



LAB 3

Resource Virtualization Using Proxmox

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- Note: screenshots need to be clear and good-looking; submissions must be in PDF format.




[Proxmox Virtual Environment](#) is a powerful open-source server virtualization platform to manage two virtualization technologies - KVM (Kernel-based Virtual Machine) for virtual machines and LXC for containers - with a single web-based interface. It also integrates out-of-the-box tools for configuring high availability between servers, software-defined storage, networking, and disaster recovery.

1. Proxmox VE Installation

- Create a virtual machine (acts as a physical server in real life) using VirtualBox (or VMWare).
 - Name: PM01; Type: Linux; Version: Debian 11 (64bit)
 - Memory: 2G; Processors: 2 CPUs (add more if possible)
 - Hard disk: 50G

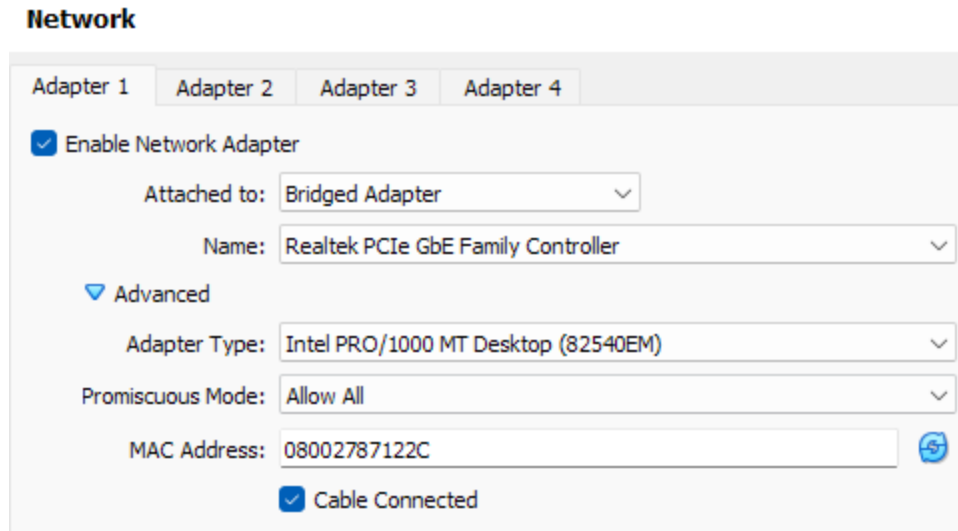
Summary

The following table summarizes the configuration you have chosen for the new virtual machine. When you are happy with the configuration press Finish to create the virtual machine. Alternatively you can go back and modify the configuration.

 Machine Name and OS Type	
Machine Name	PM01
Machine Folder	F:/Máy Ảo/VirtualBox/Proxmox VE/PM01
ISO Image	
Guest OS Type	Debian 11 Bullseye (64-bit)
 Hardware	
Base Memory	3072
Processor(s)	3
EFI Enable	false
 Disk	
Disk Size	60.00 GB
Pre-allocate Full Size	false

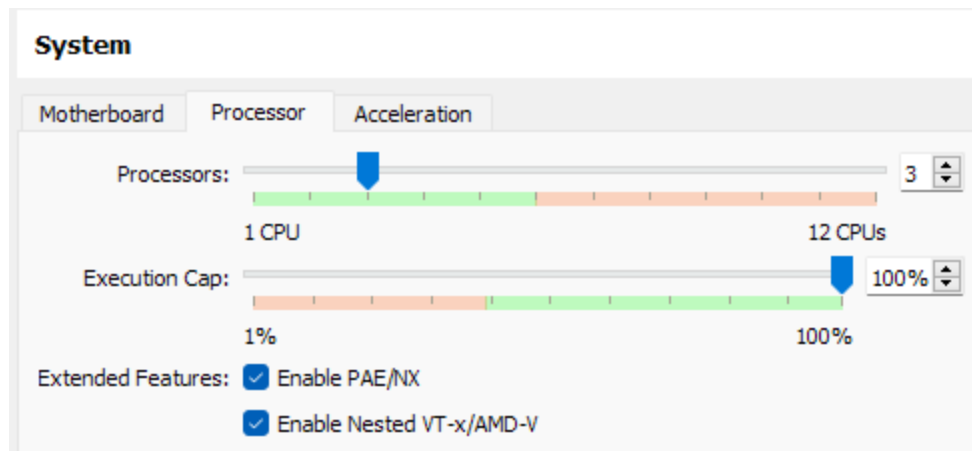
Summary of the configuration

- The network setting of the VM is bridged mode; **Advanced** → **Promiscuous mod: Allow All**



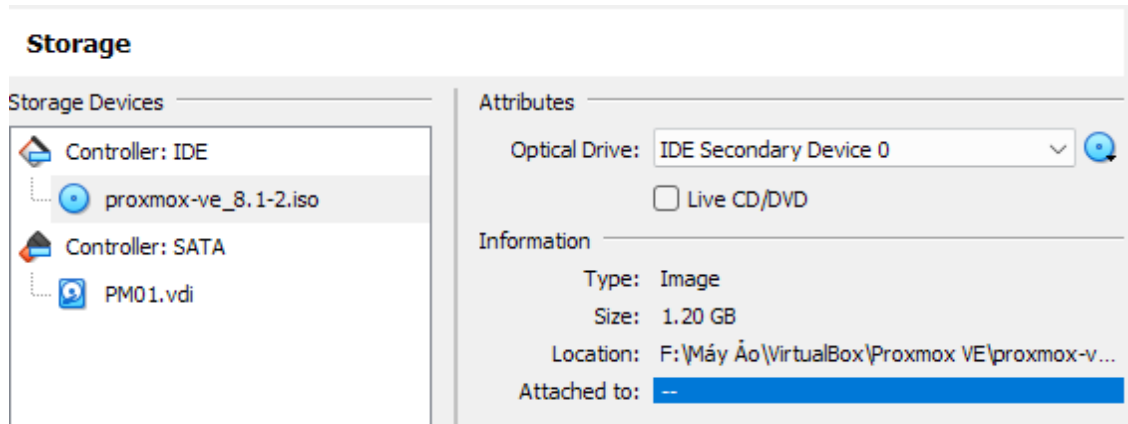
Network setting

- Enable PAE/NX and Enable Nested VT-x/AMD-v (Setting/System/Processor). If the option is grey out, enter the following command
\$ VBoxManage modifyvm "vm name" --nested-hw-virt on



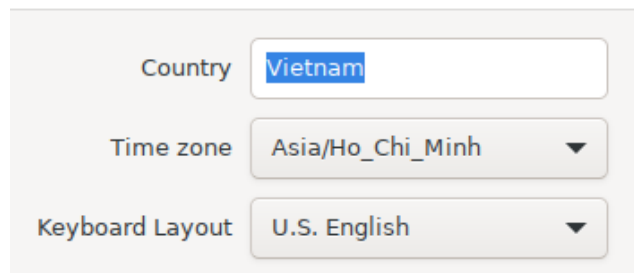
Enable PAE/NX and Enable Nested VT-x/AMD-v

- [Download](#) and attach the file Proxmox VE 8.1 ISO Installer to the Optical drive of the VM.

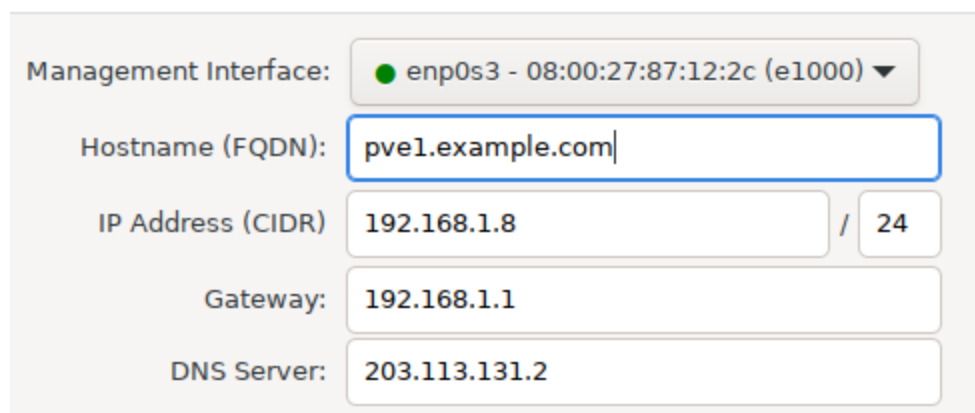


Attach the file Proxmox VE 8.1 ISO Installer

- Start the VM then follow the Promox VE installation procedure.
 - Country: Vietnam



- Hostname (FQDN): pve1.example.com



- Keep other settings as default
- Uncheck "Automatically reboot after successful installation "

Summary

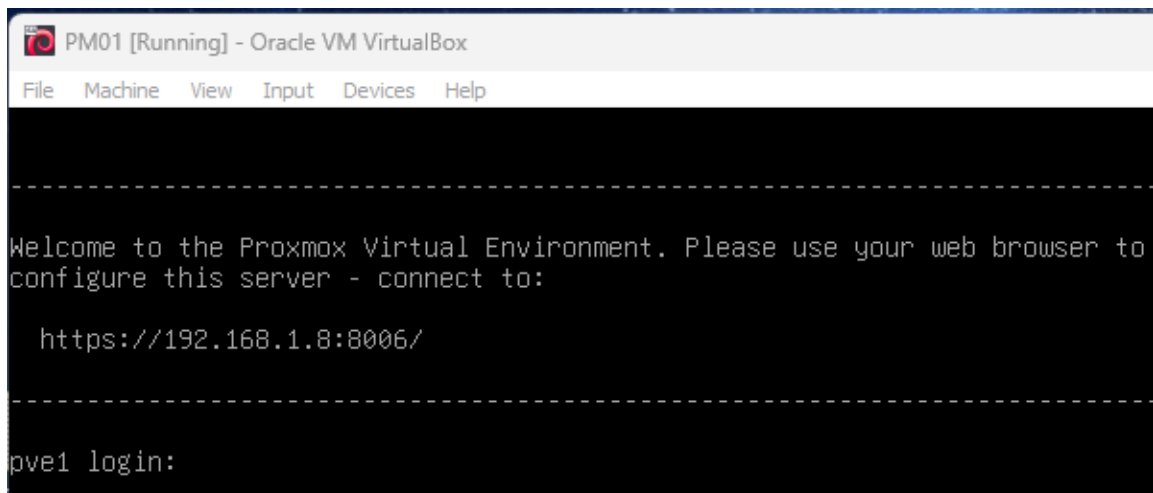
Please confirm the displayed information. Once you press the **Install** button, the installer will begin to partition your drive(s) and extract the required files.

