



# PROXMOX VIRTUAL ENVIRONMENT

## OVERVIEW

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, 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 VE is designed to scale to cluster-level and enables you to virtualize even the most demanding of Linux and Windows application workloads. By combining two virtualization technologies on a single platform, Proxmox VE provides maximum flexibility for your data center. It includes strong high-availability (HA) support and – thanks to the unique multi-master design – you don't need any additional management server, thus saving resources and allowing HA without a single point of failure (SPOF).

## ENTERPRISE-READY

Enterprises use the powerful Proxmox VE platform to easily install, manage, and monitor their hyper-converged (HCI) data centers. Multiple authentication sources, combined with role-based user and permission management enable flexible control of HA clusters. The REST API enables easy integration of third-party management tools, such as custom hosting environments. The future-proof and open-source development model of Proxmox VE guarantees full access to the product's source code as well as maximum flexibility and security.

## BENEFITS



### Streamlined IT Infrastructure

A single platform to manage VMs, containers, storage, and networks.



### Unified Operations

Seamlessly deploy and monitor VMs and containers with the intuitive REST API, GUI, and CLI for easy operation and integration.



### Software-Defined Storage

SDS made simple – Thanks to built-in support for Ceph, ZFS, and other storage backends.



### Scale without Limits

Build highly available clusters in minutes and easily scale clusters to support your growing workloads.



### 100% Open-Source

No hidden licensing fee and full access to source code for customization.



### Made for Production

Keep your business running smoothly with Enterprise-grade services & technical support from Proxmox.



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## Industry-leading Enterprise Virtualization

- ✓ Linux and Windows servers, 32- and 64-bit operating systems.
- ✓ Support for the latest Intel and AMD server chip sets – for great VM performance.
- ✓ Near bare-metal performance for real-world enterprise workloads.
- ✓ Management layer containing all the capabilities to manage and monitor an open-source, software-defined data center.
- ✓ Import wizard for VMware ESXi VMs.

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## Free & Open-Source Software

- ✓ Licensed under the GNU AGPL, v3.
- ✓ Debian-based, using the Proxmox kernel with OpenZFS support.
- ✓ Designed for community cooperation.
- ✓ Public code repository (Git).
- ✓ Open development on transparent mailing list.
- ✓ Bug tracker for issue tracking.
- ✓ Community support forum.
- ✓ Documentation, project page, video tutorials, howto guides, and much more.

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## Enterprise Support Agreement

- ✓ Avoid hidden costs with clear subscription model.
- ✓ Flexible support options that grow with your needs.
- ✓ Access to the stable and extensively tested Enterprise Repositories for Proxmox VE and Ceph.
- ✓ Updates and version upgrades via GUI.
- ✓ Proxmox Offline Mirror tool to keep air-gapped systems up-to-date.
- ✓ Premium technical support from the highly-skilled Proxmox support team.
- ✓ Supported by a global network of 3,000 official Proxmox integration partners for deployment, migration, and professional services.

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## Self-Fencing

- ✓ The Proxmox VE HA Manager uses self fencing, provided by hardware watchdog or kernel softdog timers.
- ✓ No simultaneous data access or corruption.
- ✓ Works „out-of-the-box“.
- ✓ Includes Proxmox VE HA Simulator for testing.

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## Highly Available (HA) Cluster

- ✓ No single point of failure (no SPOF).
- ✓ Multi-master cluster.
- ✓ Manage the HA settings for KVM and LXC via GUI.
- ✓ Cluster Resource Scheduling (CRS), including dynamic mode with real-time node and guest resource utilization. **NEW**
- ✓ pmxcfs – unique Proxmox VE Cluster File System: database-driven file system for storing configuration files, replicated in real-time across all nodes using Corosync.
- ✓ Based on proven Linux HA technologies, providing stable and reliable HA service.
- ✓ Resource agents for KVM and containers (LXC).
- ✓ Watchdog-based fencing.
- ✓ HA node and resource affinity rules.
- ✓ Dynamic Load Balancer for HA-managed guests to reduce node imbalance across the cluster. **NEW**
- ✓ Preserves HA resource state during planned maintenance workflows. **NEW**
- ✓ HA arm/disarm workloads. **NEW**

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## Unified Virtual Guests Operation

- ✓ Create and maintain VMs and containers on a single platform.
- ✓ Set hard and soft limits for CPU and Memory.
- ✓ Pin virtual guests to a set of CPU cores.
- ✓ Migrate to any cluster node.

