Linux服务器构建与运维管理

第09章：使用KVM实现虚拟化

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提纲

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  - 虚拟化技术简介
  - 虚拟化的工作原理
  - 虚拟化的实现方式
  - 主流虚拟化解决方案
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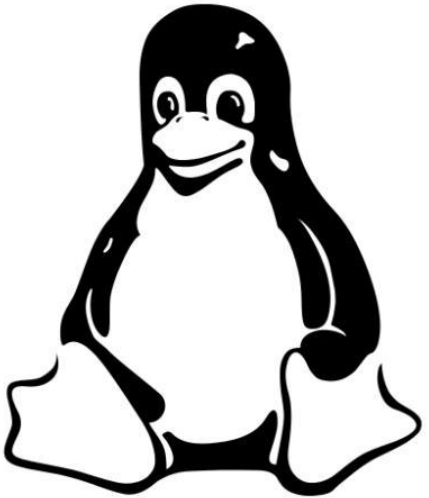
  - 创建KVM虚拟机
  - 管理KVM虚拟机
- 管理KVM虚拟化平台
  - 可视化管理工具



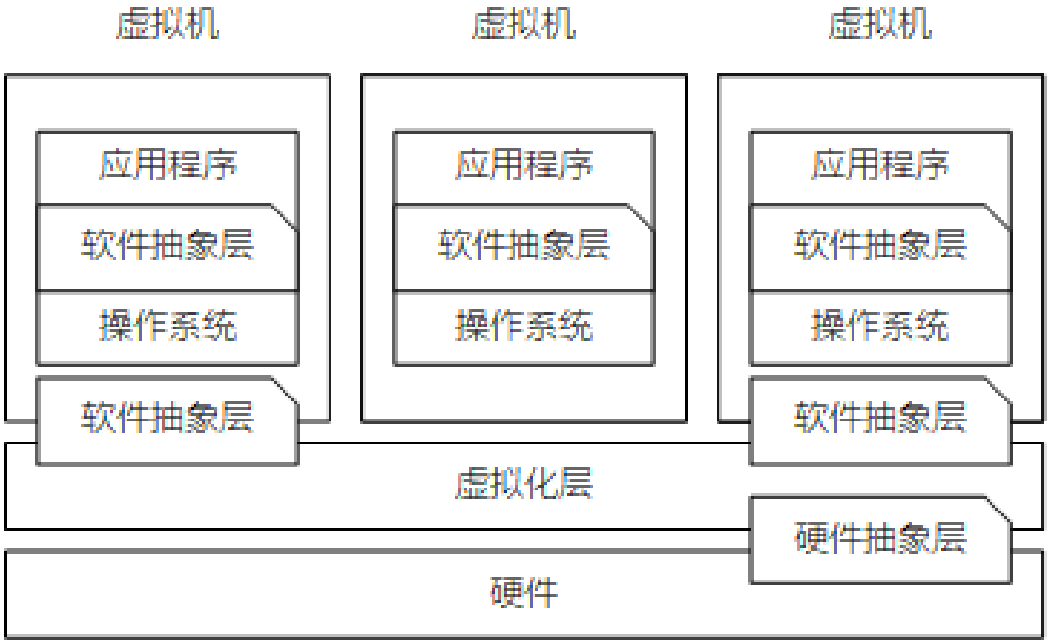
1.虚拟化技术

- 虚拟化技术（Virtualization）是伴随着计算机技术的产生而出现的，在计算机技术的发展历程中一直扮演着重要的角色。
  - 虚拟化，是指通过虚拟化技术将一台计算机虚拟为多台逻辑计算机。在一台计算机上同时运行多个逻辑计算机，每个逻辑计算机可运行不同的操作系统，并且应用程序都可以在相互独立的空间内运行而互不影响，从而显著提高计算机的工作效率。
  - 虚拟化，是一种资源管理技术，是将计算机的各种实体资源，如服务器、网络、内存及存储等，予以抽象、转换后呈现出来，打破实体结构间的不可切割的障碍，使用户可以更好应用资源。
  - 虚拟化，是一个为了简化管理、优化资源分配的解决方案。

1.虚拟化技术

- 虚拟化技术通过把物理资源抽象转换为逻辑上可以管理的资源，达到整合简化物理基础设施架构、提高资源整体利用率、降低运维管理成本等目标，解决物理基础设施之间耦合性强的弊端，实现基于业务运行实际而弹性的自动化分配资源。
- 虚拟化技术通过透明化底层物理硬件达到最大化利用物理硬件的目标，解决高性能的物理硬件产能过剩和老旧硬件产能过低的重组重用。简单来说，就是将底层资源进行分区，并向上层提供特定的、多样化的运算环境。
- 虚拟化技术通过有效管理虚拟资源和物理资源之间的映射关系，达到充分共享物理资源的目标，解决应用系统从资源独占到资源共享的转变，实现业务服务的高可用。

