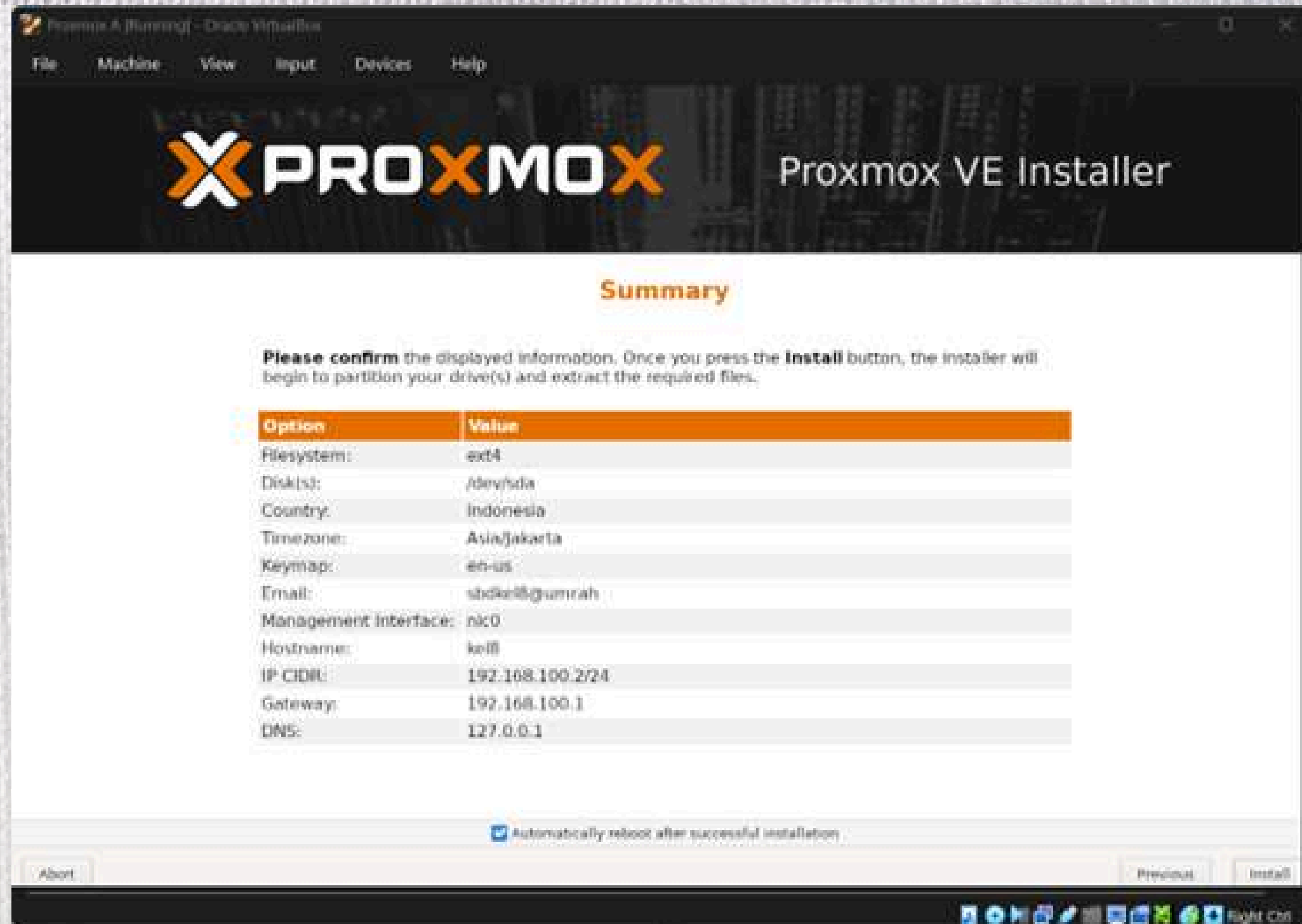
PENETAPAN KAPASITAS STORAGE



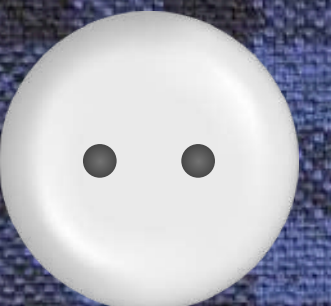
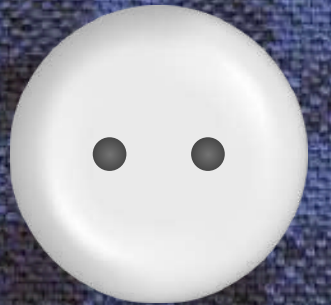
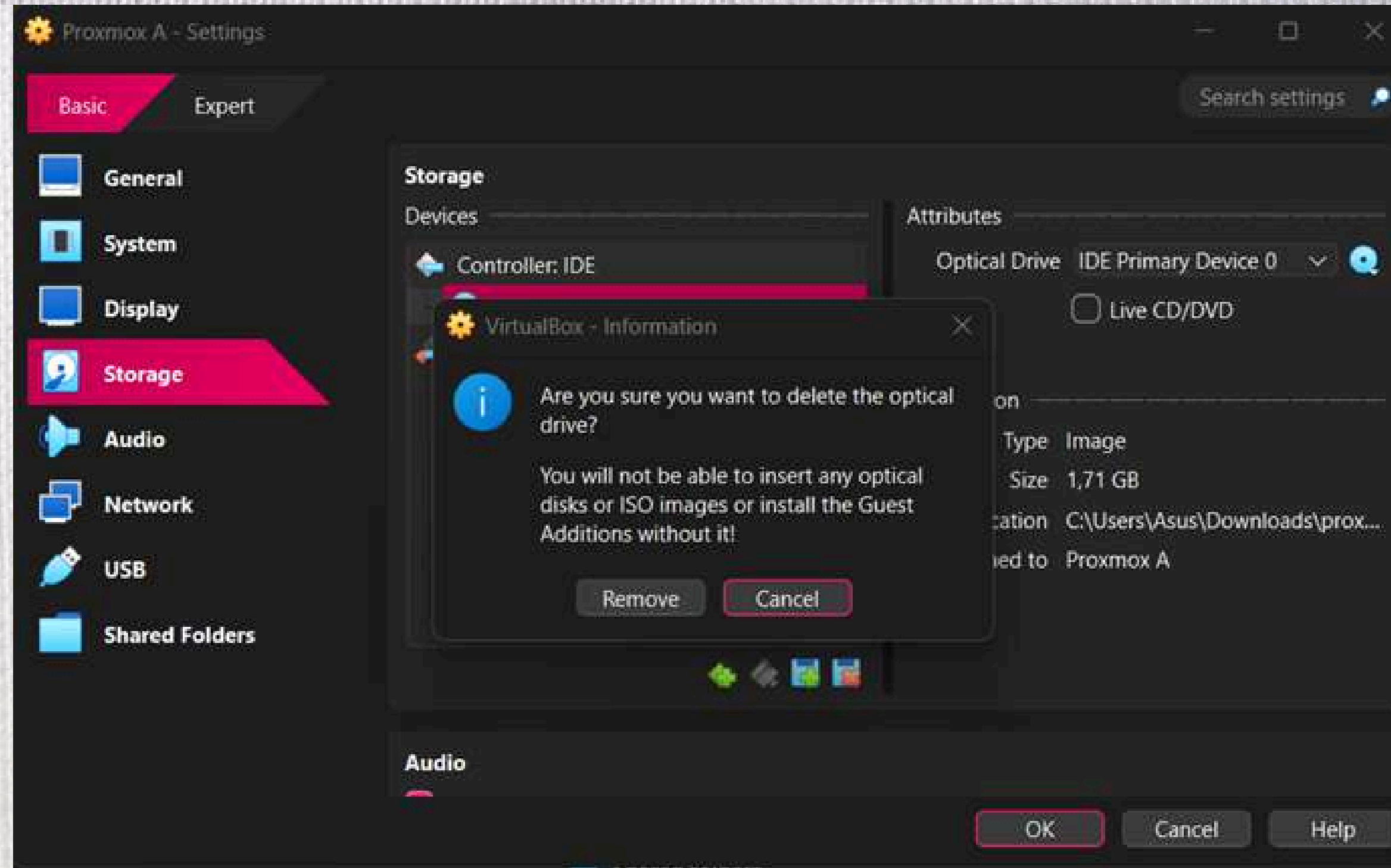
PENGATURAN BRIDGED ADAPTER PADA MESIN VIRTUAL



