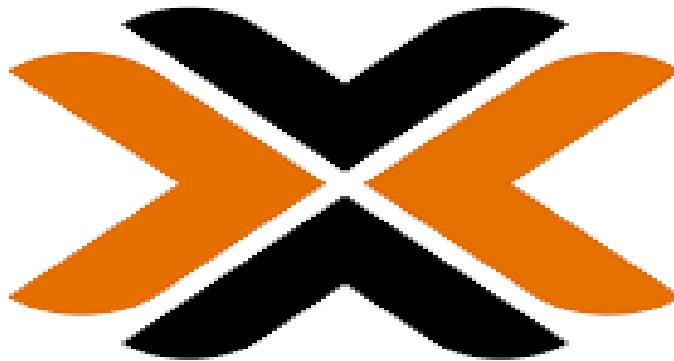


Proxmox

What is proxmox?

Proxmox Virtual Environment is a complete, open source solution for enterprise virtualization, that integrates the KVM hypervisor and Linux containers (LXC), software-defined storage (SDS) and networking (SDN), on a single platform. From the central user interface, you can manage VMs and containers, storage resources, simple or advanced network configuration, and high availability for clusters. The interface also provides access to multiple out-of-the-box tools for tasks such as backup/restore, live-migration, storage replication, and firewall configuration.



PROXMOX

Why use Proxmox?

-
1. free and open source
 2. Easy to use web interface
 3. Supports both VMs and containers with advanced features (clustering, HA, backups, etc)

System requirements for Proxmox

CPU: 64-bit with virtualization support

Ram: minimum of 2GB (8GB+ recommended)

Storage: 8GB minimum (16GB to 32GB recommended) ssd or hdd

Network: 1Gbps network interface card is recommended

How to install Proxmox?

1. Download an ISO image of proxmox:

Go to proxmox official website: <https://www.proxmox.com/en/downloads>

and download the latest version of Proxmox VE.

2. Create a bootable media or virtualize proxmox:

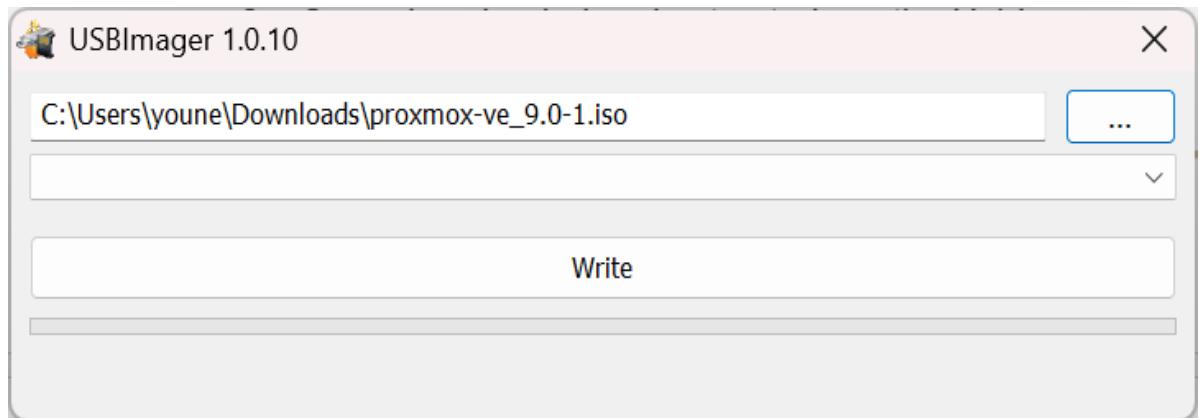
What is a bootable media?

Bootable media is a removable storage device, such as a USB drive, CD, or DVD, that contains a bootable operating system or software, allowing a computer to start up and run without using its internal hard drive.

Creating a bootable media:

1. Download a usbimager from this website: <https://bztsrc.gitlab.io/usbimager/>

-
2. Once downloaded and extracted run the UsbImager
 3. Select the iso image and the device u want to write the iso image on.



4. After it's done, you can remove the usb and plug it in your device.

note: U can also virtualize proxmox on another hypervisor

3. Boot and install:

once u plugged your usb in your device, this screen would appear and here u can install proxmox by selecting "install proxmox VE (Graphical)



Welcome to Proxmox Virtual Environment

[Install Proxmox VE \(Graphical\)](#)
[Install Proxmox VE \(Terminal UI\)](#)
[Advanced Options](#)

enter: select, arrow keys: navigate, e: edit entry, esc: back



Proxmox Virtual Environment (PVE)

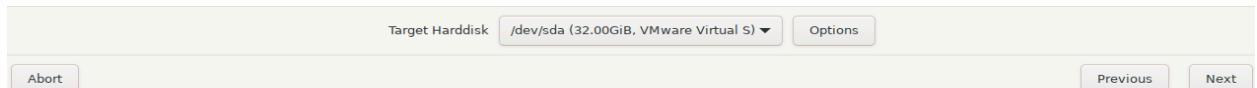
The Proxmox Installer automatically partitions your hard disk. It installs all required packages and makes the system bootable from the hard disk. All existing partitions and data will be lost.

Press the Next button to continue the installation.

- Please verify the installation target**
The displayed hard disk will be used for the installation.
Warning: All existing partitions and data will be lost.

- Automatic hardware detection**
The installer automatically configures your hardware.

- Graphical user interface**
Final configuration will be done on the graphical user interface, via a web browser.



select the disk u want to install proxmox on. (Installing proxmox would wipe everything on the disk so choose carefully)



Location and Time Zone selection

The Proxmox Installer automatically makes location-based optimizations, like choosing the nearest mirror to download files from. Also make sure to select the correct time zone and keyboard layout.

Press the Next button to continue the installation.

- **Country:** The selected country is used to choose nearby mirror servers. This will speed up downloads and make updates more reliable.
- **Time Zone:** Automatically adjust daylight saving time.
- **Keyboard Layout:** Choose your keyboard layout.

A screenshot of the Proxmox VE Installer's "Location and Time Zone selection" screen. It features three dropdown menus: "Country" set to "Algeria", "Time zone" set to "Africa/Algiers", and "Keyboard Layout" set to "U.S. English". At the bottom left is an "Abort" button, and at the bottom right are "Previous" and "Next" buttons.

choose the country and time zone that suits u the best

type in the password that you'll need to login later in the proxmox web interface,



Administration Password and Email Address

Proxmox Virtual Environment is a full featured, highly secure GNU/Linux system, based on Debian.

In this step, please provide the *root* password.

- **Password:** Please use a strong password. It must be at least 8 characters long, and contain a combination of letters, numbers, and symbols.

- **Email:** Enter a valid email address. Your Proxmox VE server will send important alert notifications to this email account (such as backup failures, high availability events, etc.).

Press the Next button to continue the installation.

A screenshot of the "Administration Password and Email Address" configuration screen. It shows fields for "Password" (empty), "Confirm" (empty), and "Email" (set to "mail@example.invalid"). Below the fields are "Abort", "Previous", and "Next" buttons.

and email to receive notifications about your server



Management Network Configuration

Please verify the displayed network configuration. You will need a valid network configuration to access the management interface after installing.

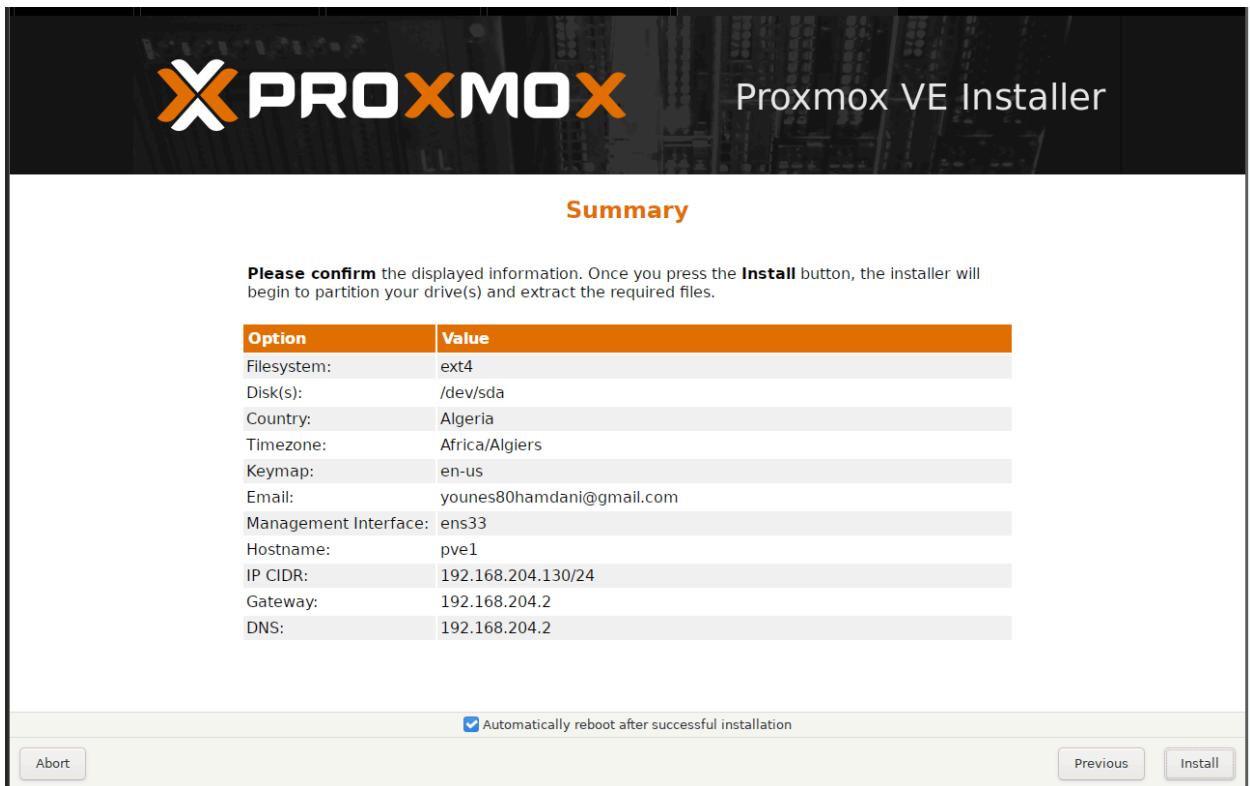
After you have finished, you will be shown a list of choices during the previous

- **IP address (CIDR):** Set the main IP address and netmask for your server in CIDR notation.

- **Gateway:** IP address of your gateway or address of your DNS server.

A screenshot of the "Management Network Configuration" screen. It shows a dropdown for "Management Interface" set to "ens33 - 00:c2:91:2:5c:fc (e1000)". Other fields include "Hostname (FQDN)" (set to "pve1.localdomain"), "IP Address (CIDR)" (set to "192.168.204.130 / 24"), "Gateway" (set to "192.168.204.2"), and "DNS Server" (set to "192.168.204.2"). Below the fields are "Abort", "Previous", and "Next" buttons.

Make sure you have the correct Management interface selected and an ip address that isn't being used by another server or firewall ect.



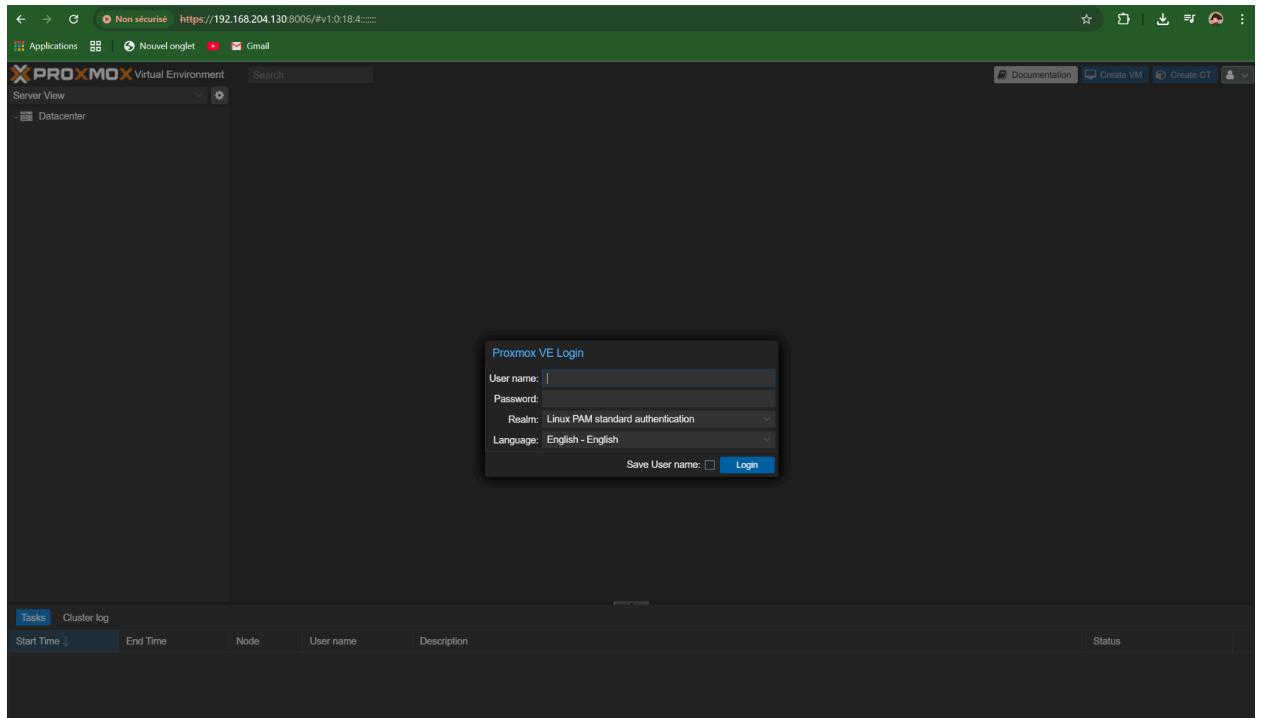
finally click install and the installation of proxmox should begin.



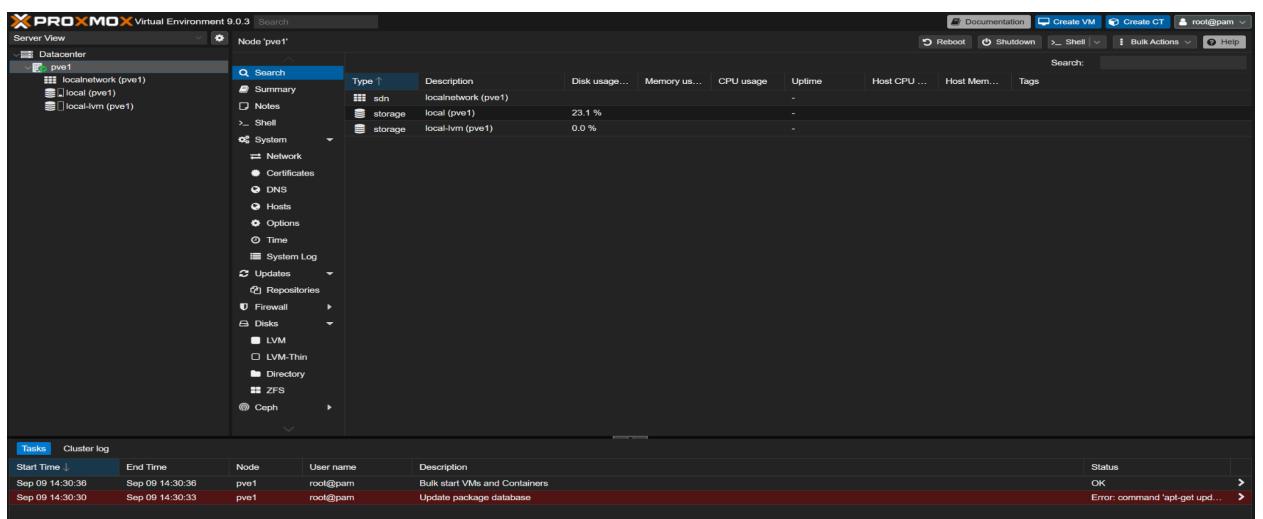
Once the installation is over, this terminal should appear and you can see the url to your proxmox web interface.

4. Accessing the web interface:

To access the web interface you need a web browser (Chrome, Firefox, edge, ect) and type in the url u see in your terminal



type in your username (root) and password that u used for the proxmox installation



and finally you are in your web interface for proxmox.

Proxmox Interface Tour:

On the left, we can see a tree menu. At the top is the datacenter, and under it are all Proxmox servers if a cluster is configured. Datacenter features are applied cluster-wide, and if a node has its own settings, the datacenter settings will override the node's.

The screenshot shows the Proxmox Virtual Environment 9.0.3 interface. The left sidebar shows a tree view with 'Datacenter' expanded, revealing 'pve1'. Under 'pve1', there are nodes: 'localnetwork (pve1)', 'local (pve1)', and 'local-lvm (pve1)'. The main panel displays a table of storage resources. The table has columns for Type, Description, Disk usage..., Memory us..., CPU usage, Uptime, Host CPU ..., Host Mem..., and Tags. It lists three entries: 'localnetwork (pve1)' (Type: idn), 'local (pve1)' (Type: storage, Disk usage: 23.1 %), and 'local-lvm (pve1)' (Type: storage, Disk usage: 0.0 %). Below the table is a 'Tasks' section showing two recent tasks: 'Sep 09 14:30:36 Bulk start VMs and Containers' and 'Sep 09 14:30:33 Update package database'. A 'Cluster log' section at the bottom shows logs for the same tasks.

When you click on a server (e.g., PVE1) and go to 'Summary,' you can see details about the CPU, RAM, and storage of that node

This screenshot shows the 'Summary' tab for node 'pve1'. The left sidebar is identical to the previous screenshot. The main panel now focuses on system monitoring. It includes a 'Package versions' section with a table for 'pve1 (Uptime: 00:24:40)'. The table shows CPU usage (1.02% of 2 CPU(s)), Load average (0.00, 0.01, 0.00), RAM usage (73.00% of 1.37 GiB of 1.88 GiB), and HD space (23.07% of 3.34 GiB of 14.47 GiB). Below this is a 'CPU Usage' graph showing CPU load over time. The graph has a yellow area representing CPU usage and a blue line representing IO delay. At the bottom, there is a 'Tasks' section with the same two tasks as the previous screenshot.

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar is titled 'Server View' and shows a 'Datacenter' node with a single host 'pve1'. The main panel has a navigation bar with 'Documentation', 'Create VM', 'Create CT', 'root@pam', 'Reboot', 'Shutdown', 'Shell', 'Bulk Actions', and 'Help'. Below the navigation bar, there are several tabs: 'Tasks' (selected), 'Cluster log', 'Nodes', 'Shell', 'System' (with sub-options: Network, Certificates, DNS, Hosts, Options, Time, System Log, Updates, Repositories, Firewall, Disks, LVM, LVM-Thin, Directory, ZFS, Ceph). The 'Notes' tab is currently selected. A 'Tasks' table at the bottom lists recent actions:

Start Time	End Time	Node	User name	Description	Status
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' >

Below the summary, there is a 'Notes' section where you can add information about the server. If multiple people have access, they can also use it to document changes or actions they performed

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar is titled 'Server View' and shows a 'Datacenter' node with a single host 'pve1'. The main panel has a navigation bar with 'Documentation', 'Create VM', 'Create CT', 'root@pam', 'Reboot', 'Shutdown', 'Shell', 'Bulk Actions', and 'Help'. Below the navigation bar, there are several tabs: 'Tasks' (selected), 'Cluster log', 'Nodes', 'Shell' (selected), 'System' (with sub-options: Network, Certificates, DNS, Hosts, Options, Time, System Log, Updates, Repositories, Firewall, Disks, LVM, LVM-Thin, Directory, ZFS, Ceph). The 'Shell' tab is currently selected. A terminal window displays the root shell session on 'pve1':

```
Linux pve1 6.14.8-2-pve #1 SMP PREEMPT_DYNAMIC PMX 6.14.8-2 (2025-07-22T10:04Z) 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@pve1:~#
```

A 'Tasks' table at the bottom lists recent actions:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04		pve1	root@pam	Shell	Running
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' >

The Shell section gives you access to a terminal window on the node (e.g., PVE1). You can run commands directly on Proxmox from here.

Name ↑	Alternative Names	Type	Active	Autostart	VLAN a...	Ports/Slaves	Bond Mode	CIDR	Gateway	Comment
ens3	enp2s1 enx00c29125fc	Network Device	Yes	No	No					
vmbr0		Linux Bridge	Yes	Yes	No	ens33		192.168.204.130/24	192.168.204.2	

Start Time ↓	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...'

The Networking section allows you to configure network interfaces, add Linux bridges, and manage network settings for the node and its VMs/CTs.

File	Issuer	Subject	Valid Since	Expires	Subject Alternative Names
pve-root-ca.pem	/CN=Proxmox Virtual Environment/OU=...	/CN=Proxmox Virtual Environment/OU=...	2025-09-08 14:30:26	2035-09-06 14:30:26	127.0.0.1 0000:0000:0000:0000:0000:0000:0000:0000 localhost 192.168.204.130 pve1 pve1.localdomain
pve-ssl.pem	/CN=Proxmox Virtual Environment/OU=...	/OU=PVE Cluster Node/O=Proxmox Vir...	2025-09-08 14:30:26	2027-09-08 14:30:26	

Domain ↑	Type	Plugin
No Domains configured		

Start Time ↓	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...'

This section shows the certificates that are enabled for your server.

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar shows a tree view of the Datacenter, with 'pve1' selected. The right pane has a sidebar with various system management options like Certificates, DNS, Hosts, Options, Time, and System Log. The 'DNS' option is currently selected. In the main content area, there's an 'Edit' button and a search bar with 'Search domain localdomain' and 'DNS server 1 192.168.204.2'. Below this is a table for hosts. At the bottom, there's a 'Tasks' section with a table of recent system activities:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' (red)

If you have a custom DNS server, you can edit the IP address here to match it.

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar shows a tree view of the Datacenter, with 'pve1' selected. The right pane has a sidebar with various system management options like Certificates, DNS, Hosts, Options, Time, and System Log. The 'Hosts' option is currently selected. In the main content area, there's an 'Edit' button and a 'Revert' button. The main pane displays a list of IPv6 addresses and their descriptions:

Address	Description
127.0.0.1	localhost.localdomain localhost
192.168.204.190	pve1.localdomain pve1
::1	ip6-localhost ip6-loopback
fe80::0	ip6-localnet
ff00::0	ip6-mcastprefix
ff02::1	ip6-allnodes
ff02::2	ip6-allrouters
ff02::3	ip6-allhosts

At the bottom, there's a 'Tasks' section with a table of recent system activities:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' (red)

Here you can access the hosts file. Any static host entries can be added in this section.

The screenshot shows the Proxmox VE 9.0.3 interface. On the left, the navigation tree shows 'Datacenter' and 'Node pve1'. The main panel is titled 'Edit' and shows the 'Time' configuration. The 'Time zone' is set to 'Africa/Algiers' and the 'Server time' is '2025-09-09 15:20:13'. The 'System Log' section at the bottom displays a log entry:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' >

This section allows you to change the server's timezone.

The screenshot shows the Proxmox VE 9.0.3 interface. On the left, the navigation tree shows 'Datacenter' and 'Node pve1'. The main panel is titled 'Live Mode' and shows the 'System Log' for node 'pve1'. The log output includes:

```

Sep 09 15:01:43 pve1 systemd[808]: Session 1 logged out. Waiting for processes to exit.
Sep 09 15:01:43 pve1 systemd[808]: Removed session 1.
Sep 09 15:01:53 pve1 systemd[1]: Stopping user@0.service - User Manager for UID 0...
Sep 09 15:01:53 pve1 systemd[1]: Activating special unit exit.target...
Sep 09 15:01:53 pve1 systemd[1]: Stopped target default.target - The User Target.
Sep 09 15:01:53 pve1 systemd[1]: Stopped target basic.target - Basic System.
Sep 09 15:01:53 pve1 systemd[1]: Stopped target paths.target - Paths.
Sep 09 15:01:53 pve1 systemd[1]: Stopped target sockets.target - Sockets.
Sep 09 15:01:53 pve1 systemd[1]: Stopped target timers.target - Timers.
Sep 09 15:01:53 pve1 systemd[1]: Closed dimming.socket - GruPu network certificate management daemon.
Sep 09 15:01:53 pve1 systemd[1]: Stopped gpg-agent-trustedkeysocket - GnuPG cryptographic agent and passphrase cache (access for web browsers).
Sep 09 15:01:53 pve1 systemd[1]: Closed libagent-extra socket - GnuPG cryptographic agent and passphrase cache (restricted).
Sep 09 15:01:53 pve1 systemd[1]: Stopped gpg-agent-ssh.socket - GnuPG cryptographic agent and passphrase cache (ssh emulation)...
Sep 09 15:01:53 pve1 systemd[1]: Stopped gpg-agent.socket - GnuPG cryptographic agent and passphrase cache.
Sep 09 15:01:53 pve1 systemd[1]: Closed keyboard.socket - OpenSSH Agent socket...
Sep 09 15:01:53 pve1 systemd[1]: Stopped ssh-agent.socket - OpenSSH Agent socket...
Sep 09 15:01:53 pve1 systemd[1]: Closed libagent-ssh.socket - GnuPG cryptographic agent (ssh-agent emulation).
Sep 09 15:01:53 pve1 systemd[1]: Stopped gpg-agent.socket - GnuPG cryptographic agent and passphrase cache.
Sep 09 15:01:53 pve1 systemd[1]: Removed slice app.slice - Application Slice.
Sep 09 15:01:53 pve1 systemd[1]: Reached target shutdown.target - Shutdown.
Sep 09 15:01:53 pve1 systemd[1]: Finished system-exit.service - Exit the Session.
Sep 09 15:01:53 pve1 systemd[1]: Reached target getty.target - Getty Session.
Sep 09 15:01:53 pve1 (sd-pam@0002): pam_unix(systemd-user-session): session closed for user root
Sep 09 15:01:53 pve1 (sd-pam@0002): user@0.service: Deactivated successfully.
Sep 09 15:01:53 pve1 systemd[1]: Stopped user@0.service - User Manager for UID 0.
Sep 09 15:01:53 pve1 systemd[1]: Stopping user-runtime-dir@0.service - User Runtime Directory /run/user/0...
Sep 09 15:01:53 pve1 systemd[1]: run-user 0 mount deactivated successfully.
Sep 09 15:01:53 pve1 systemd[1]: Stopped user-runtime-dir@0.service - User Runtime Directory /run/user/0...
Sep 09 15:01:53 pve1 systemd[1]: Removed slice user@0.slice - User Slice of UID 0.
Sep 09 15:03:42 pve1 pvedaemon[113]: <root@pam> successful auth for user 'root@pam'
Sep 09 15:16:12 pve1 kernel: [drm] interrupt took 5761022 ns
Sep 09 15:17:39 pve1 CRON[929]: cron_untrap(cron.session): session opened for user root(uid=0) by root(uid=0)
Sep 09 15:17:40 pve1 CRON[929]: (root crond) CMD (cd / & run-parts --report /etc/cron.hourly)
Sep 09 15:17:40 pve1 CRON[929]: (root crond) _cron_untrap(cron.session): session closed for user root
Sep 09 15:18:41 pve1 pvedaemon[113]: <root@pam> successful auth for user 'root@pam'

```

The 'System Log' section at the bottom displays a log entry:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' >

In the System Log, you can view your server's logs to check for any issues.