Option	Value
Filesystem:	ext4
Disk(s):	/dev/sda
Country:	Vietnam
Timezone:	Asia/Ho_Chi_Minh
Keymap:	en-us
Email:	lamb2111933@student.ctu.edu.vn
Management Interface:	enp0s3
Hostname:	pve1
IP CIDR:	192.168.1.8/24
Gateway:	192.168.1.1
DNS:	203.113.131.2

☐ Automatically reboot after successful installation

Installation

- After finishing the installation procedure, remove Proxmox ISO file from VM storage. Reboot the VM, then access Proxmox VE Web-GUI at <https://<IP of PM01>:8006>, login to Promox VE using the `root` account.



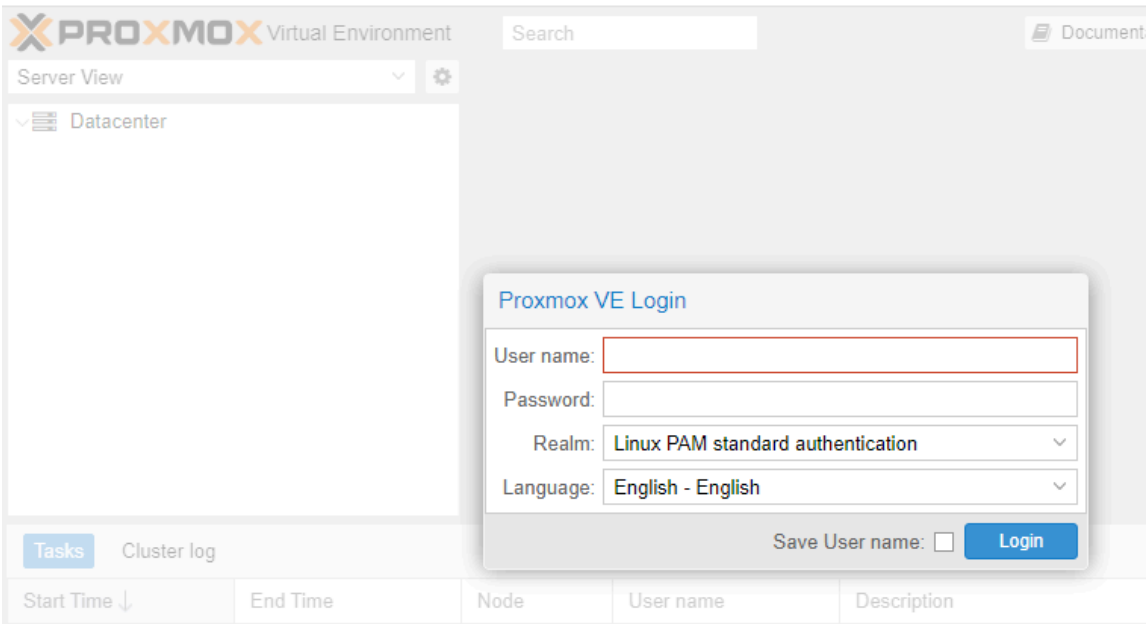
```
PM01 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

-----
Welcome to the Proxmox Virtual Environment. Please use your web browser to
configure this server - connect to:

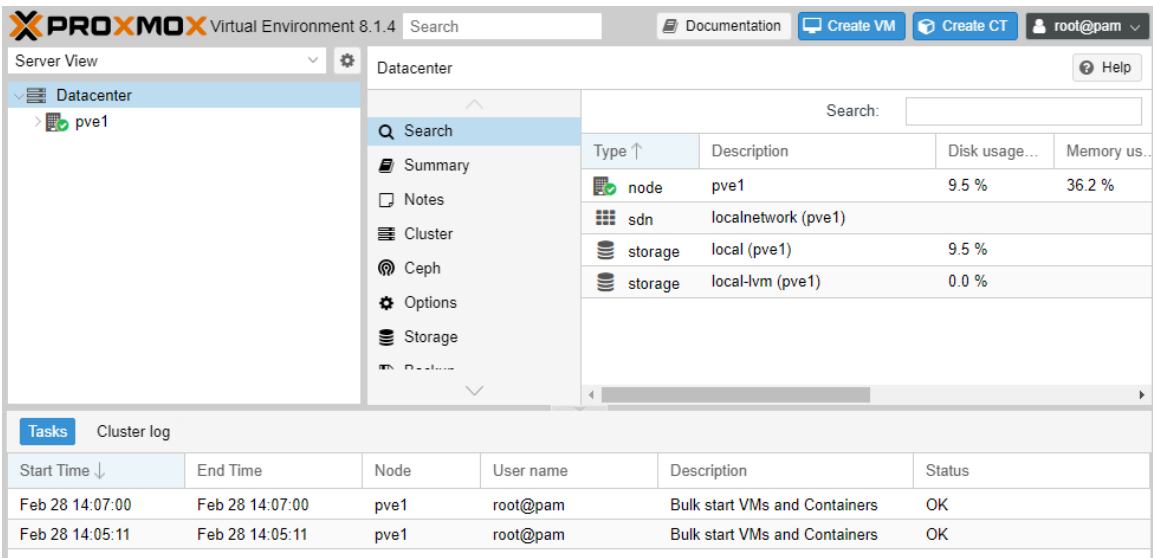
https://192.168.1.8:8006/

-----
pve1 login:
```

Reboot the VM



Login



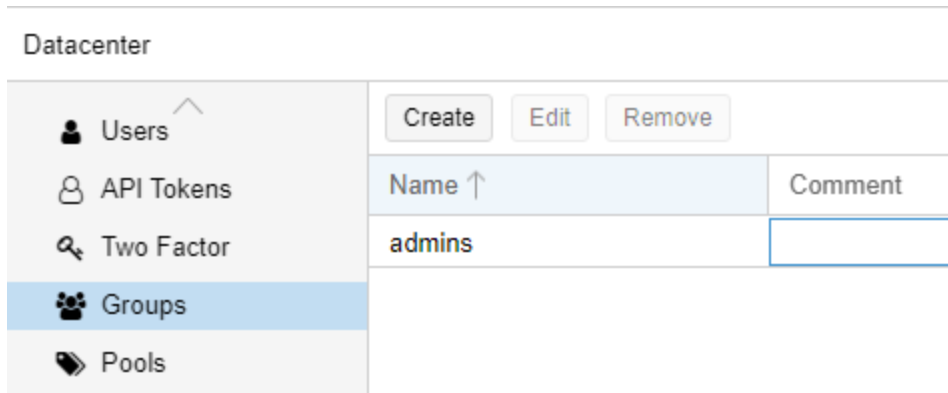
The login page

(Take a screenshot of the login page)

2. User management

It is possible that an administrator would want to create a group of users with full administrator rights (without using the `root` account).

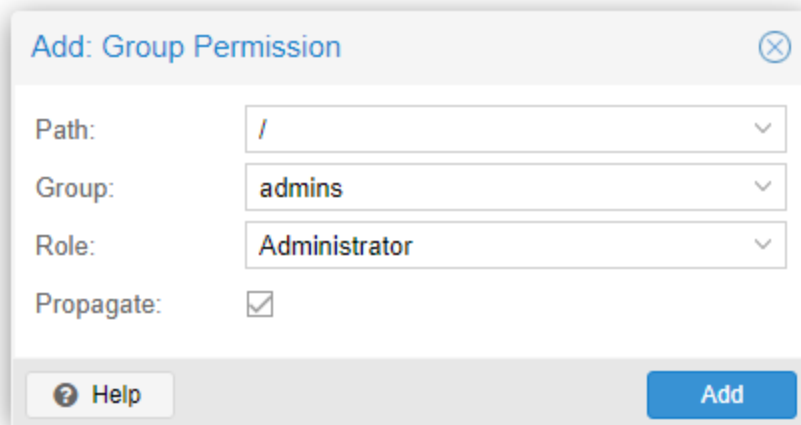
- Create the *admins* group (Datacenter → Groups → Create)



The screenshot shows the 'Datacenter' management interface. On the left is a sidebar with icons and labels for 'Users', 'API Tokens', 'Two Factor', 'Groups' (which is highlighted in blue), and 'Pools'. To the right of the sidebar, there are three buttons: 'Create', 'Edit', and 'Remove'. Below these buttons is a table with two columns: 'Name' (with an upward arrow icon) and 'Comment'. The table contains one entry with the name 'admins' and an empty comment field.

Create the *admins* group

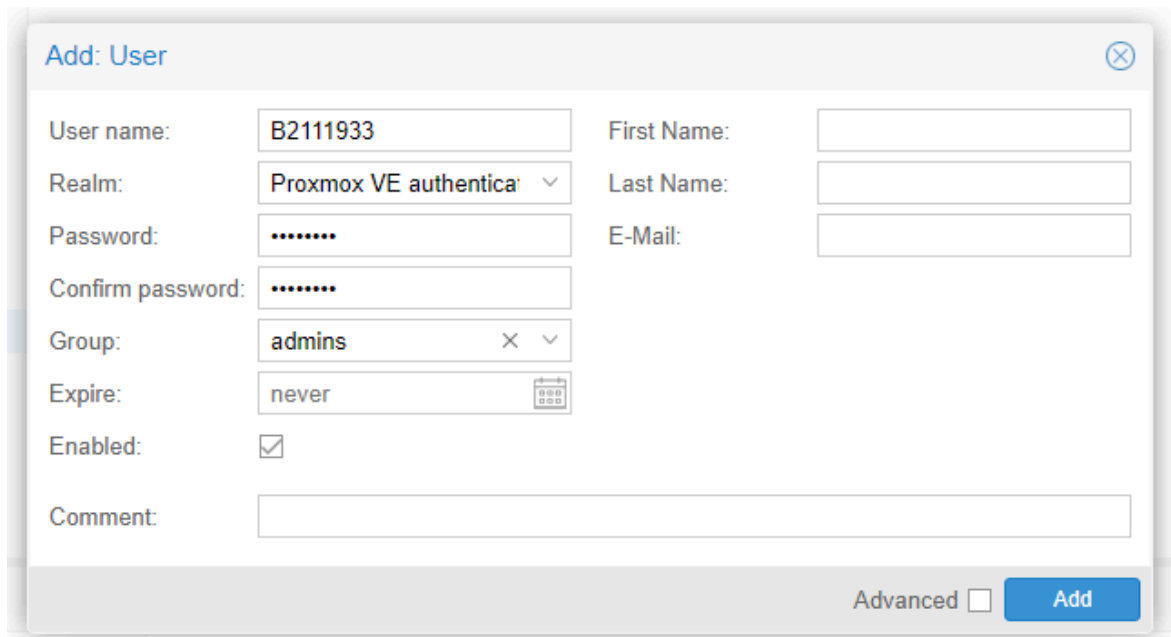
- Assign the role *Administrator* to the group *admins* (Datacenter → permissions → Add → Group Permission)
 - Path: /
 - Group: admins
 - Role: Administrator



The screenshot shows a dialog box titled 'Add: Group Permission'. It contains three dropdown menus: 'Path' with the value '/', 'Group' with the value 'admins', and 'Role' with the value 'Administrator'. There is a 'Propagate' checkbox which is checked. At the bottom left is a 'Help' button with a question mark icon, and at the bottom right is a blue 'Add' button.

