



# LEARN

Lanka Education and Research Network

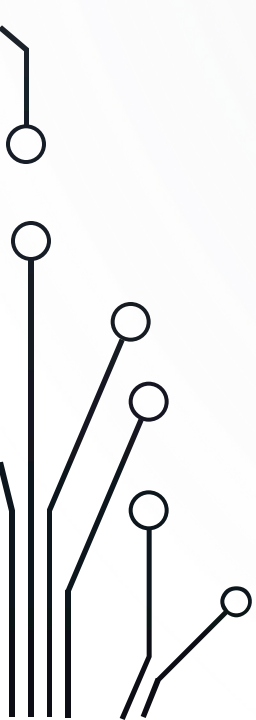
## ***Virtualization and Installation of On-Prem Video Conferencing Platform***

Proxmox



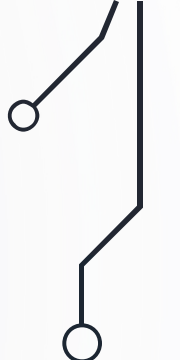
# INTRODUCTION TO PROXMOX

Proxmox VE is a complete, open-source server management platform for enterprise virtualization. It tightly integrates the KVM hypervisor and Linux Containers (LXC), software-defined storage and networking functionality, on a single platform. With the integrated web-based user interface you can manage VMs and containers, high availability for clusters, or the integrated disaster recovery tools with ease.



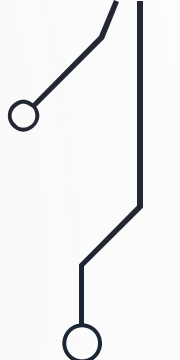
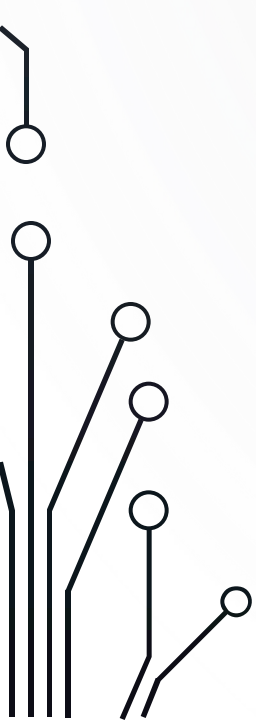
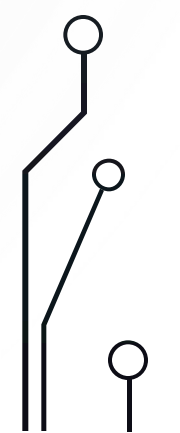


# WHY PROXMOX IS POPULAR

- **Open-source platform:** Proxmox is an open-source platform, which means that users have access to the underlying source code and can modify it to meet their needs. This makes it highly customizable and flexible.
  - **Wide range of virtualization technologies:** Proxmox supports a variety of virtualization technologies, including KVM, LXC, and OpenVZ, which allows users to choose the best technology for their specific use case.
  - **User-friendly web console:** Proxmox has a user-friendly web console that makes it easy for users to manage virtual machines and containers, configure networking, and monitor system performance.
  - **High availability (HA) clustering:** Proxmox supports HA clustering, which means that virtual machines and containers can be automatically migrated to other nodes in the event of a node failure.
- 



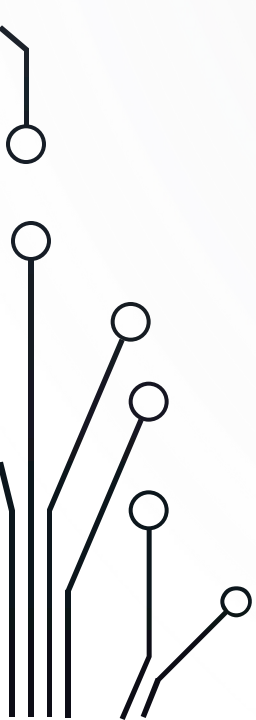
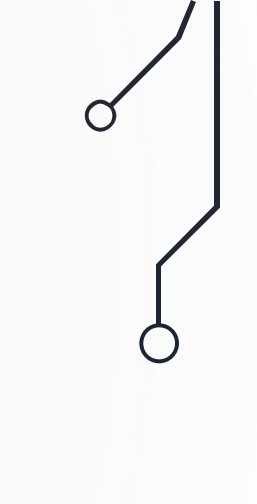
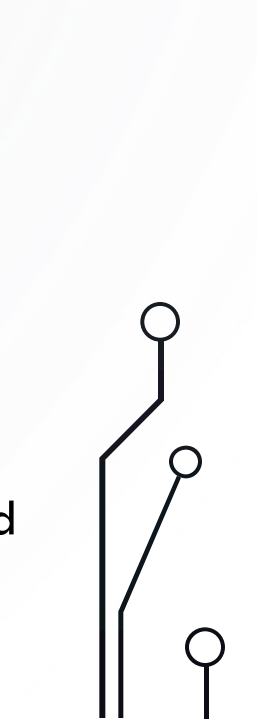
## CONT'D