Updates

Package	Version current	Version new	Description
base-files	13.8	13.8+deb1...	Debian base system miscellaneous files
ethtool	1.6.14.1-1	1.6.14.2-1	display or change Ethernet device settings
init	1.68	1.69~deb1...	metapackage ensuring an init system is installed
init-system-helpers	1.68	1.69~deb1...	helper tools for all init systems
libblas3	3.12.1-4	3.12.1-6	Basic Linear Algebra Reference implementations, shared library
libc-bin	2.41-11	2.41-12	GNU C Library: Binaries
libc10n	2.41-11	2.41-12	GNU C Library: localization files
libc6	2.41-11	2.41-12	GNU C Library: Shared libraries
libglib2.0-064	2.84.3-1	2.84.4.3-...	Glib library of C routines
libidn2	2.2.11.0+s...	2.2.11.0+e...	LDAP-like embedded database - shared library
libnss-systemd	257.7-1	257.8-1-...	nss module providing dynamic user and group name resolution
libopeniscsiusr	2.1.11-1	2.1.11+1...	iSCSI userspace library
libpam-systemd	257.7-1	257.8-1-de...	system and service manager - PAM module
libpcre2-16-0	10.45-1	10.46-1-0...	New Perl Compatible Regular Expression Library - 16 bit runtime files
libpcre2-8-0	10.45-1	10.46-1-0...	New Perl Compatible Regular Expression Library - 8 bit runtime files
libpcre2-posix3	10.45-1	10.46-1-0...	New Perl Compatible Regular Expression Library - posix-compatible runtime files
libsmbclient0	2.4.22.3+df...	2.4.22.4+df...	shared library for communication with SMB/CIFS servers
libsystemd-shared	257.7-1	257.8-1-de...	systemd shared private library
libsystemd0	257.7-1	257.8-1-de...	systemd utility library
libtalloc2	2.2.4.3+sa...	2.2.4.3+sa...	hierarchical pool based memory allocator
libldb1	2.14.13+sa...	2.14.13+sa...	Trivial Database - shared library
libtevent064	2.0.16.2+s...	2.0.16.2+e...	talloc-based event loop library - shared library

Tasks

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:00:04	Sep 09 15:01:43	pve1	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	pve1	root@pam	Update package database	Error: command 'apt-get upd...' →

Here you can check if your server is up to date. If updates are available, click 'Upgrade,' then refresh to confirm that everything is current. It's recommended to reboot the server when everything is updated.

APT Repositories

Enabled	Types	URIs	Suites	Components	Options	Origin	Comment
File: /etc/apt/sources.list.d/ceph.sources (1 repository)	deb	https://enterprise.proxmox.com/debian/ceph-squid	trixie	enterprise	Signed-By... X Proxmox	Enabled: f...	
File: /etc/apt/sources.list.d/debian.sources (2 repositories)	deb	http://deb.debian.org/debian/	trixie trixie-updates	main contrib non-free-f...	Signed-By... O Debian		
	deb	http://security.debian.org/debian-security/	trixie-security	main contrib non-free-f...	Signed-By... O Debian		
File: /etc/apt/sources.list.d/pve-enterprise.sources (1 repository)	deb	https://enterprise.proxmox.com/debian/pve	trixie	pve-enterprise	Signed-By... X Proxmox		

Tasks

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...' →
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:49	Sep 09 15:24:50	pve1	root@pam	Update package database	Error: command 'apt-get upd...' →

Under Updates, you can find Repositories. Here, you can view enabled repositories and add new ones.

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar shows a tree view of the Datacenter, with 'pve1' selected. The main panel shows the 'Firewall' configuration for node 'pve1'. The table at the bottom displays a log of system tasks:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Proxmox also includes an integrated firewall system, where you can add or remove firewall rules.

The screenshot shows the Proxmox VE 9.0.3 interface. The left sidebar shows a tree view of the Datacenter, with 'pve1' selected. The main panel shows the 'Disk' configuration for node 'pve1'. The table at the bottom displays a log of system tasks:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Here you can see all physical disks, their partitions, and their sizes.

Node 'pve1'

Name	Number of LVs	Assigned to LVs	Size	Free
pve	3	100%	33.82 GB	8.39 MB
/dev/sda3	1	100%	33.82 GB	8.39 MB

Tasks Cluster log

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Here you can view the LVM (Logical Volume Manager) partitions.

Node 'pve1'

Name	Volume Group	Usage	Size	Used	Metadata Usage	Metadata Size	Metadata Used
data	pve	0%	13.75 GB	0 B	2%	1.07 GB	16.97 MB

Tasks Cluster log

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

In the LVM-Thin section, you can see the actual free space available in the LVM.

Here you can see the directory-based storage available on the server.

There is also a section for ZFS, where you can view and manage ZFS storage pools.

The screenshot shows the Proxmox VE 9.0.3 interface. On the left, the navigation tree is expanded to show the Datacenter node 'pve1'. The 'Task History' section is selected. Below it, the 'Cluster log' section is also visible.

Task History:

Start Time	End Time	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	root@pam	Shell	OK
Sep 09 15:23:33	Sep 09 15:23:35	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:00:04	Sep 09 15:01:43	root@pam	Shell	OK
Sep 09 14:30:36	Sep 09 14:30:36	root@pam	Bulk start VMs and Containers	OK
Sep 09 14:30:30	Sep 09 14:30:33	root@pam	Update package database	Error: command 'apt-get upd...

Cluster log:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

This section shows a history of everything that has been done on the server while it was running. It displays the same information you can see at the bottom of the interface.

The screenshot shows the Proxmox VE 9.0.3 interface. The navigation tree is expanded to show the Datacenter node 'pve1'. The 'Search' section is selected. Below it, the 'Cluster log' section is visible.

Task History:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Cluster log:

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Under PVE1, you can see more options. Currently, there isn't much activity, but you can view the server's local storage.

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

In the Summary tab, you can see how much storage is being used by the node.

Name	Date	Format	Size
local-lvm (pve1)			

Start Time	End Time	Node	User name	Description	Status
Sep 09 15:28:11	Sep 09 15:28:13	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:28:04	Sep 09 15:28:04	pve1	root@pam	Bulk start VMs and Containers	OK
Sep 09 15:27:21	Sep 09 15:27:21	pve1	root@pam	Bulk shutdown VMs and Containers	OK
Sep 09 15:24:19	Sep 09 15:24:20	pve1	root@pam	Update package database	Error: command 'apt-get upd...
Sep 09 15:24:07	Sep 09 15:24:09	pve1	root@pam	Update package database	Error: command 'apt-get upd...

Here you can see how much storage each VM is using on that specific node.

The screenshot shows the Proxmox VE interface. In the top navigation bar, there are links for Documentation, Create VM, Create CT, Help, and a user session (root@pam). The main area displays a storage configuration for node 'pve1'. On the left, the 'Server View' sidebar shows a tree structure with 'Datacenter' expanded, containing 'pve1' which has 'localnetwork (pve1)', 'local (pve1)', and 'local-lvm (pve1)'. The central pane shows 'Storage Local-lvm' on node 'pve1' with tabs for Summary, VM Disks, CT Volumes (which is selected), and Permissions. A search bar at the top right allows filtering by Name, Format, Date, and Size. Below this, a table titled 'Tasks' lists recent operations: 'Sep 09 15:28:11 Sep 09 15:28:13 pve1 root@pam Update package database', 'Sep 09 15:28:04 Sep 09 15:28:04 pve1 root@pam Bulk start VMs and Containers', 'Sep 09 15:27:21 Sep 09 15:27:21 pve1 root@pam Bulk shutdown VMs and Containers', 'Sep 09 15:24:19 Sep 09 15:24:20 pve1 root@pam Update package database', and 'Sep 09 15:24:07 Sep 09 15:24:09 pve1 root@pam Update package database'. The status column indicates some errors ('Error: command') and successes ('OK').

Here you can see how much storage each container is using on that specific node.



These two buttons in the top-right corner are used to create a VM or a container.

VMs and Containers:

What is a vm?

A **Virtual Machine (VM)** is a fully isolated environment that emulates a complete computer. It runs its own operating system (Windows, Linux, etc.) and requires dedicated CPU, RAM, and storage. VMs are mainly used for heavy workloads, testing, or running different operating systems.

What is a container?

A **Container** is a lightweight virtualization method that shares the host's kernel. It is faster and uses fewer resources than a VM. Containers usually run Linux applications or services, and they are mainly used for web servers, small applications, and microservices.

Vm vs container:

- A VM is **heavier, more secure**, and can run **any OS**.
- if a VM is idle the resources allocated to that vm can't be used elsewhere.
- VMs support live migration and HA

- A Container is **lighter, faster**, but usually limited to **Linux-based systems**.
- if a container is idle or is not using all of the allocated resources, they can be used elsewhere until the container needs them again.
- Containers don't support live migration and HA

Use a VM when you need **full isolation** or want to run **Windows**.

Use a Container when you want **efficiency, speed**, and have **limited hardware**.

How to make a vm in proxmox?

Step1: download an iso image of the os u want to use

1. Get the download URL of the OS you want (e.g., Ubuntu Server).

The screenshot shows the Canonical Ubuntu website. In the center, there's a large button for "Ubuntu Server 24.04.3 LTS". Below it, a message says "Your download should start in the background. If it doesn't, [download now](#). You can [verify your download](#), or get [help on installing](#)." To the right, there's a "Ubuntu CLI cheatsheet" with various command examples. At the bottom left, there's a "Ubuntu Pro" logo.

2. In the Proxmox web interface, go to **local (PVE) → ISO Images**.

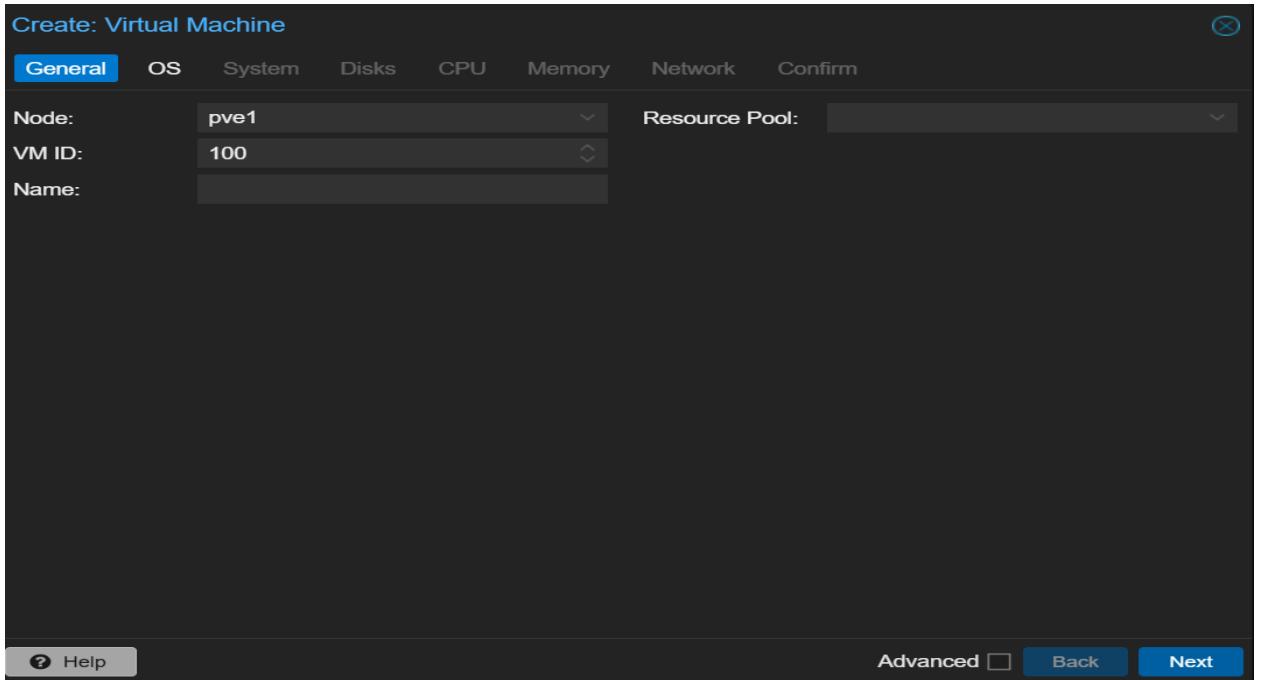
3. Click "**Download from URL**", paste the URL, click **Query URL**, then **Download**.

The screenshot shows the Proxmox VE 9.0.3 web interface. On the left, the navigation tree shows "Datacenter" with "pve1" selected. Under "pve1", "localnetwork (pve1)", "local (pve1)", and "local-lvm (pve1)" are listed. On the right, the main area is titled "Storage 'local' on node 'pve1'". It has tabs for "Summary", "Upload", "Download from URL", and "Remove". The "Download from URL" tab is active. A modal dialog titled "Download from URL" is open, showing the URL "https://releases.ubuntu.com/24.04/ubuntu-24.04.3-live-server-amd64.iso", file size "3.08 GiB", and MIME type "application/x-iso9660-image". There's a "Download" button at the bottom. Below the dialog, a table shows tasks in the "Tasks" tab, including entries like "Sep 09 15:28:11 Sep 09 15:28:13 pve1 root@pam Update package database" and "Sep 09 15:28:04 Sep 09 15:28:04 pve1 root@pam Bulk start VMs and Containers".

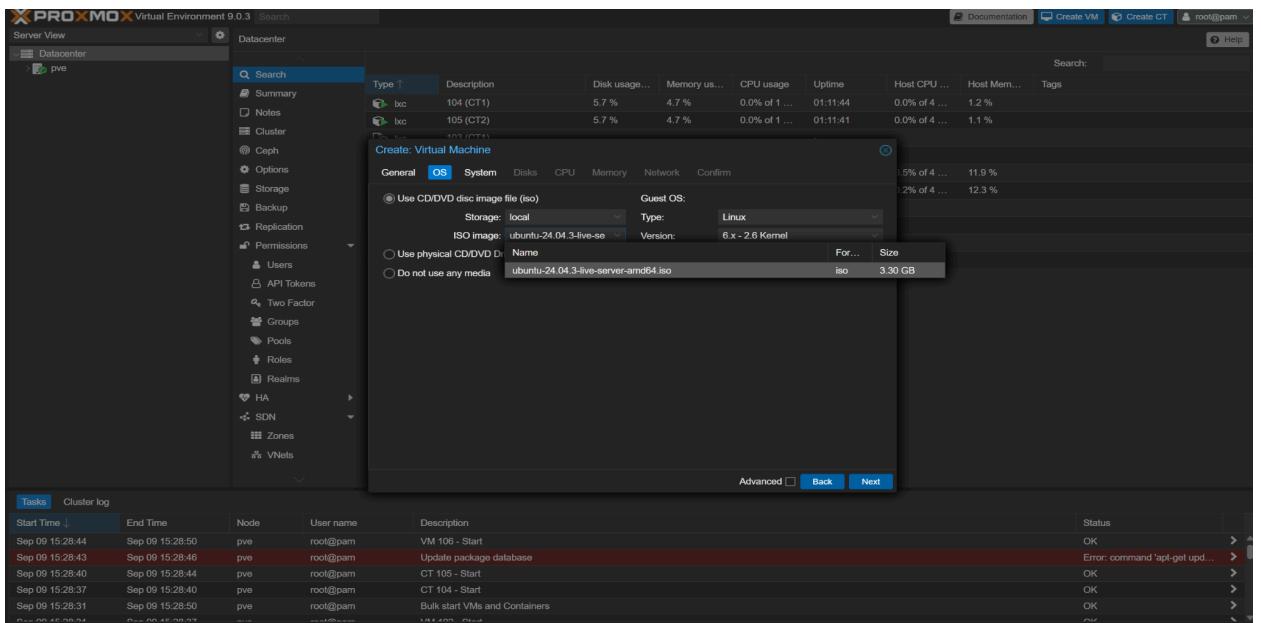
Step2: Create a vm

Click “Create VM” (blue button, top-right) and follow the steps.

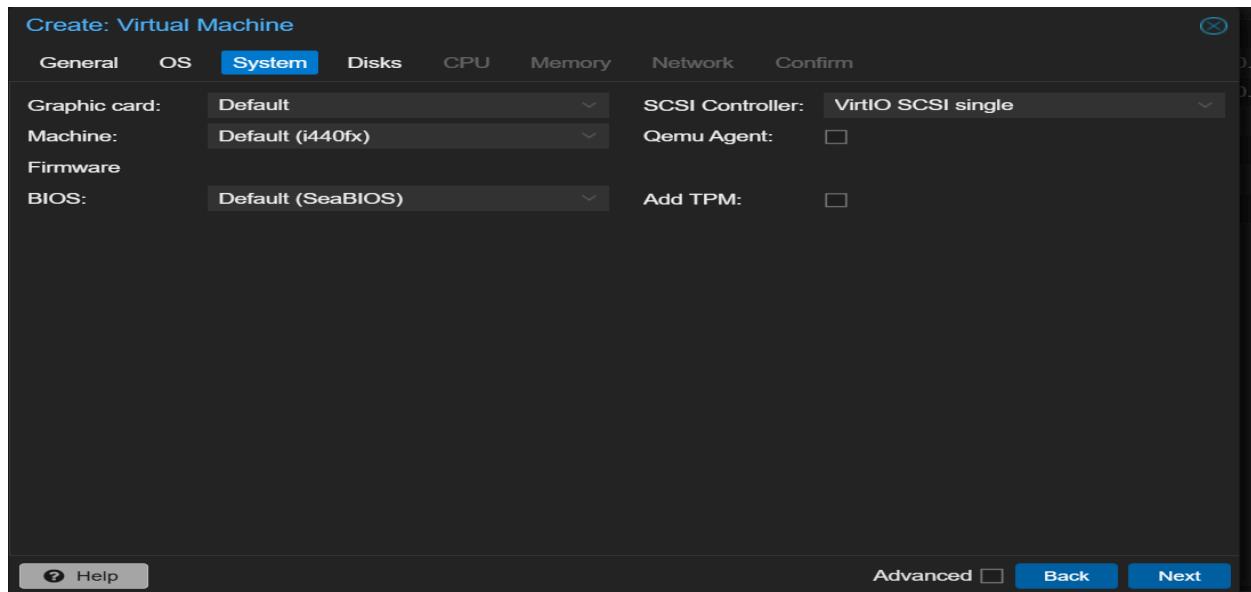
- Change VM ID or name if desired.



- Select the ISO image you downloaded and choose the correct type and version..

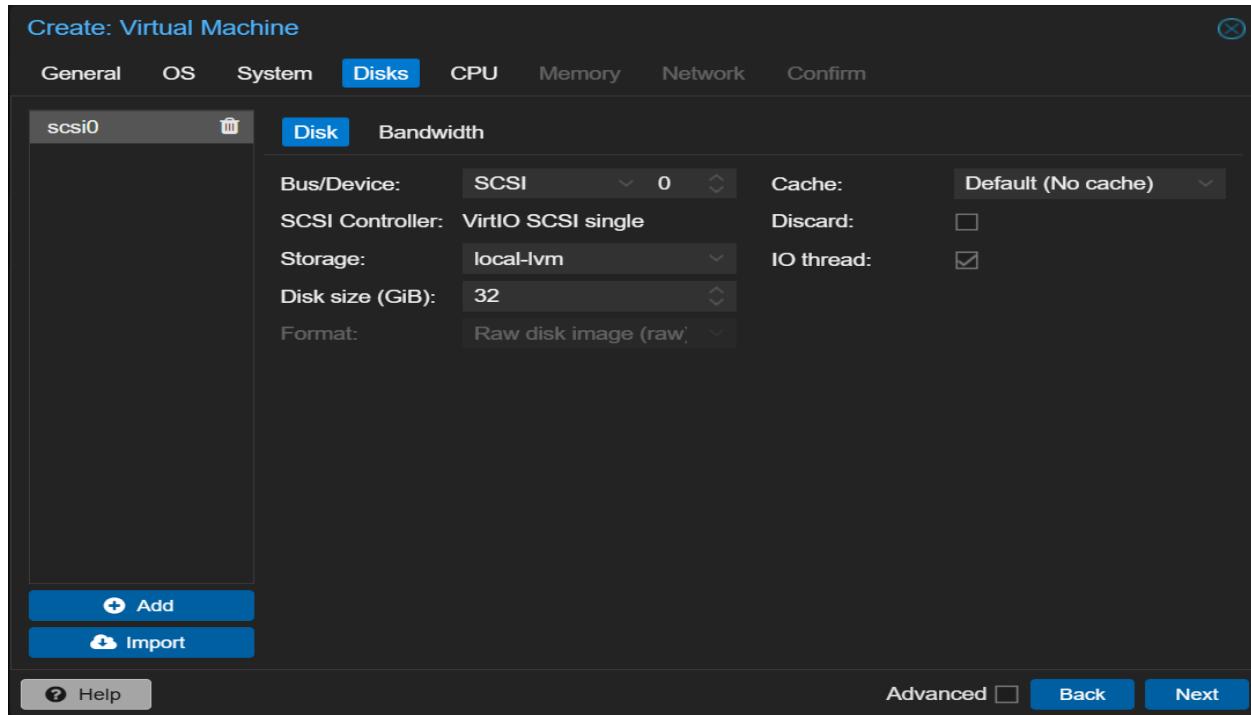


- Here the options can be left as default.

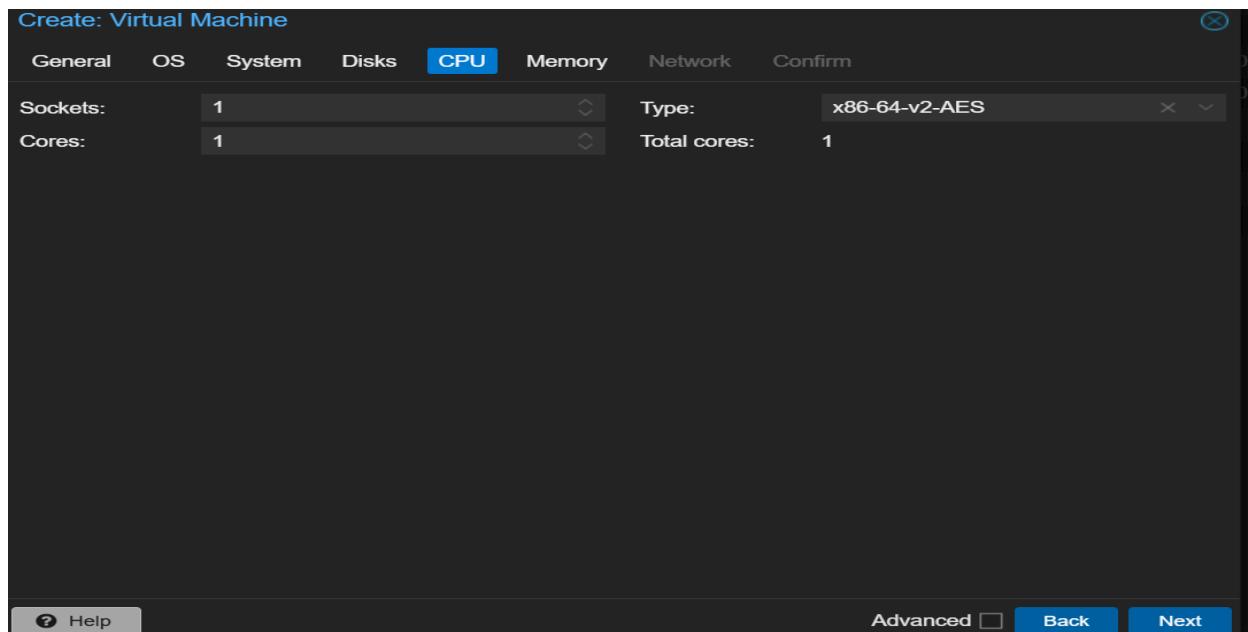


Configure resources:

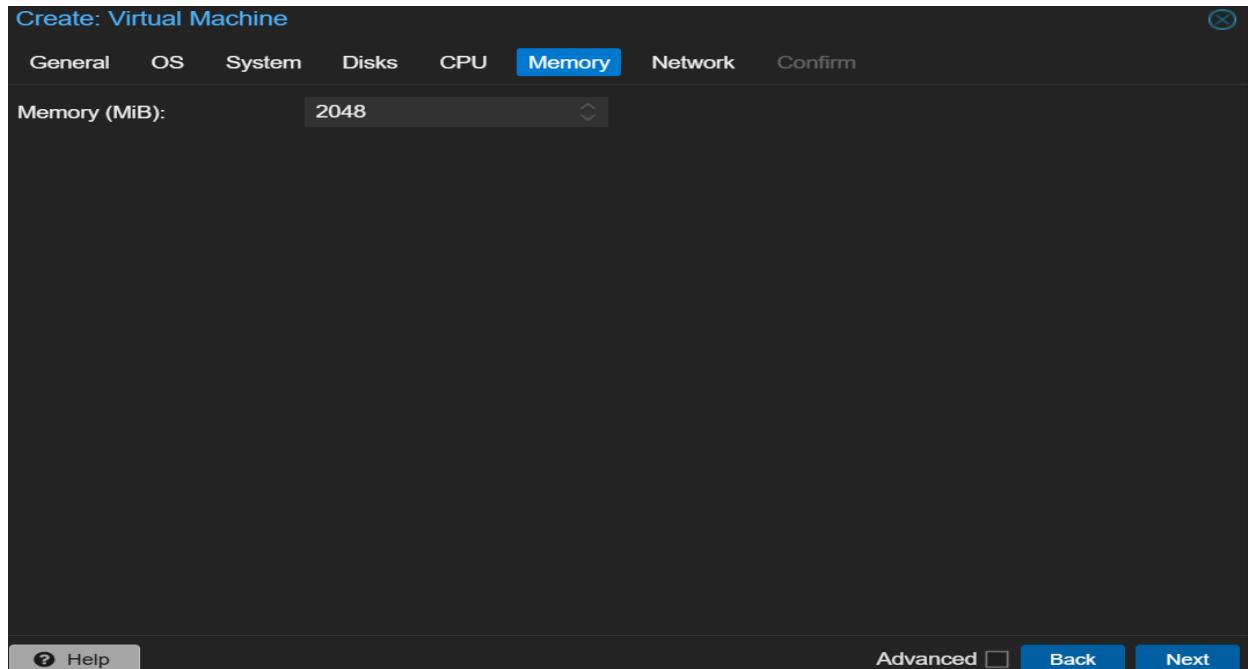
- Storage: Set disk size.