Assign the role *Administrator* to the group *admins*

- Create the user <Your student ID> (Users → Add)
 - User name: <Your student ID>
 - Realm: Proxmox VE Authentication server
 - Password: <Your password>
 - Group: admins



Add: User

User name: B2111933 First Name:

Realm: Proxmox VE authentication Last Name:

Password: E-Mail:

Confirm password:

Group: admins X

Expire: never

Enabled: ☒

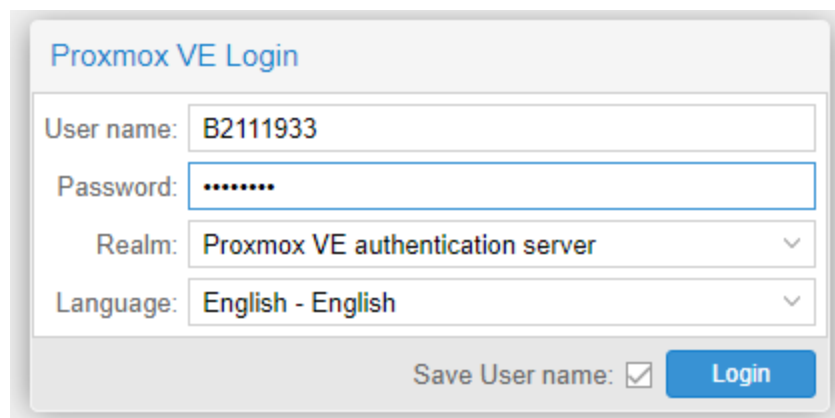
Comment:

Advanced ☐ **Add**

Create the user B2111933

(take a screenshot)

- Log out root user, then login again to Proxmox VE using the user <Your student ID>
 - Realm: Proxmox VE Authentication server



Proxmox VE Login

User name: B2111933

Password:

Realm: Proxmox VE authentication server

Language: English - English

Save User name: ☒ **Login**

Login to B211933



The result

(take a screenshot)

3. Creating a container

- Download the Ubuntu 22.04 standard container template (local (pve1) → CT Template → Templates)

lxc	devuan-4.0-standard	4.0	Devuan 4.0 (standard)
lxc	ubuntu-22.04-standard	22.04-1	Ubuntu 22.04 Jammy (standard)
lxc	ubuntu-20.04-standard	20.04-1	Ubuntu Focal (standard)

Task viewer: File ubuntu/22.04/standard_22.04-1_amd64.tar.zst - Download

Output

Status

Stop

Download

downloading http://download.proxmox.com/images/system/ubuntu-22.04-standard_22.04-1_amd64.tar.zst to /var/lib/vz/template/cache/ubuntu-22.04-standard_22.04-1_amd64.tar.zst
--2024-02-28 14:26:22-- http://download.proxmox.com/images/system/ubuntu-22.04-standard_22.04-1_amd64.tar.zst
Resolving download.proxmox.com (download.proxmox.com)... 51.79.228.122, 2402:1f00:8001:f7a::65
Connecting to download.proxmox.com (download.proxmox.com)[51.79.228.122]:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 129824858 (124M) [application/octet-stream]
Saving to: '/var/lib/vz/template/cache/ubuntu-22.04-standard_22.04-1_amd64.tar.zst.tmp_dwnl.3511'
0K 25% 8.26M 11s
32768K 51% 7.36M 8s
65536K 77% 2.84M 6s
98304K 100% 2.98M=29s
2024-02-28 14:26:54 (4.29 MB/s) - '/var/lib/vz/template/cache/ubuntu-22.04-standard_22.04-1_amd64.tar.zst.tmp_dwnl.3511' saved [129824858/129824858]
calculating checksum...OK, checksum verified
download of 'http://download.proxmox.com/images/system/ubuntu-22.04-standard_22.04-1_amd64.tar.zst' to '/var/lib/vz/template/cache/ubuntu-22.04-standard_22.04-1_amd64.tar.zst' completed
TASK OK

Download the following container template

- After finishing the template downloading, create a LXC Container with the following information:
 - Hostname: lamp
 - Password: <Your password>
 - Template: Ubuntu 22.04
 - Disk size: 8G
 - Network, IPv4: DHCP; (Static if there are no DHCPs server in your network)
 - Keep other settings as default

Create: LXC Container

General
Template
Disks
CPU
Memory
Network
DNS
Confirm

Key ↑	Value
cores	1
features	nesting=1
hostname	lamp
memory	512
net0	name=eth0,bridge=vbr0,firewall=1,ip=dhcp
nodename	pve1
ostemplate	local:vztmpl/ubuntu-22.04-standard_22.04-1_amd64.tar.zst
pool	
rootfs	local-lvm:8
ssh-public-keys	
swap	512
unprivileged	1
vmid	100

☐ Start after created

Advanced ☐
Back
Finish

Create a LXC Container

- Start the container, then login to the container console using the user/password
root/<Your password>

Container 100 (lamp) on node 'pve1'
No Tags
Start
Shutdown

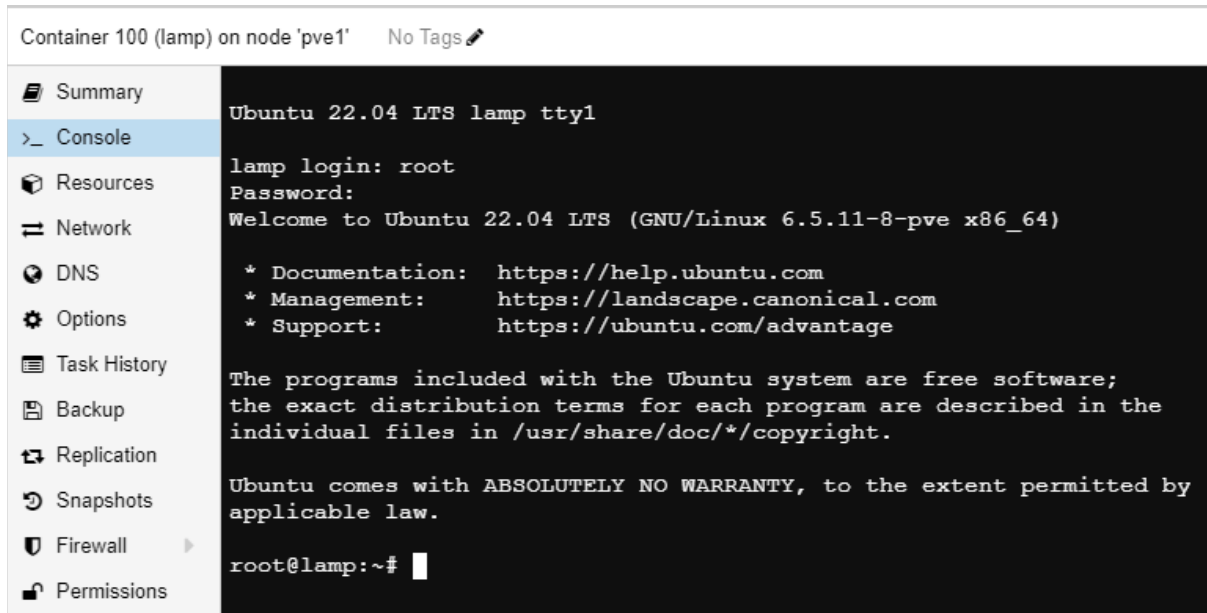
Summary
Console
Resources
Network
DNS
Options
Task History
Backup
Replication

lamp (Uptime: 00:01:39)
Ubuntu
Notes

i Status
HA State
Node
Unprivileged
CPU usage
Memory usage
SWAP usage

running
none
pve1
Yes
0.00% of 1 CPU(s)
5.68% (29.06 MiB of 512.00 MiB)
0.00% (0 B of 512.00 MiB)

Start the container



Container 100 (lamp) on node 'pve1' No Tags

```
Summary
> Console
Resources
Network
DNS
Options
Task History
Backup
Replication
Snapshots
Firewall
Permissions
```

```
Ubuntu 22.04 LTS lamp tty1

lamp login: root
Password:
Welcome to Ubuntu 22.04 LTS (GNU/Linux 6.5.11-8-pve x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

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

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

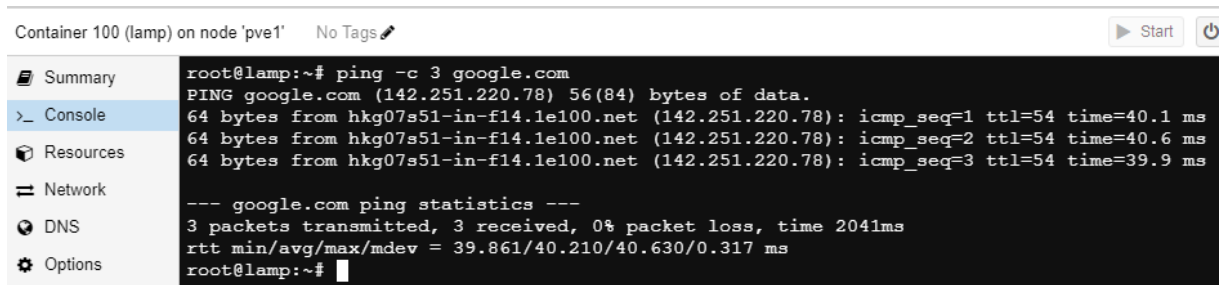
root@lamp:~#
```

Login to the container

(take a screenshot)

