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# PROXMOX VIRTUAL ENVIRONMENT

Efficient Virtualization with Full Control



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# OVERVIEW

**Proxmox develops centralized solutions for virtualization, infrastructure management, and security, enabling organizations to implement efficient, secure, and scalable IT environments.**

Proxmox Virtual Environment (Proxmox VE) is an enterprise virtualization platform based on Debian Linux that integrates KVM virtualization, LXC containers, software-defined storage (SDS), and software-defined networking (SDN) into a single management platform. Administration is carried out through a centralized web interface, command-line interface (CLI), or REST API.

The platform includes features such as live migration, storage replication, snapshots, an integrated firewall, high availability (HA), and automation mechanisms, supporting Linux and Windows workloads in environments of any size.

Thanks to its multi-master architecture, Proxmox VE does not require a dedicated management server, simplifying infrastructure management and eliminating single points of failure (SPOFs).



# 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.



## Adaptability

A platform adaptable to different virtualization scenarios, from small infrastructures to large-scale enterprise environments.



## Made for Production

Support services and enterprise subscriptions available for production environments.





# FEATURES

## ➤ 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.

## ➤ Free Software and Centralized Management

- ✓ Debian-based, using the Proxmox kernel with OpenZFS support.
- ✓ Continuous development and active platform maintenance.
- ✓ Public code repository (Git).
- ✓ Transparent development process.
- ✓ Bug tracker for issue tracking.
- ✓ Community support forum.
- ✓ Documentation, project page, video tutorials, howto guides, and much more.

## ➤ Enterprise Support Agreement

- ✓ MAvoid 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.
- ✓ Large network of resellers & partners who help with your project.

## > 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.

## > 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 Scheduler (CRS) with dynamic mode for automatic resource distribution across nodes.

- ✓ 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 workload balancing to optimize cluster resource utilization.
- ✓ Preservation of resource states during planned maintenance operations.
- ✓ Individual activation and deactivation of resources configured for high availability.

## > 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.

## > Virtual Machines with QEMU/KVM

- ✓ Independent from OS: Run unmodified Windows, Linux, BSD, or others.
- ✓ QEMU/KVM-based virtualization, providing low processing overhead.
- ✓ Configuration of custom CPU models for specific performance and compatibility requirements.
- ✓ Creation of full VM snapshots, with the option to include the memory state.
- ✓ 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).

## > 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).

## > Live/Online Migration

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

## > 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.

## ➤ 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).

## ➤ Storage Replication Stack (ZFS)

- ✓ Integrated storage replication framework based on OpenZFS.
- ✓ 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.

## ➤ 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.

## ➤ 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).
- ✓ Support for different network architectures, including NAT, 802.1Q VLAN, QinQ, VXLAN, and BGP-based EVPN.



- ✓ Cluster-wide synchronization of the configuration.
- ✓ Live reload after a configuration is changed.
- ✓ Dynamic routing protocols OpenFabric, OSPF and BGP.

## ➤ 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.

## ➤ Integration of Proxmox Backup Server

- ✓ Native integration with Proxmox Backup Server.
- ✓ 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.
- ✓ DWith live-restore, guests start as soon as the restore does.

## ➤ 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.

## ➤ 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.

## ➤ 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

## ➤ 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.
- ✓ 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.

## ➤ VM Templates and Clones

- ✓ Rapid creation of VM from templates.
- ✓ Full Clones and Linked Clones, helping optimize deployment time and storage utilization.

## ➤ VM Hardware passthrough

- ✓ Assign PCI(e) or USB devices to VMs and containers.
- ✓ Hot-plug USB devices and ports into running VMs.

- ✓ Support for SR-IOV through the use of Virtual Functions (VFs).
- ✓ Pass through whole disks using the CLI.
- ✓ Resource mappings for VMs, with hardware passthrough/cluster-wide mapping of PCI/USB devices.

### > 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.

### > 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.

### > Command Line (CLI)

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

## > 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.

## > 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.

## > Android App

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

## > GPU workloads

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





# SUBSCRIPTION PLANS



## PREMIUM

Maximum coverage for business-critical infrastructure

- ✓ Stable and Secure Updates
- ✓ Access to all features: High Availability (HA), Live Migration, Clustering, and more
- ✓ Support through the Customer Portal
- ✓ **Unlimited support tickets**
- ✓ 2-hour response time\* (during business hours)
- ✓ Remote support via SSH
- ✓ Offline subscription key activation
- ✓ Access to the Datacenter Manager Enterprise Repository and related support



## STANDARD

Balanced coverage for established IT teams

- ✓ Stable and Secure Updates
- ✓ Access to all features: High Availability (HA), Live Migration, Clustering, and more
- ✓ Support through the Customer Portal
- ✓ **10 support tickets per year**
- ✓ 4-hour response time\* (within one business day)
- ✓ Remote support via SSH
- ✓ Offline subscription key activation
- ✓ Access to the Datacenter Manager Enterprise Repository and related support



## BASIC

For Growing Businesses

- ✓ Stable and Secure Updates
- ✓ Access to all features: High Availability (HA), Live Migration, Clustering, and more
- ✓ Support through the Customer Portal.
- ✓ **3 support tickets per year**
- ✓ 1-business-day response time
- ✓ Access to the Datacenter Manager Enterprise Repository and related support



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