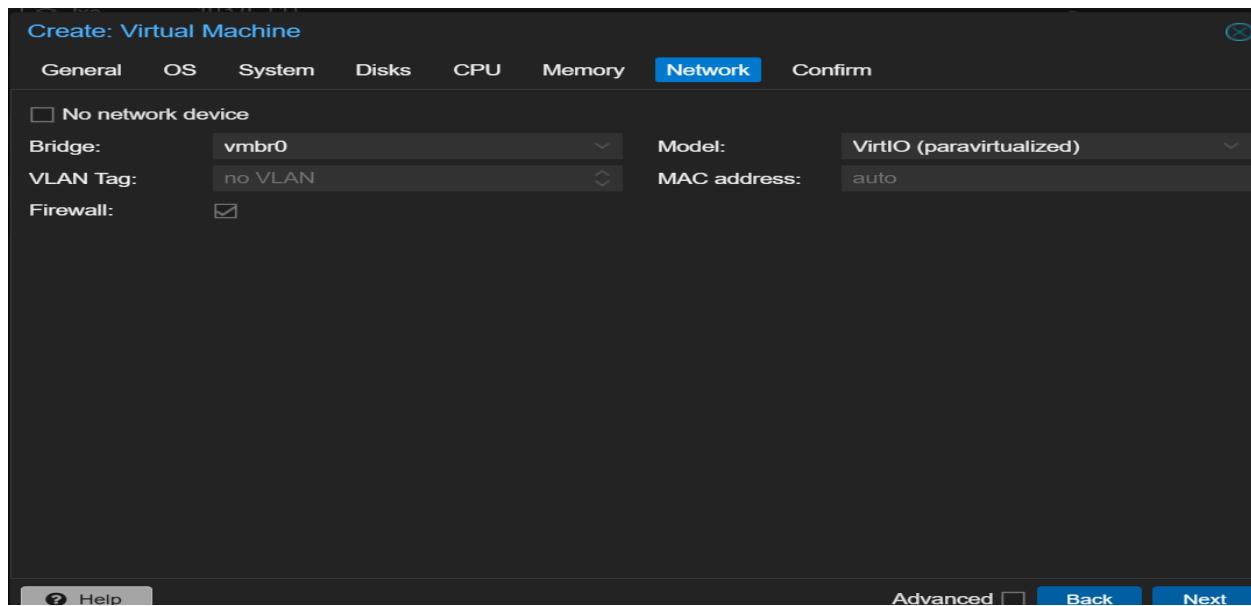
- **CPU:** Select number of cores.



- **RAM:** Set desired memory.



- **Network:** Select NIC; recommended to separate management network from VM network.



Confirmation screen:

- Optionally start the VM immediately after creation.
- Click **Finish**. Your VM appears under **PVE1**.

Key ↑	Value
cores	1
cpu	x86-64-v2-AES
ide2	local:iso/ubuntu-24.04.3-live-server-amd64.iso,media=cdrom
memory	2048
name	Vm01
net0	virtio,bridge=vmbr0,firewall=1
nodename	pve
numa	0
ostype	l26
scsi0	local-lvm:32,discard=on,iothread=on
scsihw	virtio-scsi-single
sockets	1
vmid	101

Start after created

Advanced Back Finish

Interesting options:

Summary	
Console	Name vm2
Hardware	Start at boot Yes
Cloud-Init	Start/Shutdown order order=any
Options	OS Type Linux 6.x - 2.6 Kernel
Task History	Boot Order scsi0, ide2, net0
Monitor	Use tablet for pointer Yes
Backup	Hotplug Disk, Network, USB
Replication	ACPI support Yes
Snapshots	KVM hardware virtualization Yes
Firewall	Freeze CPU at startup No
Permissions	Use local time for RTC Default (Enabled for Windows)
	RTC start date now
	SMBIOS settings (type1) uuid=a34d19f4-afa4-4ec1-8d96-8a1655714648
	QEMU Guest Agent Enabled
	Protection No
	Spice Enhancements none
	VM State storage Automatic
	AMD SEV Default (Disabled)

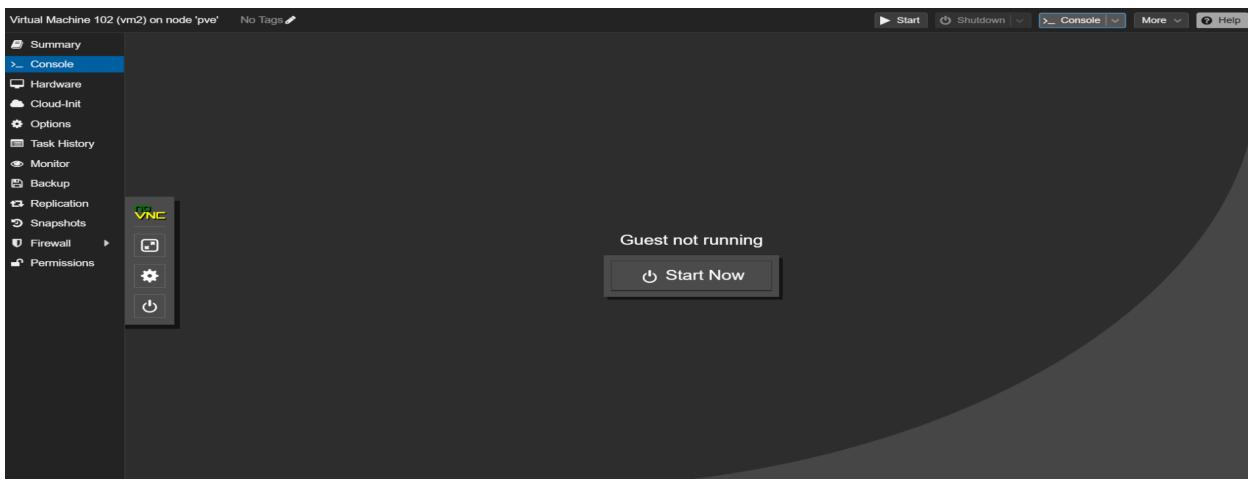
Start on boot: VM starts automatically with host.

Start/shutdown order: Control the sequence of VM startup/shutdown.

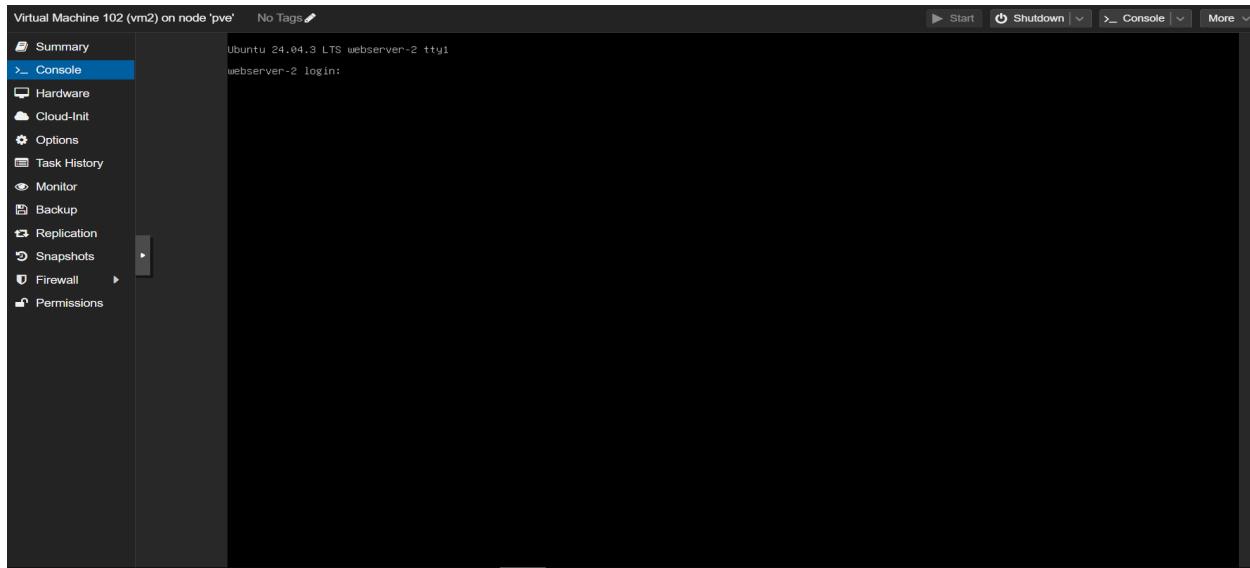
QEMU Guest Agent: Small program inside VM enabling Proxmox to communicate with the guest OS.

Starting the vm:

- Go to the Console tab and click Start.



Post-installation:

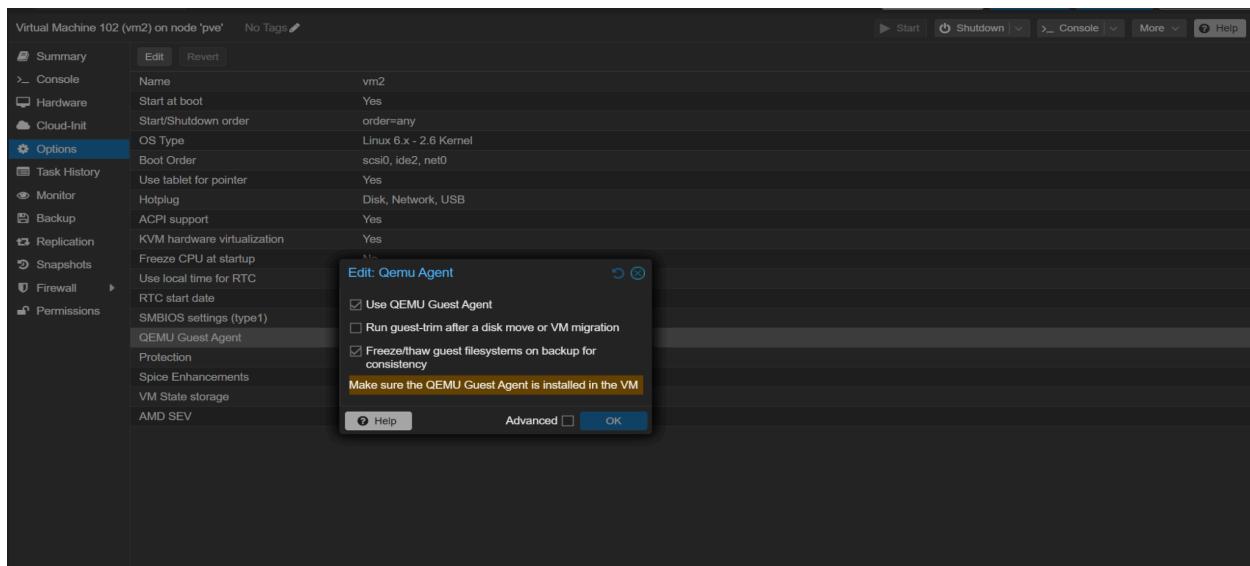


- Update your Linux server.

```
lenovo@webserver-2:~$ sudo apt update && sudo apt dist-upgrade
```

- Install and enable **QEMU Guest Agent** (reboot VM for effect).

```
lenovo@webserver-2:~$ sudo apt install qemu-guest-agent
```



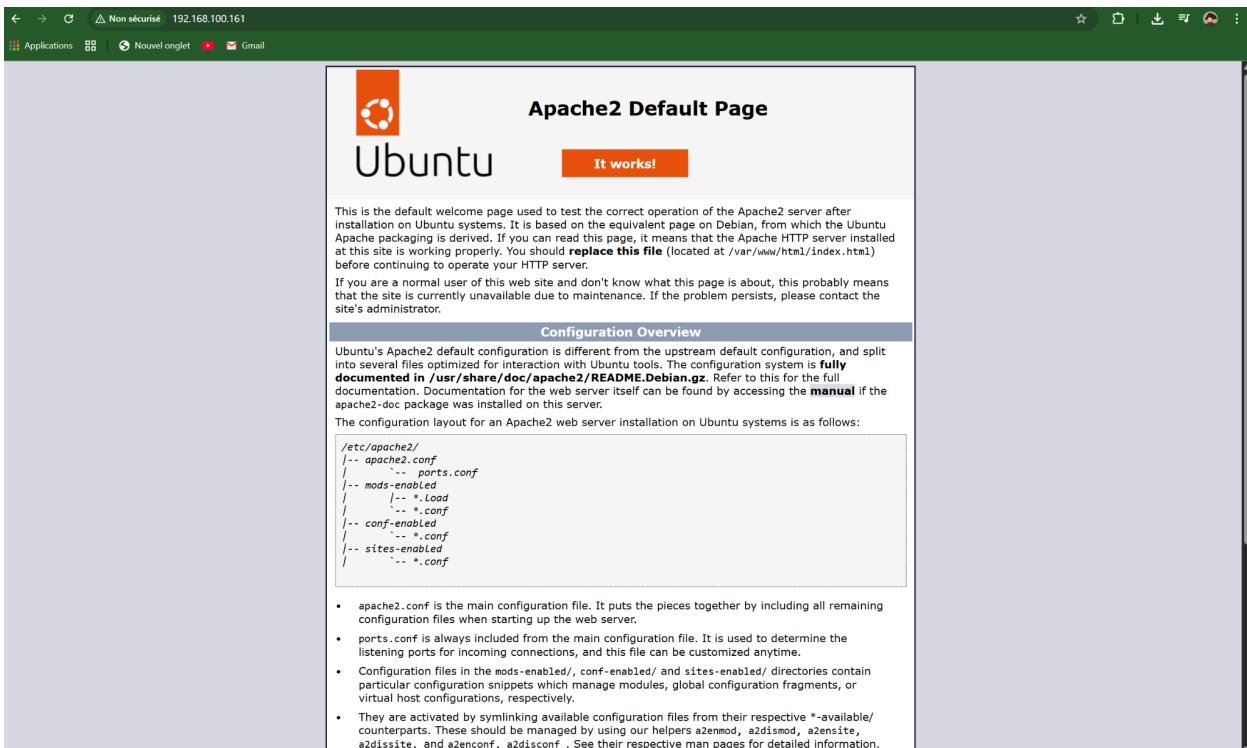
```
lenovo@webserver-2:~$ systemctl status qemu-guest-agent.service
● qemu-guest-agent.service - QEMU Guest Agent
  Loaded: loaded (/usr/lib/systemd/system/qemu-guest-agent.service; static)
  Active: active (running) since Tue 2025-09-09 15:56:19 UTC; 10min ago
    Main PID: 672 (qemu-ga)
      Tasks: 2 (limit: 2268)
     Memory: 1.4M (peak: 1.7M)
        CPU: 753ms
       CGroup: /system.slice/qemu-guest-agent.service
               └─672 /usr/sbin/qemu-ga

Sep 09 15:56:19 webserver-2 systemd[1]: Started qemu-guest-agent.service - QEMU Guest Agent.
```

- Optionally install services like **Apache**.

```
lenovo@webserver-2:~$ sudo apt install apache2
```

- Verify VM is accessible by typing its IP in a web browser.



VM Templates:

What is a template?

- A pre-configured VM or container that can be cloned quickly.
- Saves time when creating multiple similar VMs or containers.

Creating a VM Template:

- Delete SSH host keys and clear the machine-id file.

```
lenovo@webserver-2:~$ cd /etc/ssh  
lenovo@webserver-2:/etc/ssh$ sudo rm ssh_host_*
```

```
lenovo@webserver-2:~$ cat /etc/machine-id  
a34d19f4afa44ec18d968a1655714648
```

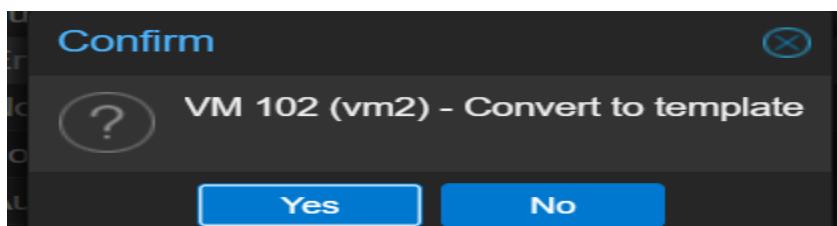
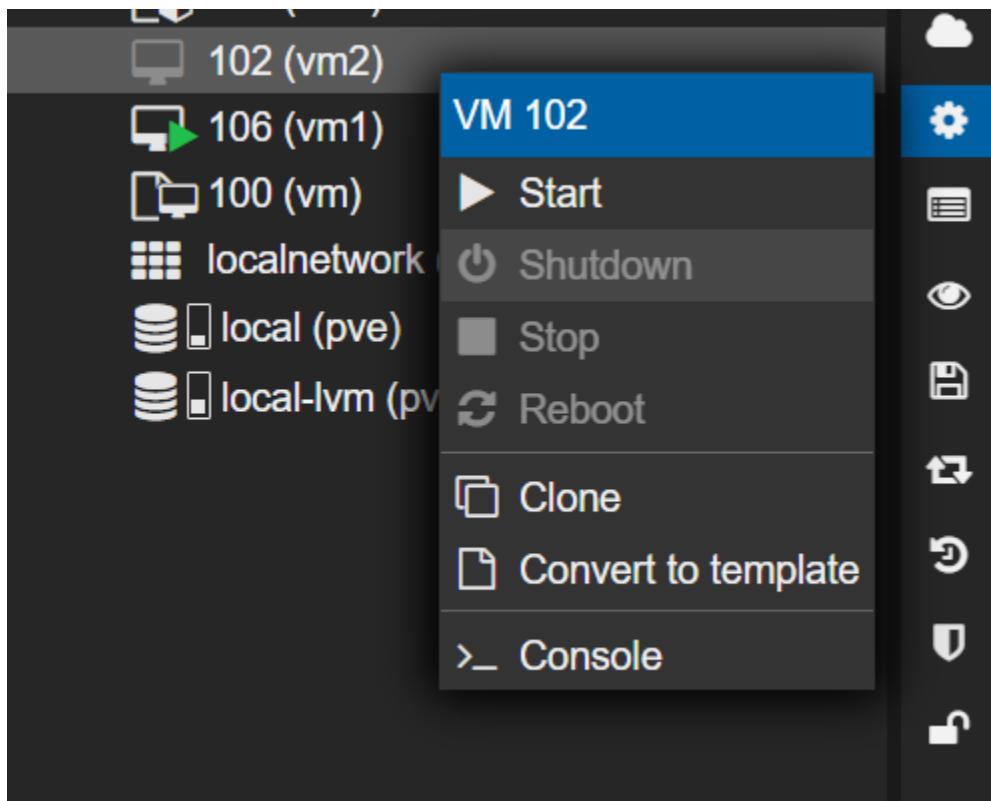
```
lenovo@webserver-2:~$ sudo truncate -s 0 /etc/machine-id
```

- Clean up the VM (removes outdated or orphan packages).

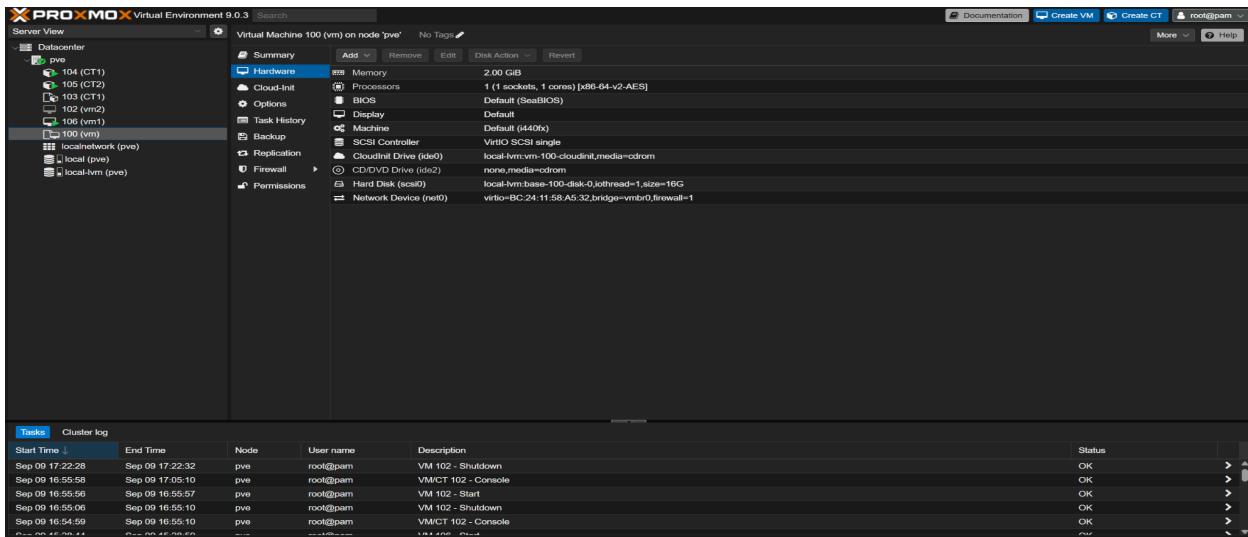
```
lenovo@webserver-2:~$ sudo apt clean
```

```
lenovo@webserver-2:~$ sudo apt autoremove  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
0 upgraded, 0 newly installed, 0 to remove and 4 not upgraded
```

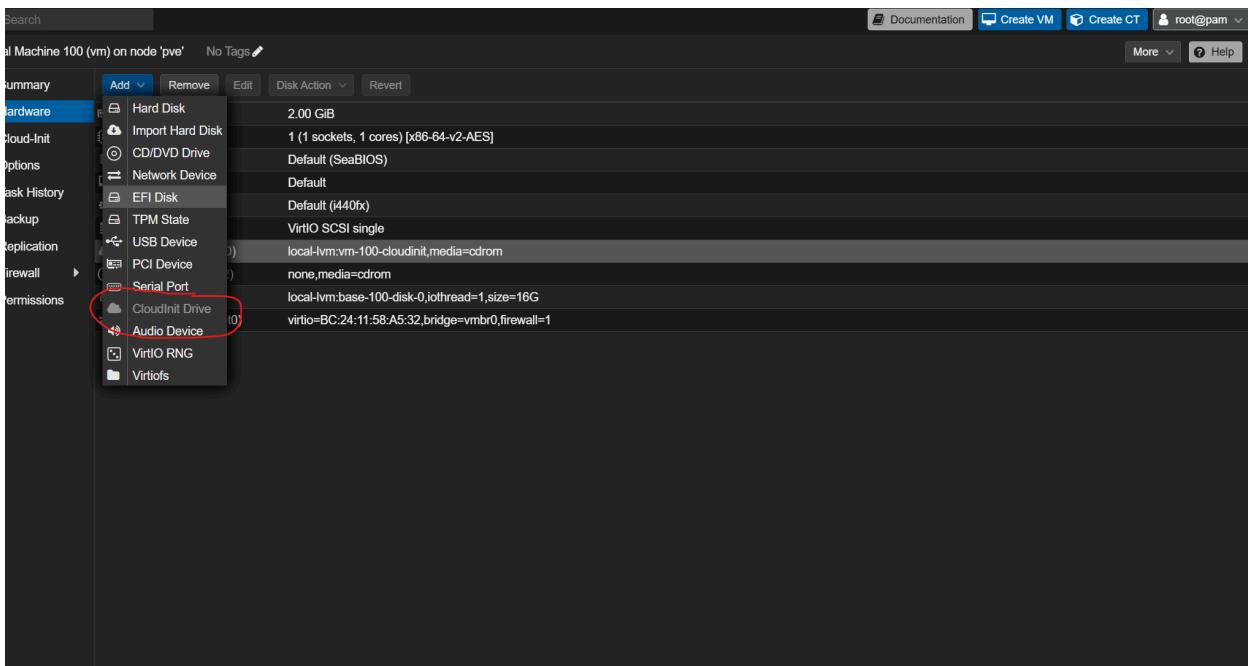
- Turn off the VM → right-click → **Convert to Template** → Confirm.