KONFIGURASI AWAL PROXMOX VE



PENGHAPUSAN FILE ISO INSTALASI



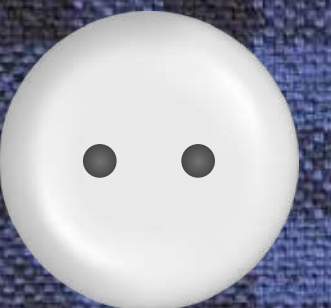
AKSES WEB INTERFACE PROXMOX VE

```
ProxmoxA [Running] - Oracle VirtualBox
File Machine View Input Devices Help
-----
Welcome to the Proxmox Virtual Environment. Please use your web browser to
configure this server - connect to:

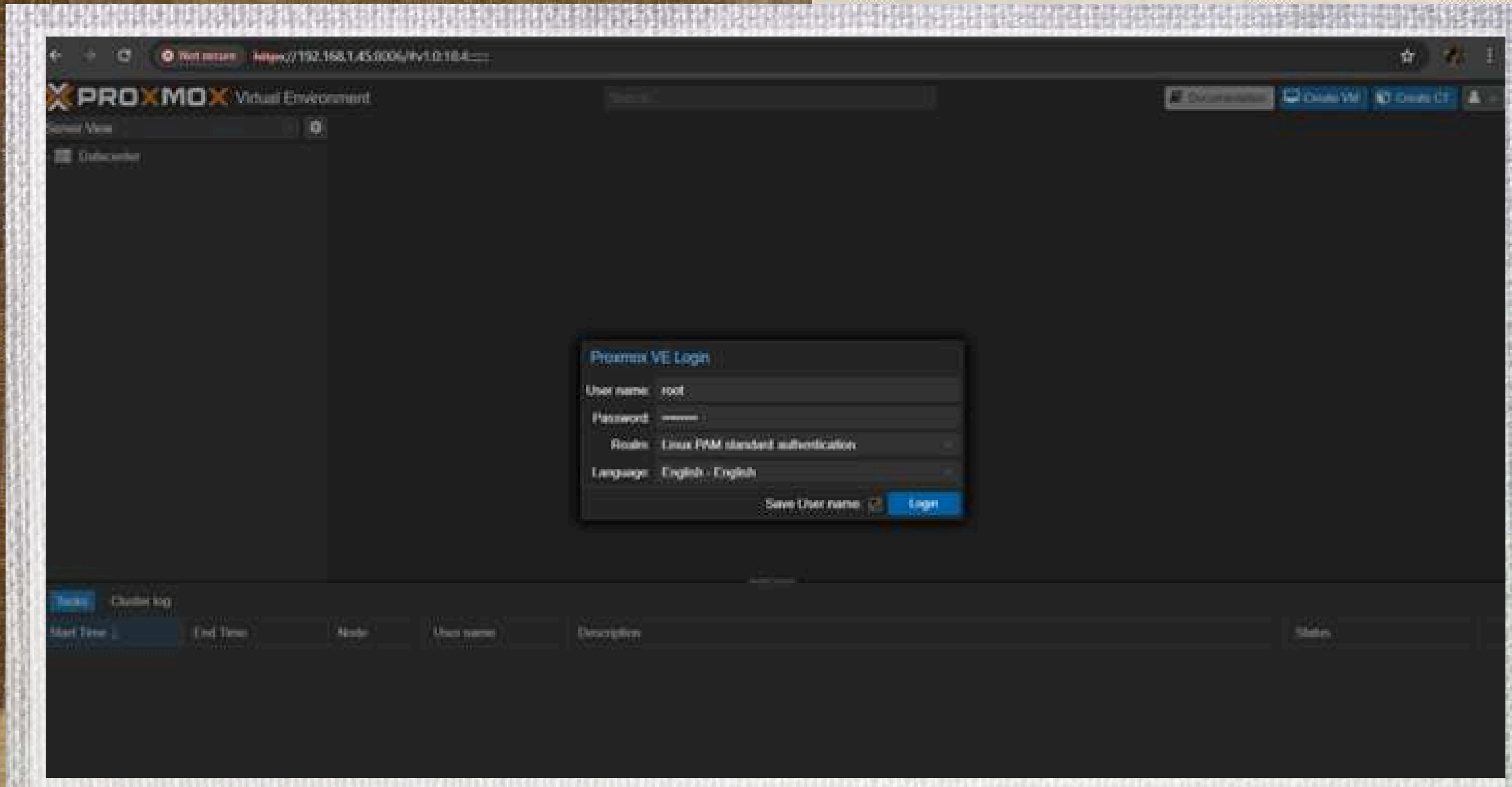
https://192.168.1.45:8006/
-----
miris login: ^
miris login:
miris login: root
Password:
Linux miris 6.17.2-1-pve #1 SMP PREEMPT_DYNAMIC PMX 6.17.2-1 (2025-10-21T11:55Z) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@miris:~# _
```



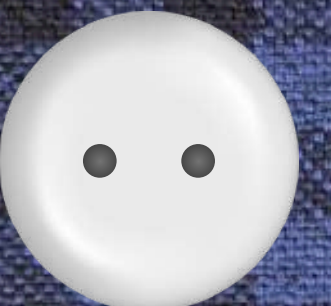
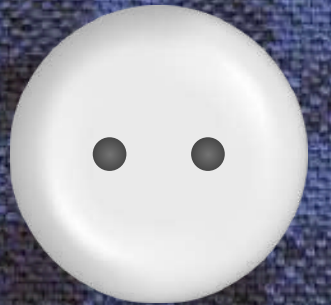
HALAMAN LOGIN ANTARMUKA WEB PROXMOX VE



The screenshot shows the Proxmox VE login interface. The browser address bar displays the URL `https://192.168.1.45:8006/pv1.0.18.4/`. The page title is "PROXMOX Virtual Environment". A central login form titled "Proxmox VE Login" contains the following fields:

- User name: `root`
- Password: `*****`
- Role: `Linux PAM standard authentication`
- Language: `English - English`

At the bottom of the form are two buttons: "Save User name" and "Login". Below the login form is a table with the following columns: "Start Time", "End Time", "Node", "User name", "Description", and "Status". The table is currently empty.