- Testing the network connections

#ping google.com



Container 100 (lamp) on node 'pve1' No Tags Start

```
Summary
> Console
Resources
Network
DNS
Options
```

```
root@lamp:~# ping -c 3 google.com
PING google.com (142.251.220.78) 56(84) bytes of data.
64 bytes from hkg07s51-in-f14.1e100.net (142.251.220.78): icmp_seq=1 ttl=54 time=40.1 ms
64 bytes from hkg07s51-in-f14.1e100.net (142.251.220.78): icmp_seq=2 ttl=54 time=40.6 ms
64 bytes from hkg07s51-in-f14.1e100.net (142.251.220.78): icmp_seq=3 ttl=54 time=39.9 ms

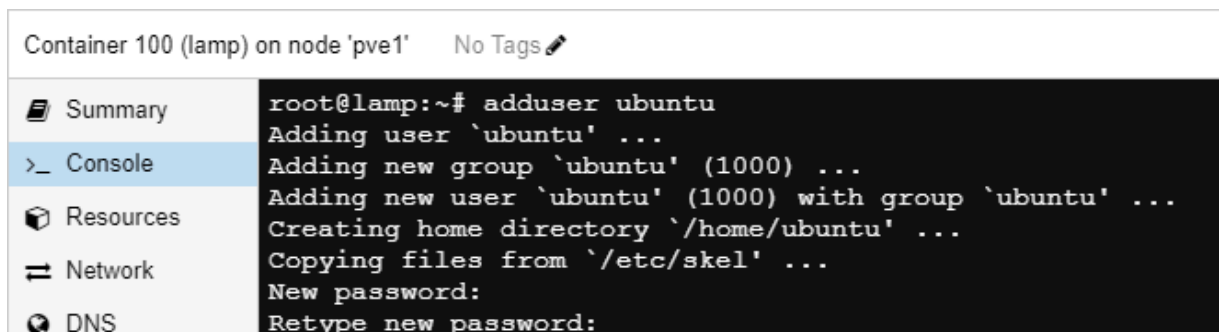
--- google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 39.861/40.210/40.630/0.317 ms
root@lamp:~#
```

Testing the network connections

(take a screenshot)

- Create the user/password ubuntu/ubuntu and assign sudo privilege to it

#adduser ubuntu



Container 100 (lamp) on node 'pve1' No Tags

```
Summary
> Console
Resources
Network
DNS
```

```
root@lamp:~# adduser ubuntu
Adding user 'ubuntu' ...
Adding new group 'ubuntu' (1000) ...
Adding new user 'ubuntu' (1000) with group 'ubuntu' ...
Creating home directory '/home/ubuntu' ...
Copying files from '/etc/skel' ...
New password:
Retype new password:
```

DNS	<pre>Retype new password: passwd: password updated successfully Changing the user information for ubuntu Enter the new value, or press ENTER for the default Full Name []: Room Number []: Work Phone []: Home Phone []: Other []: Is the information correct? [Y/n] Y root@lamp:~#</pre>
Options	
Task History	
Backup	
Replication	
Snapshots	
Firewall	

Create the user ubuntu

```
#adduser ubuntu sudo
```

Container 100 (lamp) on node 'pve1' No Tags	
Summary	<pre>root@lamp:~# adduser ubuntu sudo Adding user `ubuntu' to group `sudo' ... Adding user ubuntu to group sudo Done. root@lamp:~#</pre>
Console	
Resources	

Assign sudo privilege to ubuntu

- Log out from the container

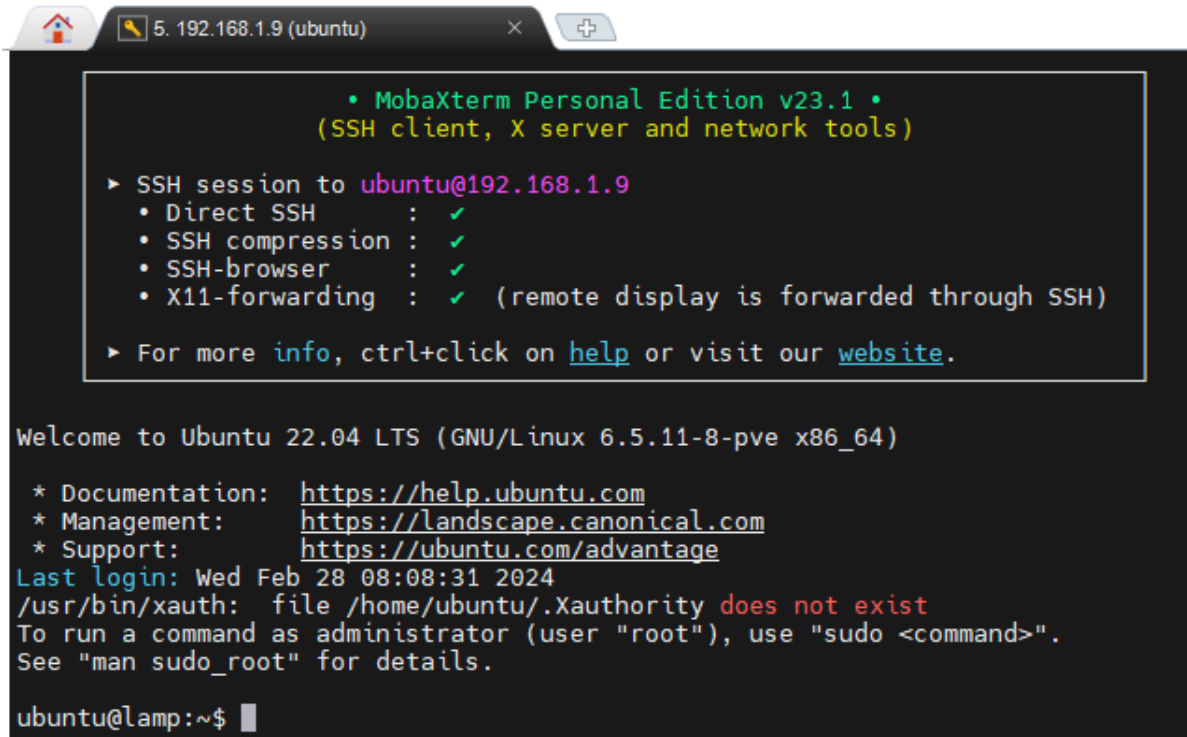
```
#exit
```

Container 100 (lamp) on node 'pve1' No Tags	
Summary	<pre>root@lamp:~# exit Ubuntu 22.04 LTS lamp tty1 lamp login:</pre>
Console	
Resources	

Log out from the container

- Close web-based console

- From the [physical machine](#), download and install [Mobaxterm](#). From Mobaxterm to SSH to the container using user/password `ubuntu/ubuntu`



The screenshot shows a MobaXterm window titled "5. 192.168.1.9 (ubuntu)". The terminal displays the MobaXterm logo and version information, followed by a list of SSH session details for the connection to `ubuntu@192.168.1.9`. The session is successful, with X11-forwarding enabled. Below this, the Ubuntu 22.04 LTS login banner is shown, including documentation links and the last login time. The prompt is `ubuntu@lamp:~$`.

```
• MobaXterm Personal Edition v23.1 •
(SSH client, X server and network tools)

► SSH session to ubuntu@192.168.1.9
  • Direct SSH      : ✓
  • SSH compression : ✓
  • SSH-browser     : ✓
  • X11-forwarding  : ✓ (remote display is forwarded through SSH)

► For more info, ctrl+click on help or visit our website.

Welcome to Ubuntu 22.04 LTS (GNU/Linux 6.5.11-8-pve x86_64)

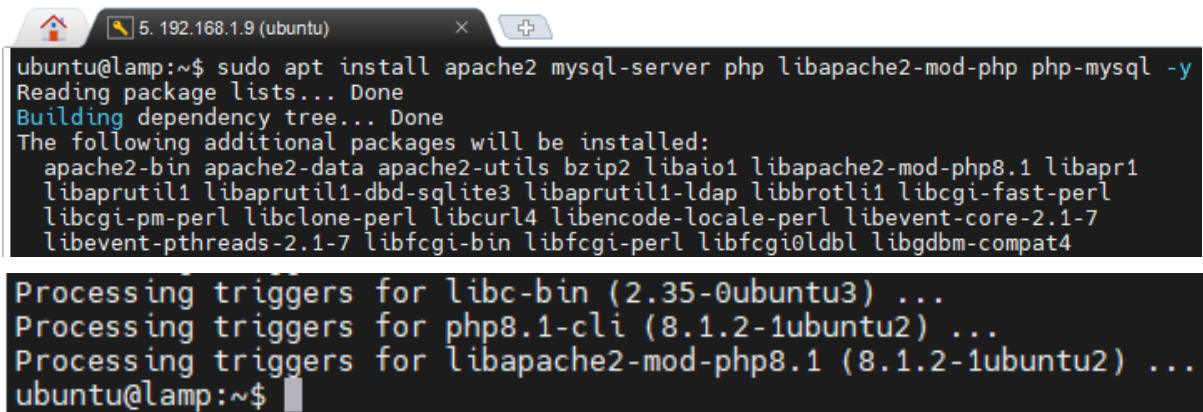
* Documentation:  https://help.ubuntu.com
* Management:    https://landscape.canonical.com
* Support:        https://ubuntu.com/advantage
Last login: Wed Feb 28 08:08:31 2024
/usr/bin/xauth: file /home/ubuntu/.Xauthority does not exist
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@lamp:~$
```

From the physical machine SSH to the container with user `ubuntu`

- Install LAMP stack

```
$ sudo apt update -y && sudo apt install apache2
mysql-server php libapache2-mod-php php-mysql -y
```



The screenshot shows a terminal window with the command `sudo apt install apache2 mysql-server php libapache2-mod-php php-mysql -y` being executed. The output shows the package lists being read, the dependency tree being built, and a list of additional packages to be installed. The installation progress is shown for several packages, including `libc-bin`, `php8.1-cli`, and `libapache2-mod-php8.1`. The prompt is `ubuntu@lamp:~$`.

```
ubuntu@lamp:~$ sudo apt install apache2 mysql-server php libapache2-mod-php php-mysql -y
Reading package lists... Done
Building dependency tree... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils bzip2 libaio1 libapache2-mod-php8.1 libapr1
  libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap libbrotli1 libcgi-fast-perl
  libcgi-pm-perl libclone-perl libcurl4 libencode-locale-perl libevent-core-2.1-7
  libevent-pthreads-2.1-7 libfcgi-bin libfcgi-perl libfcgi0ldbl libgdbm-compat4
Processing triggers for libc-bin (2.35-0ubuntu3) ...
Processing triggers for php8.1-cli (8.1.2-1ubuntu2) ...
Processing triggers for libapache2-mod-php8.1 (8.1.2-1ubuntu2) ...
ubuntu@lamp:~$
```

Install packages

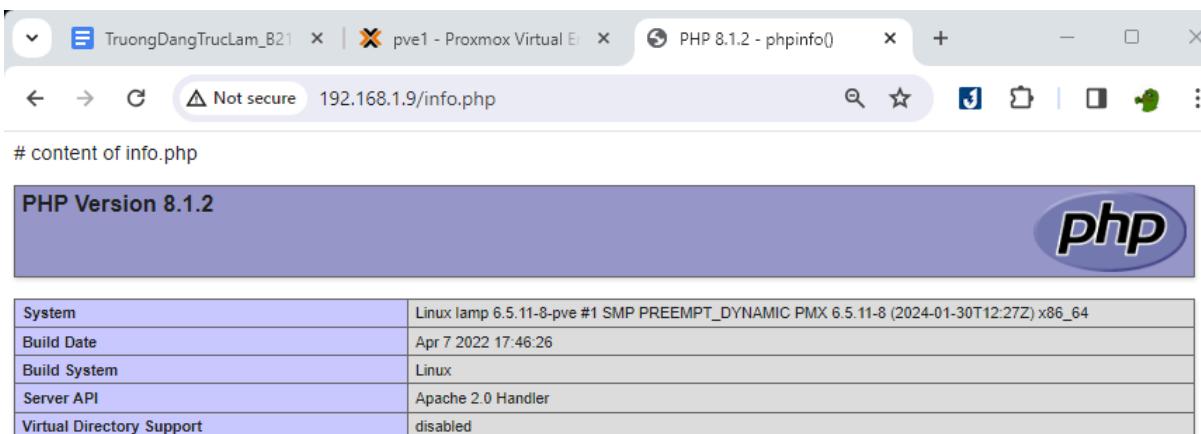
```
$ sudo nano /var/www/html/info.php
# content of info.php
<?php
phpinfo();
```

Modify the content of `info.php`

```
$ sudo systemctl enable apache2
```

Enable service `apache2`

- From a web browser, access http://<Container_IP>/info.php.