- **Robust feature set:** Proxmox has a wide range of features, including live migration, backup and restore, disaster recovery, and more.
  - **Cost-effective:** Proxmox is a cost-effective solution for virtualization, as it is open source and does not require expensive licensing fees.
  - **Community support:** Proxmox has an active community of users and developers who provide support and contribute to the development of the platform.
  - **Security:** Proxmox is designed with security in mind, with features such as encrypted communication and secure containerization.
- 
- 
- 



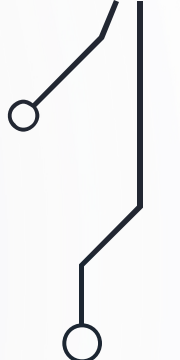
# PROS AND CONS OF PROXMOX

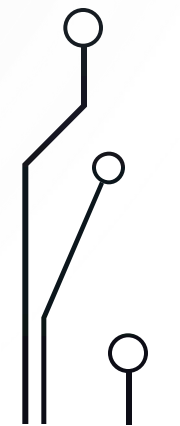
## Pros:

- **Open-source:** Proxmox is an open-source platform, which means that users have access to the underlying source code and can modify it to meet their needs. This makes it highly customizable and flexible.
  - **Easy to use:** Proxmox has a user-friendly web console that makes it easy for users to manage virtual machines and containers, configure networking, and monitor system performance.
  - **Flexible:** Proxmox supports a variety of virtualization technologies, including KVM, LXC, and OpenVZ. This allows users to choose the best technology for their specific use case.
  - **High availability:** Proxmox supports high availability (HA) clustering, which means that virtual machines and containers can be automatically migrated to other nodes in the event of a node failure.
  - **Robust feature set:** Proxmox has a wide range of features, including live migration, backup and restore, disaster recovery, and more.
- 
- 
- 



## Cons:

- **Steep learning curve:** Proxmox can have a steep learning curve for users who are not familiar with virtualization concepts or Linux administration.
  - **Limited support:** While Proxmox has an active community of users and developers, official support is limited and can be expensive.
  - **Resource-intensive:** Proxmox can be resource-intensive, requiring significant CPU and RAM resources to operate efficiently.
  - **Compatibility issues:** Proxmox may have compatibility issues with certain hardware or software platforms, which can cause issues for users.
  - **Limited integration:** Proxmox has limited integration with third-party software platforms, which can limit its usefulness in certain environments
- 



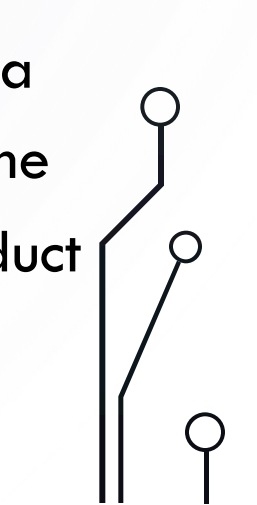
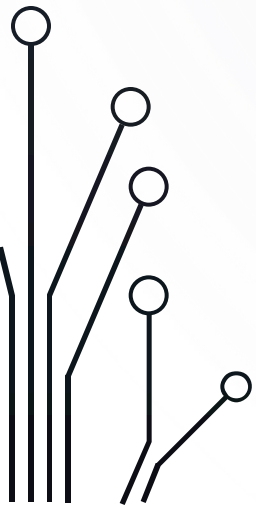


# FEATURES

## *Server Virtualization*

Proxmox Virtual Environment is based on Debian GNU/Linux and uses a custom Linux Kernel. The Proxmox VE source code is free, released under the GNU Affero General Public License, v3 (GNU AGPL, v3). This means that you are free to use the software, inspect the source code at any time and contribute to the project yourself.