KONFIGURASI ZFS STORAGE PADA PROXMOX VE

PROXMOX Virtual Environment 9.1.1

Server View

Node 'mimi'

Time
System Log
Updates
Repositories
Firewall
Disks
LVM
LVM Thin
Directory
ZFS
Ceph
Replication
Task History
Subscription

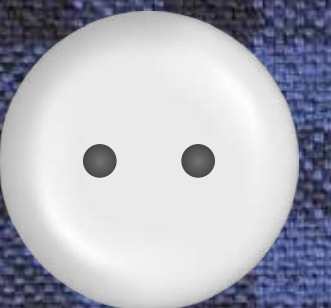
Refresh Create ZFS Cancel

Name	Size	Free	Allocated	Fragments	Health
------	------	------	-----------	-----------	--------

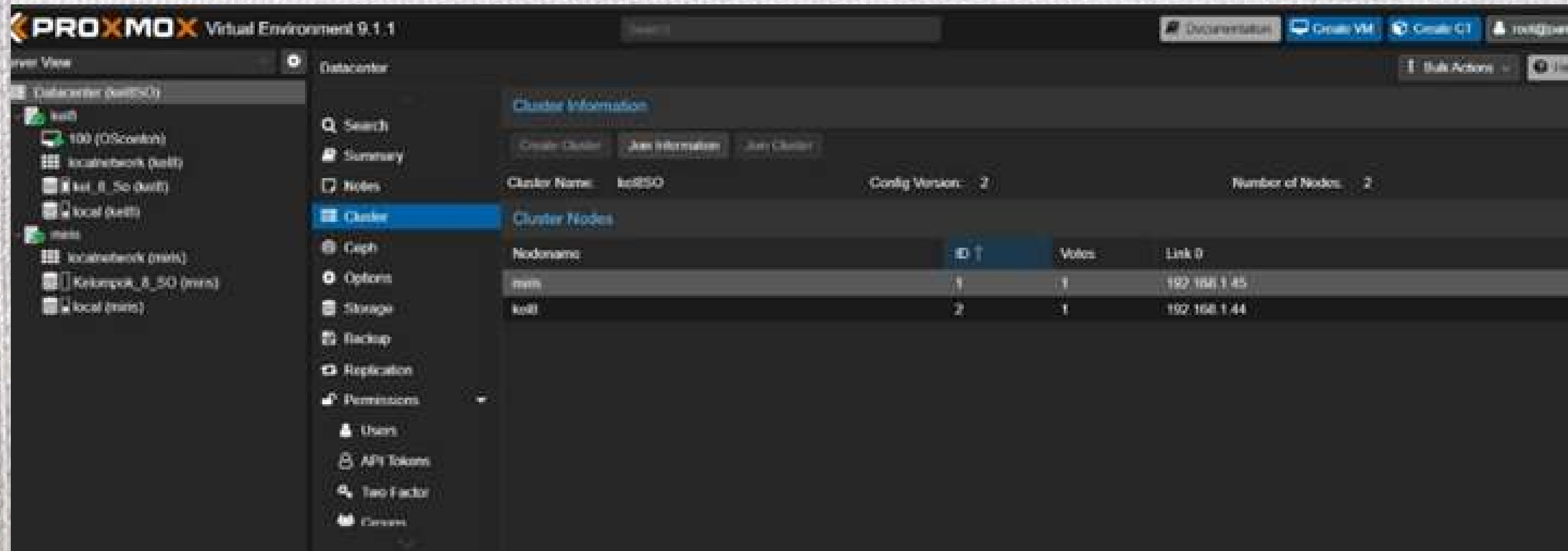
No pool selected

Tasks Cluster log

Start Time	End Time	Node	User name	Description	Status
Dec 07 17:30:41	Dec 07 17:30:41	mimi	root@pam	Bulk start VMs and Containers	OK
Dec 07 17:37:16	Dec 07 17:38:34	mimi	root@pam	Update package database	Error: command 'apt-get update' failed

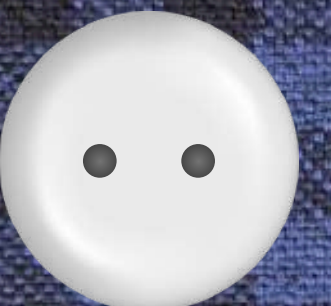
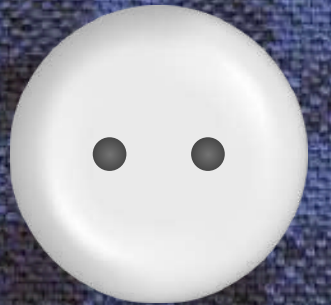


PROSES PEMBUATAN CLUSTER PADA NODE MIRIS

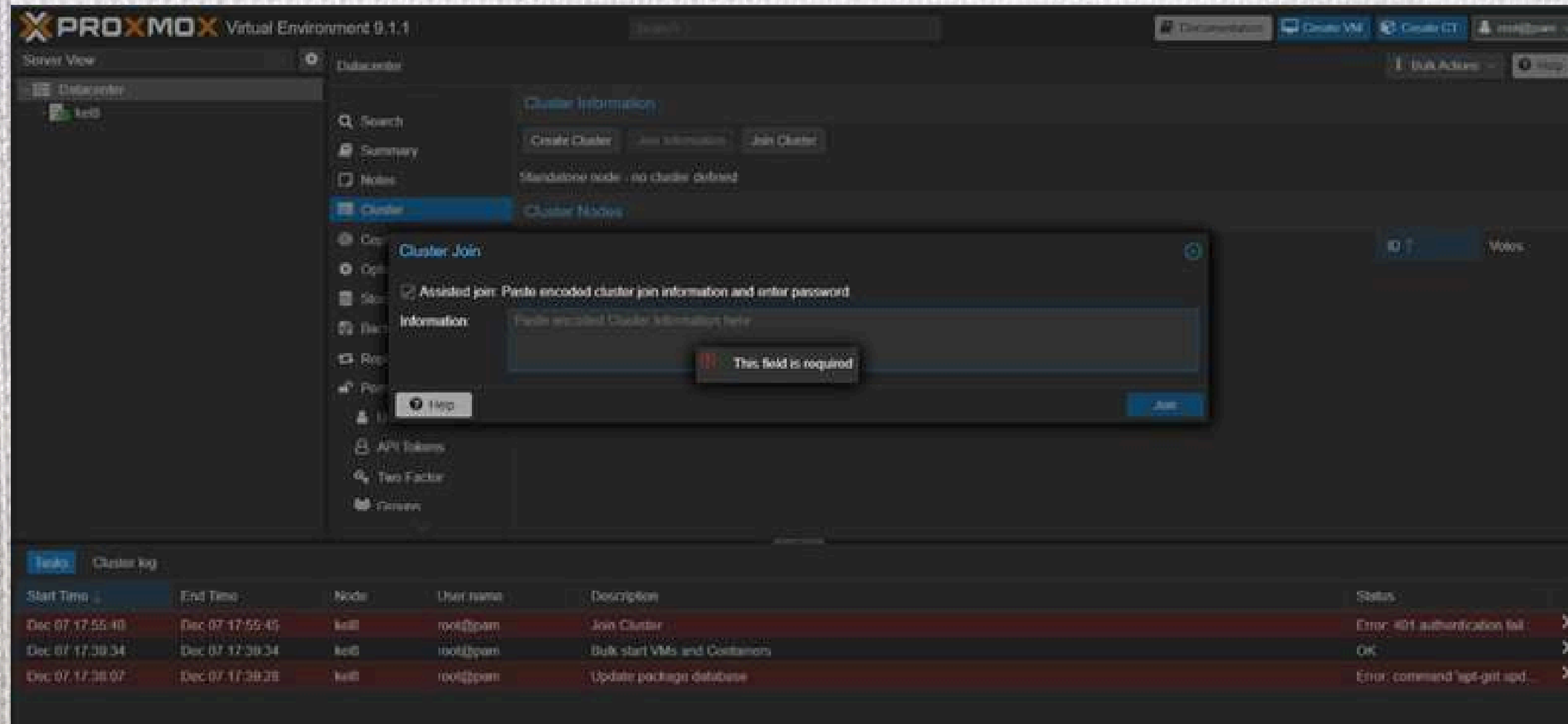


The screenshot displays the Proxmox Virtual Environment (VE) 9.1.1 web interface. The left sidebar shows the navigation menu with 'Cluster' selected. The main content area displays 'Cluster Information' for a cluster named 'test50'. Below this, the 'Cluster Nodes' table lists two nodes: 'miris' and 'test50'.