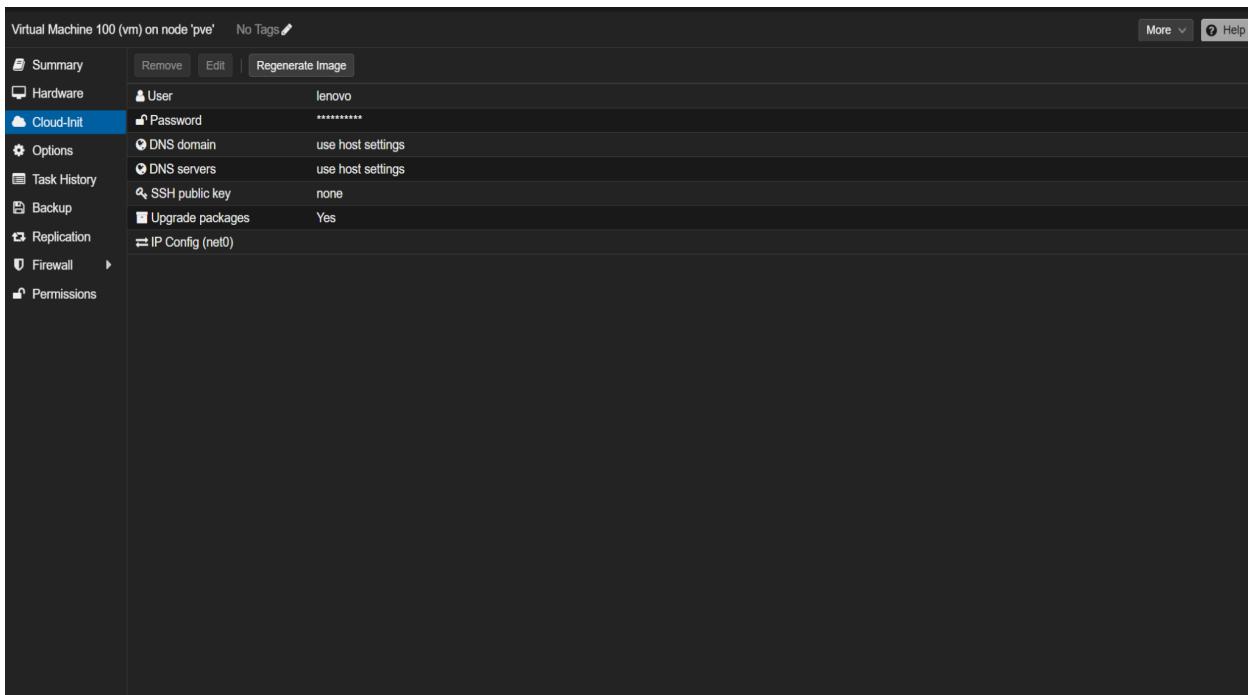


- Adjust settings: remove ISO from virtual disk, add CloudInit drive.



- Configure CloudInit: set default user/password → **Regenerate Image**.





Cloning a Template:

- Right-click template → **Clone** → Full clone → Name → **Clone**.

Clone VM Template 100

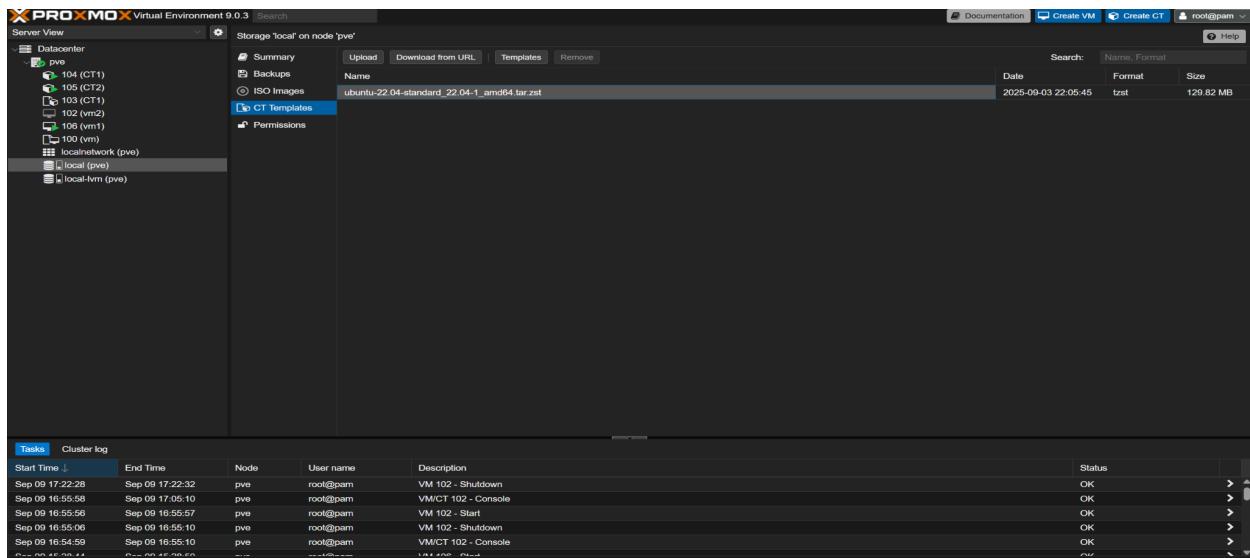
Clone VM Template 100

Target node:	pve	Mode:	Linked Clone
VM ID:	101	Target Storage:	Same as source
Name:		Format:	QEMU image format (qc)
Resource Pool:		Clone	

Help

Containers in Proxmox

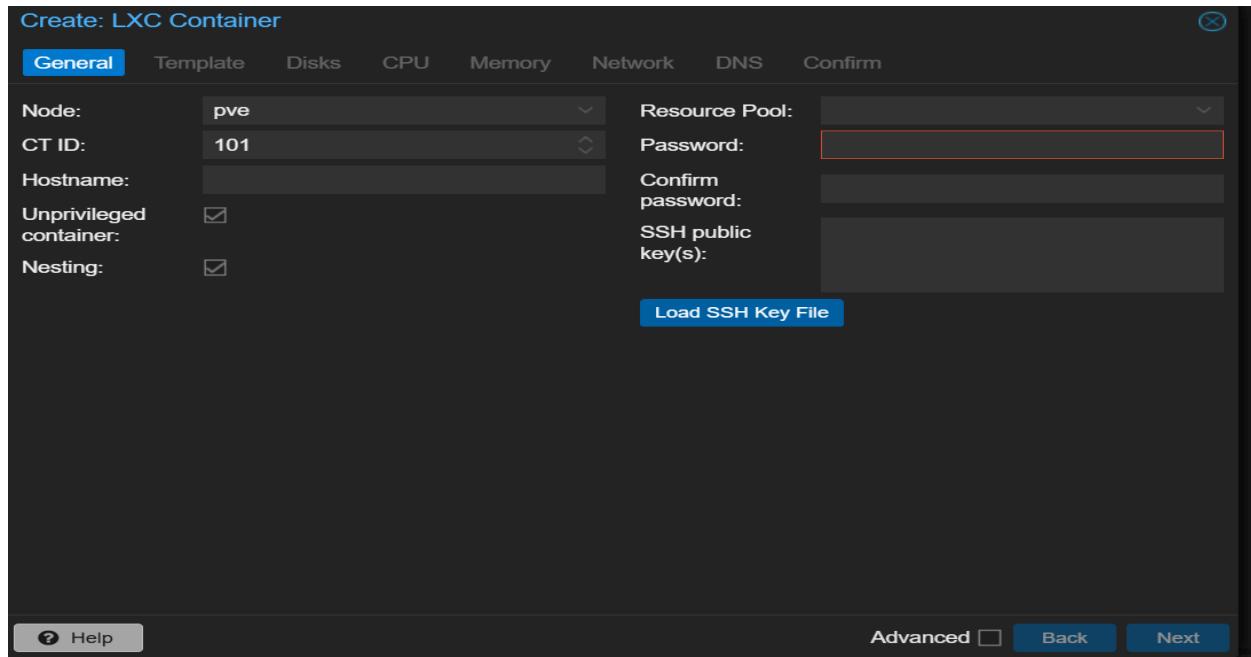
Creating a Container:



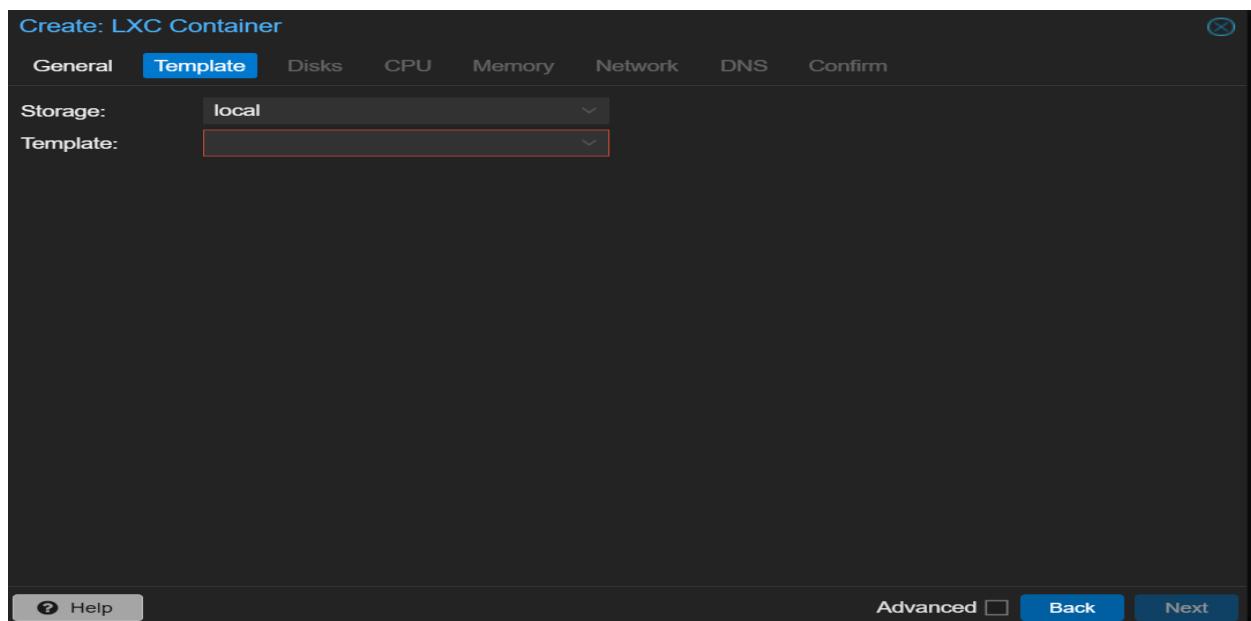
- Download a container template: **Local (PVE) → CT Templates → Templates → Download.**

Type	Package	Version	Description
Section: mail (1 Item)			
lxc	proxmox-mail-gateway-8.2-standard	8.2-1	Proxmox Mail Gateway 8.2
Section: system (14 Items)			
lxc	centos-9-stream-default	20240828	LXC default image for centos 9-stream (20240828)
lxc	alpine-3.22-default	20250617	LXC default image for alpine 3.22 (20250617)
lxc	ubuntu-25.04-standard	25.04-1	Ubuntu 25.04 Plucky (standard)
lxc	debian-12-standard	12.7-1	Debian 12 Bookworm (standard)
lxc	ubuntu-24.04-standard	24.04-2	Ubuntu 24.04 Noble (standard)
lxc	devuan-5.0-standard	5.0	Devuan 5 (standard)
lxc	openeuler-25.03-default	20250507	LXC default image for openeuler 25.03 (20250507)
lxc	opensuse-15.6-default	20240910	LXC default image for opensuse 15.6 (20240910)
lxc	almalinux-9-default	20240911	LXC default image for almalinux 9 (20240911)
lxc	ubuntu-22.04-standard	22.04-1	Ubuntu 22.04 Jammy (standard)
lxc	fedora-42-default	20250428	LXC default image for fedora 42 (20250428)
lxc	gentoo-current-openrc	20250508	LXC openrc image for gentoo current (20250508)
lxc	openeuler-24.03-default	20250507	LXC default image for openeuler 24.03 (20250507)
lxc	rockylinux-9-default	20240912	LXC default image for rockylinux 9 (20240912)
Section: turnkeylinux (111 Items)			

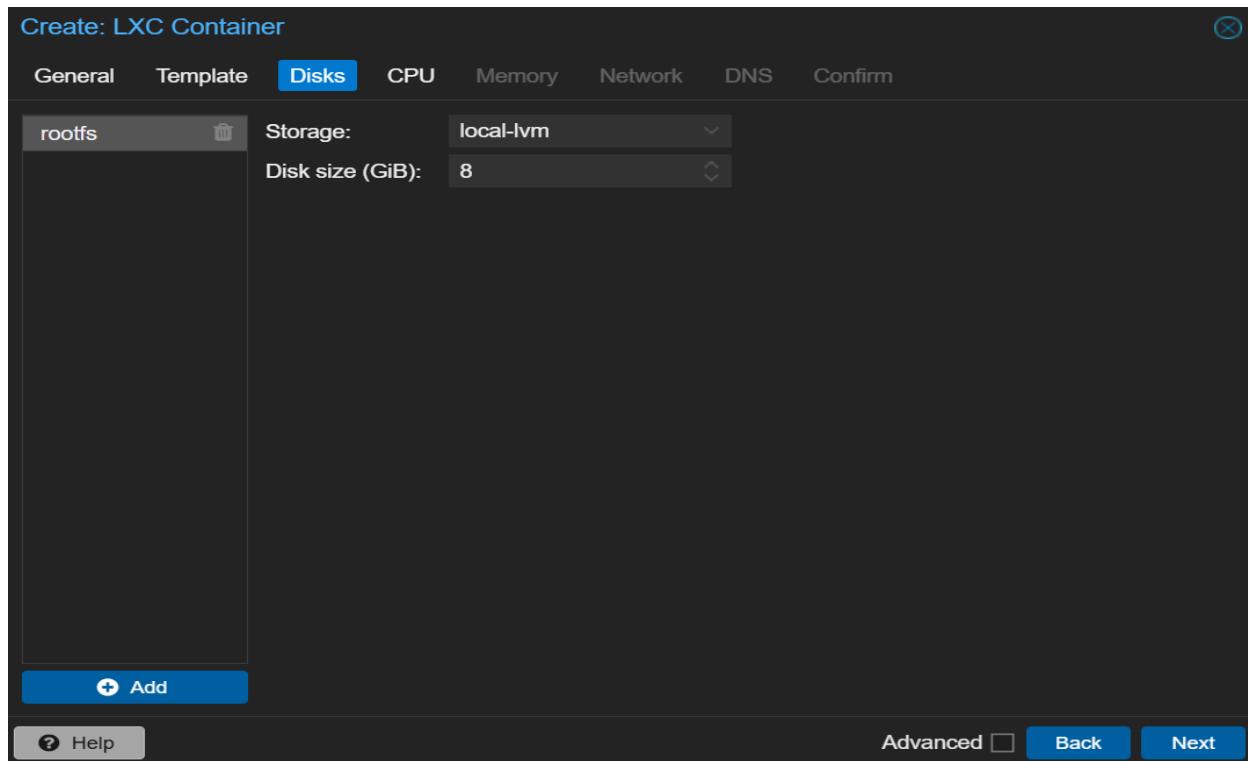
- Click **Create CT** (blue button).
- Set container name, password.



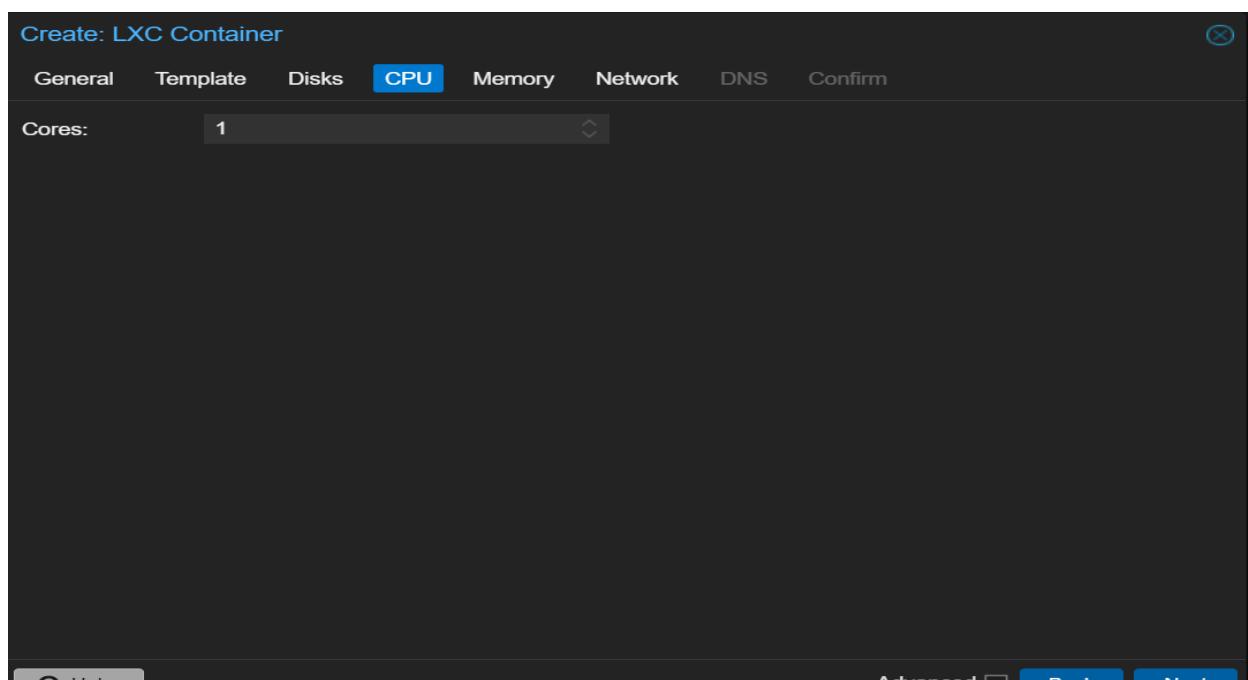
- Select the downloaded template.



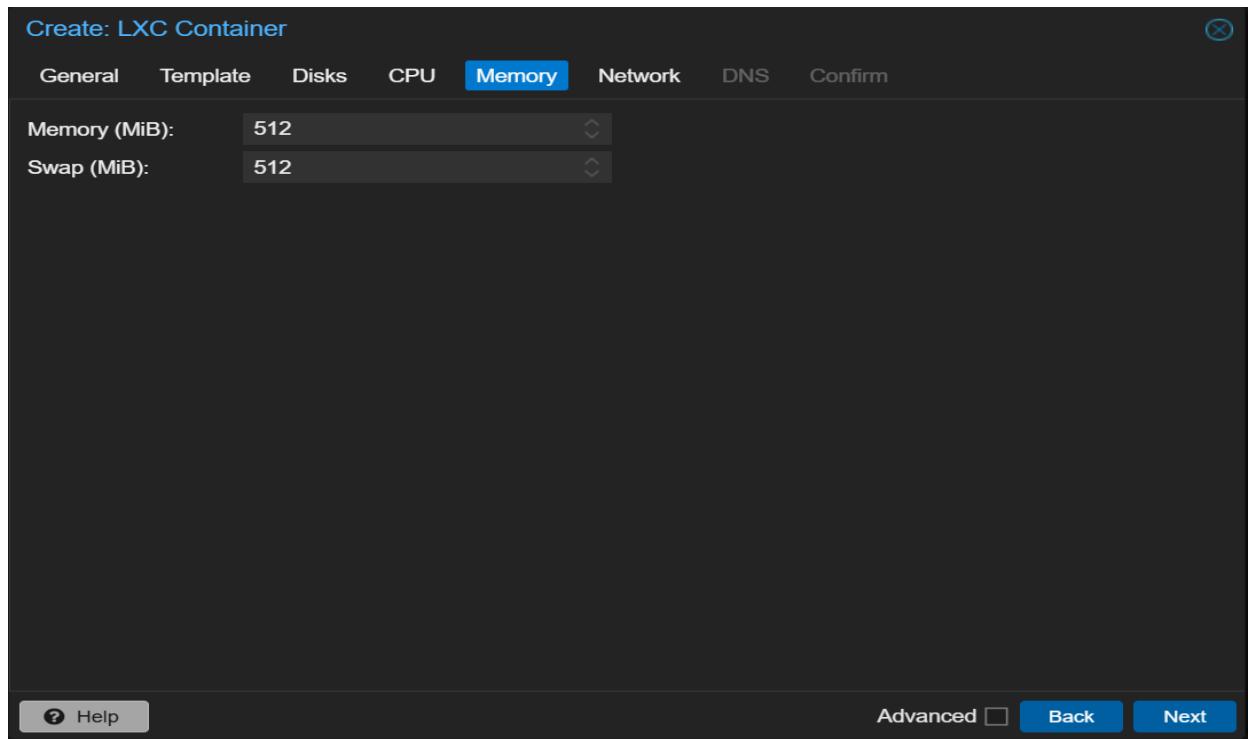
- Set container storage.



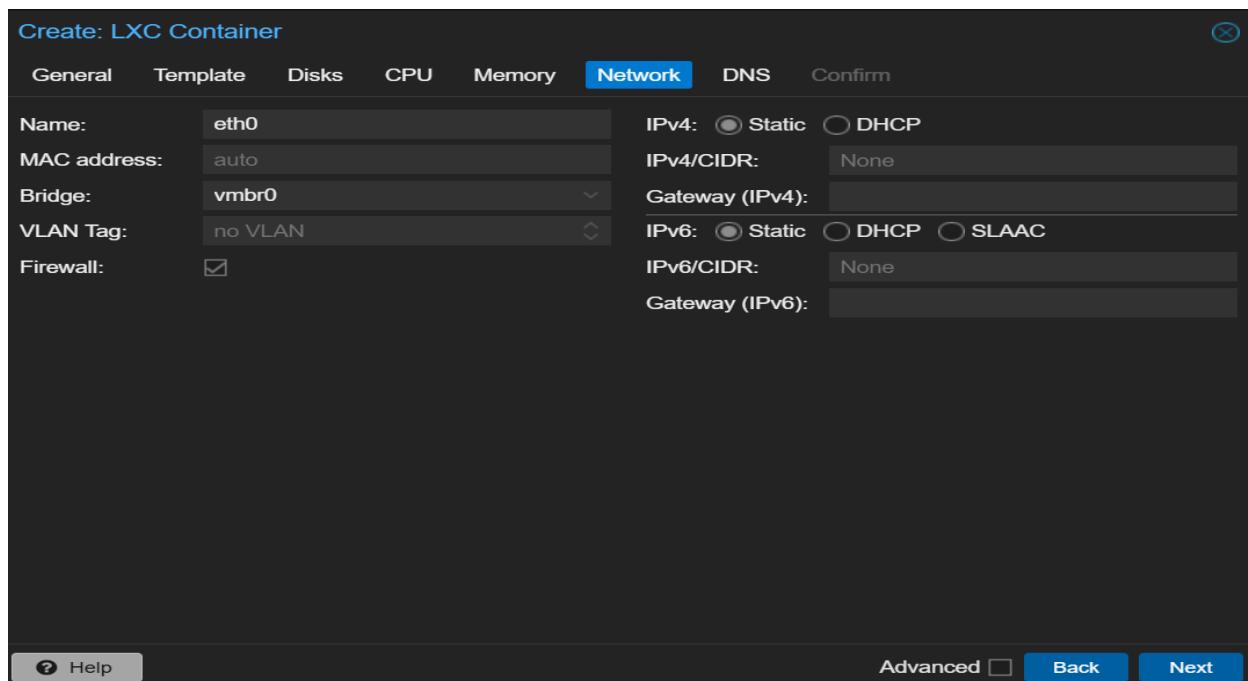
- Set container CPU cores.

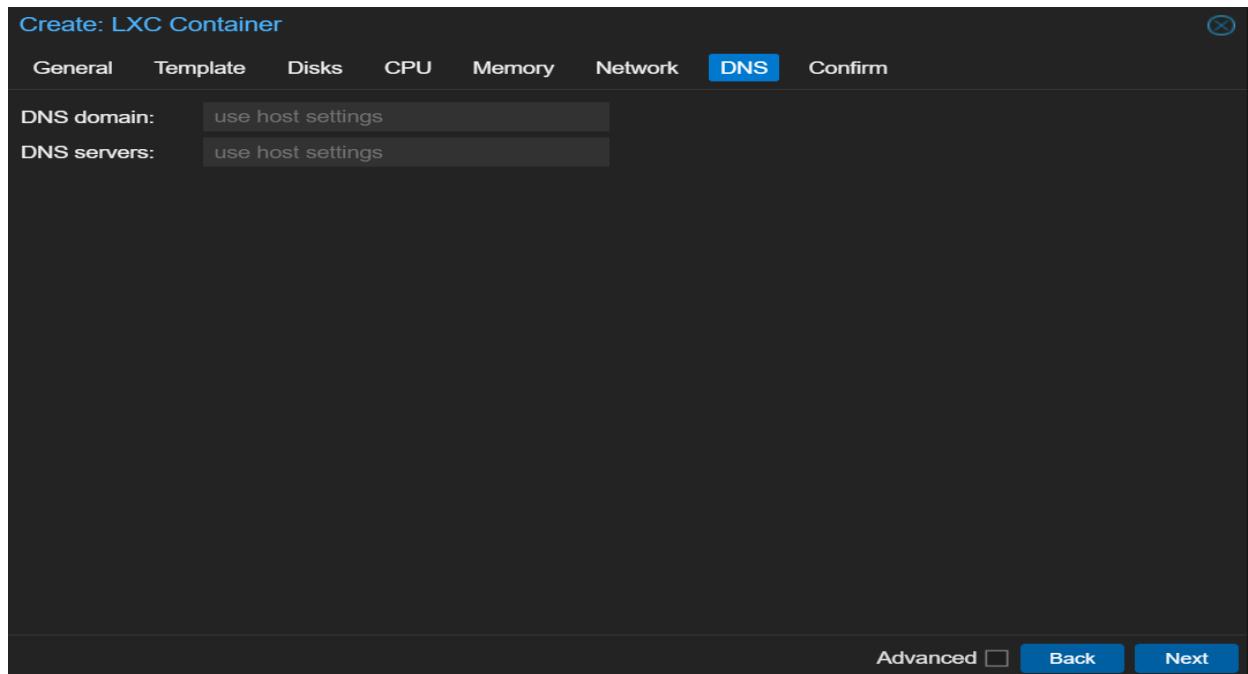


- Set container memory.