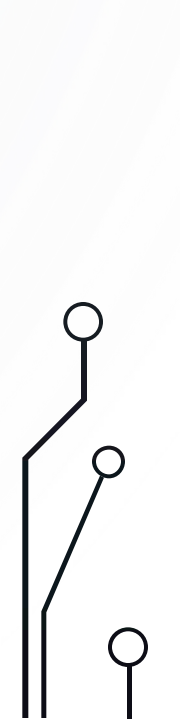
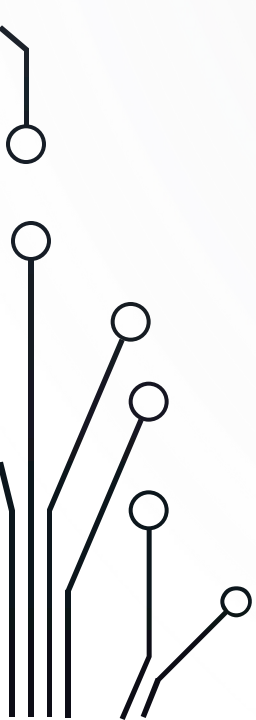
Using open-source software guarantees full access to all functionality, as well as a high level of reliability and security. We encourage everybody to contribute to the Proxmox VE project, while Proxmox, the company behind it, ensures that the product meets consistent, enterprise-class quality criteria.





# KERNEL-BASED VIRTUAL MACHINE (KVM)

KVM is the industry-leading Linux virtualization technology for full virtualization. It's a kernel module, that's merged into the mainline Linux kernel, and it runs with near-native performance on all x86 hardware with virtualization support—either Intel VT-x or AMD-V.



With KVM you can run both Windows and Linux in virtual machines (VMs), where each VM has private, virtualized hardware: a network card, disk, graphics adapter, etc. Running several applications in VMs on a single system, enables you to save power and reduce costs, while at the same time, giving you the flexibility to build an agile and scalable software-defined data center, that meets your business demands.



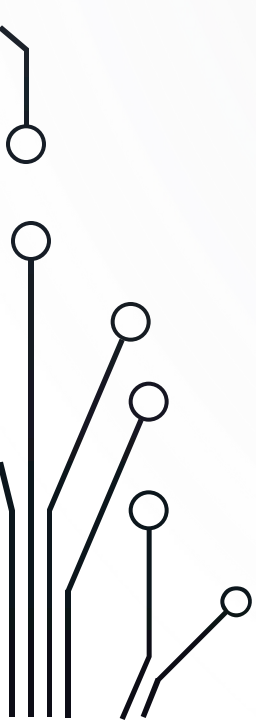


# CONTAINER-BASED VIRTUALIZATION

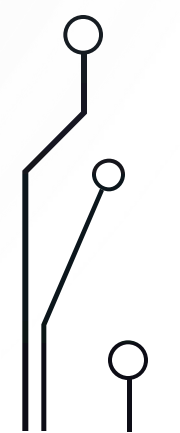


Container-based virtualization technology is a lightweight alternative to full machine virtualization, because it shares the host system's kernel.

## **Linux Containers (LXC)**



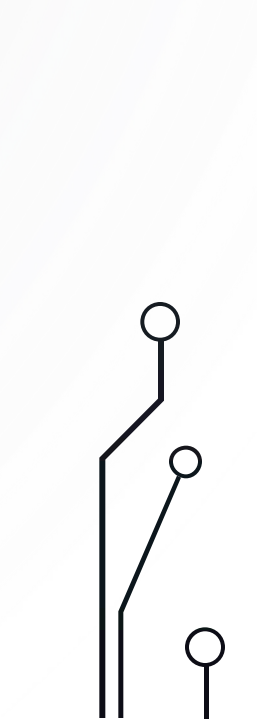
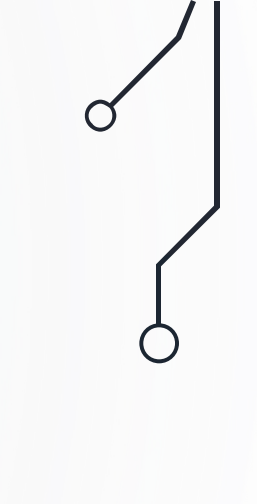
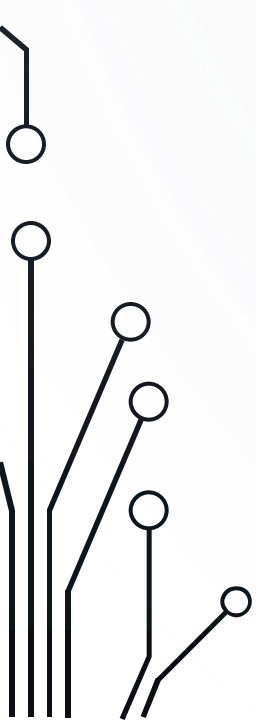
LXC is an operating-system-level virtualization environment for running multiple, isolated Linux systems on a single Linux control host. LXC works as a userspace interface for the Linux kernel containment features. Users can easily create and manage system or application containers with a powerful API and simple tools.