Node Name	ID	Voices	Link 0
miris	1	1	192.168.1.45
test50	2	1	192.168.1.44



PROSES JOIN NODE KEL8 KE CLUSTER MIRIS



PROXMOX Virtual Environment 9.1.1

Cluster Information

Create Cluster Join Information Join Cluster

Standalone node - no cluster defined

Cluster Nodes

Cluster Join

☒ Attended join: Paste encoded cluster join information and enter password

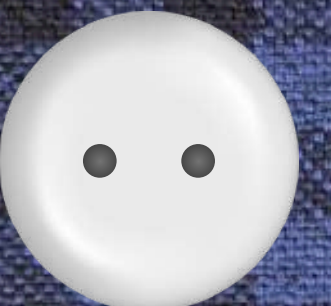
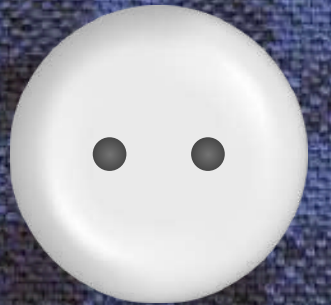
Information: Paste encoded Cluster Information here

This field is required

Join

Tasks Cluster log

Start Time	End Time	Node	User name	Description	Status
Dec 07 17:55:40	Dec 07 17:55:45	kel8	root@pam	Join Cluster	Error: 401 authentication fail
Dec 07 17:58:34	Dec 07 17:58:34	kel8	root@pam	Bulk start VMs and Containers	OK
Dec 07 17:58:07	Dec 07 17:58:28	kel8	root@pam	Update package database	Error: command 'apt-get update' failed



PEMBUATAN VIRTUAL MACHINE SEBAGAI MEDIA MIGRASI

Create: Virtual Machine

General

OS

System

Disks

CPU

Memory

Network

Confirm

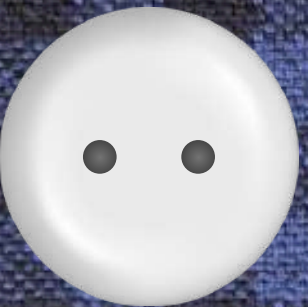
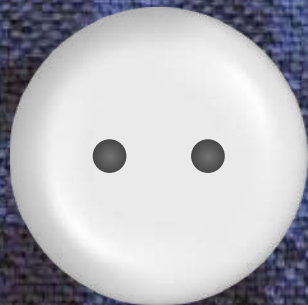
Key ↑	Value
bios	ovmf
cores	2
cpu	x86-64-v2-AES
efidisk0	Kelompok_8_SO:1,efitype=4m,pre-enrolled-keys=1
ide2	none,media=cdrom
memory	2048
net0	virtio,bridge=vmbr0,firewall=1
nodename	mins
numa	0
ostype	l26
scsi0	Kelompok_8_SO:32,iothread=on
scsihw	virtio-scsi-single
sockets	1
vmid	100

☐ Start after created

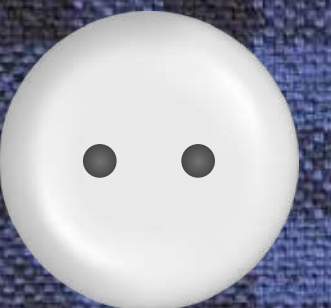
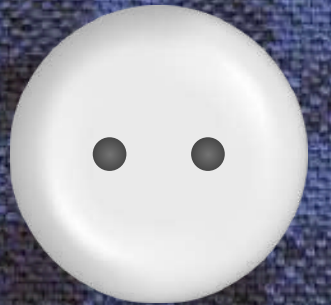
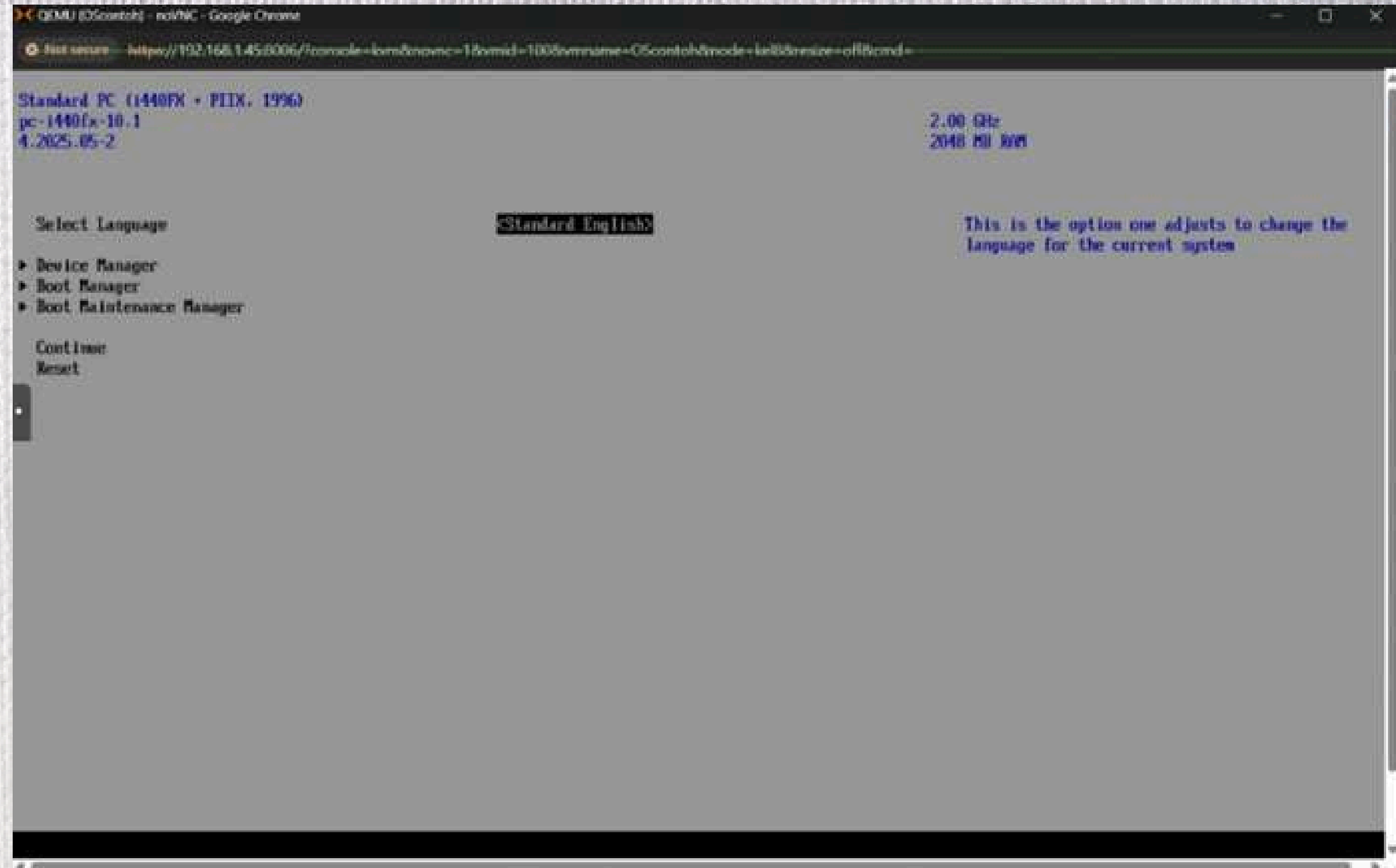
Advanced ☐