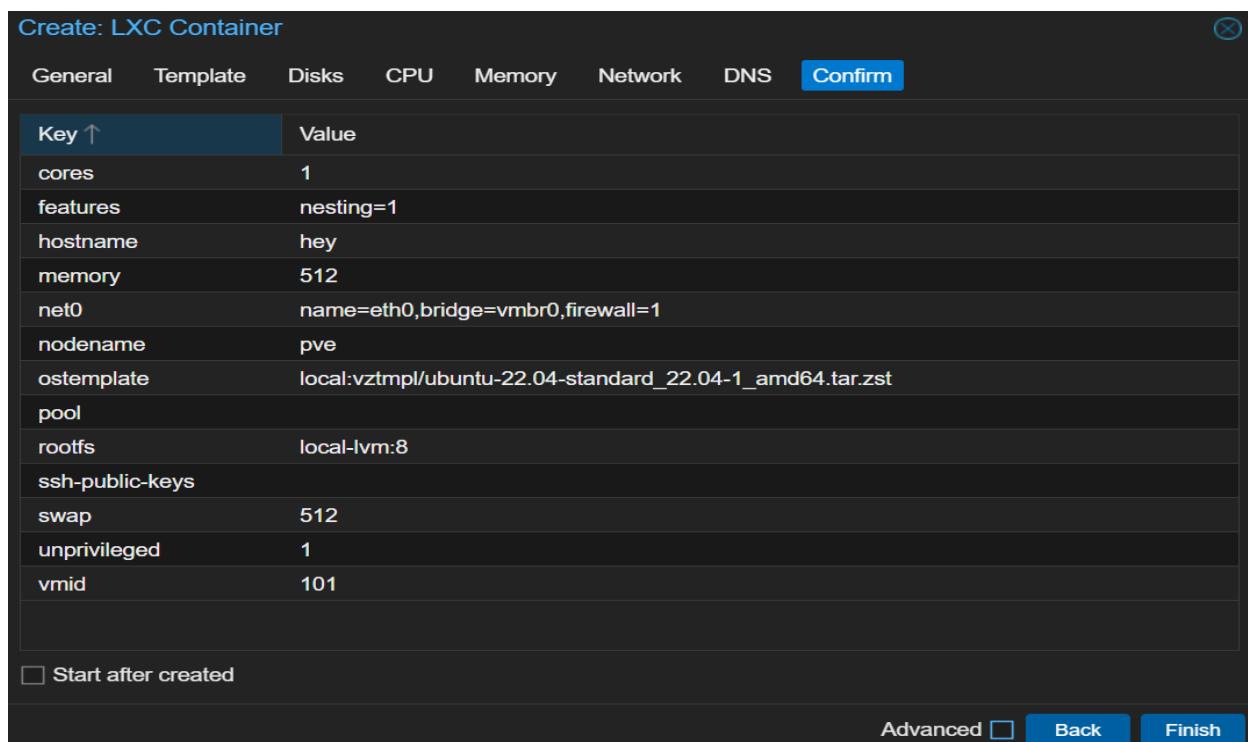


- Configure network and DNS settings.





- Click **Finish**.



Unprivileged vs Privileged Containers:

- **Unprivileged:** Safer; root inside container does not map to host root.
- **Privileged:** Root inside container maps to host root (less secure).

Logging into Container:

- Username: root
- Password: container password

```
CT2 login: root
Password:
Welcome to Ubuntu 22.04.5 LTS (GNU/Linux 6.14.8-2-pve x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro
Last login: Wed Sep  3 21:51:20 UTC 2025 on ttym1
root@CT2:~# █
```

Post-installation:

- Install services (e.g., Apache) and test by accessing the container IP.

```
root@CT2:~# apt install apache2
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
apache2 is already the newest version (2.4.52-1ubuntu4.16).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded
root@CT2:~# █
```



Container Templates

Creating a Container Template:

- Update all packages.

```
lenovo@CT1:~$ sudo apt update && sudo apt dist-upgrade
```

- Clean package manager.

```
lenovo@CT1:~$ sudo apt clean
```

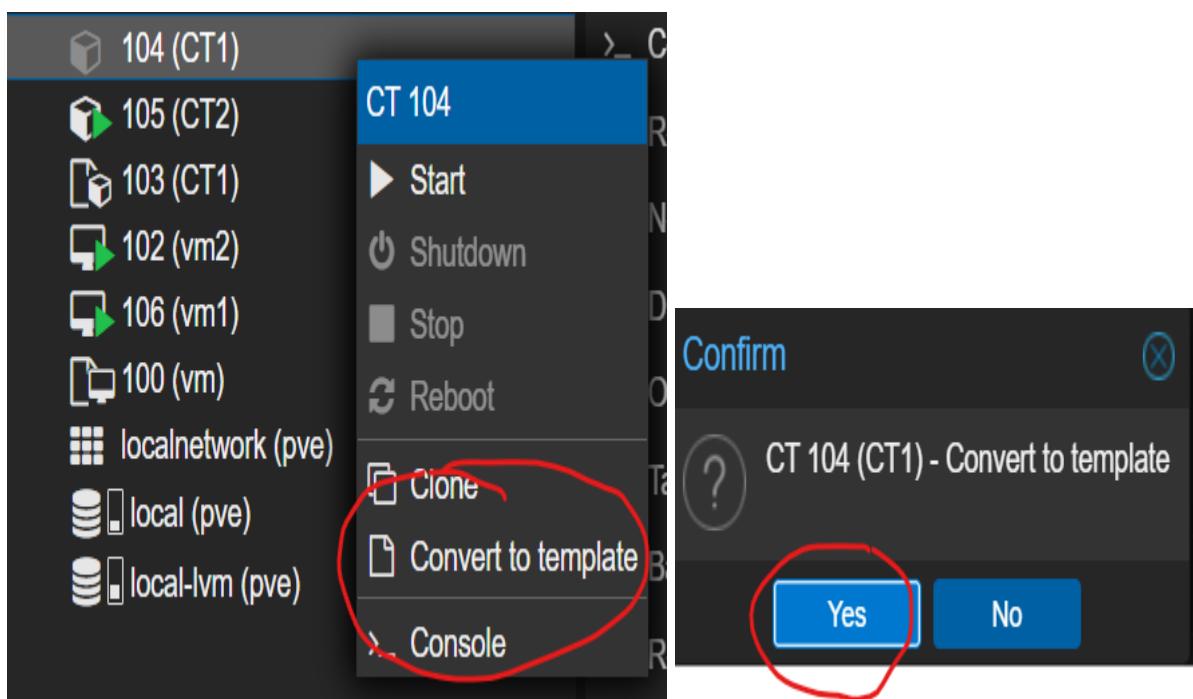
```
lenovo@CT1:~$ sudo apt autoremove
```

- Delete SSH host keys and empty machine-id.

```
lenovo@CT1:~$ cd /etc/ssh  
lenovo@CT1:/etc/ssh$ sudo rm ssh_host_*
```

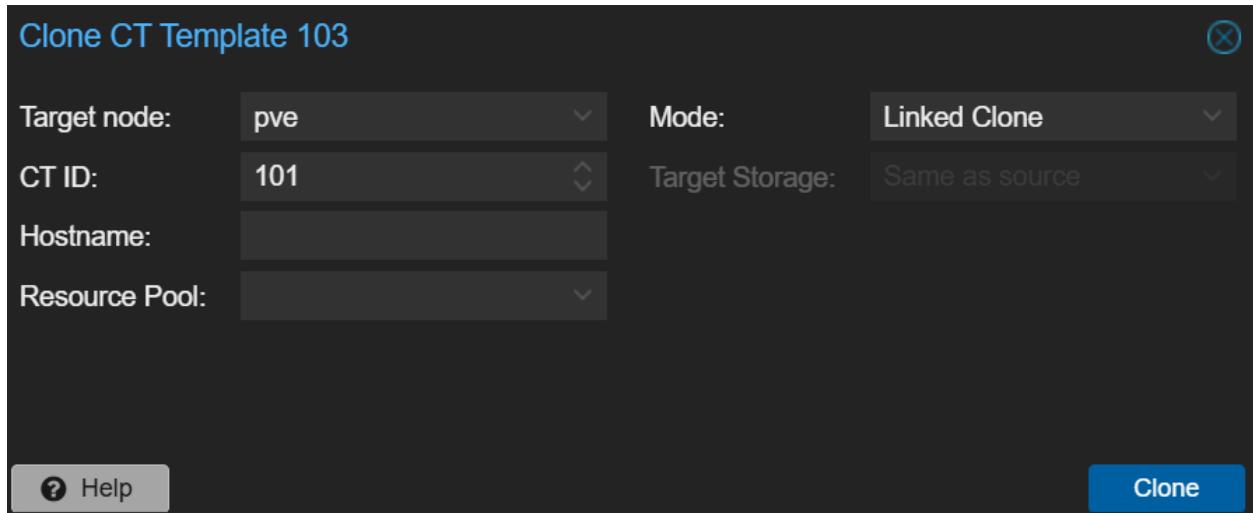
```
lenovo@CT1:/etc/ssh$ cd  
lenovo@CT1:~$ sudo truncate -s 0 /etc/machine-id
```

- Turn off container → **Convert to Template** → Confirm.



Cloning a Container:

- Right-click template → **Clone** → Full clone → Set hostname.



- Reset SSH keys in the new container.

```
lenovo@CT1:~$ cd /etc/ssh  
lenovo@CT1:/etc/ssh$ sudo rm ssh_host_*
```

```
lenovo@CT1:~$ sudo dpkg-reconfigure openssh-server
```

User management:

PAM User (Linux system user):

- Exists on the underlying Debian system where Proxmox is installed.
- Can access the server via SSH and the command line.

How to create a Pam user?

- Datacenter → Users → Add → Select PAM type.

The screenshot shows the Proxmox VE 9.0.3 interface. On the left, the navigation tree is expanded to show the Datacenter section, which includes nodes like pve, 104 (CT1), 105 (CT2), 103 (CT1), 102 (vm2), 106 (vm1), 100 (vm), localnetwork (pve), local (pve), and local-lvm (pve). The main panel displays a table of users. The columns are: User name ↑, Realm ↑, Enabled, Expire, Name, TFA, Groups, and Comment. There are three entries: Younes (realm pve, enabled yes, expire never, no TFA, admins group), lenovo (realm pam, enabled yes, expire never, no TFA, admins group), and root (realm pam, enabled yes, expire never, no TFA, admins group). Below the table, there is a sidebar with links for Search, Summary, Notes, Cluster, Ceph, Options, Storage, Backup, Replication, Permissions, Users, API Tokens, Two Factor, Groups, Pools, Roles, Realms, HA, SDN, Zones, and VNets.

- All the users are displayed here, creating new ones by clicking on "add":

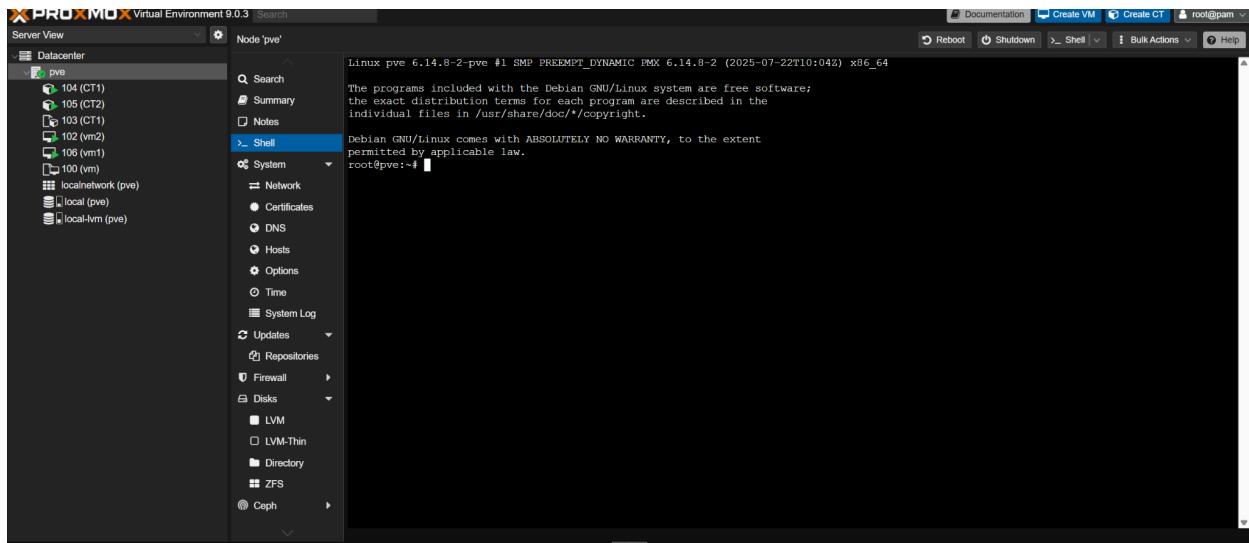
The screenshot shows the same Proxmox VE 9.0.3 interface as above, but with a modal dialog box titled "Add: User" overlaid. The dialog has fields for User name (Younes), Realm (Linux PAM standard auth), First Name (empty), Last Name (empty), Group (empty), E-Mail (empty), Expire (never), Enabled (checked), and Comment (empty). At the bottom right of the dialog are "Advanced" and "Add" buttons.

- Giving a name, group and type to the user.

Note:

Creating a PAM user in the Proxmox web interface does nothing by itself—the user doesn't exist yet. A PAM user must also be created on the Linux host using the terminal. To do this, navigate to the PVE node and open the Shell section.

- Here, you can run the command to create a new PAM user on the Linux host:

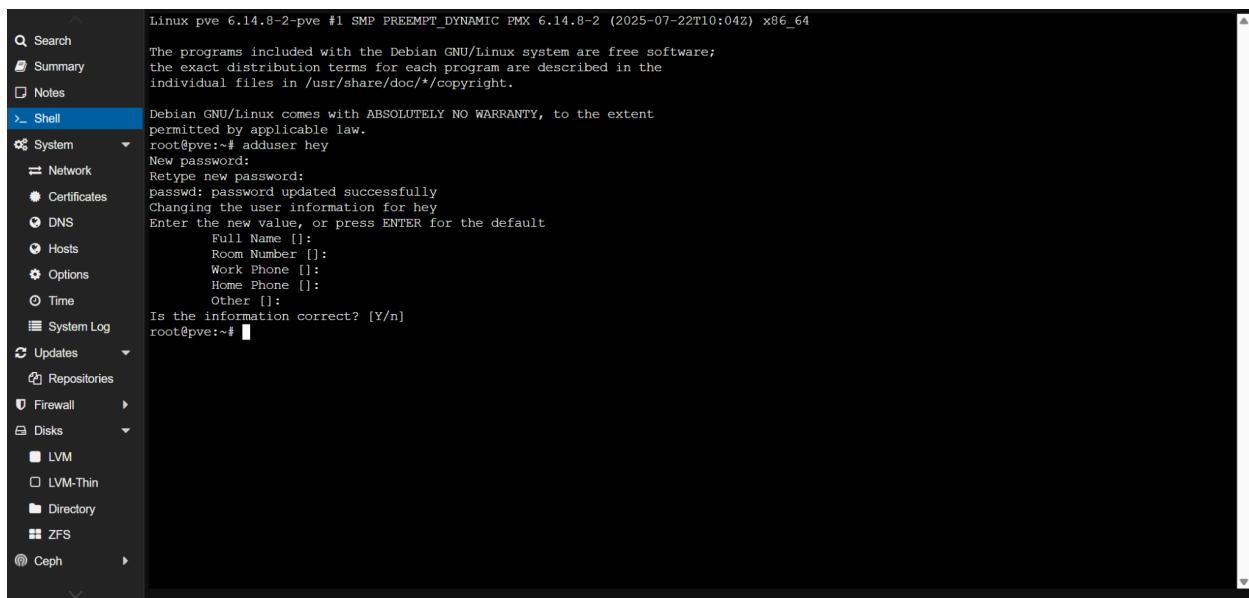


The screenshot shows the Proxmox Web Interface version 9.0.3. The left sidebar lists nodes: pve (104 (CT1), 105 (CT2), 103 (CT1), 102 (vm2), 106 (vm1), 100 (vm)), localnetwork (pve), local (pve), and local-lvm (pve). The right panel is titled "Node 'pve'" and shows the "Shell" section of the Linux host. The terminal window displays the following text:

```
Linux pve 6.14.8-2-pve #1 SMP PREEMPT_DYNAMIC PMX 6.14.8-2 (2025-07-22T10:04Z) 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@pve:~#
```

You can then provide a username, password, and any additional information for the new user.



The screenshot shows the Proxmox Web Interface version 9.0.3. The left sidebar lists nodes: pve (104 (CT1), 105 (CT2), 103 (CT1), 102 (vm2), 106 (vm1), 100 (vm)), localnetwork (pve), local (pve), and local-lvm (pve). The right panel is titled "Node 'pve'" and shows the "Shell" section of the Linux host. The terminal window displays the following text, showing the creation of a new user "hey":

```
Linux pve 6.14.8-2-pve #1 SMP PREEMPT_DYNAMIC PMX 6.14.8-2 (2025-07-22T10:04Z) 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@pve:~# adduser hey
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for hey
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]
root@pve:~#
```

PVE User (Proxmox internal user):

- Exists only inside Proxmox VE, not the Linux host.
- Can only access the Proxmox GUI.

How to create a Pve user?

Datacenter → Users → Add → Type: **Proxmox VE Authentication**.

The screenshot shows the Proxmox VE 9.0.3 web interface. On the left, there's a sidebar with various system components like Datacenter, Cluster, Storage, and Network. The main area is titled 'Datacenter' and shows a table of users:

User name ↑	Realm ↑	Enabled	Expire	Name	TFA	Groups	Comment
Younes	pve	Yes	never		No	admins	
lenovo	pam	Yes	never		No	admins	
root	pam	Yes	never		No		

A modal dialog titled 'Add: User' is open in the center. It has fields for User name (set to 'pve'), Realm (set to 'Proxmox VE authentication'), Password, Confirm password, Group (set to 'users'), Expire (set to 'never'), Enabled (checkbox checked), and Comment. At the bottom right of the dialog are 'Advanced' and 'Add' buttons.

At the bottom of the screen, there's a 'Tasks' section showing a log of recent events:

Start Time	End Time	Node	User name	Description	Status
Sep 09 19:03:25	Sep 09 19:09:36	pve	root@pam	Shell	OK
Sep 09 18:49:40	Sep 09 18:49:43	pve	root@pam	CT 104 - Start	OK
Sep 09 18:37:33	Sep 09 18:37:33	pve	root@pam	CT 104 - Shutdown	OK
Sep 09 18:26:06	Sep 09 18:38:06	pve	root@pam	VMCT 104 - Console	OK
Sep 09 18:25:55	Sep 09 18:28:06	pve	root@pam	VMCT 104 - Console	OK

but this time in the type it has to be "Proxmox VE authentication", and that's it.

When to use PVe and when to use Pam?

PVE user:

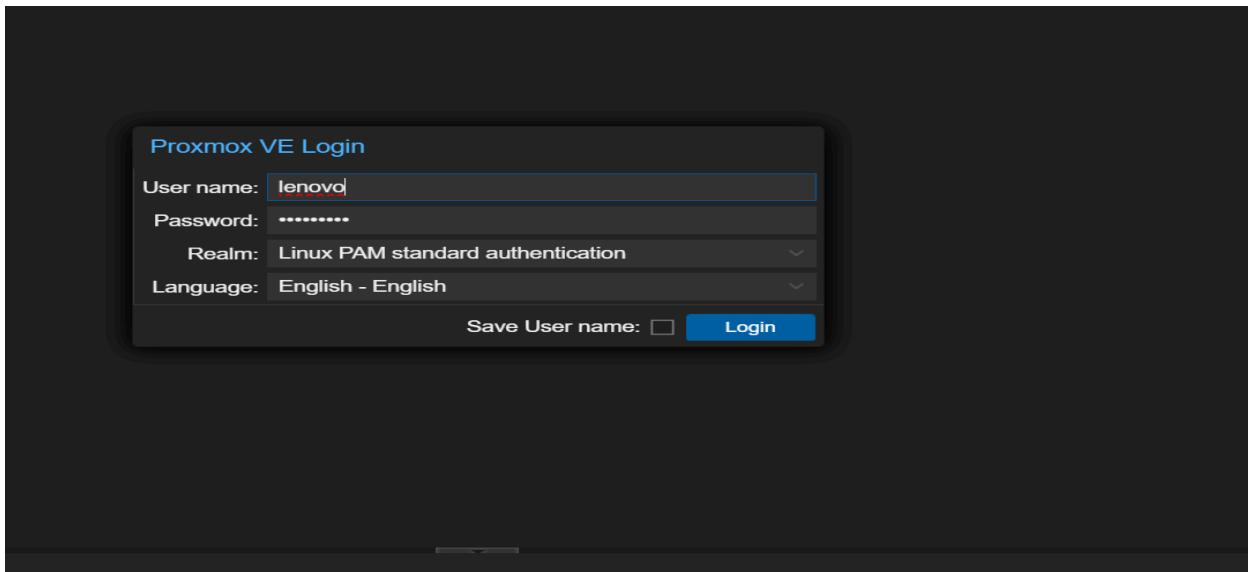
A PVE user (Proxmox VE Authentication Server) is used when you only need to manage Proxmox VE through its web interface or API.

PAM user:

A PAM user (Linux PAM Standard Authentication) for users who require direct SSH access and command-line interaction with the host operating system.

Logging in:

- Select the correct user and **realm** when logging in.

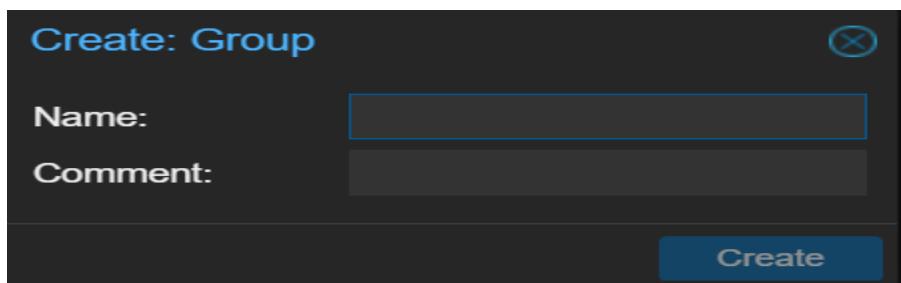
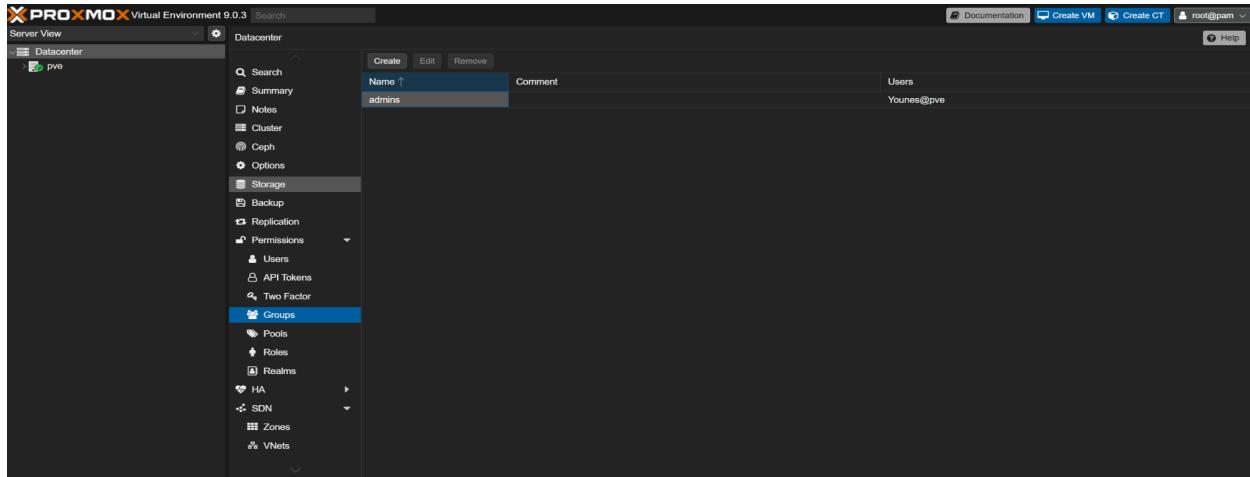


- New users cannot access VMs or containers until permissions are assigned.

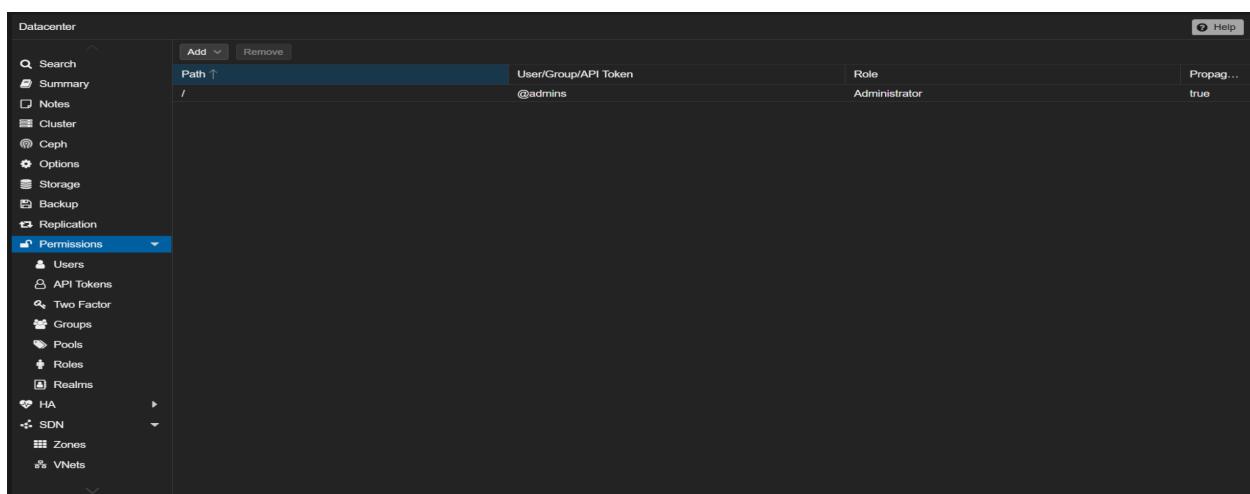
A screenshot of the Proxmox VE Datacenter interface, specifically the "Users" section. The top navigation bar includes "Server View", "Datacenter", "Documentation", "Create VM", "Create CT", and a user dropdown for "lenovo@pam". The main area shows a table of users. The table has columns: "User name", "Realm", "Enabled", "Expire", "Name", "TFA", "Groups", and "Comment". A single row is present, showing "lenovo" as the user name, "pam" as the realm, "Yes" as enabled, "never" as expire, and "No" as TFA. The "Groups" and "Comment" columns are empty. On the left sidebar, under "Datacenter", there are sections for "pve", "API Tokens", and "Two Factor".