# *CENTRAL MANAGEMENT*

While many people start with a single node, Proxmox Virtual Environment can scale out to a large set of clustered nodes. The cluster stack is fully integrated and ships with the default installation. To manage all tasks of your virtual data center, you can use the central, web-based management interface.






- **Web-based management interface**

Proxmox VE is easy to use. You can do all management tasks with the integrated graphical user interface (GUI), there is no need to install a separate management tool. The central web interface is based on the ExtJS JavaScript framework and can be accessed from any modern browser. In addition to management tasks, it also provides an overview of the task history and system logs of each node. This includes running backup tasks, live migration, software-defined storage, or HA triggered activities. The multi-master tool allows you to manage your whole cluster from any node of your cluster; you don't need a dedicated manager node.

- **Command Line Interface (CLI)**

For advanced users who are used to the comfort of the Unix shell or Windows Powershell, Proxmox VE provides a command line interface to manage all the components of your virtual environment. This command line interface has intelligent tab completion and full documentation in the form of UNIX man pages.





- **Proxmox VE Mobile**

You can access Proxmox VE on mobile devices either via an Android app or via the HTML5-based mobile version of the web interface. The Proxmox VE Android app is based on the Flutter framework, and allows you to access your Proxmox VE server and manage your cluster, nodes, VMs, and containers. The Proxmox VE HTML5 mobile client enables you to manage Proxmox VE on the go, including access to the SPICE and HTML5 console. This allows you to manage VMs and containers, and view their configuration.


- **Unique multi-master design**

To simplify the management of a cluster, you can carry out maintenance tasks cluster-wide, from any node. The integrated web-based management interface gives you a clean overview of all your KVM guests and Linux containers across your cluster. You can easily manage your VMs and containers, storage or cluster from the GUI. There is no need to install a separate, complex, and pricey management server.

- **Proxmox Cluster File System (pmxcfs)**

Proxmox VE uses the unique Proxmox Cluster File System (pmxcfs), a database-driven file system developed by Proxmox.

The pmxcfs enables you to synchronize configuration files across your cluster. By using Corosync, these files are replicated in real time to all cluster nodes. The file system stores all data inside a persistent database on disk, nonetheless, a copy of the data resides in RAM. The maximum storage size is currently 30 MB - more than enough to store the configuration of several thousands of VMs.





- **Live/Online Migration**

With the integrated live/online migration feature, you can move running virtual machines from one Proxmox VE cluster node to another, without any downtime or noticeable effect from the end-user side.

Administrators can initiate this process from either the web interface or the command line. This enables you to minimize downtime, in case you need to take the host system offline for maintenance.

- **REST API**


Proxmox VE uses a RESTful API. We chose JSON as the primary data format, and the whole API is formally defined using JSON Schema. This enables fast and easy integration for third party management tools, such as custom hosting environments.

- **Role-based Administration**

You can define granular access to all objects (like VMs, storage, nodes, etc.) by using the role-based permission management system. This allows you to define privileges and helps you to control access to objects. This concept is also known as access control lists: Each permission specifies a subject (a user group, or API token) and a role (set of privileges) on a specific path.

- **Authentication Realms**

Proxmox VE supports multiple authentication sources, for example Linux PAM, an integrated Proxmox VE authentication server, LDAP, Microsoft Active Directory, and OpenID Connect.





# *PROXMOX VE HIGH AVAILABILITY (HA) CLUSTER*

A multi-node Proxmox VE Cluster enables the creation of highly available virtual servers. The Proxmox VE HA Cluster is based on proven Linux HA technologies, providing stable and reliable HA service.

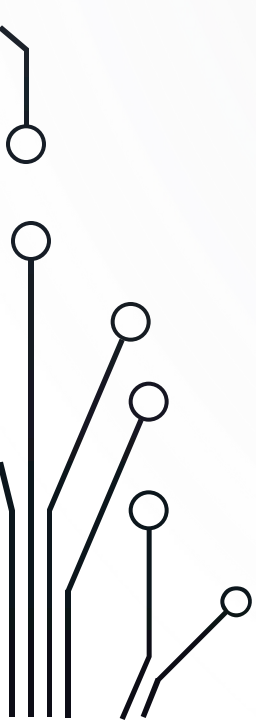
- **Proxmox VE HA Manager**

The resource manager, Proxmox VE HA Manager, monitors all VMs and containers in the cluster and automatically comes into action if one of them fails. The Proxmox VE HA Manager works out-of-the-box. Zero configuration is needed. Additionally, the watchdog-based fencing dramatically simplifies deployment.

