Introduction to Proxmox Virtualization Platform Postprint

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Abstract

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Full Text

Abstract

This paper provides a brief introduction to the open-source Proxmox VE (Proxmox Virtual Environment) virtualization management platform, explains how to manage and use the Proxmox platform, and concludes with a summary of its advantages and disadvantages.

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Proxmox VE (Proxmox Virtual Environment) is an integrated virtualization application platform that provides an open-source solution for running OpenVZ and KVM virtual machines. It features a convenient and user-friendly web interface, Java-based UI, and internal APIs that allow users to easily log in to VMs for operations. Additionally, Proxmox VE offers simple template functionality for application deployment, enabling rapid creation of new virtual servers and significantly reducing server installation and deployment costs.

Proxmox VE is based on the Debian Etch (x86_{64}) distribution and therefore cannot be installed on x86 systems. To use KVM, the CPU must support Intel VT or AMD-V hardware virtualization technology, and this feature must be enabled in the BIOS. There are two installation methods: installing a minimal Debian operating system and then adding the Proxmox installation source, or downloading the Proxmox ISO image.

1. Proxmox VE Installation and Configuration

1.1 Installation and Configuration

Download a Proxmox VE ISO image from the official website and burn it to a CD. Begin the installation by pressing ENTER at boot, just like installing a standard operating system. Configure the country, timezone, and keyboard layout, then set the root password (used for logging into the underlying Linux shell and the web management interface). Proceed with network configuration by entering the hostname, IP address (e.g., 192.168.10.100), subnet mask (e.g., 255.255.255.0), gateway (e.g., 192.168.10.1), and DNS server (e.g., 145.253.2.75). The automated installation process then begins, as shown in [Figure 1: see original paper].

Upon completion, Proxmox is installed on the physical server. The installation process automatically partitions the hard drive using LVM format, which is why no partition dialog appears during installation. Proxmox uses LVM because it allows creating snapshot backups for virtual machines, dynamically adjusting disk capacity, and conveniently expanding storage pool capacity.

After installation, the server reboots into a Debian operating system without a graphical interface, with the virtualization platform now running on the physical server. Using another PC on the same network segment, open the management address in a browser: `https://192.168.10.111:8006` (HTTPS is required). The browser will display the platform login interface. Enter the previously configured username and password to access the virtualization platform' s graphical management interface. Proxmox offers two authentication methods: Linux system-based authentication and Proxmox-specific authentication. Select the Linux PAM standard authentication method and choose Chinese for the language option to display the interface in Chinese, as shown in [Figure 2: see original paper] and [Figure 3: see original paper].

The UI is divided into two main functional areas: the left side displays the data center view, while the right side shows detailed functions. The left sidebar includes a tree menu for resources, listing the system resource pool (pve), created virtual servers, virtual server disk storage (local-lvm), and Proxmox platform reserved storage (local) for uploading images and other files. The interface displays the overall resource pool status, such as pool capacity, usage, memory consumption, and the number of online virtual servers. [Figure 4: see original paper] shows the configuration of a virtual server, where parameters can be

adjusted. The top-right corner contains "Logout," "Create VM," and "Create CT" buttons.

1.3 Creating Virtual Servers

To begin, upload a bootable ISO image file. Click "local (pve)" in the left sidebar, then click "Content" on the right to see the "Upload" button. Upload the downloaded system image (which can be Linux, Windows, or other system images). Once uploaded, the image will appear in the list of available boot images when creating a virtual machine.

Click "Create VM" and follow the prompts to fill in the virtual server name, number of CPUs, memory size, hard disk size, boot image, and network configuration. Customize the virtual server according to requirements, then click "OK" to complete the configuration. The created virtual server will appear in the left sidebar list (as shown in [Figure 4: see original paper]). Clicking "Data Center" displays the virtual resource pool status, including health and resource utilization. Clicking "pve" shows the list of virtual servers on the platform (e.g., 101, 102), which are the currently running virtual servers. Clicking on a server ID (e.g., 101) displays its health status, CPU, memory, network, and disk usage and load.