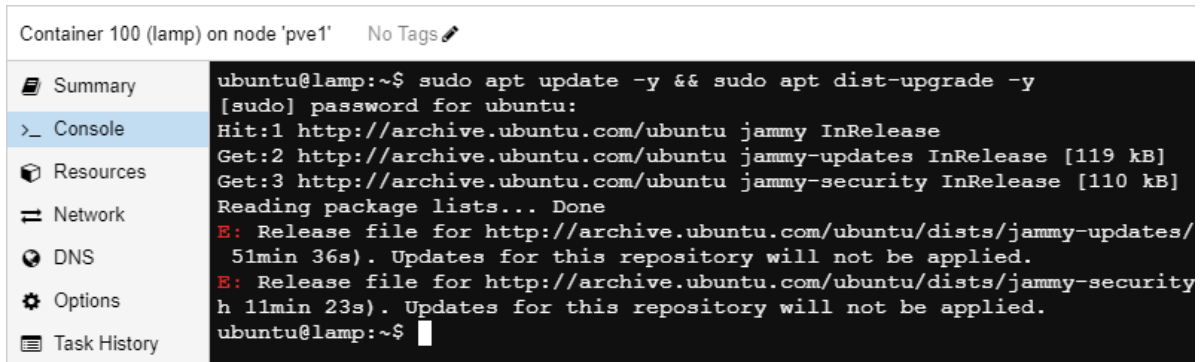
Access to `192.168.1.9/info.php` from a web browser

(take a screenshot)

4. Creating a container template

- On the container, upgrade its OS

```
$ sudo apt update -y && sudo apt dist-upgrade -y  
(can skip this step to save time)
```

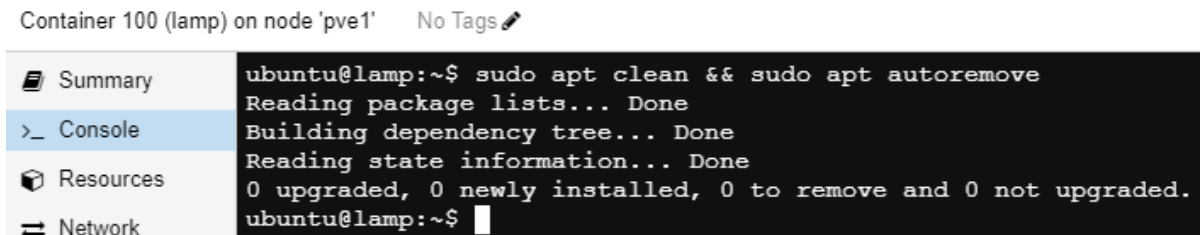


```
Container 100 (lamp) on node 'pve1' No Tags  
Summary  
Console  
Resources  
Network  
DNS  
Options  
Task History  
ubuntu@lamp:~$ sudo apt update -y && sudo apt dist-upgrade -y  
[sudo] password for ubuntu:  
Hit:1 http://archive.ubuntu.com/ubuntu jammy InRelease  
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]  
Get:3 http://archive.ubuntu.com/ubuntu jammy-security InRelease [110 kB]  
Reading package lists... Done  
E: Release file for http://archive.ubuntu.com/ubuntu/dists/jammy-updates/  
51min 36s). Updates for this repository will not be applied.  
E: Release file for http://archive.ubuntu.com/ubuntu/dists/jammy-security  
h 11min 23s). Updates for this repository will not be applied.  
ubuntu@lamp:~$
```

Upgrade the container

- Clean the apt tool

```
$ sudo apt clean && sudo apt autoremove
```

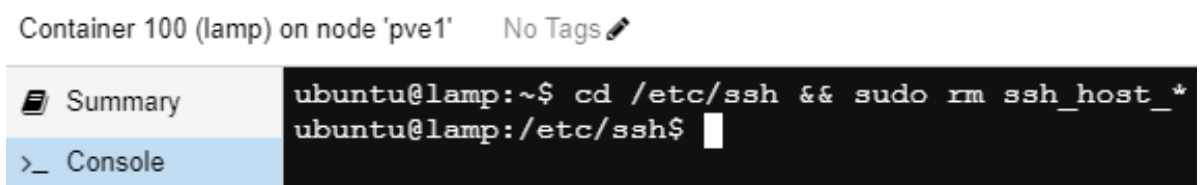


```
Container 100 (lamp) on node 'pve1' No Tags  
Summary  
Console  
Resources  
Network  
ubuntu@lamp:~$ sudo apt clean && sudo apt autoremove  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
ubuntu@lamp:~$
```

Clean the apt tool

- Remove ssh keys

```
$ cd /etc/ssh && sudo rm ssh_host_*
```

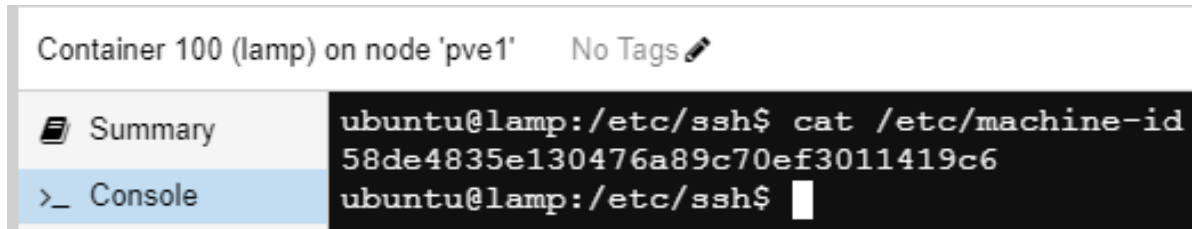


```
Container 100 (lamp) on node 'pve1' No Tags  
Summary  
Console  
ubuntu@lamp:~$ cd /etc/ssh && sudo rm ssh_host_*  
ubuntu@lamp:/etc/ssh$
```

Remove ssh keys

- Remove machine ID

```
$ cat /etc/machine-id
```



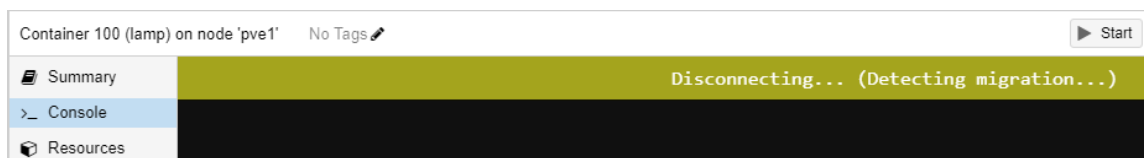
Show the machine ID

```
$ sudo truncate -s 0 /etc/machine-id
```

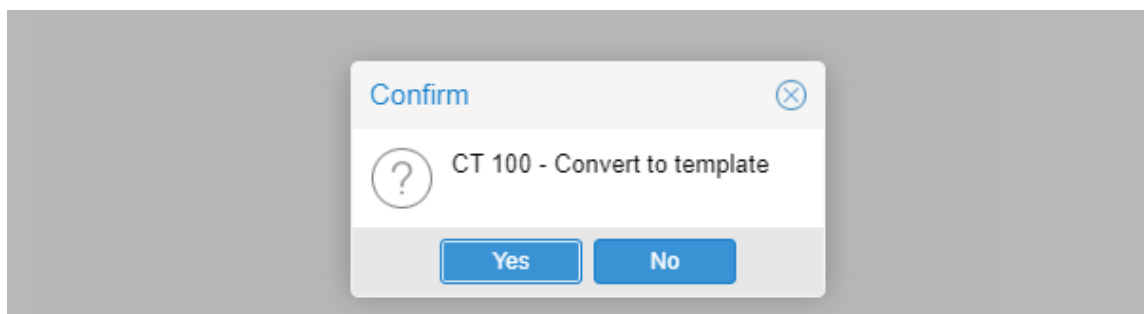


Remove the machine ID

- Shutdown the container, then create a CT template (More → Convert to template).



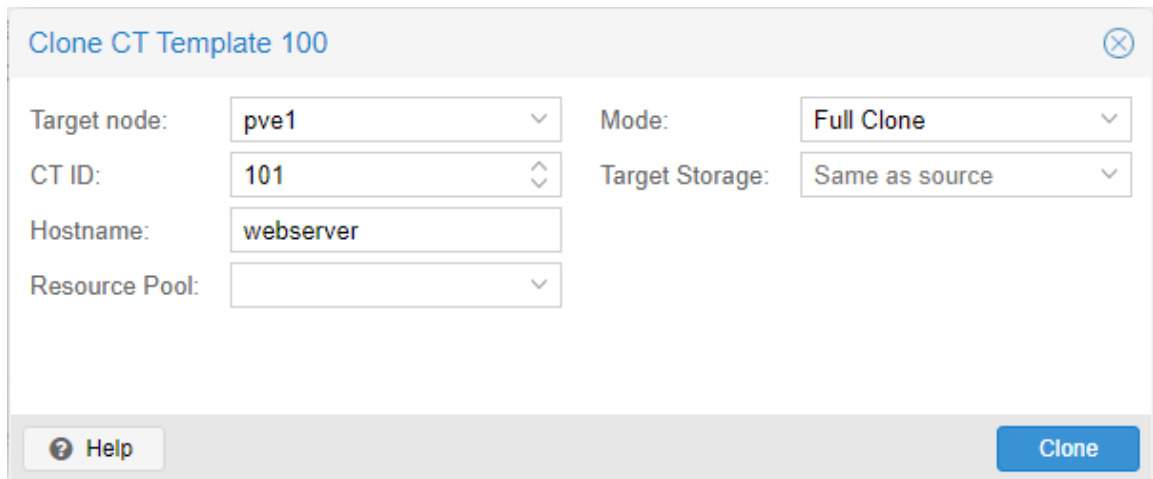
Shutdown the container



Create a CT template

- Create (Clone) a new container using the template

- **Hostname:** webserver
- **Mode:** Full Clone



Clone CT Template 100

Target node: Mode:

CT ID: Target Storage:

Hostname:

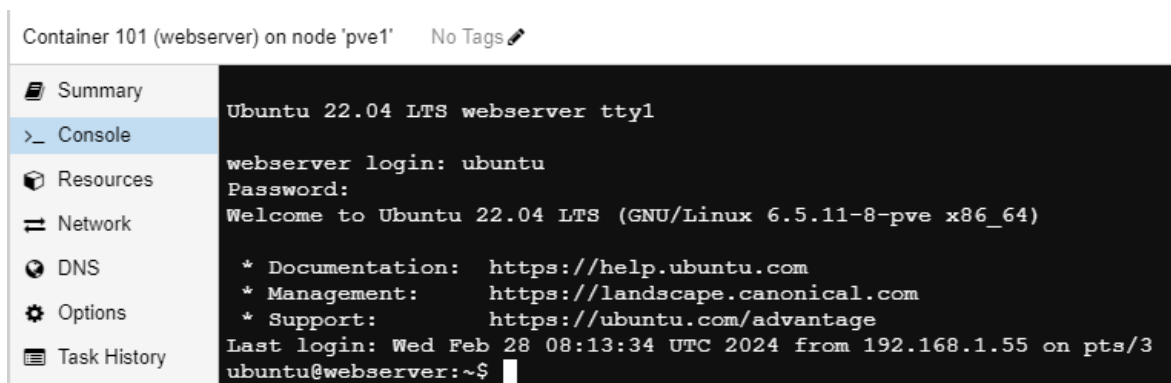
Resource Pool:

[Help](#) [Clone](#)

Clone a new container using the template

(take a screenshot)

- Start the container, then log on to the container using the user/password ubuntu/ubuntu



```
Container 101 (webserver) on node 'pve1' No Tags
Summary
> Console
Resources
Network
DNS
Options
Task History

Ubuntu 22.04 LTS webserver tty1
webserver login: ubuntu
Password:
Welcome to Ubuntu 22.04 LTS (GNU/Linux 6.5.11-8-pve x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Wed Feb 28 08:13:34 UTC 2024 from 192.168.1.55 on pts/3
ubuntu@webserver:~$
```

Start the container and login

- Create new SSH keys

\$ cd /etc/ssh && sudo dpkg-reconfigure openssh-server

Container 101 (webserver) on node 'pve1' No Tags

Summary

Console

Resources

Network

DNS

Options

ubuntu@webserver:~\$ cd /etc/ssh && sudo dpkg-reconfigure openssh-server
[sudo] password for ubuntu:
Creating SSH2 RSA key; this may take some time ...
3072 SHA256:neeixX5FTtOYoDSju4e4o7NgZW5o6YuLv/H85sWZSDQ root@webserver (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:6lmG3ho04AIXJBiTlUv2CKWs47yQYBbVLeyMnS3RmWE root@webserver (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:8xezuK+zOdJ5cPTOa+SbMYXPWA09zZiB/HBkYvBZKoY root@webserver (ED25519)
rescue-ssh.target is a disabled or a static unit not running, not starting it.
ubuntu@webserver:/etc/ssh\$

Create new SSH keys

- From MobaXterm to SSH to the container using user/password ubuntu/ubuntu

► SSH session to ubuntu@192.168.1.9

- Direct SSH : ✓
- SSH compression : ✓
- SSH-browser : ✓
- X11-forwarding : ✓ (remote display is forwarded through SSH)

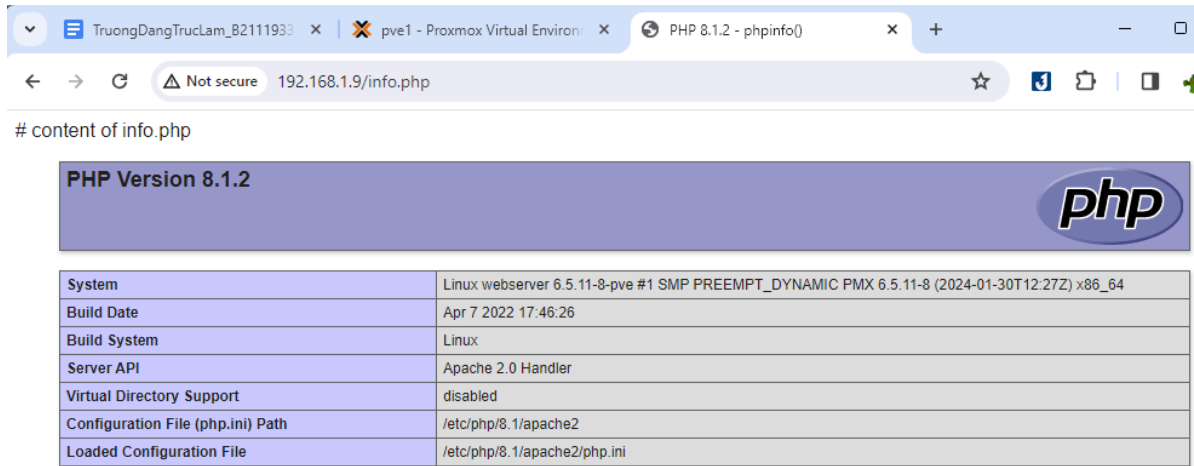
► For more info, ctrl+click on [help](#) or visit our [website](#).

Welcome to Ubuntu 22.04 LTS (GNU/Linux 6.5.11-8-pve x86_64)

* Documentation: <https://help.ubuntu.com>
* Management: <https://landscape.canonical.com>
* Support: <https://ubuntu.com/advantage>
Last login: Wed Feb 28 08:52:50 2024 from 192.168.1.55
ubuntu@webserver:~\$

SSH to the container

- From a web browser, access http://<Container_IP>/info.php

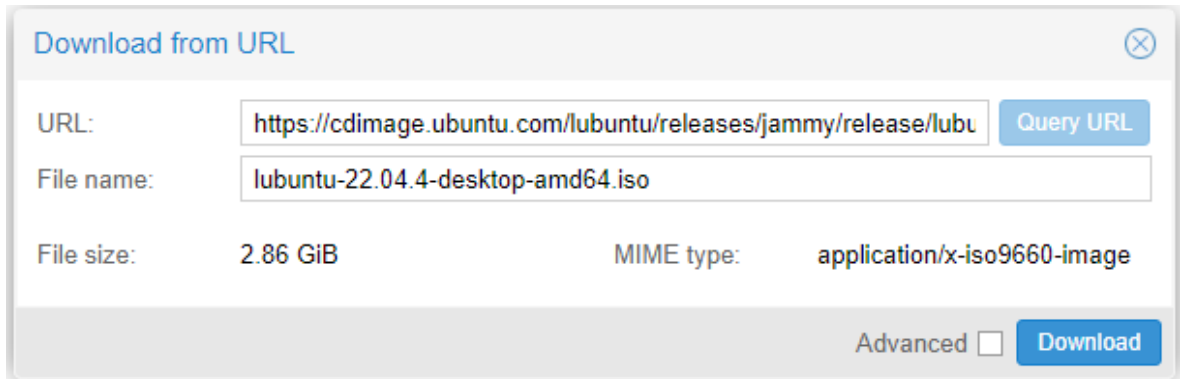


Access <http://192.168.1.9/info.php>

(take a screenshot)

5. Creating a Virtual Machine

- Download the `Lubuntu 22.04` ISO file (local (pm1) → ISO Images → Download from URL)
- URL: <https://cdimage.ubuntu.com/lubuntu/releases/jammy/release/lubuntu-22.04.4-desktop-amd64.iso>



Download from URL

URL:

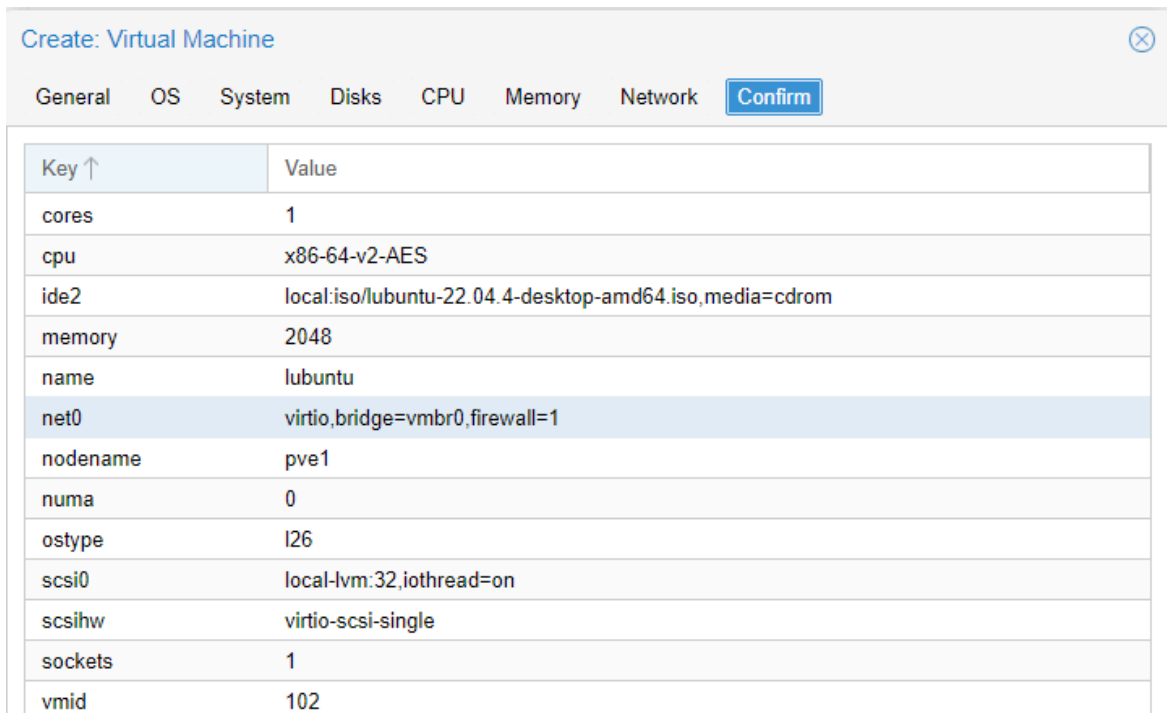
File name:

File size: 2.86 GiB MIME type: application/x-iso9660-image

Advanced ☐

Download the `Lubuntu 22.04` ISO file

- Create a Virtual Machine with the following information:
 - Hostname: `lubuntu`
 - ISO Image: `Lubuntu 22.04`
 - Keep other settings as default



Create: Virtual Machine

General OS System Disks CPU Memory Network

Key ↑	Value
cores	1
cpu	x86-64-v2-AES
ide2	local:iso/lubuntu-22.04.4-desktop-amd64.iso,media=cdrom
memory	2048
name	lubuntu
net0	virtio,bridge=vbr0,firewall=1
nodename	pve1
numa	0
ostype	l26
scsi0	local-lvm:32,iothread=on
scsihw	virtio-scsi-single
sockets	1
vmid	102

Create a Lubuntu VM

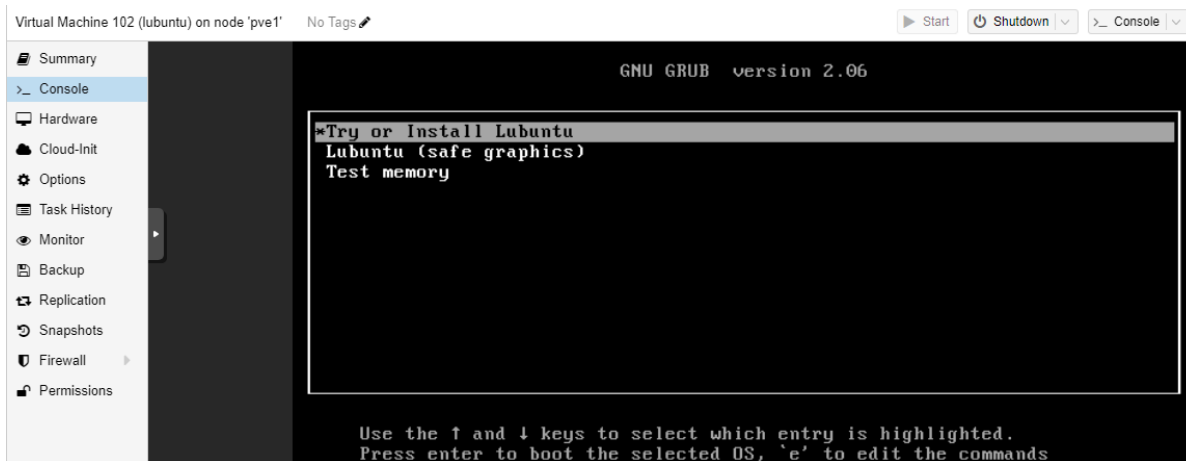
(take a screenshot)

- Upgrade server system to: Ram: 6gb / CPU: 4

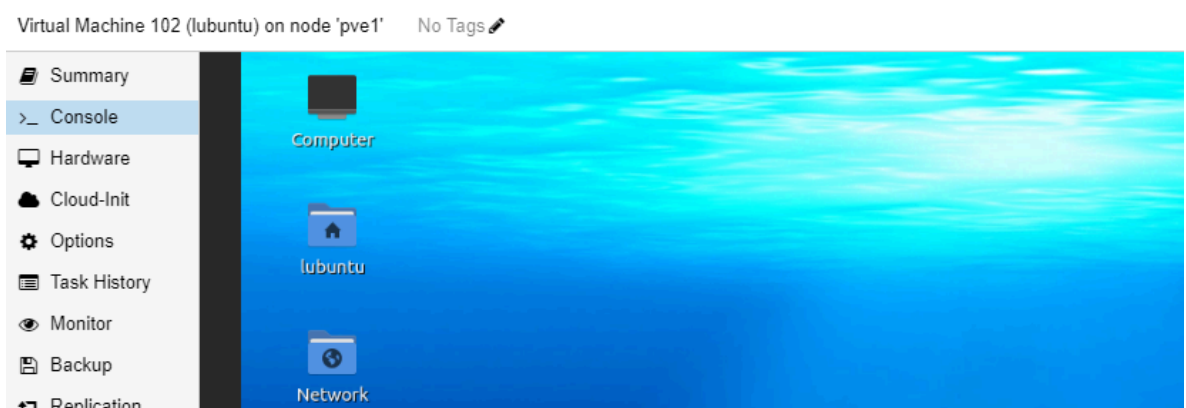


Upgrade server system

- Start the VM, then install the Lubuntu OS to the VM.



Start the VM



Install the Lubuntu OS




(take a screenshot of the log on screen after finishing the installation)
(students can skip step if there a lack of resources)

6. Creating a cluster

- Create a second virtual machine using VirtualBox (hoặc VMWare).
 - Name: PM02;
 - Other information is the same as the first one (PM01)


Summary


The following table summarizes the configuration you have chosen for the new virtual machine. When you are happy with the configuration press Finish to create the virtual machine. Alternatively you can go back and modify the configuration.


 Machine Name and OS Type	
Machine Name	PM02
Machine Folder	F:\Máy Ảo\VirtualBox\Proxmox VE\PM02
ISO Image	
Guest OS Type	Debian 11 Bullseye (64-bit)
 Hardware	
Base Memory	3096
Processor(s)	2
EFI Enable	false
 Disk	
Disk Size	60.00 GB
Pre-allocate Full Size	false


Storage

Storage Devices


 Controller: IDE

-  proxmox-ve_8.1-2.iso

 Controller: SATA

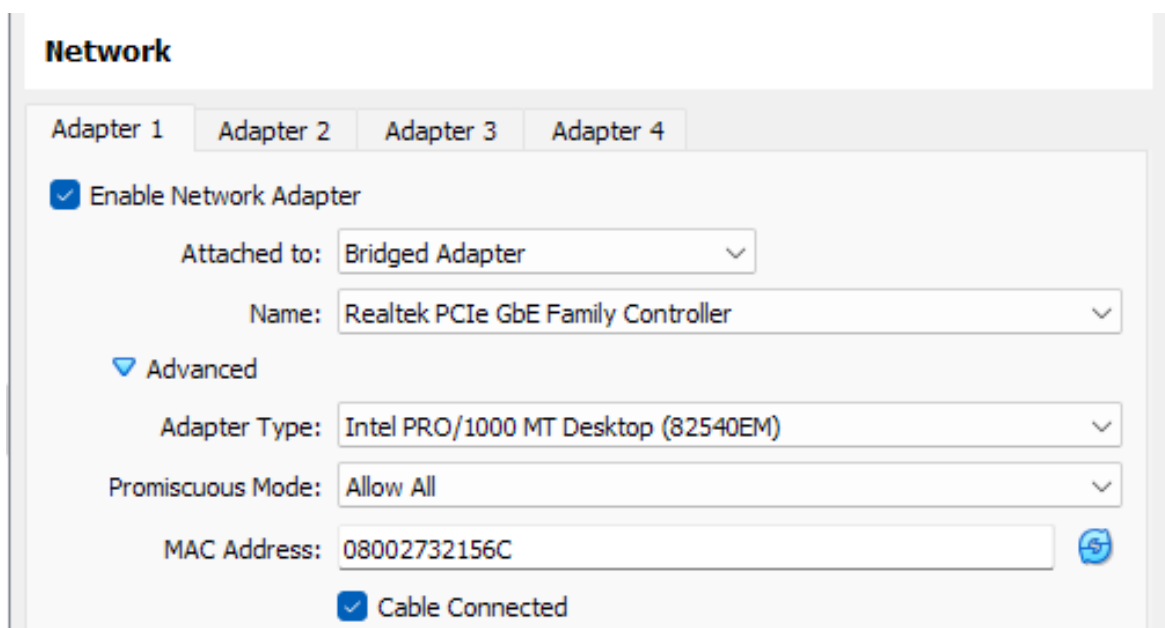
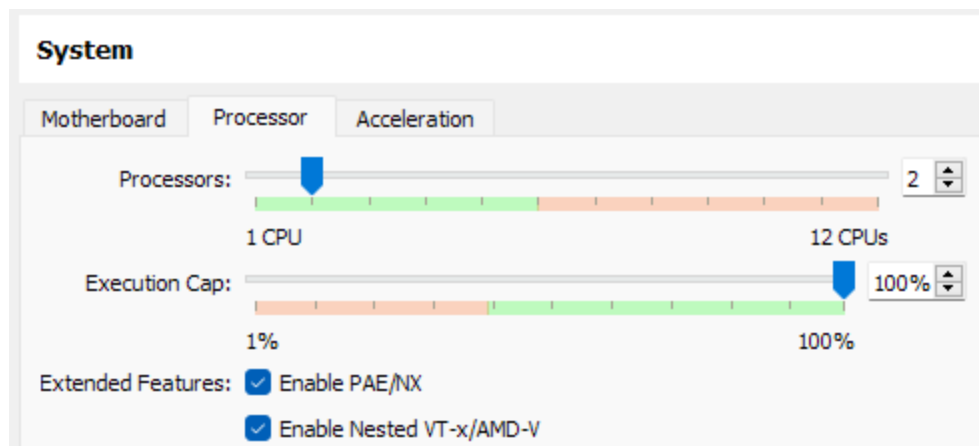
-  PM02.vdi

Attributes

Optical Drive: IDE Secondary Device 0 
☐ Live CD/DVD

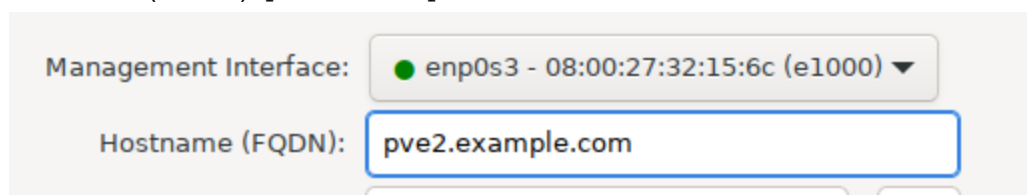
Information

Type: Image
Size: 1.20 GB
Location: F:\Máy Ảo\VirtualBox\Proxmox VE\proxmo...
Attached to: --



Create a second virtual machine named `PM02`

- Installing Proxmox VE to `PM02`.
- Start the VM then follow the Promox VE installation procedure.
 - Country: `Vietnam`
 - Hostname (FQDN): `pve2.example.com`