Back

Finish



MENJALANKAN VM SEBELUM PROSES MiGRASI



PROSES LIVE MiGRATION ANTAR-NODE

PROXMOX Virtual Environment 9.1.1

Server View

Datcenter (all nodes)

kol8

mir8

VM 100 (CFS control)

Local backup (mir8)

Kotempok_8_50 (mir8)

Local (mir8)

Virtual Machine 100 (CFS control) on node 'mir8' (prograte) No logs

Summary

Task viewer: VM 100 - Migrate (mir8 → kol8)

Output

Status

Stop

Download

2025-12-07 19:56:45 ssh tunnel ver 1

2025-12-07 19:56:45 starting storage migration

2025-12-07 19:56:45 start migration to /mnt/ssh-jumpbox-server/100_migrate/backup/backup-drive-ssd

drive mirror is starting for drive-ssd

mirror-ssd: transferred 69.0 MB of 32.0 GB (0.21%) in 3s

mirror-ssd: transferred 156.0 MB of 32.0 GB (0.48%) in 2s

mirror-ssd: transferred 207.0 MB of 32.0 GB (0.65%) in 3s

mirror-ssd: transferred 238.0 MB of 32.0 GB (0.74%) in 4s

mirror-ssd: transferred 349.0 MB of 32.0 GB (1.09%) in 5s

mirror-ssd: transferred 444.0 MB of 32.0 GB (1.39%) in 6s

mirror-ssd: transferred 548.0 MB of 32.0 GB (1.71%) in 7s

mirror-ssd: transferred 603.0 MB of 32.0 GB (1.88%) in 8s

mirror-ssd: transferred 1.0 GB of 32.0 GB (3.14%) in 10s

mirror-ssd: transferred 1.1 GB of 32.0 GB (3.44%) in 10s

mirror-ssd: transferred 1.4 GB of 32.0 GB (4.38%) in 11s

mirror-ssd: transferred 1.5 GB of 32.0 GB (4.69%) in 12s

mirror-ssd: transferred 1.7 GB of 32.0 GB (5.31%) in 12s

mirror-ssd: transferred 1.9 GB of 32.0 GB (5.94%) in 14s

mirror-ssd: transferred 2.0 GB of 32.0 GB (6.27%) in 15s

mirror-ssd: transferred 2.1 GB of 32.0 GB (6.60%) in 16s

mirror-ssd: transferred 2.2 GB of 32.0 GB (7.01%) in 17s

mirror-ssd: transferred 2.5 GB of 32.0 GB (7.79%) in 18s

mirror-ssd: transferred 2.7 GB of 32.0 GB (8.39%) in 19s

mirror-ssd: transferred 2.8 GB of 32.0 GB (8.77%) in 20s

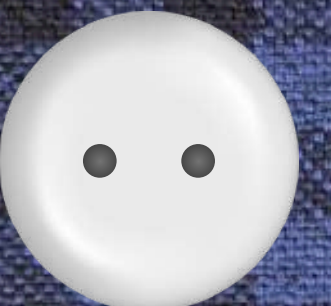
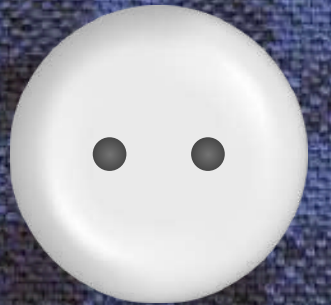
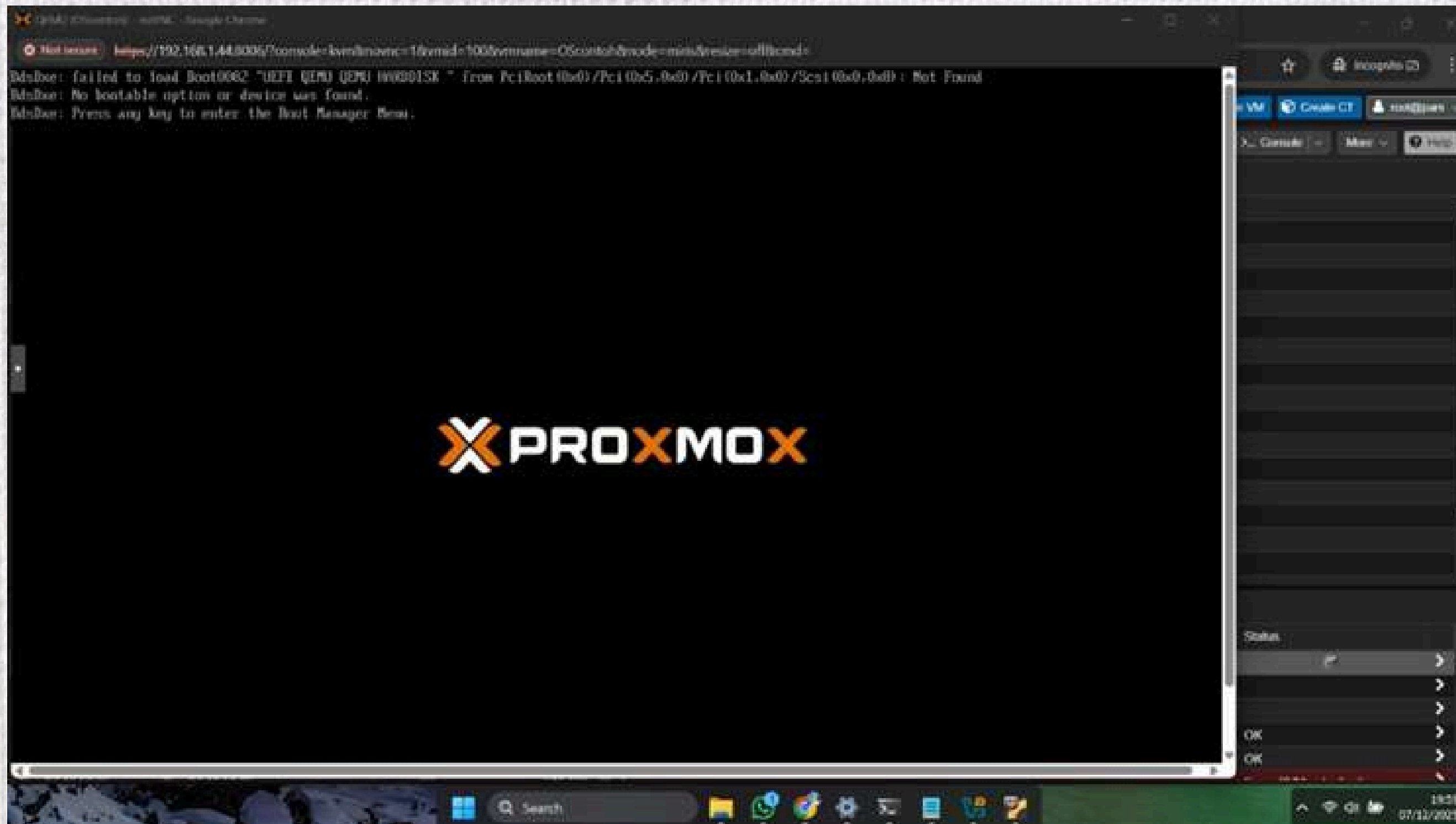
Tasks