1.虚拟化技术


虚拟机
虚拟机
虚拟机
应用程序
软件抽象层
操作系统
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硬件

1.虚拟化技术

- 根据实现方式不同，虚拟化技术可以分为全虚拟化、半虚拟化、操作系统级虚拟化等。
  - 全虚拟化
    - 在全虚拟化中，虚拟机（“guest”，客户机）和硬件之间，安装有“Hypervisor（超级管理器）”。Hypervisor是一切硬件资源的管理者，并将其虚拟成各种设备，客户机操作系统无需做任何修改，就能直接对虚拟化的硬件发出请求。客户机操作系统内核执行的任何有特权的指令都需要经过Hypervisor翻译，才能正确地被处理。
    - 全虚拟化是最为安全的一种虚拟化技术，因为客户机操作系统和底层硬件之间已被隔离。客户机操作系统的内核不要求做任何修改，可以在不同底层体系结构之间自由移植客户机操作系统。只要有虚拟化软件，客户机就能在任何体系结构的处理器上运行，但是在翻译CPU指令时会有一定的性能损失。

1.虚拟化技术

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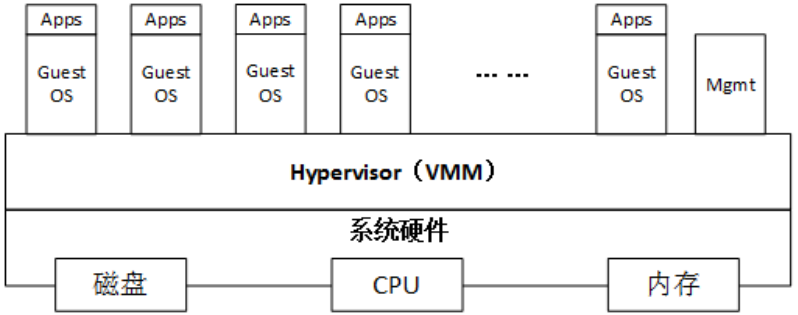
  - 全虚拟化

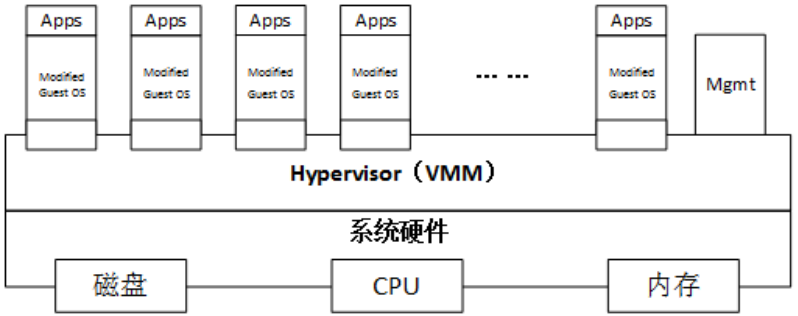


1.虚拟化技术

- 根据实现方式不同，虚拟化技术可以分为全虚拟化、半虚拟化、操作系统级虚拟化等。
  - 半虚拟化
    - 半虚拟化技术也叫做准虚拟化技术，是在全虚拟化的基础上，对客户机操作系统进行修改，增加一个专门的API，使用API将客户机操作系统发出的指令进行最优化处理，不需要Hypervisor耗费一定的资源进行翻译操作，因此Hypervisor的工作负担变得非常小，系统整体的性能有较大提升。
    - 半虚拟化技术的缺点是需要修改操作系统以包含API，不能够实现对通用操作系统的支持。

1.虚拟化技术

- 根据实现方式不同，虚拟化技术可以分为全虚拟化、半虚拟化、操作系统级虚拟化等。
  - 半虚拟化

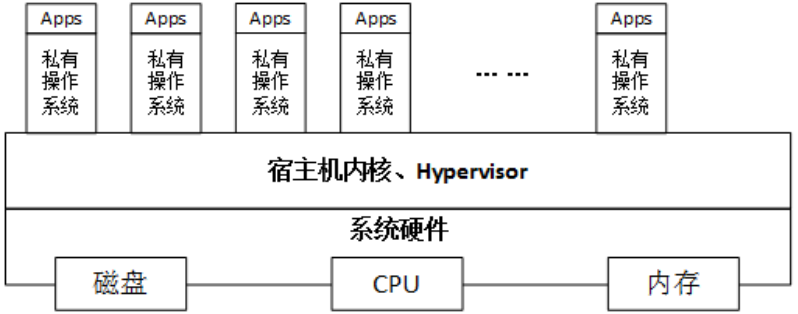


1.虚拟化技术

- 根据实现方式不同，虚拟化技术可以分为全虚拟化、半虚拟化、操作系统级虚拟化等。
  - 操作系统级虚拟化
    - 操作系统级虚拟化并不是在硬件系统里创建多个虚拟机环境，而是让一个操作系统创建多个彼此相互独立的应用环境，这些应用环境访问同一内核。操作系统级的虚拟化可以想象是内核的一种功能，而不是抽象成一层独立的软件。
    - 因为不存在实际的翻译层或者虚拟化层，所以操作系统级的虚拟机开销很小，大多数都能达到原本的性能。该类型不能使用多种操作系统，所有虚拟机需要共享一个内核。