The entire Proxmox VE HA Cluster can be easily configured from the integrated web-based user interface.

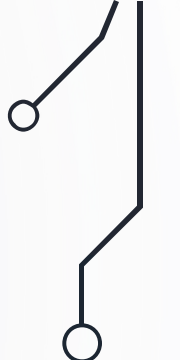
- **Proxmox VE HA Simulator**

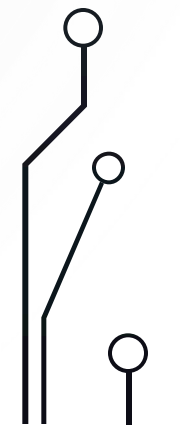
Proxmox VE includes a HA Simulator. This allows you to test the behavior of a real-world 3 node cluster with 6 VMs. The Proxmox HA Simulator runs out-of-the-box and helps you to learn and understand how Proxmox VE HA works.





# *BRIDGED NETWORKING*

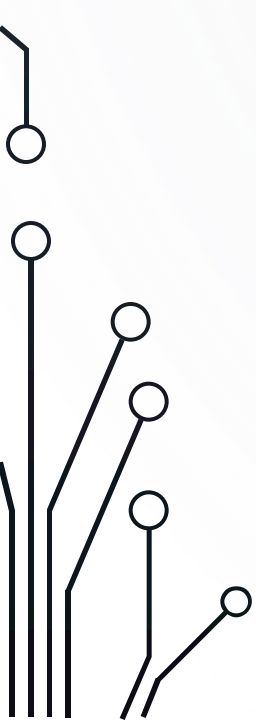
- Proxmox VE uses a bridged networking model. Each host can have up to 4094 bridges.
  - Bridges are like physical network switches, implemented in software on the Proxmox VE host. All VMs can share one bridge, as if virtual network cables from each guest were all plugged into the same switch. For connecting VMs to the outside world, bridges are attached to physical network cards assigned a TCP/IP configuration.
  - For further flexibility, VLANs (IEEE 802.1q) and network bonding/aggregation are possible. In this way, it is possible to build complex, flexible, virtual networks for the Proxmox VE hosts, leveraging the full power of the Linux network stack.
  - In case you have more specific needs, Proxmox VE also supports Open vSwitch (OVS) as an alternative to Linux bridges, bonds, and VLAN interfaces. OVS provides advanced features, such as RSTP support, VXLANs and OpenFlow, and also support multiple VLAN on a single bridge.
- 





# *FLEXIBLE STORAGE OPTIONS*

The Proxmox VE storage model is very flexible. VM images can either be stored on one or several local storage devices or on shared storage like NFS and SAN. There are no limits. You can configure as many storages as you like, and can use all storage technologies available for Debian GNU/Linux. The benefit of storing VMs on shared storage is the ability to live-migrate running machines without any downtime.







## Network storage types supported

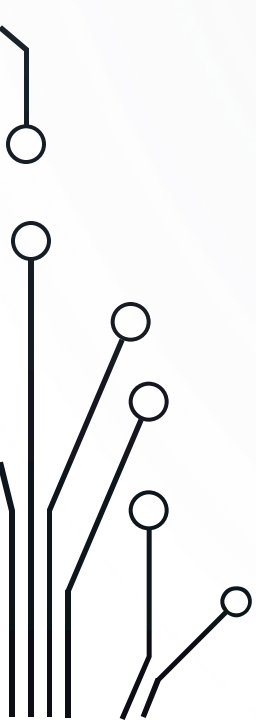
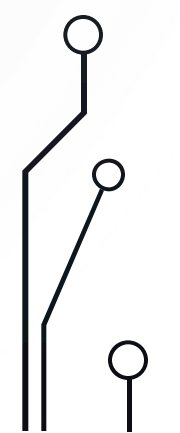
- LVM Group (network backing with iSCSI targets)
- iSCSI target
- NFS Share
- SMB/CIFS
- Ceph RBD
- Direct to iSCSI LUN
- GlusterFS
- CephFS

## Local storage types supported

- LVM Group
  - Directory (storage on an existing filesystem)
  - ZFS
- 



# SOFTWARE-DEFINED STORAGE WITH CEPH

- Ceph is an open-source distributed object store and file system designed to provide excellent performance, reliability and scalability. Proxmox Virtual Environment fully integrates Ceph, giving you the ability to run and manage Ceph storage directly from any of your cluster nodes.
  - Ceph provides two types of storage, RADOS Block Device (RBD) and CephFS. An RBD provides block level storage, for content such as disk images and snapshots. CephFS implements a POSIX-compliant filesystem using a Ceph storage cluster to store its data.
- 
- 