Cluster log

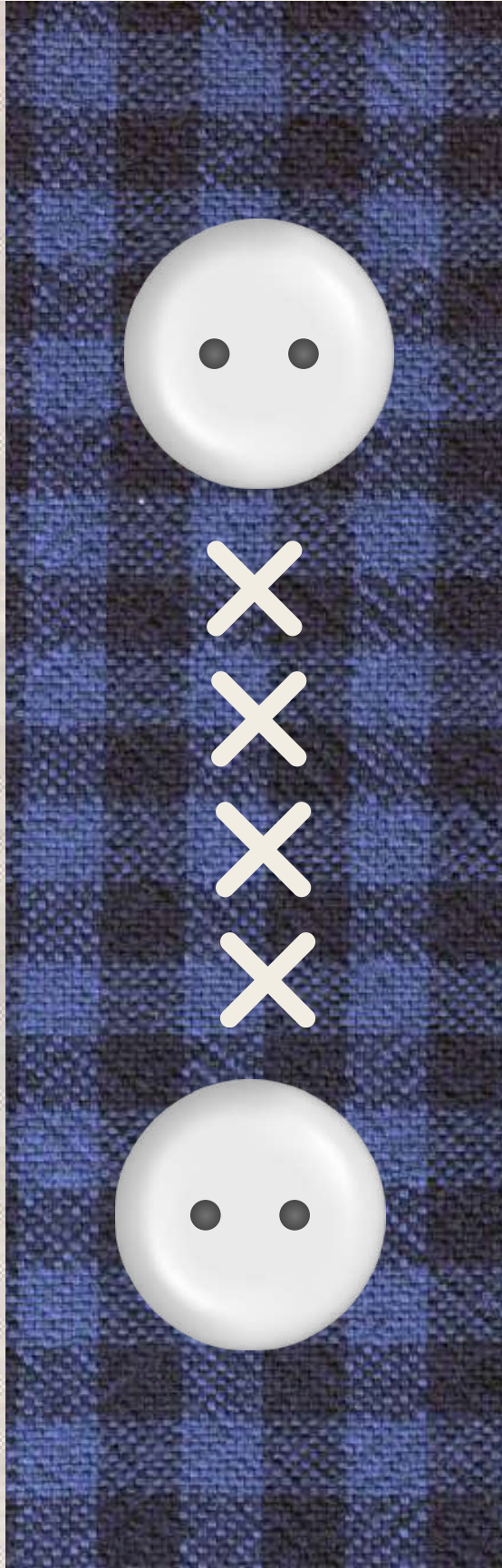
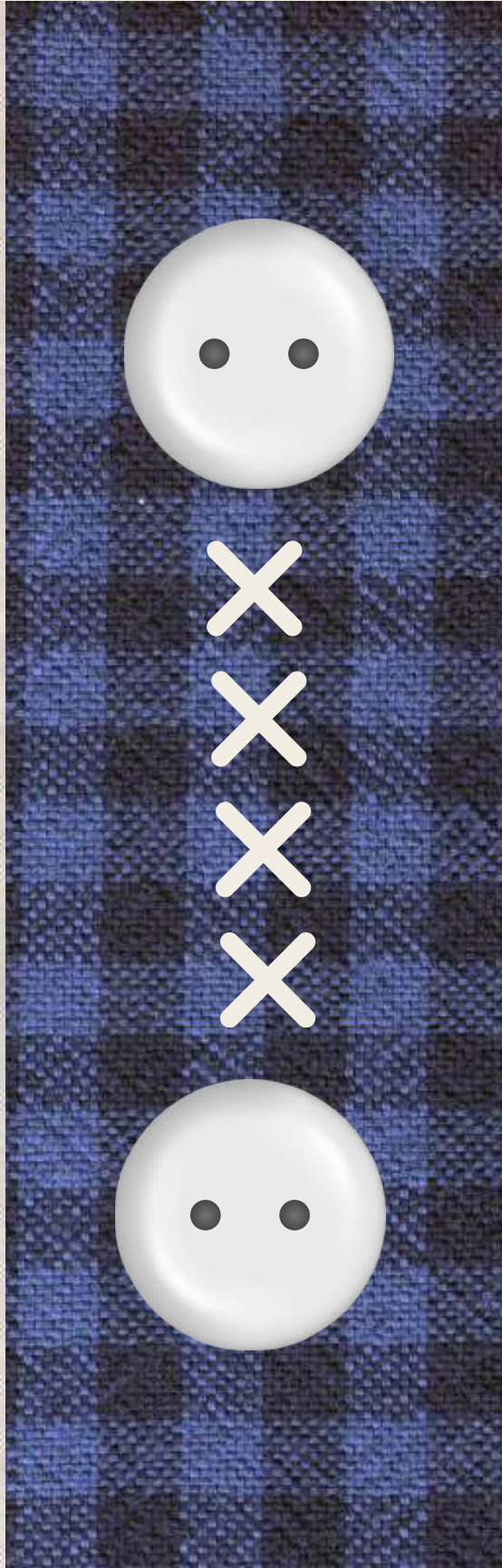
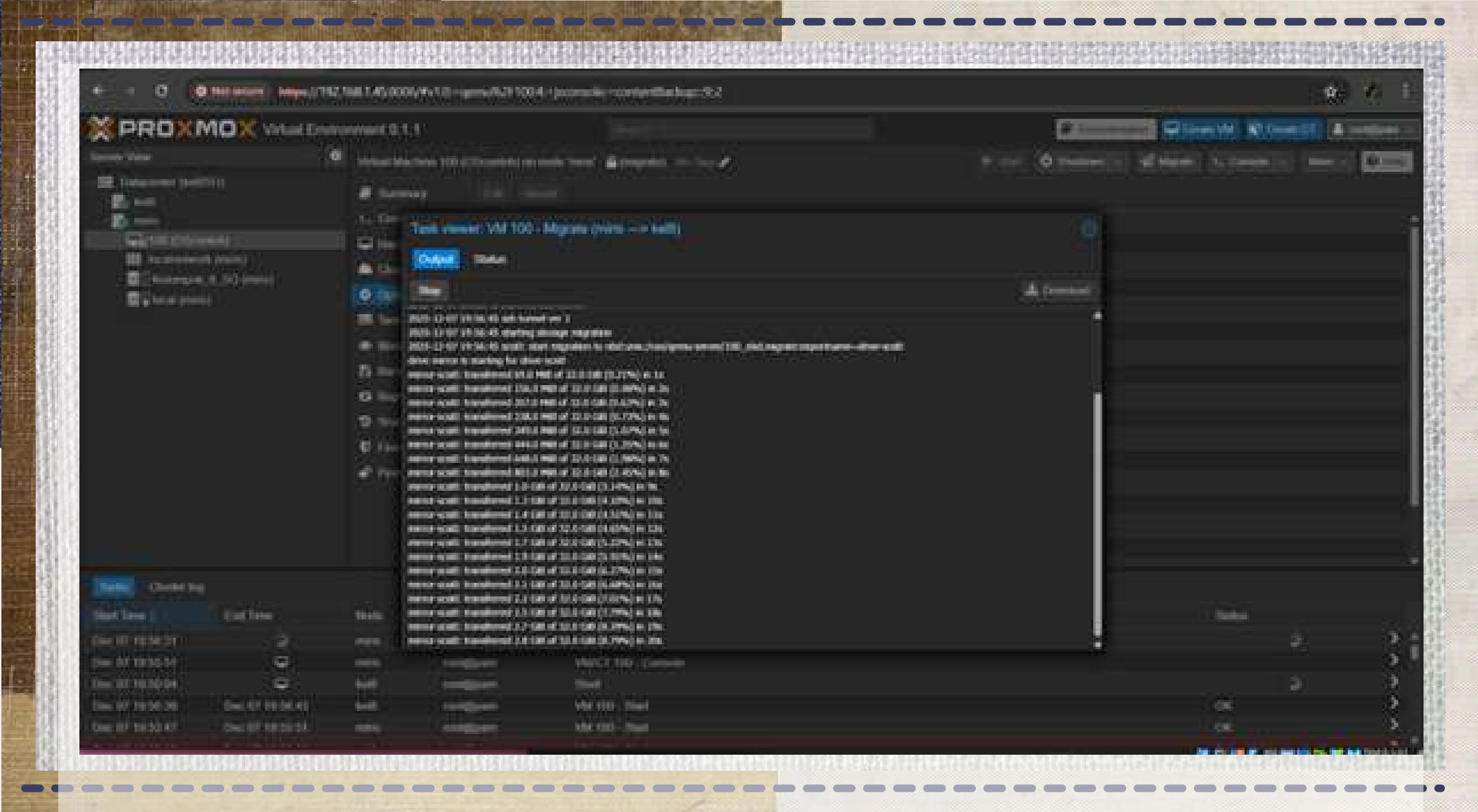
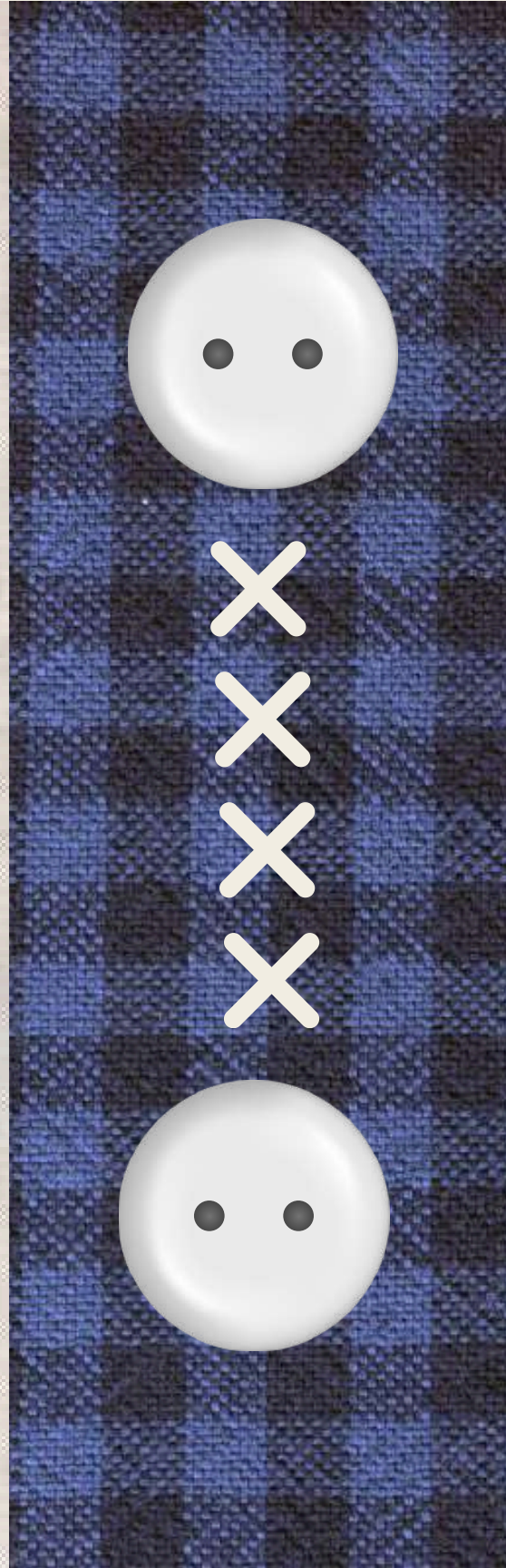