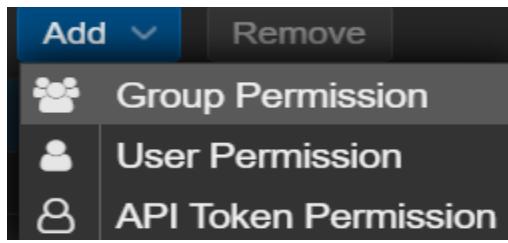
Adding permissions to the users:

Log in as **root** → **Datacenter** → **Groups** → **Create** → Name group (e.g., admins).



Datacenter → **Permissions** → **Add** → **Group Permission**.





- Assign **role** (e.g., Administrator).

Add: Group Permission

Path: /

Group: admins

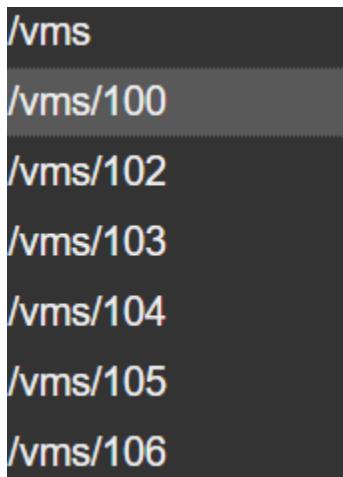
Role: Administrator

Propagate:

Add

This is a screenshot of a modal dialog titled "Add: Group Permission". It contains four input fields: "Path" with the value "/", "Group" with the value "admins", "Role" with the value "Administrator", and "Propagate" with a checked checkbox. At the bottom left is a "Help" button, and at the bottom right is a large blue "Add" button.

- Select **path** (e.g., /vms or specific VM ID).



- Edit user → Assign to the new group.

The screenshot shows the Proxmox VE 9.0.3 Datacenter interface. On the left, there's a sidebar with various management options like Summary, Notes, Cluster, Ceph, Options, Storage, Backup, Replication, Permissions, HA, SDN, Zones, and VNets. Under the 'Permissions' section, 'Users' is selected, which is also highlighted in the main content area. The main content area displays a table of users with columns: User name, Realm, Enabled, Expire, Name, TFA, and Groups. There are three entries: Younes (realm pve, enabled yes, expire never, name Younes, TFA no, groups admins), lenovo (realm pam, enabled yes, expire never, name lenovo, TFA no, groups admins), and root (realm pam, enabled yes, expire never, name root, TFA no, groups none). Below this table, a modal dialog titled 'Edit: User' is open for the 'lenovo' user. The dialog fields are: User name: lenovo@pam, Group: admins (selected), Expire: never, Enabled: checked, and Comment: empty. There are 'Advanced' and 'OK' buttons at the bottom right of the dialog.

Result:

- Users in the group now have access to manage all VMs and containers according to assigned permissions.

The screenshot shows the Proxmox VE 9.0.3 Server View interface. The left sidebar lists nodes: Datacenter, pve, and several VMs (104 (CT1), 105 (CT2), 103 (CT1), 102 (vm2), 106 (vm1), 100 (vm)). The main content area shows a terminal window with the prompt 'pve login:'. The top navigation bar includes links for Documentation, Create VM, Create CT, lenovo@pam, Reboot, Shutdown, Shell, Bulk Actions, and Help. The 'Shell' tab is currently selected in the sidebar.

Backup and Snapshots in Proxmox:

Backup:

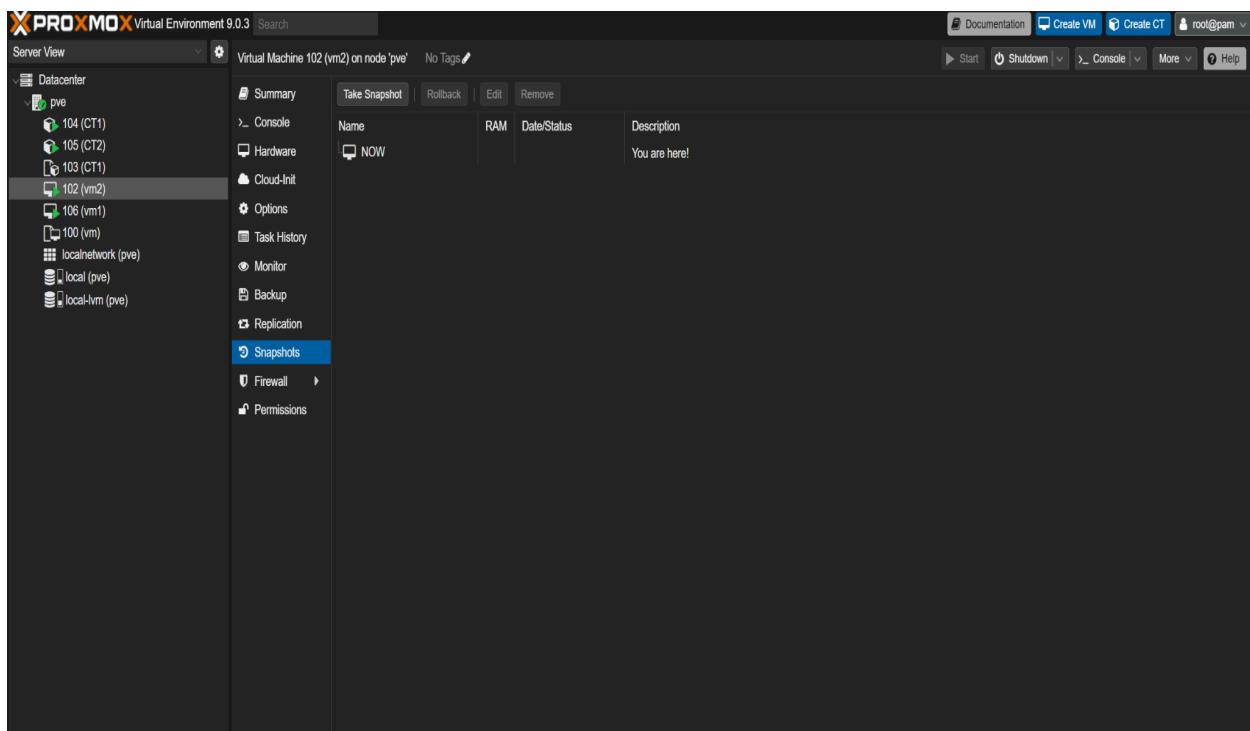
- A complete, independent copy of data stored in a separate location for long-term protection and disaster recovery.

Snapshot:

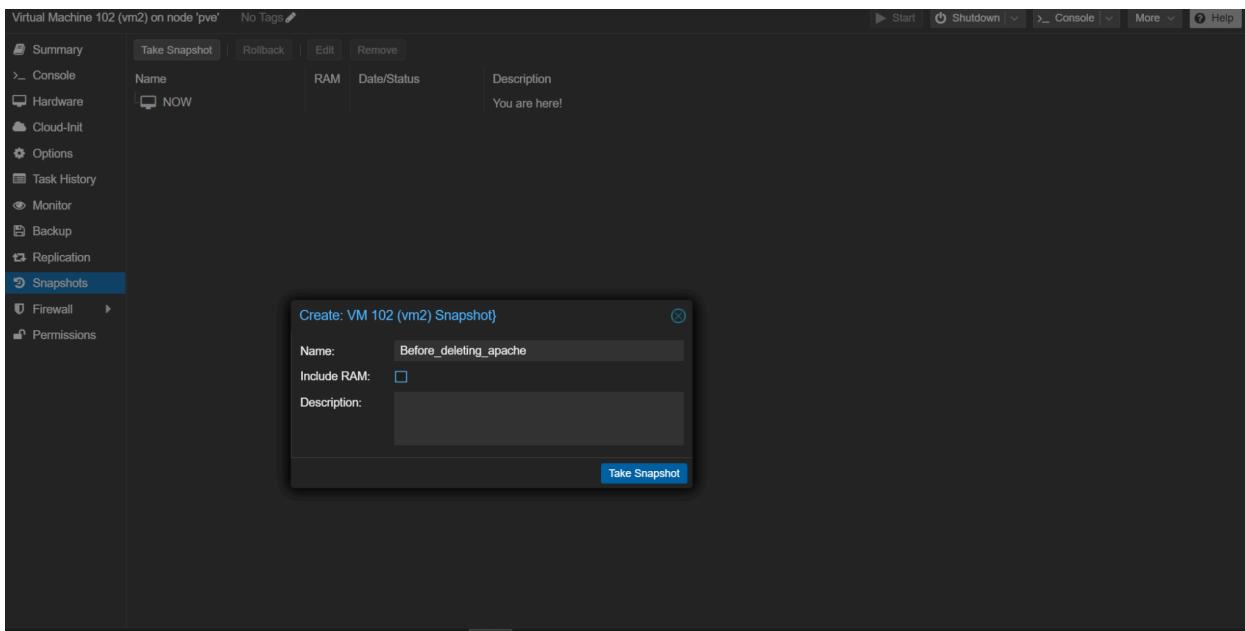
- A point-in-time “picture” of a system’s state.
- Stored in the same location; allows quick restoration to a recent version to reverse problematic changes.

Creating a Snapshot:

- Navigate to a VM → **Snapshots**



- →**Take a Snapshot**

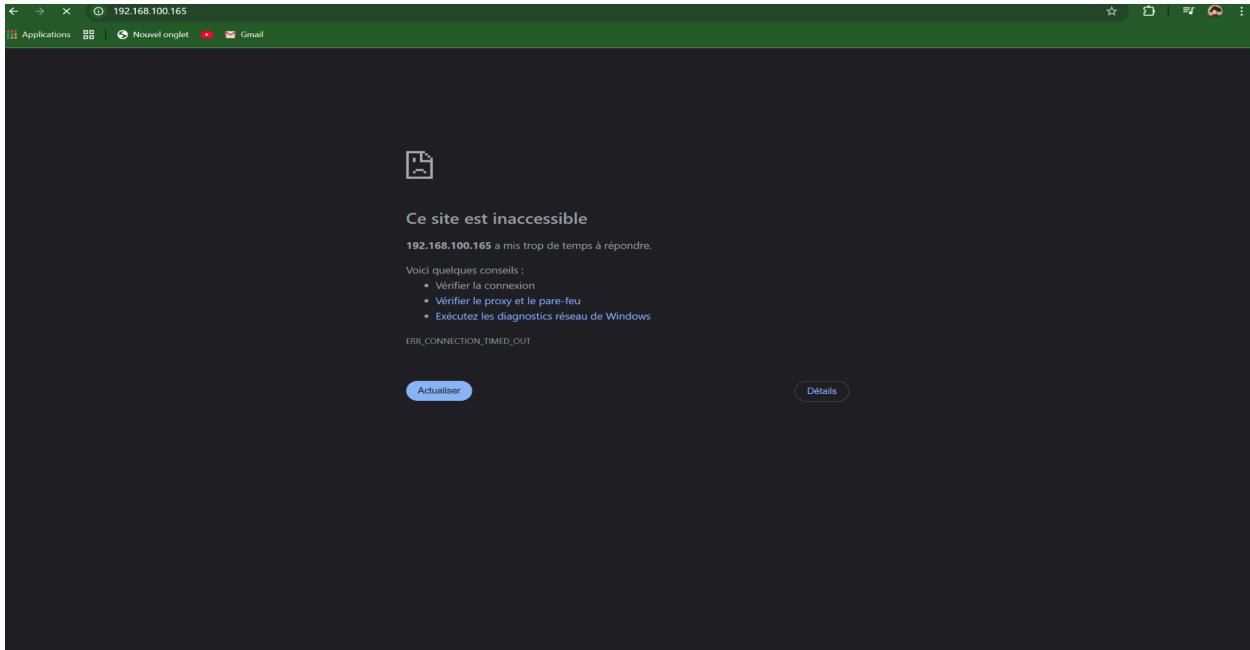


- → Take.

Restoring a Snapshot:

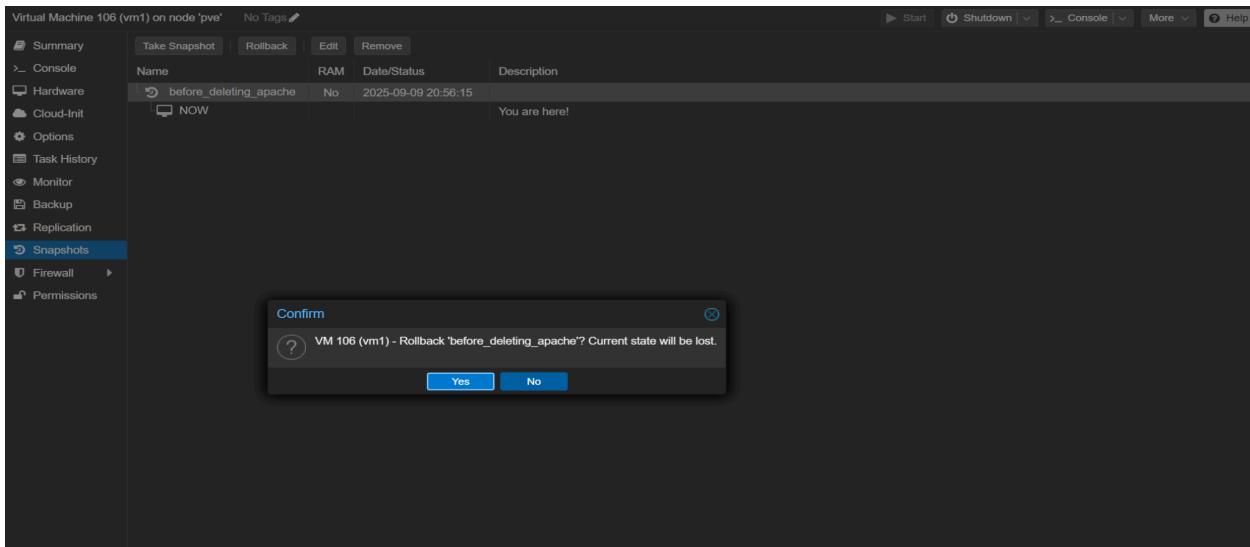
- Make a change in the VM (e.g., delete Apache).

```
lenovo@webserver:~$ sudo apt remove --purge apache2
[sudo] password for lenovo:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  apache2-bin apache2-data apache2-utils libapr1t64 libaprutil1-dbd-sqlite3 libaprutil1-ldap libaprutil1t64
  liblua5.4-0 ssl-cert
Use 'sudo apt autoremove' to remove them.
The following packages will be REMOVED:
  apache2*
0 upgraded, 0 newly installed, 1 to remove and 4 not upgraded.
After this operation, 465 kB disk space will be freed.
Do you want to continue? [Y/n]
(Reading database ... 87733 files and directories currently installed.)
Removing apache2 (2.4.58-1ubuntu8.8) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for ufw (0.36.2-6) ...
(Reading database ... 87683 files and directories currently installed.)
Purging configuration files for apache2 (2.4.58-1ubuntu8.8) ...
Processing triggers for ufw (0.36.2-6) ...
lenovo@webserver:~$
```

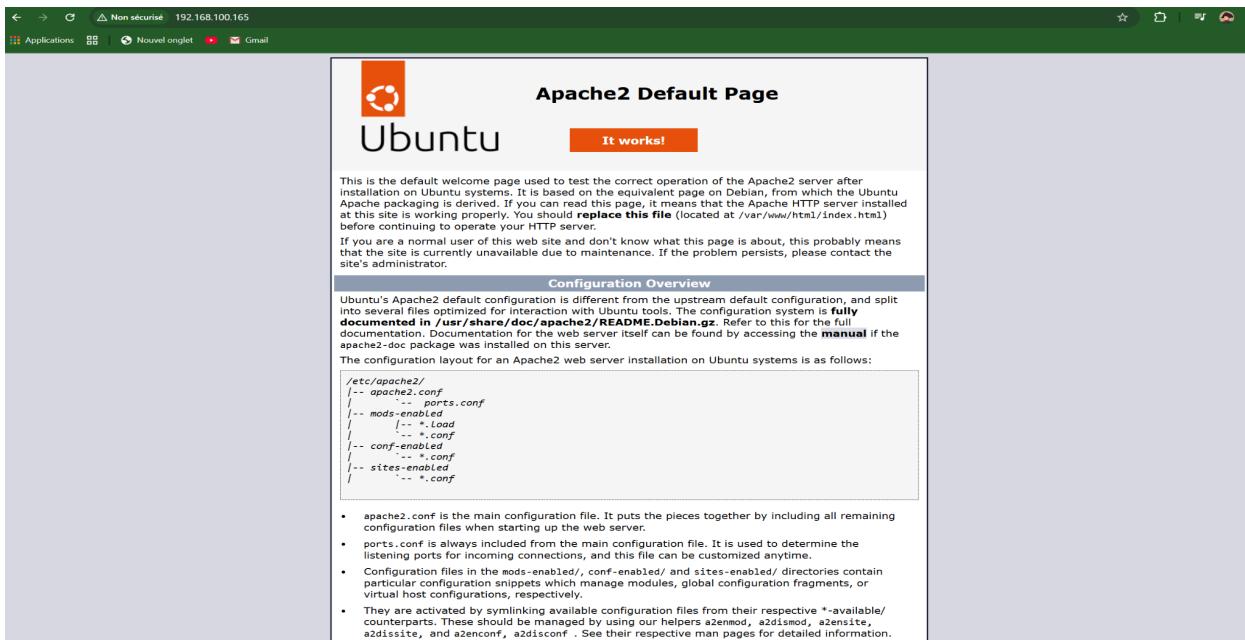


Apache no longer works.

- Go to **Snapshots**, select the snapshot → **Rollback**.



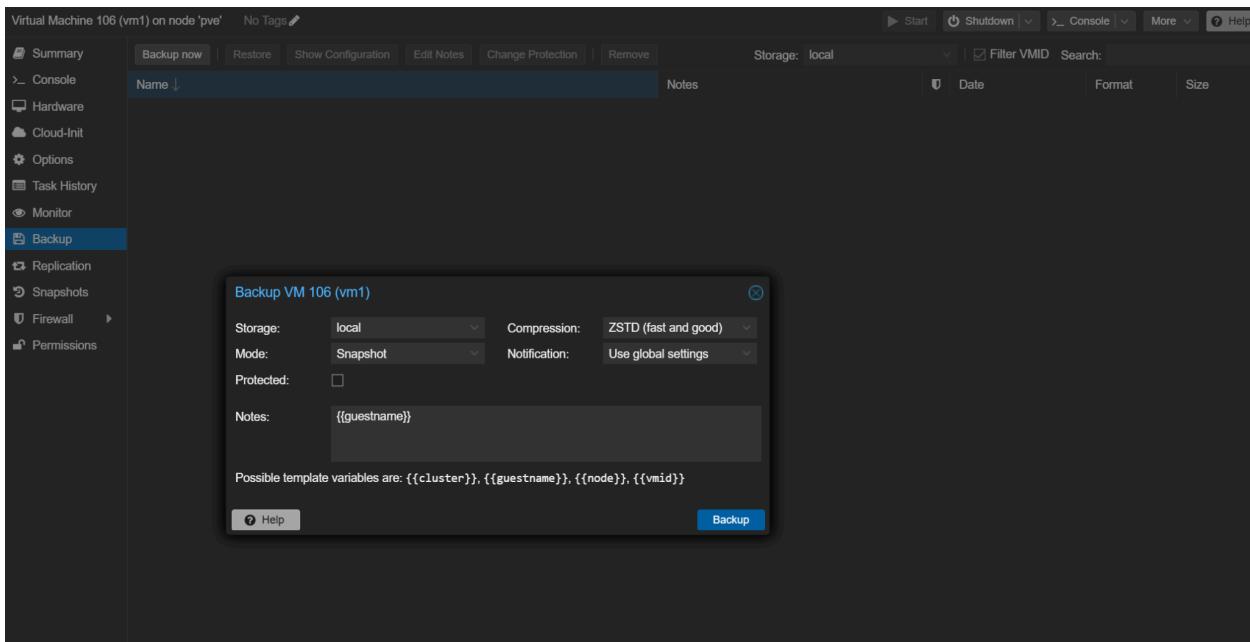
- Confirm.



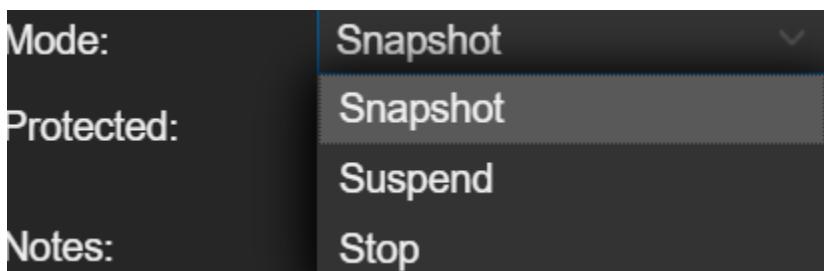
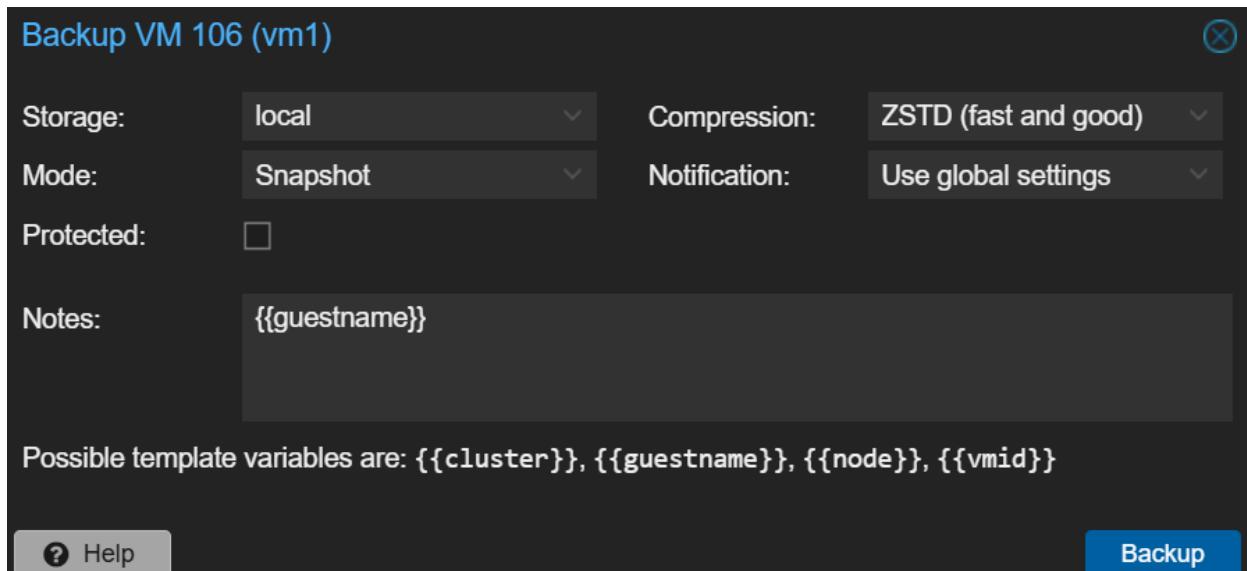
- Apache is back.

Creating a Backup:

Navigate to VM → Backup → Backup Now.



-
- Choose **Storage** and **Mode**:



we have 3 different modes:

Snapshot: Fastest, no downtime.

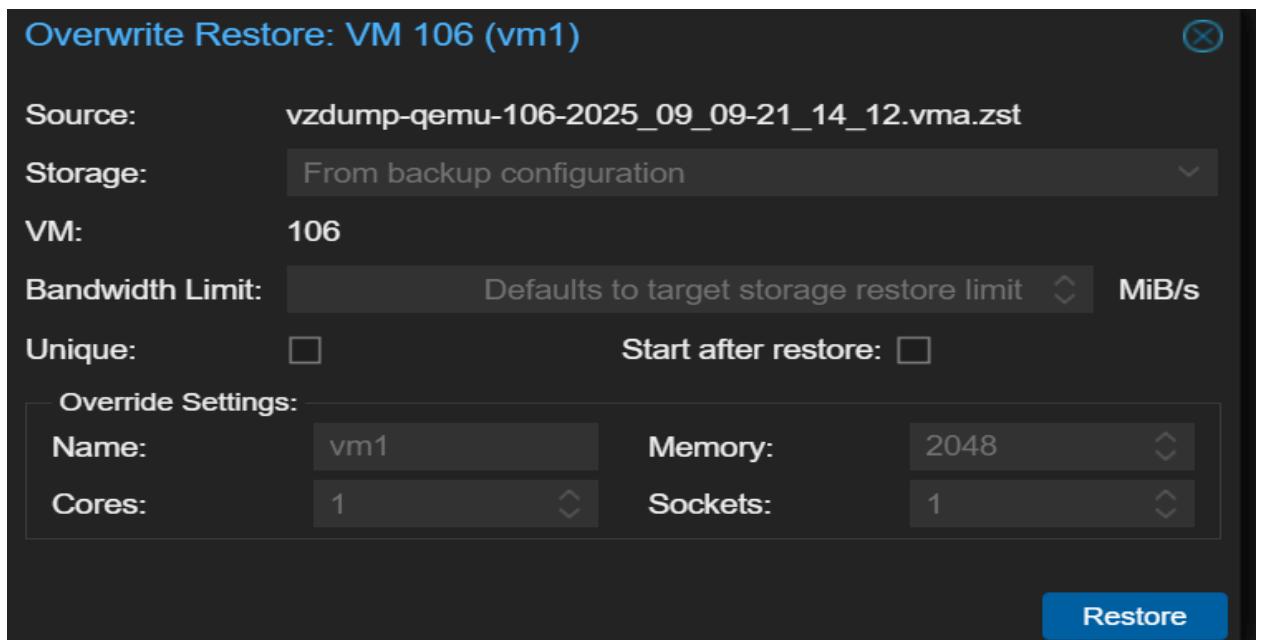
Suspend: Pauses VM briefly, then backs up.