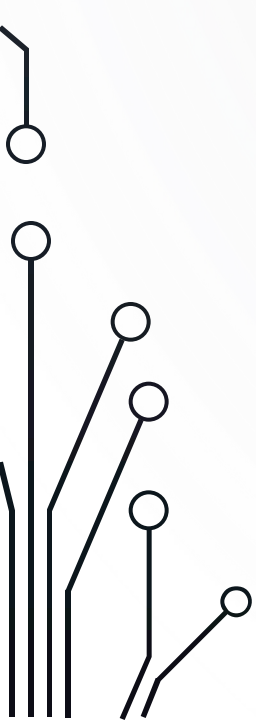
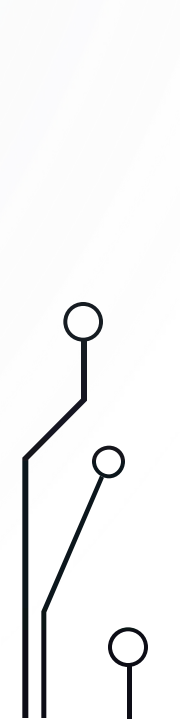
## Benefits of Ceph with Proxmox VE

- Easy setup and management through the GUI and CLI
- Self-healing
- Scalable to the exabyte level
- Setup pools with different performance and redundancy characteristics
- Runs on economical commodity hardware





# *BACKUP/RESTORE*

- Backups are a basic requirement for any sensible IT environment. The Proxmox VE platform provides a fully integrated solution, using the capabilities of each storage and each guest system type. Backups can be easily started with the GUI or with the `vzdump` backup tool (via command line). These backups are always full backups - containing the configuration of VMs and container, and all data.
  - The integrated backup tool (`vzdump`) creates consistent snapshots of running containers and KVM guests. It basically creates an archive of the VM or container data and also includes the configuration files.
- 
- 

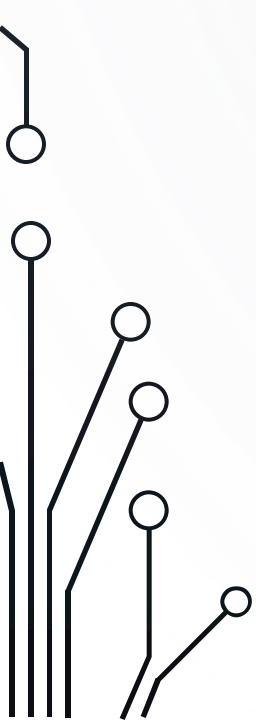


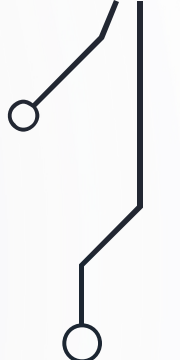
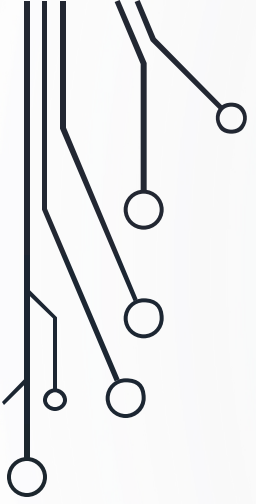
- **Scheduled Backup**

Backup jobs can be scheduled so that they are executed automatically on specific days and times, for selectable nodes and guest systems.

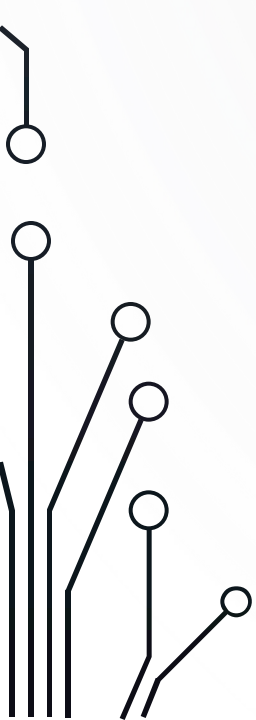
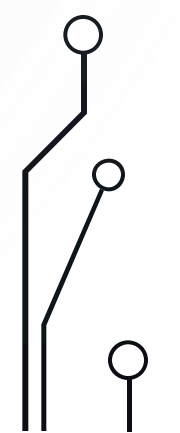
- **Backup Storage**

KVM live backup works for all storage types including VM images on NFS, iSCSI LUN, and Ceph RBD. The Proxmox VE backup format is optimized for storing VM backups quick and effectively (accounting for sparse files, out of order data, minimized I/O).