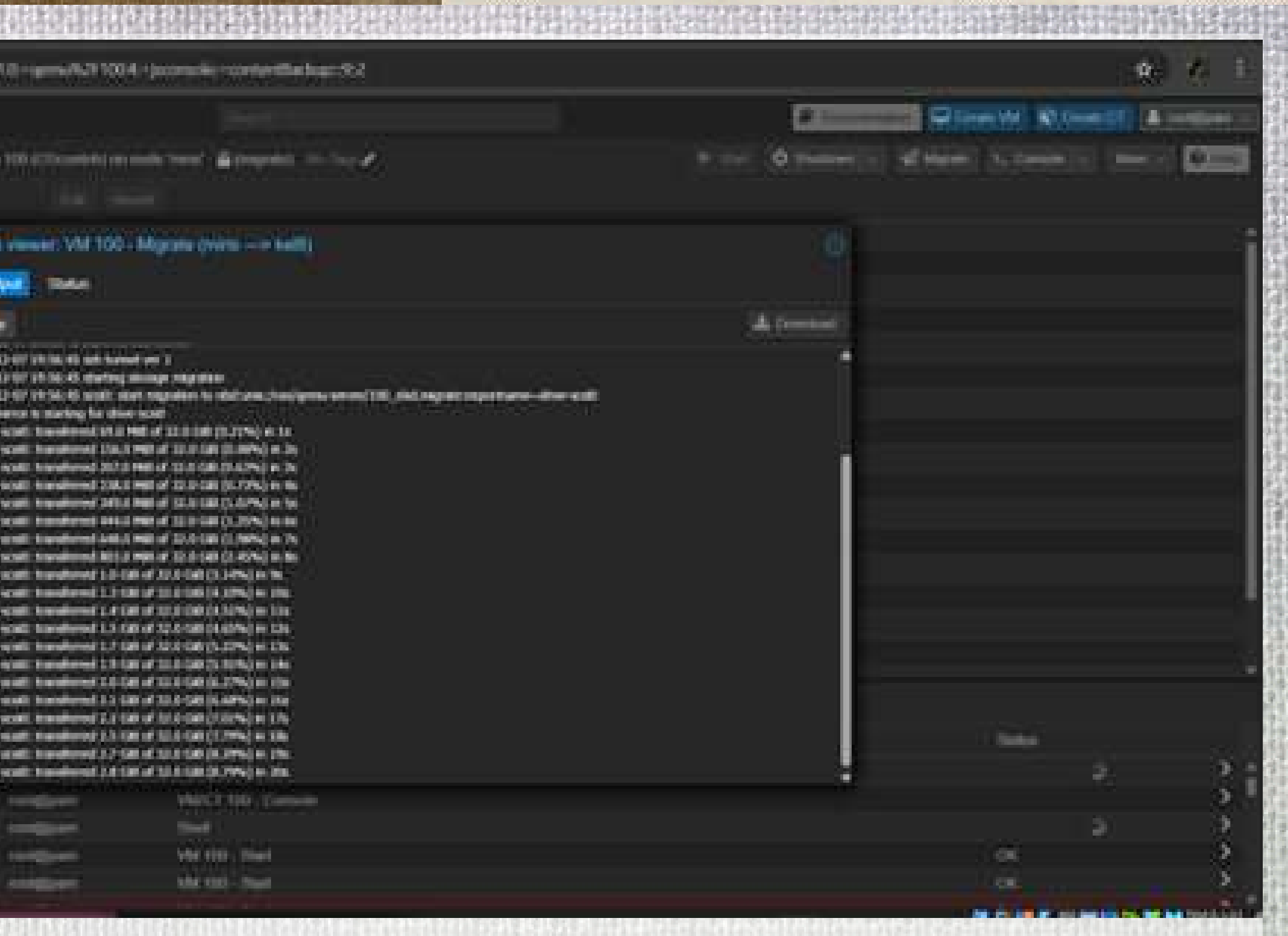
Start Time	End Time	Node
Dec 07 19:56:31		mir8
Dec 07 19:56:51		mir8
Dec 07 19:56:04		kol8
Dec 07 19:56:38	Dec 07 19:56:43	kol8
Dec 07 19:56:47	Dec 07 19:56:51	mir8