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## Virtual Machines with QEMU/KVM

- ✓ Independent from OS: Run unmodified Windows, Linux, BSD, or others.
- ✓ QEMU/KVM for low overhead.
- ✓ Custom CPU models to tailor virtual CPU features for specific workloads and compatibility requirements. **NEW**
- ✓ Snapshot a full VM; optionally with memory (live).
- ✓ Hot-plug network devices, USB devices, disks, CPUs, and memory to a running VM.
- ✓ PCI(e) pass-through using the GUI.
- ✓ Import VMs from other hypervisors (via OVF/OVA files) directly via the GUI from file-based storages.
- ✓ Setup UEFI with secure boot and a Trusted Platform Module (TPM) to run modern guest OS.
- ✓ View guest display from anywhere with noVNC HTML5 web console or SPICE client (virt-viewer).



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## Containers with LXC

- ✓ Proxmox Container Toolkit (pct) provides easy and flexible management of Linux Container (LXC).
- ✓ Ready-to use images of most common Linux distributions, TurnKey Linux templates, and support for OCI images.
- ✓ Fine-grained memory and CPU resource control.
- ✓ Shares the host kernel: Almost zero overhead.
- ✓ Security features like AppArmor, seccomp, Cgroups, and kernel namespaces.
- ✓ Snapshot and rollback the full container state at any time.
- ✓ Quick maintenance with web console (xterm.js).

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## Live/Online Migration

- ✓ Move QEMU VMs from one physical host to another with zero downtime.
- ✓ Local storage live-migration.
- ✓ Live migration with mediated devices.

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## Flexible Storage Options

- ✓ Local storage such as ZFS, Btrfs, LVM, and LVMthin.
- ✓ Shared storage such as CIFS, iSCSI or NFS.
- ✓ Distributed storage such as Ceph RBD and CephFS.
- ✓ Encryption support for Ceph OSD and ZFS.
- ✓ Unlimited number of storage definitions (clusterwide).

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## Storage Replication Stack (ZFS)

- ✓ Built-in, open-source storage replication framework.
- ✓ Redundancy for guests using local storage.
- ✓ Data availability without using shared storage.
- ✓ Asynchronous replication.
- ✓ Minimize data loss in the case of a failure.
- ✓ Improve reliability, fault-tolerance, and accessibility of your data.
- ✓ Enables fast, live migration (sync only delta since last replication).
- ✓ Flexible scheduling options with the calendar events format.

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## Software-Defined Storage (SDS) with Ceph

- ✓ Integrated Ceph, a distributed object store and file system.
- ✓ Management via GUI or CLI.
- ✓ Easy-to-use installation wizard.
- ✓ Run Ceph RBD and CephFS directly on the Proxmox VE cluster nodes.
- ✓ Proxmox delivers its own Ceph packages.
- ✓ Ceph support is included in the support agreement.
- ✓ Add external Ceph clusters as storage via GUI.

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## Software-Defined Network (SDN)

- ✓ Manage and control complex networking configurations and multi-tenant setups via GUI.
- ✓ Separate the different network areas into zones consisting of virtual networks (VNETs), optionally including IP address management (IPAM).
- ✓ Applicable to all sizes of networks, from a simple routed NAT setup, traditional separation into 802.1q VLANs, to features like QinQ, VXLAN tunneling, and BGP-based EVPN infrastructures.
- ✓ Cluster-wide synchronization of the configuration.
- ✓ Live reload after a configuration is changed.
- ✓ Dynamic routing protocols including OpenFabric, OSPF and BGP. **NEW**

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## Linux Network Stack

- ✓ Flexible options to manage local nodes.
- ✓ Well-known tools with configuration via the GUI.
- ✓ IPv4 and IPv6 support.
- ✓ Support for VLANs, bonds, and bridges.