# PROXMOX BACKUP SERVER INTEGRATION

- Proxmox Backup Server is our enterprise-class backup solution, that is capable of backing up VMs, containers, and physical hosts. Support for this is fully integrated into Proxmox VE, meaning you can seamlessly back up and restore guests using the same common interface that the other storage types use.
  - These backups are incremental, only transferring newly changed data over the network. This is highly beneficial in terms of network bandwidth and backup job run time. Data can also be easily encrypted on the client side, so that your backed up data is inaccessible to attackers.
- 
- 

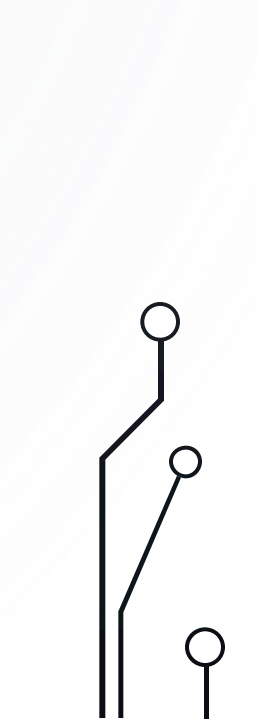
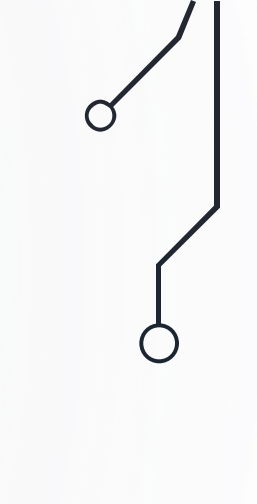
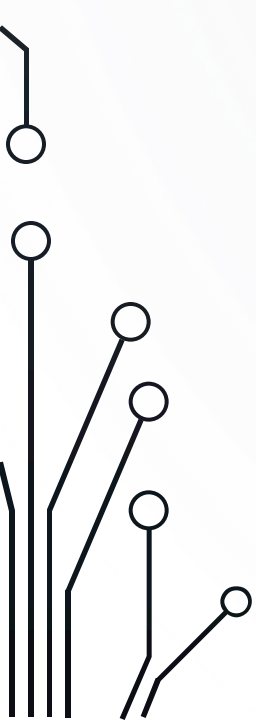


- **Single-file Restore**

Oftentimes, only a single file or directory is needed from a backup. From the Proxmox VE web interface, you can securely search for and restore individual files or directories from a VM or container backup.

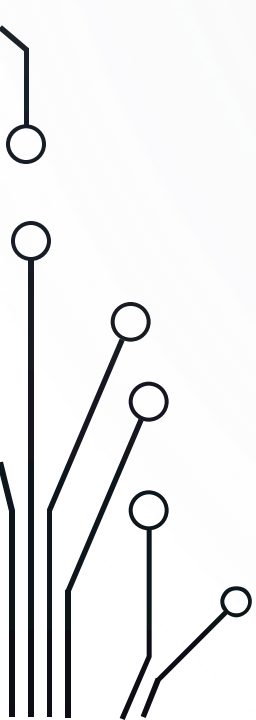
- **Live-Restore**

Restoring large backups can take a long time and be a major source of downtime in case of disaster. However, for VM backups that are stored on a Proxmox Backup Server, the live-restore feature minimizes this downtime, allowing the VM to start as soon as the restore begins. In this case, the data is continuously copied in the background, prioritizing chunks that the VM is actively accessing.





# *PROXMOX VE FIREWALL*

- The built-in Proxmox VE Firewall provides an easy way to protect your IT infrastructure. The firewall is completely customizable, allowing complex configurations via the GUI or CLI.
  - You can set up firewall rules for all hosts inside a cluster, or define rules for virtual machines and containers only. Features like firewall macros, security groups, IP sets and aliases help to make that task easier.
- 