Stop: Shuts down VM completely, then backs up.

- Click **Backup**.

Restoring a Backup:

- Shutdown the VM.
- Select backup → **Restore** → Optionally **Start after restore**



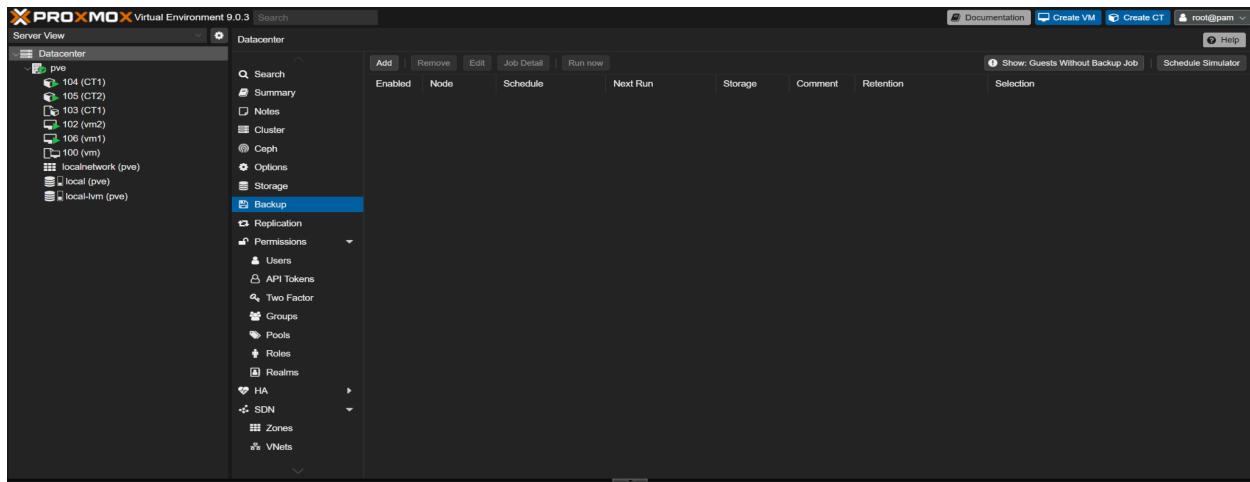
- Confirm.

The screenshot shows the 'Task viewer: VM 106 - Restore' window. The 'Output' tab is selected, displaying a log of the restore process. The log shows the progress of reading data from the backup file, with percentages increasing from 0% to 70.2%. The 'Status' tab is also visible. Above the task viewer, a table lists the backup file details: Name (vzdump-qemu-106-2025_09_09-21_14_12.vma.zst), Notes (vm1), Storage (local), Date (2025-09-09 21:14:12), Format (vma.zst), and Size (2.98 GB). The left sidebar shows navigation links like Summary, Console, Hardware, Cloud-Init, Options, Task History, Monitor, Backup (which is selected), Replication, Snapshots, Firewall, and Permissions.

- Done.

Automating Backups (Backup Job):

1. Datacenter → **Backups** → Add.



- Select **Nodes, Storage, Time, VMs, and Backup Mode**.

The screenshot shows the 'Create: Backup Job' dialog box. The 'General' tab is selected. The configuration includes:

- Node: -- All --
- Storage: local
- Schedule: Editable
- Selection mode: Include selected VMs
- Compression: ZSTD (fast and good)
- Mode: Snapshot
- Enable:

Below the configuration, there is a table listing VMs:

ID	Node	Status	Name	Type
100	pve	stopped	vm	Virtual Machine
102	pve	running	vm2	Virtual Machine
103	pve	stopped	CT1	LXC Container
104	pve	running	CT1	LXC Container
105	pve	running	CT2	LXC Container
106	pve	running	vm1	Virtual Machine

At the bottom of the dialog are 'Help' and 'Create' buttons.

- Click **Create** to schedule automated backups.

Firewalls

- **Firewall location in Proxmox:**

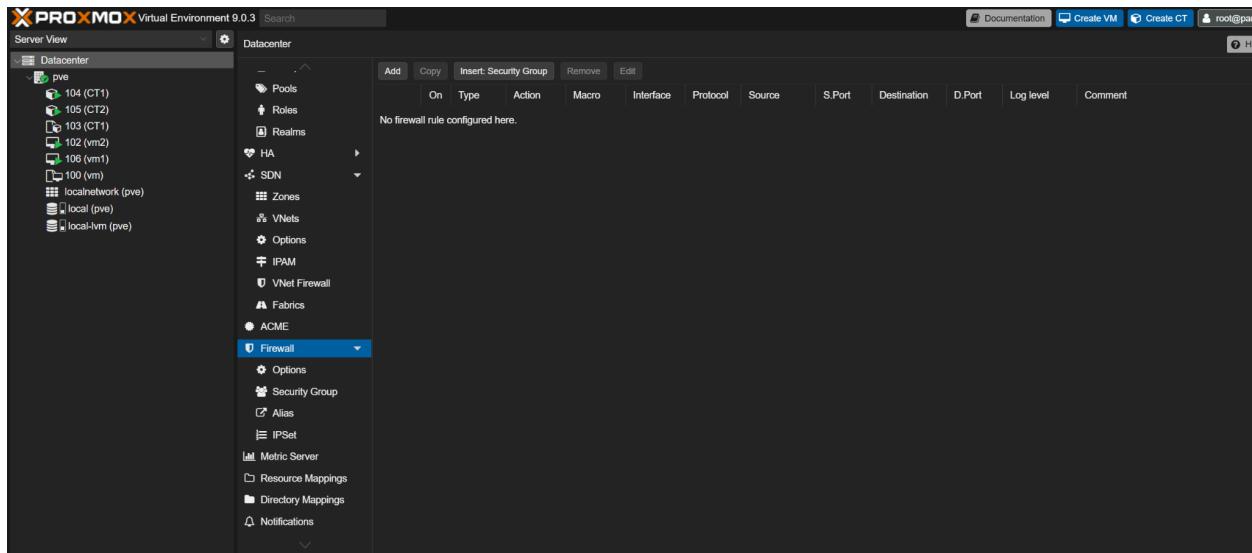
You can find a firewall section everywhere in Proxmox—whether in Datacenter, a node (PVE), VMs, or containers.

- Adding a firewall rule at the Datacenter level affects all nodes, VMs, and containers.

Creating a firewall:

Warning: Enabling the firewall before creating rules may kick you out of your server.

1. Go to **Datacenter → Firewall** and click **Add**.



Add: Rule

Direction: **in**

Action: **ACCEPT**

Interface:

Source:

Destination:

Comment:

Enable:

Macro:

Protocol:

Source port:

Dest. port:

Advanced Add

The screenshot shows a configuration interface for adding a rule. The 'Direction' field is set to 'in'. The 'Action' field is set to 'ACCEPT'. There are dropdown menus for 'Interface', 'Source', 'Destination', and 'Protocol'. A checkbox for 'Enable' is unchecked. Buttons for 'Advanced' and 'Add' are visible at the bottom.

Direction:

“in”: inbound traffic arriving at the zone

“out”: outbound traffic leaving the zone

“forward”: traffic passing through the zone

Action:

“Accept”: allows matching traffic

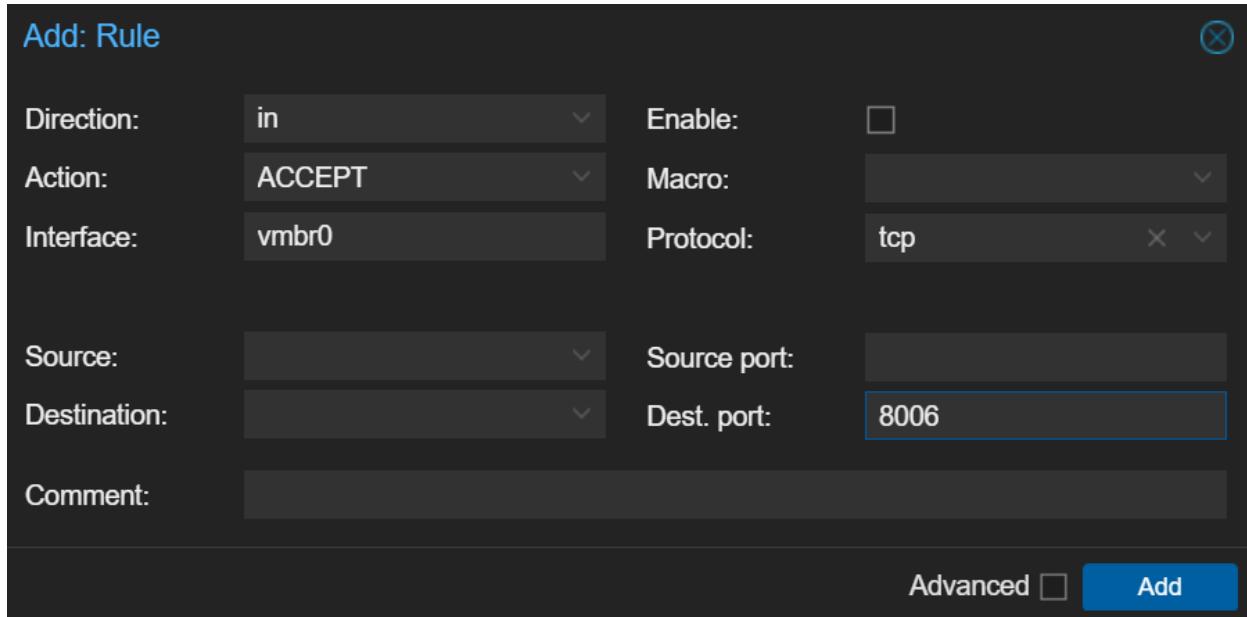
“Reject”: blocks traffic and sends a response

“Drop”: silently discards traffic without notifying the sender

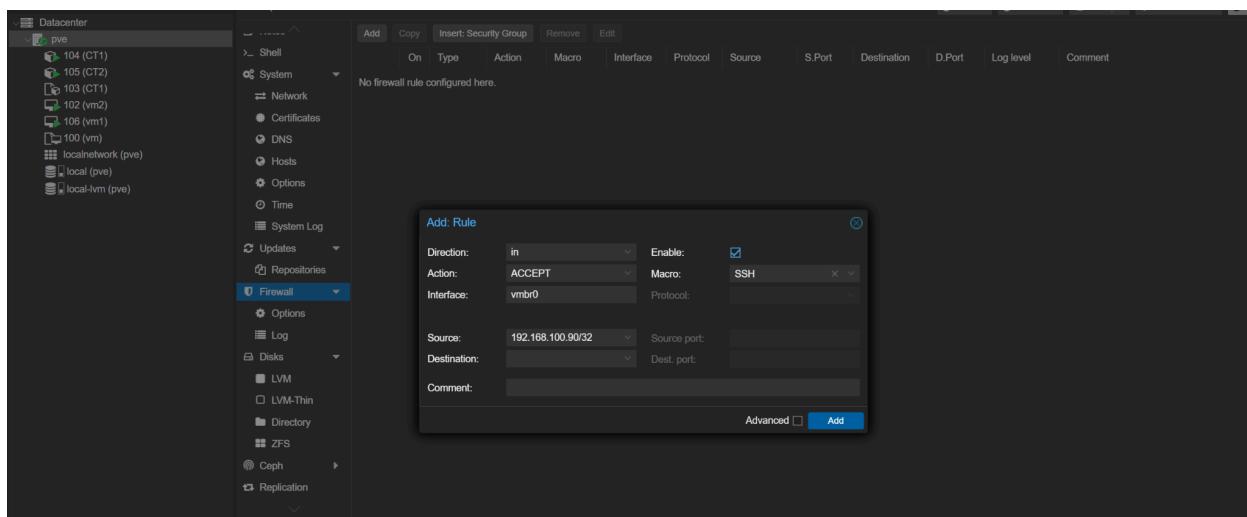
Interface: choose where the rule applies (e.g., vmbr0, the default interface)

Examples:

- Accept all incoming traffic on port 8006 (web console)



- Allow SSH connections to the PVE node



Terminal commands:

Connecting to the Proxmox server via OpenSSH:

Open the terminal of your os and run this command:

```
ssh root@yourserveripaddress
```

```
PS C:\Users\youne> ssh root@192.168.100.158
root@192.168.100.158's password:
Linux pve 6.14.8-2-pve #1 SMP PREEMPT_DYNAMIC PMX 6.14.8-2 (2025-07-22T10:04Z) 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.
Last login: Sat Sep  6 20:16:27 2025 from 192.168.100.90
root@pve:~#
```

Managing Virtual machines with commands:

The qm command is used to manage the virtual machines as it stands for: qemu manager.

Common qm commands:

qm list: lists all the virtual machines in the node.

```
root@pve:~# qm list
    VMID NAME          STATUS     MEM(MB)   BOOTDISK(GB) PID
      100 vm           stopped    2048          16.00  0
      102 vm2          running    2048          16.00  57648
      106 vm1          running    2048          16.00  111197
root@pve:~#
```

qm shutdown: shutdown a virtual machine

```
root@pve:~# qm shutdown 102
```

qm start: starts a virtual machine.

```
root@pve:~# qm start 102
generating cloud-init ISO
```

qm reboot: reboots a virtual machine.

```
root@pve:~# qm reboot 102
```

Handling misbehaving virtual machines:

if a virtual machine runs into a problem and doesn't want to shutdown or reboot you could use these commands:

qm reset: forcibly restarts a virtual machine, similar to unplugging and replugging a physical machine's power cord, and then restarts it.

qm stop: same as reset but doesn't restart.

Changing a virtual machine options with the qm command:

Get the list of a virtual machine options:

```
root@pve:~# qm config 102
agent: 1
boot: order=scsi0;ide2;net0
cipassword: *****
ciuser: lenovo
cores: 1
cpu: x86_64-v2-AES
ide0: local-lvm:vm-102-cloudinit,media=cdrom,size=4M
ide2: none,media=cdrom
memory: 2048
meta: creation-qemu=10.0.2,ctime=1756915873
name: vm2
net0: virtio=BC:24:11:A7:5C:1F,bridge=vmbr0,firewall=1
numa: 0
onboot: 1
ostype: l26
parent: Before_deleting_apache
scsi0: local-lvm:vm-102-disk-0,iothread=1,size=16G
scsihw: virtio-scsi-single
smbios1: uuid=a34d19f4-afa4-4ec1-8d96-8a1655714648
sockets: 1
vmgenid: 4c9bff6b-09c7-471c-bab6-1cd5b237546f
```

changing a setting with the qm command:

```
root@pve:~# qm set --onboot 0 102
qmupdate VM 102: --onboot 0
root@pve:~# qm set --onboot 1 102
update VM 102: --onboot 1
```

```
root@pve:~# qm config 102 | grep cores
cores: 1
```

Managing Containers with commands:

The pct command is used to manage the virtual machines as it stands for: proxmox container toolkit.

Common pct commands:

pct list: gets the list of every container in the node.

```
root@pve:~# pct list
VMID      Status      Lock      Name
103       stopped
104       running
105       running
106       running
```

pct shutdown: shutdown the container.

```
root@pve:~# pct shutdown 105
```

pct start: starts the container.

```
root@pve:~# pct start 105
```

pct reboot: reboots the container

```
root@pve:~# pct reboot 105
```

pct enter: Accessing the shell within a container

exit: To exit the container.

```
root@pve:~# pct enter 105
root@CT2:~# exit
exit
root@pve:~#
```

Changing a container options with the pct command:

```
root@pve:~# pct config 103
arch: amd64
cores: 1
features: nesting=1
hostname: CT1
memory: 1024
net0: name=eth0,bridge=vmbr0,firewall=1,hwaddr=BC:24:11:C7:F1:DC,ip=dhcp,ip6=dhcp,type=veth
onboot: 1
ostype: ubuntu
rootfs: local-lvm:base-103-disk-0,size=16G
swap: 1024
template: 1
unprivileged: 1
```

give the full list of the container options.

```
root@pve:~# pct set 105 --onboot 0
root@pve:~# pct set 105 --onboot 1
```

sets the start on boot option for the container to false and then true.

Networking:

Linux bridges:

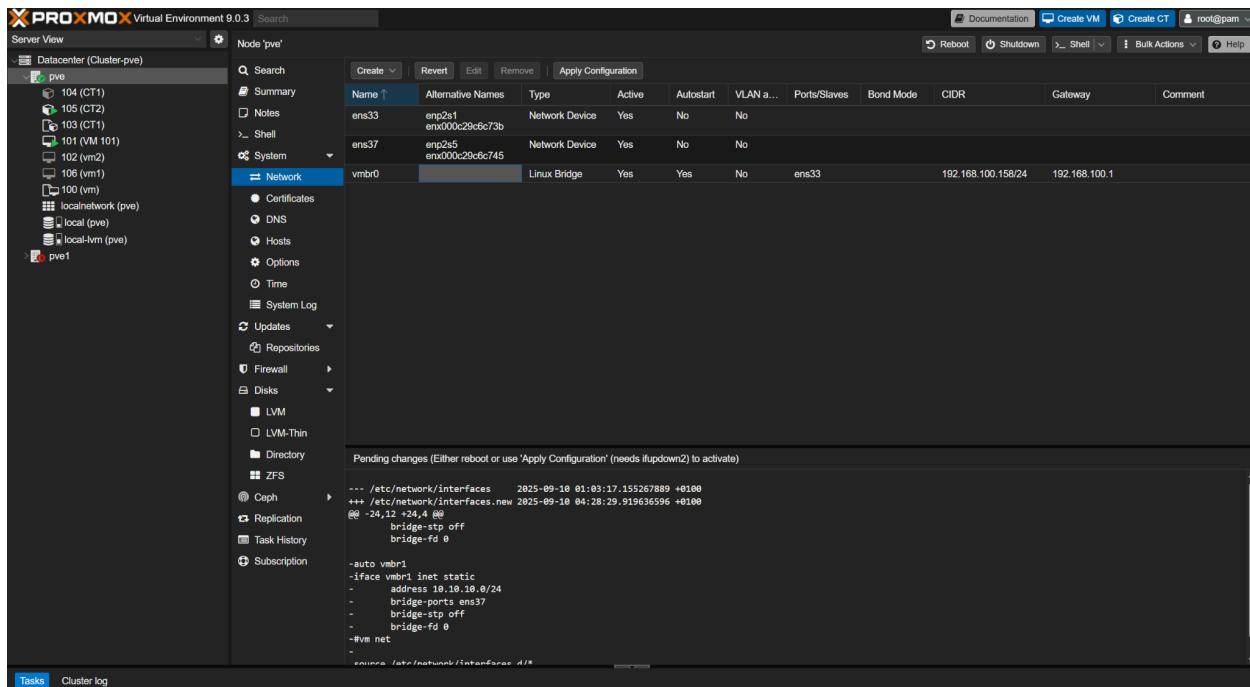
A Linux bridge is a software-based virtual switch that connects VMs and containers to each other and to the host's physical network, allowing traffic to pass between them.

Separating the management network from the VM network:

Requirement: an additional NIC for the new linux bridge.

Steps to create a Linux bridge:

- Go to the node → **Network**



ens33 and **ens37**: are Network interfaces used by the bridges to pass traffic.

vmb0: is the linux bridge connecting everything to the network

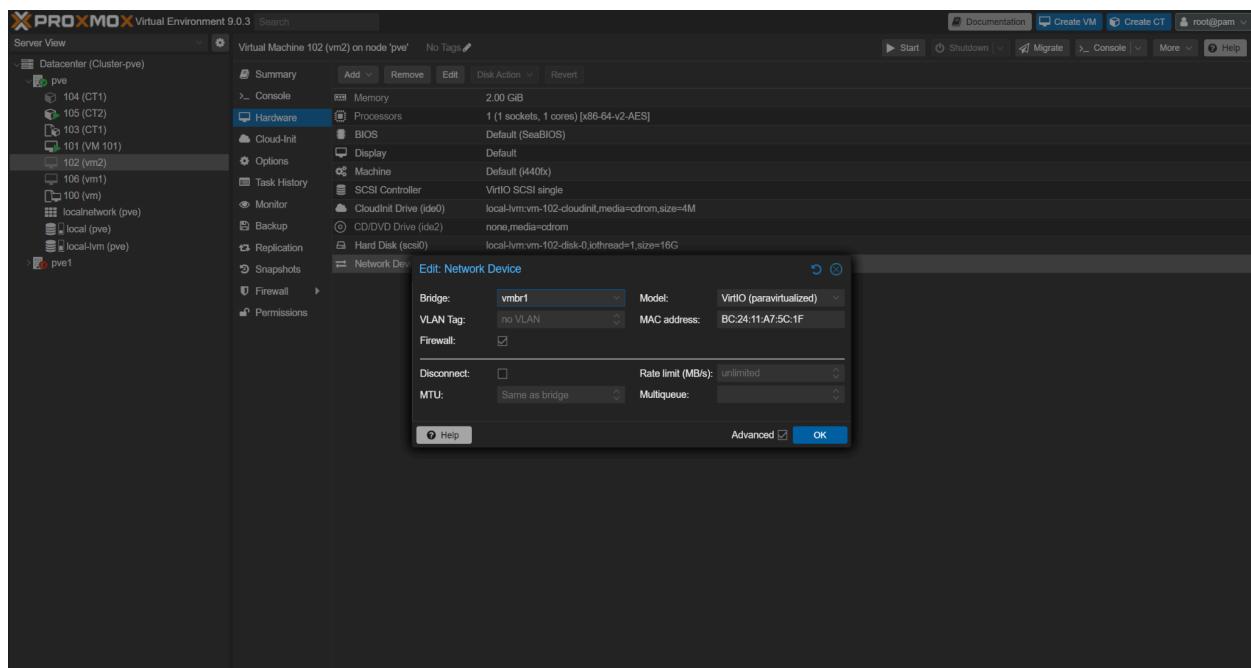
- Click **Create** → **Linux Bridge**

Create: Linux Bridge

Name:	vmbr1	Autostart:	<input checked="" type="checkbox"/>
IPv4/CIDR:	10.10.10.0/24	VLAN aware:	<input type="checkbox"/>
Gateway (IPv4):		Bridge ports:	ens37
IPv6/CIDR:		Comment:	
Gateway (IPv6):			
MTU:	1500	VLAN IDs:	2-4094
? Help		Advanced <input checked="" type="checkbox"/>	Create

Configure:

- **Name** → new bridge name
- **IP address** → IP for communication on the network
- **Bridge port** → the NIC it uses



Moving a VM to the new network:

- In the VM hardware settings (while VM is off), change the bridge to the new Linux bridge.
- The VM will receive a new IP address.

```
2: ens18: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
  up default qlen 1000
    link/ether e6:5e:ef:4f:cb:d4 brd ff:ff:ff:ff:ff:ff
      inet 10.10.10.206/24 brd 10.10.10.255 scope global dynamic ens18
        valid_lft 43065sec preferred_lft 43065sec
      inet6 fe80::e45e:effff:fe4f:cbd4/64 scope link
        valid_lft forever preferred_lft forever
```

Shared Storage:

What is shared storage?

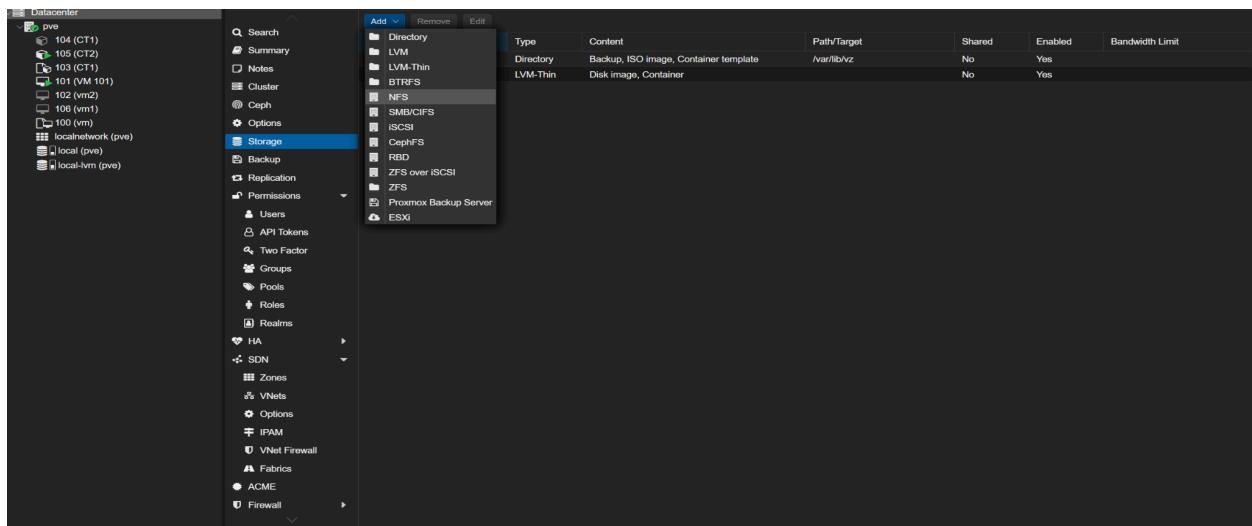
- A shared storage is a central place where multiple proxmox nodes can access the same virtual machine data.
- It's mainly needed for clustering and HA, because the VMs must be accessible from any node.