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## Backup and Restore

- ✓ Full backups of VMs and containers.
- ✓ Live snapshot backups.
- ✓ Define flexible backup job schedules with the calendar event format.
- ✓ Configure multiple backup storages.
- ✓ GUI and CLI integration.
- ✓ Backup and restore via GUI.
- ✓ Set up backup retention policies via GUI.
- ✓ Run scheduled backup jobs manually in the GUI.
- ✓ Monitor backup jobs in the GUI via the tab "Tasks".
- ✓ Automatically add notes to backups using a template.
- ✓ Backup fleecing using fast local storage as a buffer for I/O-heavy guests with slow backup targets.
- ✓ Support for 3rd party backup provider plugins.

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## Integration of Proxmox Backup Server

- ✓ Full support for the open-source, enterprise backup solution from Proxmox.
- ✓ Incremental, fully deduplicated backups of VMs, containers, and physical hosts.
- ✓ QEMU dirty-bitmaps for extremely fast VM backup.
- ✓ Strong encryption on the client-side, with easy encryption key management.
- ✓ Single-file and directory restore.
- ✓ With live-restore, guests start as soon as the restore does.

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## Disk Management

- ✓ View all disks and their partitions.
- ✓ Check S.M.A.R.T health status of disks.
- ✓ Wipe all data from a partition or disk via the GUI.
- ✓ Create ZFS (RAID-Z, dRAID, RAID 0/1/10), LVM(-thin) and file based (ext4, XFS) storages.

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## Two-Factor Authentication

- ✓ Providing high security.
- ✓ Support for multiple 2nd factors for a single account.
- ✓ Ability to use a hardware token (Webauthn, TOTP, Yubikey-OTP).
- ✓ Generate single-use recovery codes.
- ✓ TFA/TOTP lockout to protect against brute-force attacks.

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## Multiple Authentication Sources

- ✓ Proxmox VE supports multiple authentication realms.
- ✓ Linux PAM standard authentication (e.g., 'root' and other local users).
- ✓ Built-in Proxmox VE authentication server.
- ✓ Microsoft Active Directory (MS ADS).
- ✓ LDAP
- ✓ Single Sign-On (SSO) with OpenID Connect.
- ✓ Regular and automated user synchronization for LDAP/AD realms

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## Flexible Access Control

- ✓ User and permission management for all objects (VMs, storage systems, nodes, hardware resources, networking zones, etc.) .
- ✓ Proxmox VE comes with a number of predefined roles (groups of privileges) which cover common use cases. The contained privileges can be seen in the GUI.
- ✓ Permissions to control access to objects (access control lists). Each permission specifies a subject (user or group) and a role (set of privileges) on a specific path.
- ✓ Create API Tokens and lock them further down for secure, and easily revocable access.
- ✓ Restricted by default: new users or API tokens do not have any permissions.

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## VM Templates and Clones

- ✓ Deploying VMs from templates is blazing fast, very convenient, and if you use linked clones, highly storage efficient.
- ✓ Linked and full clones.

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## VM Hardware passthrough

- ✓ Assign PCI(e) or USB devices to VMs and containers via the GUI.
- ✓ Hot-plug USB devices and ports into running VMs.
- ✓ Use virtual functions to share a single device with multiple guests.
- ✓ Pass through whole disks using the CLI.
- ✓ Resource mappings for VMs, with hardware pass-through/cluster-wide mapping of PCI/USB devices.