Configuration



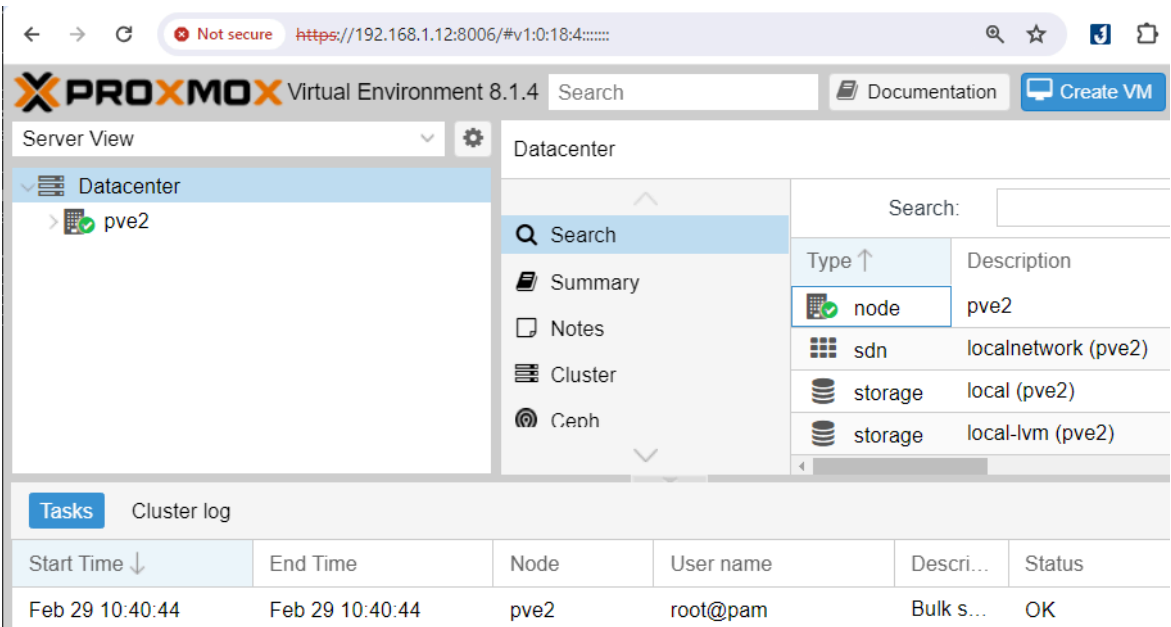
Installation successful!

Proxmox VE is now installed and ready to use.

• ted IP
https://192.168.1.12:8006
Also visit www.proxmox.com for more information.

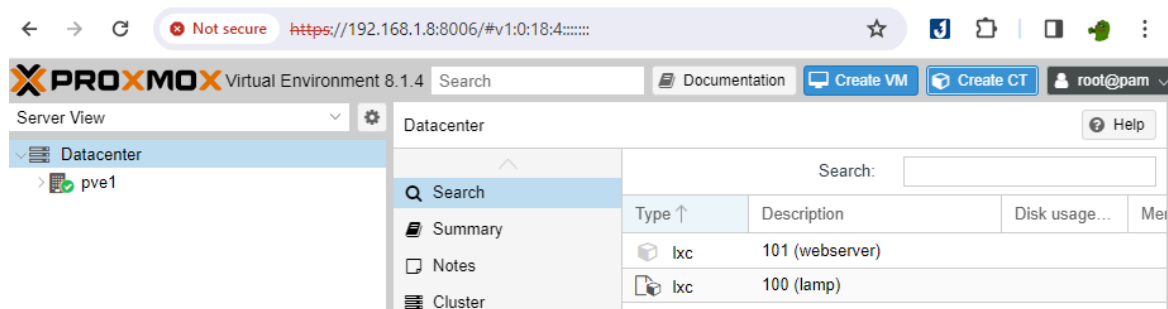
Install complete

- After finishing the installation procedure, access Proxmox VE GUI at <https://<IP of PM02>:8006>, then log in to Promox VE using the root account.



Access Proxmox VE GUI of PM02

- On the Proxmox web interface of PM01:
 - Login using `root` user



Login using `root` user

- Create a cluster (Data center → Cluster → Create Cluster)
 - Name: mydatacenter
 - Copy the join information

Create Cluster

Cluster Name:

mydatacenter

Cluster Network:

Link:

0

192.168.1.8

Add

Multiple links are used as failover, lower numbers have higher priority.

? Help

Create

Cluster Join Information

Copy the Join Information here and use it on the node you want to add.

IP Address:

192.168.1.8

Fingerprint:

5A:33:97:64:20:60:E1:B1:9E:BC:6F:50:C0:F2:9F:DA:1C:F7:C4:9C:23:43:A7:D7:F2:5D:8B:31:30:31:A3:AA

Join Information:

EyJpcEFkZHJlc3MiOiIxOTluMTY4LjEuOCIsImZpbmdlcnByeW50IjoieUE6MzYwMDQ6NDUxNjVjbG9jaXoibm9udGlzaW50ZXJmYW9nZWlnbiZlaAo=

Copy Information

Create a cluster and copy the join information

(take a screenshot)

- On the Proxmox web interface of PM02:
 - Log on using `root` user
 - Join to a cluster (Data center → Cluster → Join Cluster)
 - Paste the join information

The screenshot shows the 'Cluster Join' dialog box in Proxmox. It has a title bar with a close button. Below the title bar, there is a checkbox labeled 'Assisted join: Paste encoded cluster join information and enter password.' which is checked. The 'Information' field contains a long alphanumeric string: `zE6MzA6MzE6QTM6QUEiLCJwZWVYTGlua3MiOnsiMCi6ljE5Mi4xNjguMS44In0sInJpbmdfYWRkcil6WylxOTIuMTY4LjEuOCJdLCJ0b3Rlbi6eyJsaW5rX21vZGUiOiJwYXNzaXZlIiwic2VjYXV0aCI6Im9uliwiaW50ZXJmYWwNlljp7ljAiOnsibGlua251bWJlcil6ljAifX0sImlwX3ZlcnNpb24iOiJpcHY0LTlYiLCJjb25maWdfdmVyc2lvbil6ljEiLCJjbHVzdGVyX25hbWUiOiJteWRhdGFjZW50ZXlilCJ2ZXJzaW9uljoilMiJ9fQ==`. Below this, there are input fields for 'Peer Address' (192.168.1.8), 'Password' (masked with dots), 'Fingerprint' (5A:33:97:64:20:60:E1:B1:9E:BC:6F:50:C0:F2:9F:DA:1C:F7:C4:9C:23:43:A7:D7:F2:5D:8B:31:30:31:A3:AA), and 'Cluster Network' (Link: 0, IP resolved by node's hostname, peer's link address: 192.168.1.8). At the bottom, there is a 'Help' button and a 'Join 'mydatacenter'' button.

Join to a cluster with PM01

- Then waiting the join process to finish

The screenshot shows the Proxmox web interface. The browser address bar shows `https://192.168.1.8:8006/#v1:0:18:4:.....=cluster`. The interface has a top navigation bar with 'PROXMOX Virtual Environment 8.1.4', a search bar, and buttons for 'Documentation', 'Create VM', 'Create CT', and a user profile 'root@pam'. The left sidebar shows a 'Server View' with a 'Datacenter' folder expanded, containing 'pve1' and 'pve2'. The main content area is titled 'Datacenter' and has a 'Cluster' tab selected. The 'Cluster Information' section shows 'Cluster Name: mydatacenter', 'Config Version: 2', and 'Number of Nodes: 2'. Below this, the 'Cluster Nodes' table is displayed:

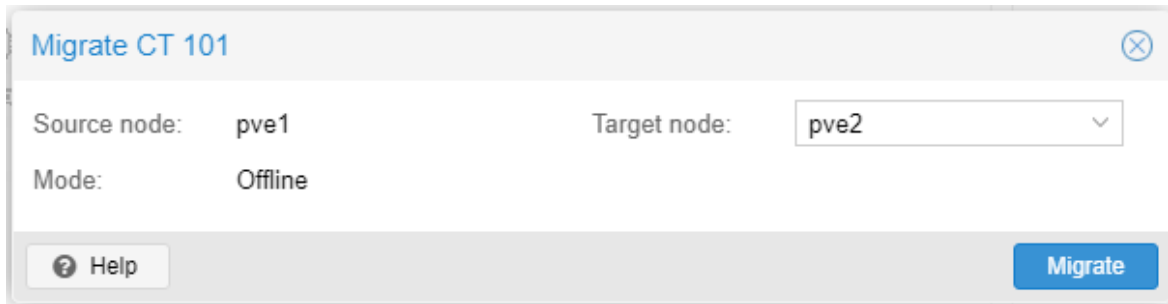
Nodename	ID ↑	Votes	Link 0
pve1	1	1	192.168.1.8
pve2	2	1	192.168.1.1

The result

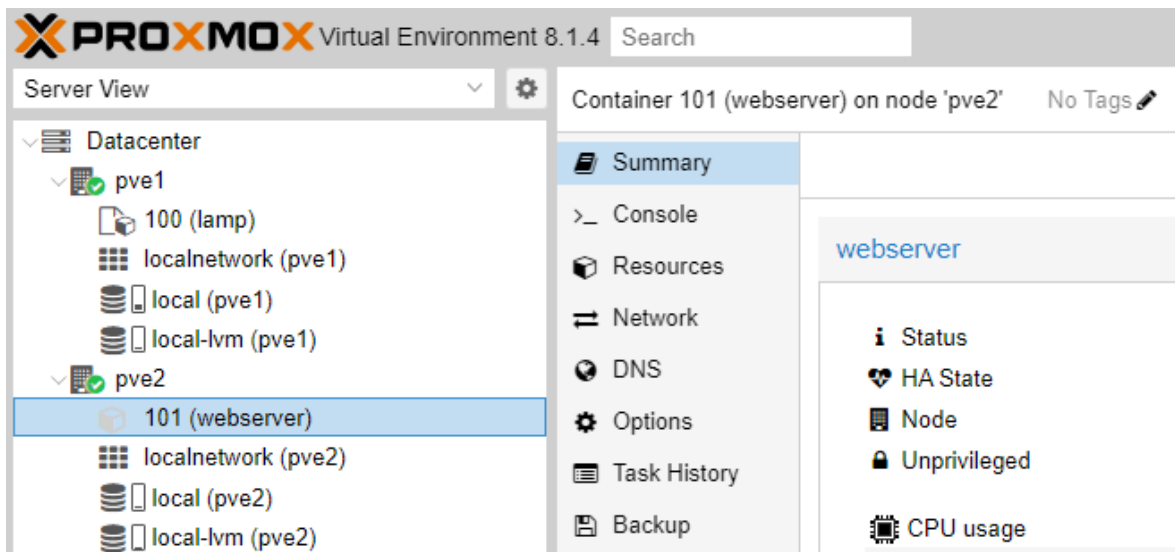
(take a screenshot)

7. Migrate a Container/Virtual Machine

- On the Proxmox web interface of PM01, migrating the container `webserver` from PM01 to PM02.



Migrate the container `webserver` from PM01 to PM02



The result

(take a screenshot)

Note: We can also manage Proxmox using [CLIs](#)

---END---