Requirement to setup a shared storage in proxmox:

- Storage system supporting network protocols (NFS, iSCSI, Ceph, TrueNAS, etc.)
- Working network connection between Proxmox and storage server

Steps to configure a shared storage in proxmox:

- Go to Datacenter → Storage → Add



- Choose storage type (NFS, iSCSI,Ceph,etc)

Add: NFS

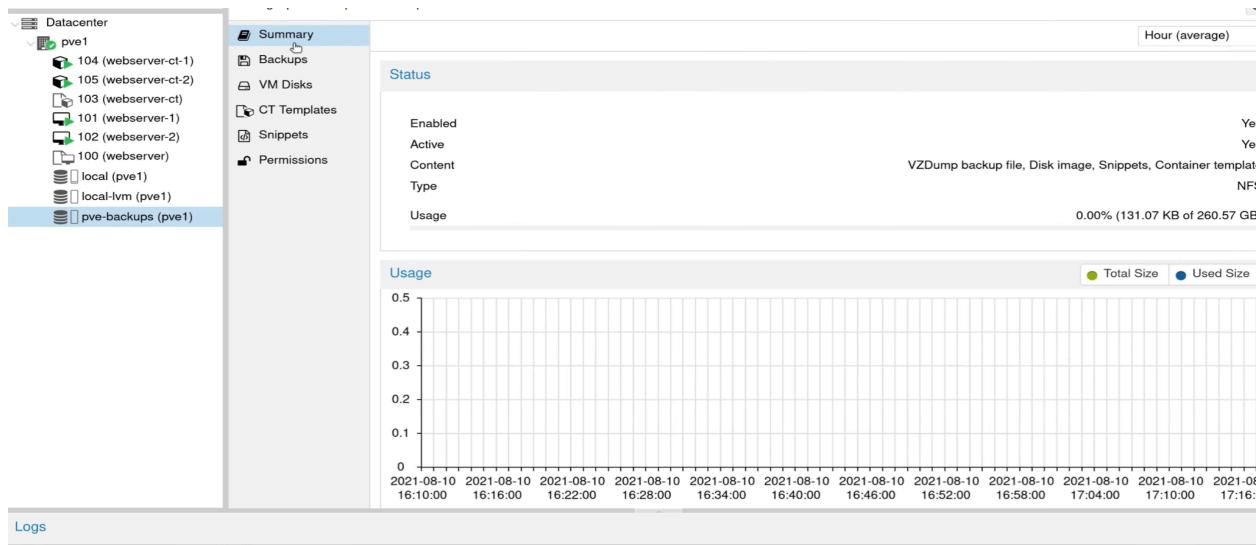
General **Backup Retention**

ID:	pve-shared	Nodes:	All (No restrictions)
Server:		Enable:	<input checked="" type="checkbox"/>
Export:			
Content:	Container template, Bac		

Advanced **Add**

Enter:

- Storage ID (name)
- IP or domain of the storage server
- Export path
- Content types (VM disks, ISO, backups)



1. Click **Add**
- Access the storage from every node in the cluster and view stored content.

Clustering

Definition:

A cluster is a group of two or more Proxmox servers (nodes) managed as a single system.

Benefits of a cluster:

- **High Availability (HA)** → automatic failover of critical VMs
- **Scalability** → add/remove servers easily.
- **Improved Performance** → distribute workloads.
- **Fault Tolerance & Redundancy** → replicate data across nodes
- **Load Balancing** → distribute traffic evenly
- **Simplified Management** → single management interface

Requirements:

- At least 2 servers with the same Proxmox version
- Shared storage (recommended)

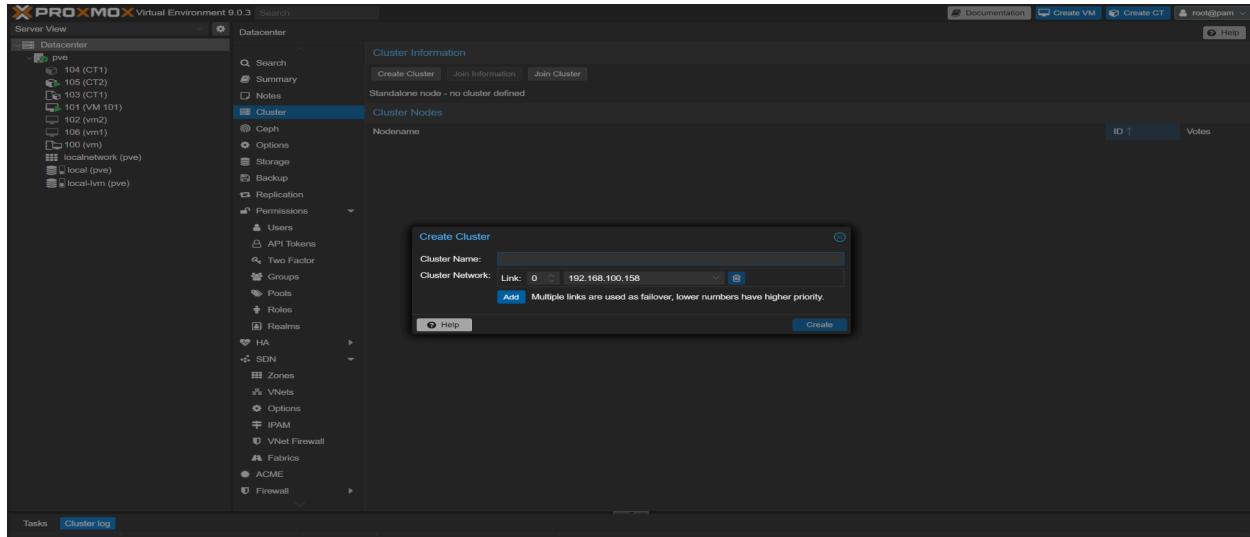
Steps to make a cluster in proxmox:

- Ensure networks match on all nodes

Name ↑	Alternative Names	Type	Active	Autostart	VLAN a...	Ports/Slaves	Bond Mode	CIDR	Gateway
ens33	enp2s1 enx000c29125cfc	Network Device	Yes	No	No				
ens37	enp2s5 enx000c29125c06	Network Device	No	No	No				
vmbr0		Linux Bridge	Yes	Yes	No	ens33		192.168.204.130/24	192.168.204.2
vmbr1		Linux Bridge	No	Yes	No	ens37		10.10.10.0/24	

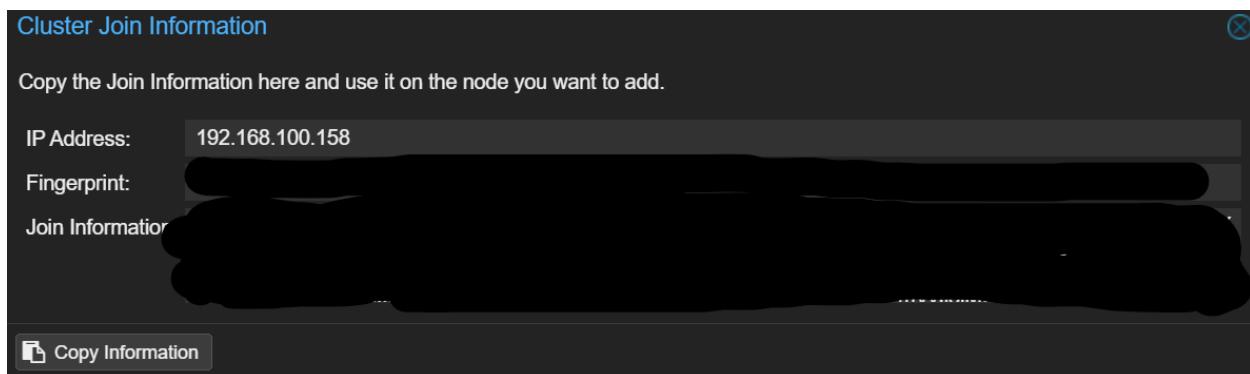
Name ↑	Alternative Names	Type	Active	Autostart	VLAN a...	Ports/Slaves	Bond Mode	CIDR	Gateway	Comment
ens33	enp2s1 enx000c29c6c73b	Network Device	Yes	No	No					
ens37	enp2s5 enx000c29c6c745	Network Device	Yes	No	No					
vmbr0		Linux Bridge	Yes	Yes	No	ens33		192.168.100.158/24	192.168.100.1	
vmbr1		Linux Bridge	Yes	Yes	No	ens37		10.10.10.0/24		vm net

- On first node → **Datacenter** → **Cluster** → **Create Cluster** → name → create

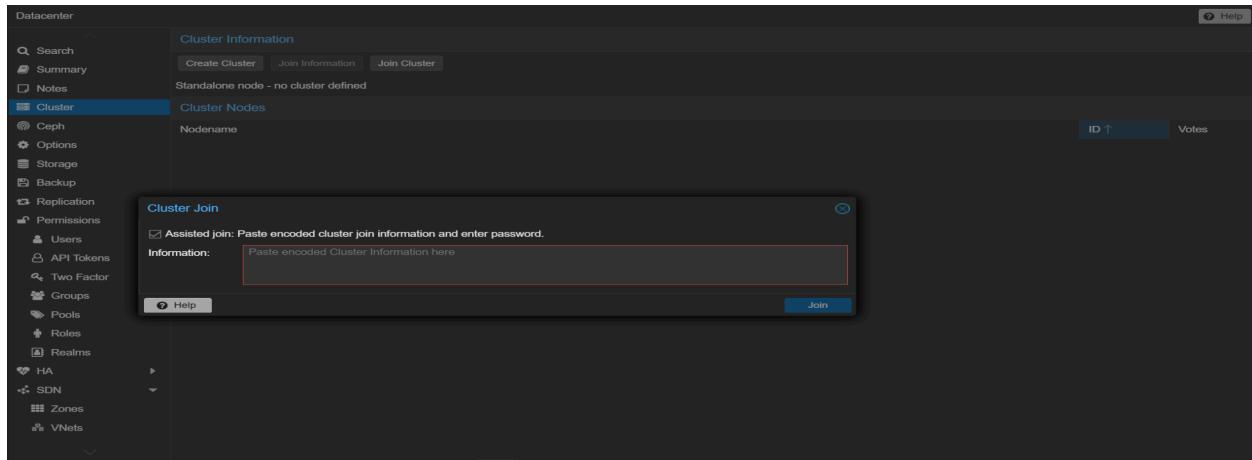


now, we have to add a node to this cluster, so that we have 2 nodes in the cluster:

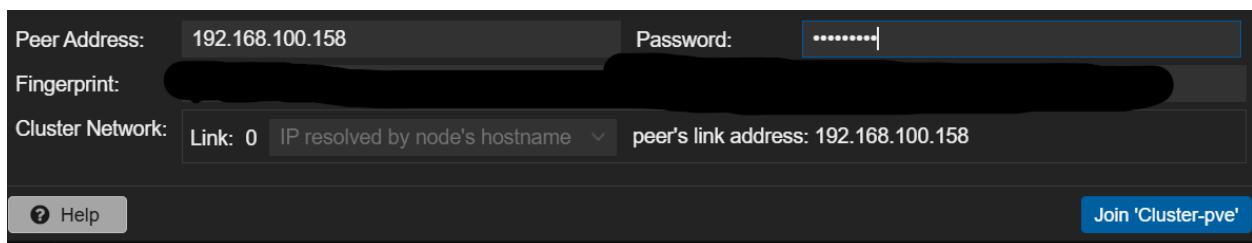
in the same section of the first node click on join information and copy them.



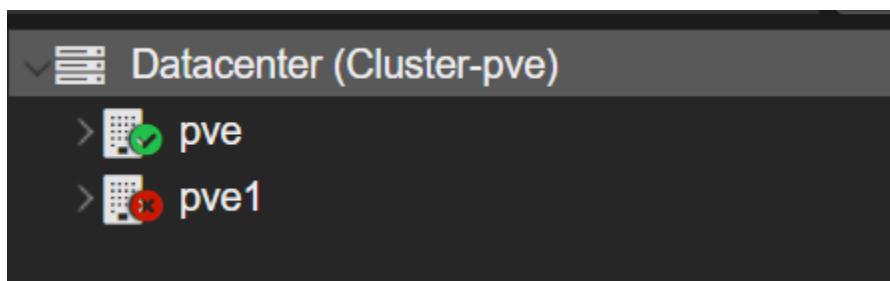
- On second node → **Datacenter** → **Cluster** → **Join Cluster** → paste join info from first node → enter password → join



Once u paste them in and new fields should open:



type in your password and then join the cluster.



and there you have two nodes in the same cluster.

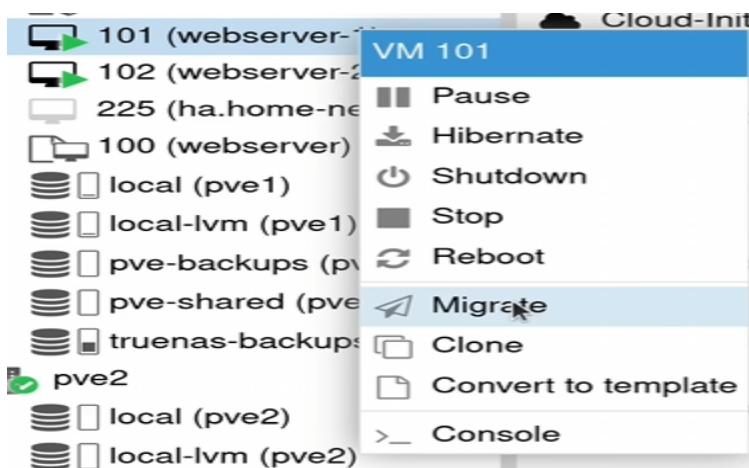
Live migration in a proxmox cluster:

Live migration allows you to move a running vm from one proxmox node to another with no downtime.

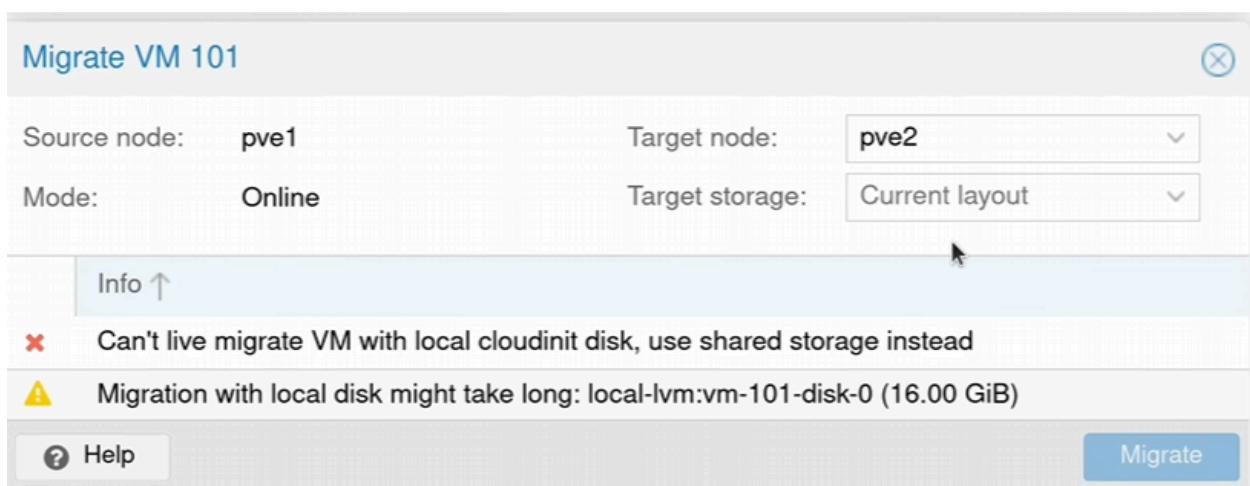
Steps:

Note: live migration works better with a shared storage, otherwise it takes longer.

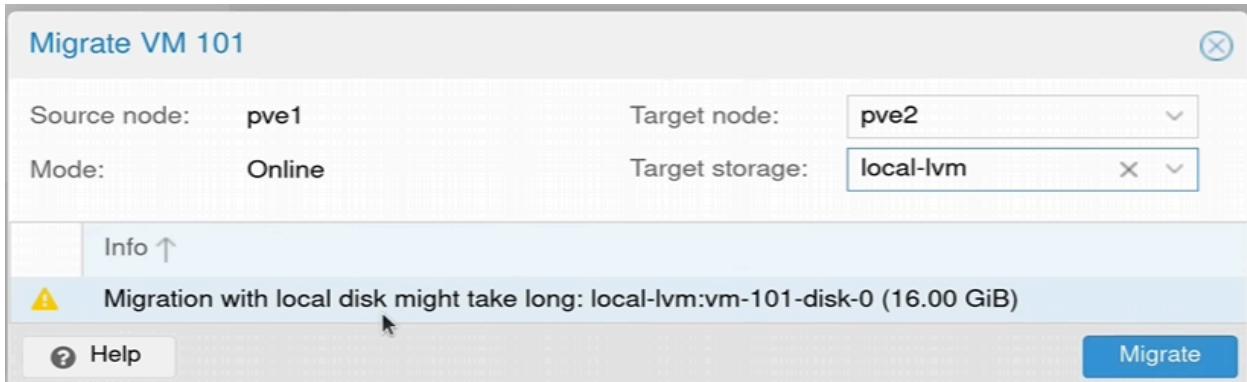
- Right-click VM → **Migrate**



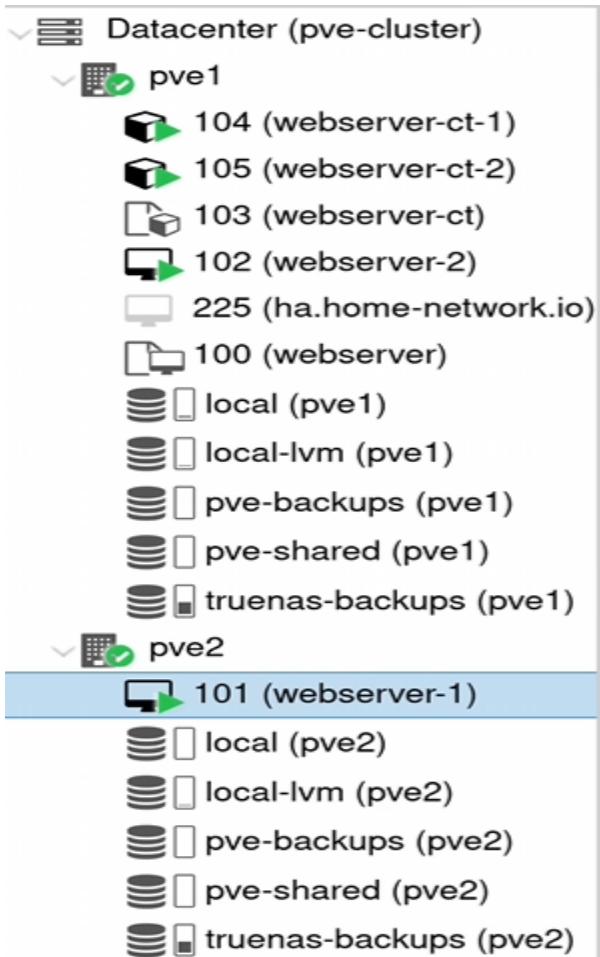
note: You cant live migrate a Vm with couldinit if you don't have shared storage.



- Select target node and storage



- Click **Migrate**



- successfully migrated a vm from one node to another.

Note: Live migration only works for VMs. Migrating containers requires them to stop and restart on the other node.

High Availability (HA):

What is HA?

Ensures critical VMs/services to keep running even if one physical server (node) fails.

How does HA works?

It functions by using a cluster-wide HA manager that monitors defined resources, and in case of a node failure, the cluster uses a quorum-based voting system to decide where to restart the affected VMs and containers, which requires shared storage to access the VM/container data.

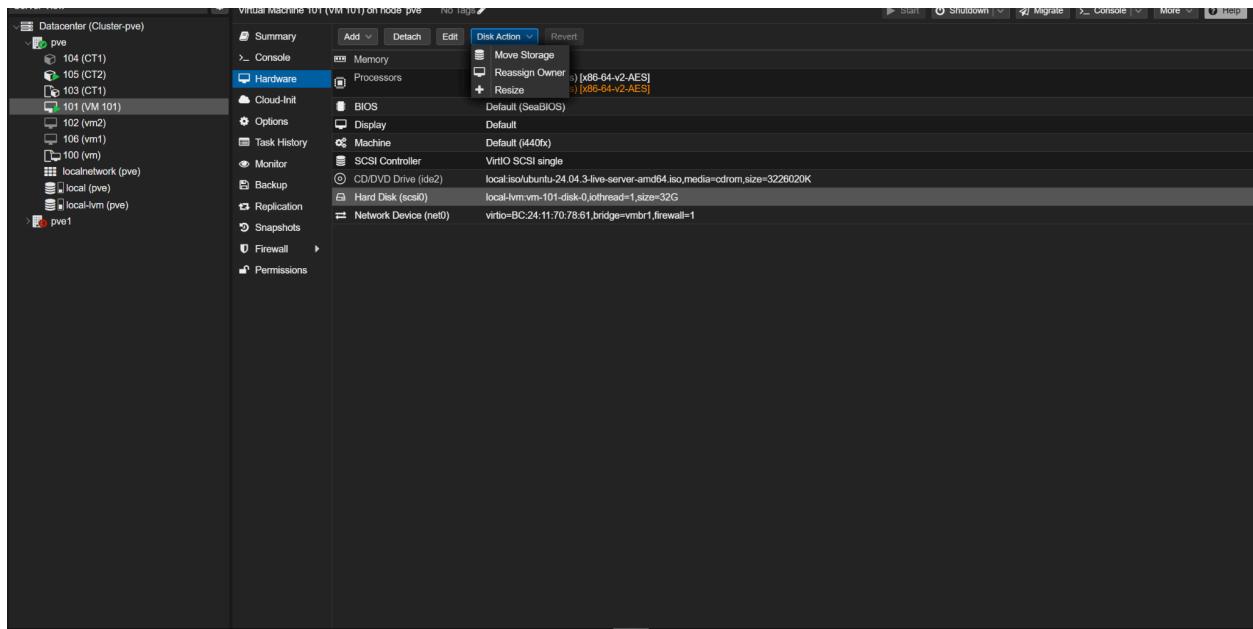
Requirements for HA:

At least 3 nodes in the cluster (for quorum)

Shared storage (So all nodes can access the VM data)

How to set up HA in proxmox?

- Turn off VM and move it to shared storage if needed



Move disk

Disk: scsi0

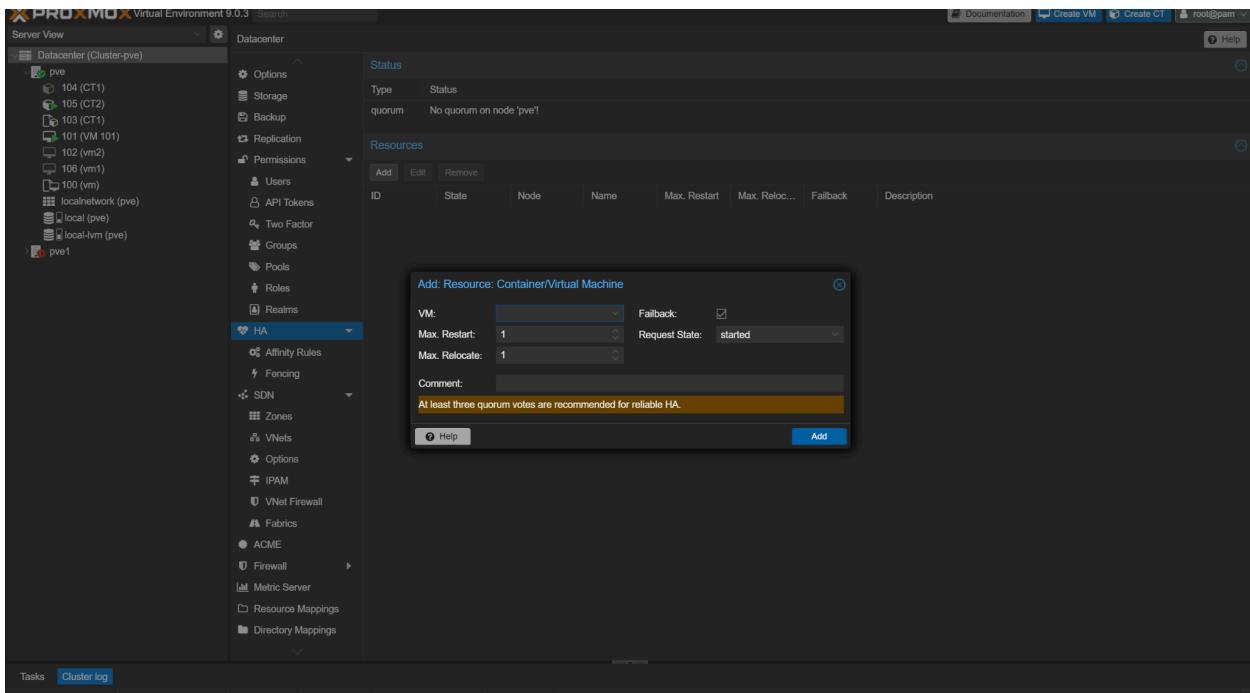
Target Storage:

Format: QEMU image format (qcow2)

Delete source:

Move disk

- Go to **Datacenter** → **HA** → **Add** → select VM



- Set **Request State**:

Started: This is the default. The HA manager will actively try to ensure the resource is running. If the resource fails on its current node, the HA manager will attempt to restart it or relocate it to another healthy node in the cluster.

Stopped: The HA manager will try to keep the resource in a stopped state. However, it will still monitor the resource and attempt to relocate it to another node if the original node fails. This state is useful when you want to prevent a resource from running but still want it to be managed by HA for potential relocation.

Disabled: The HA manager will attempt to stop the resource and will not try to relocate it to another node if the current node fails. This state is primarily used for error recovery, as it's the only way to move a resource out of an "error" state.

Ignored: When a resource is set to "ignored," it's removed from the HA manager's active monitoring. The CRM and Local Resource Manager (LRM) will no longer manage

or relocate this resource. All Proxmox API calls or commands affecting this resource will be executed directly, bypassing the HA stack. This allows for manual control of the resource without HA interference.

Max.restart: how many times VM will attempt to restart

Max.relocate: how many times VM will attempt relocation