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## Proxmox VE Firewall

- ✓ Supporting IPv4 and IPv6.
- ✓ Linux-based netfilter technology. Stateful firewall for easy, dynamic filtering.
- ✓ Distributed: configurations in Proxmox VE cluster file system, with filtering rules applied on each node.
- ✓ Cluster-wide IP sets, aliases, and security groups.
- ✓ Tight integration with the SDN functionality (access of IPAM information as IP-sets).
- ✓ 3 levels of configuration (data center, host, VM/CT).
- ✓ Support for custom 'raw' tables; enable SYN flood attack protection.

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## Web-based Management Interface

- ✓ Integrated - no need to install a separate management tool nor any additional management node.
- ✓ Fast and easy creation of VMs and containers.
- ✓ Seamless integration and easy management of an entire cluster. Group virtual guests by assigned tags.
- ✓ Fast, search-driven interface able to handle thousands of VMs and containers.
- ✓ Based on the Ext JS JavaScript framework.
- ✓ Secure HTML5 console, supporting SSL.
- ✓ Let's Encrypt TLS certificates via the ACME-based DNS or HTTP challenge mechanism.
- ✓ Subscription management via GUI.
- ✓ Simple management of APT package repositories, and upgrades via GUI.
- ✓ Modern web interface for cluster management on mobile devices.
- ✓ Integrated documentation.

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## Command Line (CLI)

- ✓ Manage all components of your virtual environment.
- ✓ CLI with intelligent tab completion.
- ✓ Full UNIX man page documentation.

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## REST API

- ✓ Easy integration for third-party management tools.
- ✓ Rest API (JSON as primary data format).
- ✓ Alternative human-readable API format with interactive browser, as built-in documentation.
- ✓ Full support for API tokens.
- ✓ Automatic JSON Schema powered parameter verification.
- ✓ Easy means of creating command line tools (use the same API).
- ✓ Resource Oriented Architecture (ROA).
- ✓ Declarative API definition using JSON Schema.

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## Modern Linux Server Experience

- ✓ Flexible notification system: rule-based notifications sent as email via local Postfix MTA or authenticated SMTP, or sent via a Gotify instance.
- ✓ Webhooks for the notification system enable system events to trigger HTTP requests.
- ✓ Secure boot compatibility.
- ✓ Kernel pinning: select preferred kernel version.
- ✓ Automated and unattended installation for full automation of the setup of bare-metal nodes.
- ✓ Tailored installation ISO offering installation via GUI, terminal, or serial port.

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## Android App

- ✓ Connect to Proxmox VE instances.
- ✓ Manage clusters, nodes, VMs, and containers.
- ✓ Access SPICE and HTML5 consoles.
- ✓ Based on the Flutter framework.

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## GPU workloads

- ✓ GPU Passthrough.
- ✓ Officially supported platform for NVIDIA vGPU.



## LEARN MORE

Project page: [pve.proxmox.com](https://pve.proxmox.com)  
Bugtracker: [bugzilla.proxmox.com](https://bugzilla.proxmox.com)  
Code repository: [git.proxmox.com](https://git.proxmox.com)

## HOW TO BUY

Visit the Proxmox Online Shop to purchase a subscription: [shop.proxmox.com](https://shop.proxmox.com)  
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Proxmox Customer Portal: [my.proxmox.com](https://my.proxmox.com)  
Community Support Forum: [forum.proxmox.com](https://forum.proxmox.com)

## TRAINING PROXMOX VE

Learn Proxmox VE easily – Visit a training:  
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## SALES INQUIRIES?

Please contact our team:  
[sales@proxmox.com](mailto:sales@proxmox.com).

## ABOUT PROXMOX

Proxmox Server Solutions GmbH is a software provider dedicated to developing powerful and efficient open-source server solutions. The privately held company is based in Vienna (Europe).

### Proxmox Server Solutions GmbH

Bräuhausgasse 37, 1050 Vienna, Austria  
[office@proxmox.com](mailto:office@proxmox.com), [www.proxmox.com](https://www.proxmox.com)