Right-clicking on a server (e.g., 101) and selecting "Edit" allows configuration changes, such as renaming, taking snapshots, configuring networks, or adding storage capacity. Right-clicking "Console" opens the virtual machine' s system interface, where required business applications can be deployed.

2. Service Deployment

This section demonstrates building a forum and a shared software download service. The forum uses the mainstream LAMP architecture (Linux + nginx + mysql + php) plus an open-source forum software (dizz) to create a standard forum platform.

After accessing the Proxmox graphical interface, download a Linux system image (CentOS 7) and upload it to the virtualization platform. Create a virtual server using the CentOS 7 ISO image, configure it with 3GB memory, 50GB hard disk, and bridged networking, then save the configuration. Click "Start" to begin installing the Linux system.

After installing CentOS 7, access the virtual server' s console and install nginx, mysql, and php from source packages (using nginx-1.6, mysql-5.6, and php-5.5). Configure nginx' s server name as 192.168.10.100 with the default data directory at /var/www/html. Install the necessary PHP modules and initialize the database by creating a database named "test" for forum data. Finally, upload the forum software to the `/var/www/html` directory of the nginx service, configure SELinux permissions, and restart the virtual server. This completes all service configurations, and the virtual server can now provide services externally.

Note that supporting dynamic web pages requires many additional PHP modules (fonts, images, SSL, etc.), which are not detailed here but can be referenced in online documentation.

After completing the above steps, enter `http://192.168.10.100` in a browser to access the forum installation wizard. Fill in the database server, database name, and database password. Since the database (mysql) is installed on this virtual server, the database server is localhost. The database name and password were created during database software installation on the virtual server. The lower section allows setting the forum administrator account and password arbitrarily for this test environment. Click "Next" to initialize the forum, after which it becomes usable. Any computer on the LAN can access the forum by entering `http://192.168.10.100` in a browser. Users can register accounts, post articles, and write comments. Since no legitimate domain name was applied for, the forum is only accessible within the internal LAN. The forum homepage is shown in [Figure 5: see original paper].

3. Platform Analysis

Based on the installation, configuration, and service deployment process described above, the platform can be understood as virtualizing a physical resource into a large resource pool, which is then divided into multiple resources for utilization. This virtualization platform employs a typical "divide large into small" virtualization technology, where one physical server can be virtualized into n virtual servers to build more services. This approach improves physical resource utilization—traditional deployment methods often achieve less than 10% utilization, while this technology can effectively increase and exploit physical resource usage.

From a service management perspective, Proxmox makes service management very convenient, enabling graphical operations and maintenance. Administrators can easily create virtual servers, perform backups, take snapshots, quickly restore systems, and adjust resource allocations. The platform also provides graphical monitoring of service operation status and resource usage, making everything clear at a glance.

The platform also supports resource pool expansion. If one resource pool (called a "data center" in Proxmox management terminology) has insufficient resources, another resource pool can be created and clustered with the first, allowing unified management and virtual resource allocation through the Proxmox management platform. For Proxmox version 4, virtual resource clusters theoretically support up to 50 physical nodes. Compared with OpenStack, OpenStack supports virtualization on a much larger scale. In terms of virtualization principles, Proxmox virtualizes a single physical server into a resource pool for allocation, requiring each virtualized physical server to be clustered when expanding the resource pool. OpenStack, by contrast, virtualizes many physical servers into one large resource pool for allocation—a typical "aggregate small into large"

approach.

Proxmox is similar to commercial software like VMware running on Windows, or virtualization platforms developed by H3C based on the Linux 底层, and Sangfor' s cloud desktop underlying virtualization. The key difference is that Proxmox is open-source and free.

References

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Note: Figure translations are in progress. See original paper for figures.