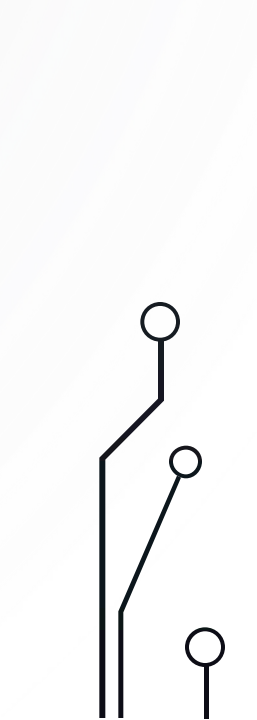
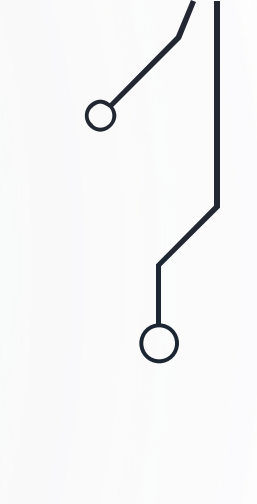
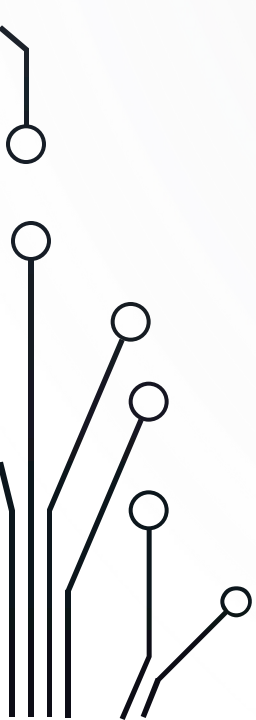


- **Distributed Firewall**

While all configuration is stored in the cluster file system, the iptables-based firewall runs on each cluster node, and thus provides full isolation between virtual machines. The distributed nature of this system also provides much higher bandwidth than a centralized firewall solution.

- **IPv4 and IPv6**

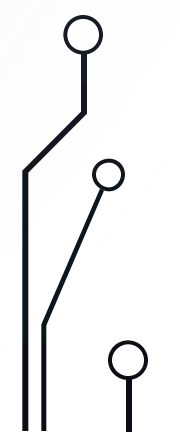
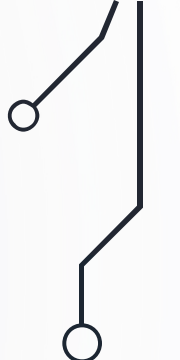
The firewall has full support for IPv4 and IPv6. IPv6 support is fully transparent, and we filter traffic for both protocols by default. Thus, there is no need to maintain a different set of rules for IPv6.





# SYSTEM REQUIREMENTS

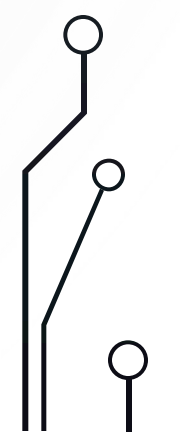
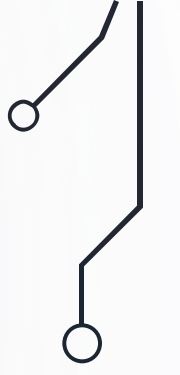
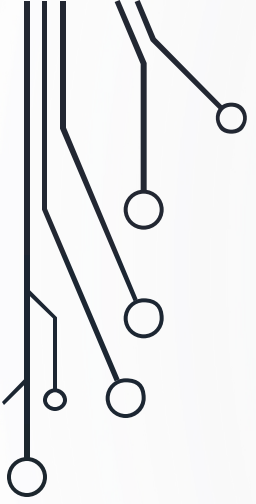
Proxmox VE supports clustering, this means that multiple Proxmox VE installations can be centrally managed thanks to the integrated cluster functionality. Proxmox VE can use local storage like (DAS), SAN, NAS, as well as shared, and distributed storage (Ceph).



# SYSTEM REQUIREMENTS

## Recommended Hardware

- Intel EMT64 or AMD64 with Intel VT/AMD-V CPU flag.
- Memory, minimum 2 GB for OS and Proxmox VE services. Plus designated memory for guests. For Ceph or ZFS additional memory is required, approximately 1 GB memory for every TB used storage.
- Fast and redundant storage, best results with SSD disks.
- OS storage: Hardware RAID with batteries protected write cache (“BBU”) or non-RAID with ZFS and SSD cache.
- VM storage: For local storage use a hardware RAID with battery backed write cache (BBU) or non-RAID for ZFS. Neither ZFS nor Ceph are compatible with a hardware RAID controller. Shared and distributed storage is also possible.
- Redundant Gbit NICs, additional NICs depending on the preferred storage technology and cluster setup – 10 Gbit and higher is also supported.
- For PCI(e) passthrough a CPU with VT-d/AMD-d CPU flag is needed.



THANK YOU