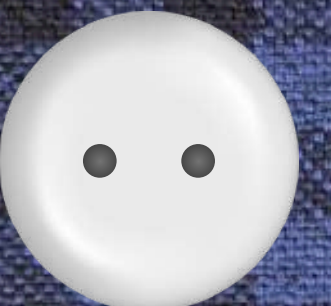
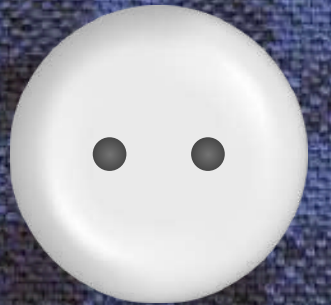
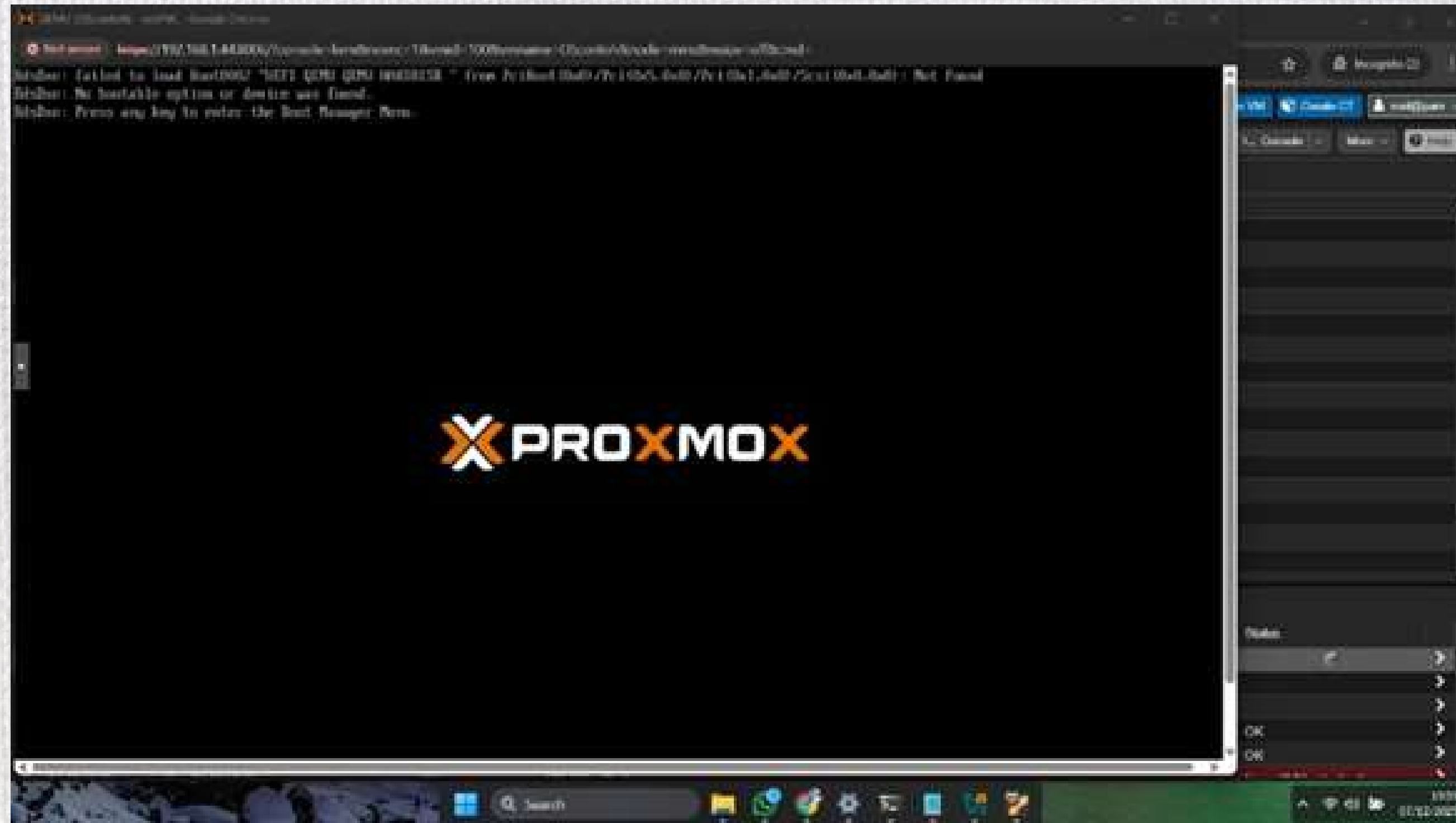
PROSES LIVE MIGRATION VM ANTAR-NODE PADA CLUSTER PROXMOX VE



PROSES MIGRATION

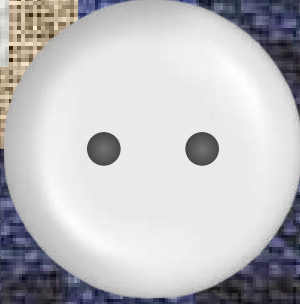


HASIL MiGRATION





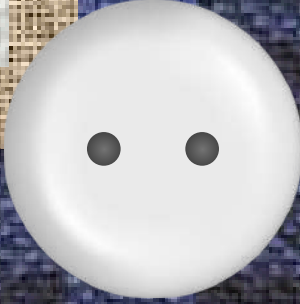
ANALISIS HASIL

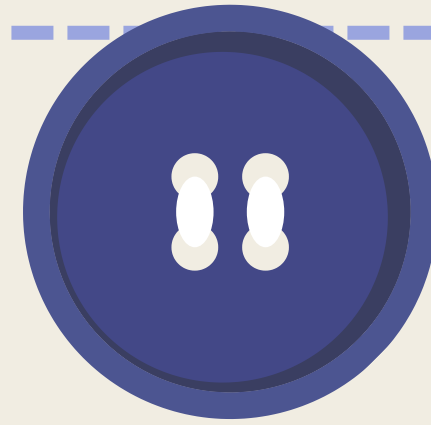
1. Live migration berjalan sukses
 2. WiFi menyebabkan migrasi sedikit lebih lambat
 3. Kendala storage dan KVM virtualization berhasil diatasi
 4. Sistem tetap stabil setelah perbaikan konfigurasi
- 



KESIMPULAN

Proyek implementasi cluster Proxmox VE berhasil dilakukan melalui tahapan instalasi node, konfigurasi jaringan, pembuatan cluster, serta pengujian fitur live migration. Hasil pengujian menunjukkan bahwa virtual machine dapat berpindah antar-node tanpa menghentikan layanan, meskipun menggunakan jaringan WiFi yang menyebabkan waktu migrasi sedikit lebih lama dibandingkan jaringan LAN. Secara keseluruhan, sistem cluster berjalan stabil dan mampu memberikan gambaran nyata mengenai penerapan shared storage, live migration, dan high availability pada Proxmox VE, sehingga tujuan proyek dapat tercapai dengan baik.





**TERIMA
KASIH**