1.虚拟化技术

- 根据实现方式不同，虚拟化技术可以分为全虚拟化、半虚拟化、操作系统级虚拟化等。
  - 操作系统级虚拟化



1.虚拟化技术

- 虚拟化产品分为开源虚拟化软件和商业虚拟化软件两大阵营。
  - 典型的代表有Xen、KVM、VMware、Hyper-V、Docker容器等，其中Xen、KVM是开源免费的虚拟化软件，VMware、Hyper-V是付费的虚拟化软件。
  - 虚拟化软件产品有很多，无论是开源还是商业的，每款软件产品有其特点及应用场景，需要根据业务场景选择合适的软件。
  - 最常见的虚拟化软件提供商有Citrix、IBM、VMware、Microsoft等，国产虚拟化平台有云宏CNware等。

1.虚拟化技术

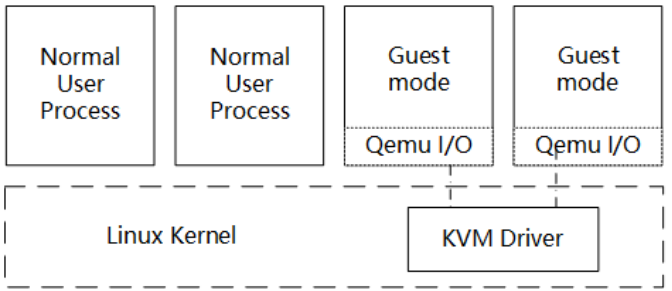
- 虚拟化产品分为开源虚拟化软件和商业虚拟化软件两大阵营。

表 9-0-1 常见虚拟化软件产品对比

名称	开发厂商	虚拟类型	执行效率	GuestOS跨平台	许可证
Xen	Virtual Iron http://www.xensource.com	半虚拟化	高	支持	GPL
OpenVZ	Swsoft http://www.openvz.org	操作系统级虚拟化	高	不支持	GPL
VMware	VMware http://www.vmware.com	全虚拟化	中	支持	私有
QEMU	QEMU http://www.qemu.com	仿真	低	支持	LGPL/GPL
VirtualBox	Oracle http://www.virtualbox.org	桌面虚拟化	低	支持	GPL
KVM	http://kvm.sourceforge.net	全虚拟化	中	支持	GPL
z/VM	IBM http://www.vm.ibm.com	全虚拟化	高	不支持	私有

2.使用KVM实现虚拟化

- KVM是基于Linux内核的虚拟机软件（Kernel-based Virtual Machine），是第一个整合到Linux内核的虚拟化软件。
  - KVM嵌入Linux系统内核，使Linux变成了一个Hypervisor，通过优化内核来使用虚拟技术，使用Linux自身的调度器进行虚拟机管理。
  - KVM是内核的一个模块，用户空间通过QEMU模拟硬件提供虚拟机使用，一台虚拟机就是一个普通的Linux进程，通过对这个进程的管理，完成对虚拟机的管理。



2.使用KVM实现虚拟化

- KVM的主要优势：
  - 开源免费
    - KVM是一个开源项目，一直以开放的姿态接受各种新技术，许多虚拟化的新技术都首先在KVM上应用，再到其他虚拟化引擎上推广。因为开源，绝大部分KVM的解决方案都是免费方案。随着KVM的发展，KVM虚拟机越来越稳定，兼容性越来越好，因而得到了广泛应用。
  - 紧密结合Linux
    - KVM是第一个整合进Linux内核的虚拟化技术，和Linux系统紧密结合，因此形成了从底层Linux操作系统，中间层Libvirt管理工具，到云管平台OpenStack的KVM生态链。
  - 性能
    - KVM性能优越，在同样的硬件环境下，能提供更好的虚拟机性能。

2.使用KVM实现虚拟化

任务1：安装KVM

任务2：配置宿主机网络

任务3：创建KVM虚拟机

任务4：管理KVM虚拟机

2.使用KVM实现虚拟化

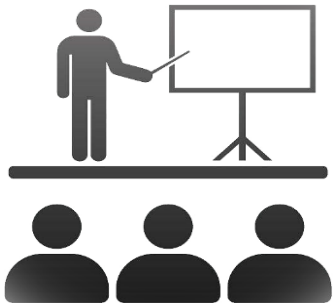
任务1：安装KVM

- 步骤1：创建虚拟机并完成CentOS的安装
- 步骤2：完成虚拟机的主机配置、网络配置及通信测试
- 步骤3：配置宿主机支持虚拟化
- 步骤4：配置宿主机网络混杂模式
- 步骤5：检测CPU是否支持虚拟化

2.使用KVM实现虚拟化

任务1：安装KVM

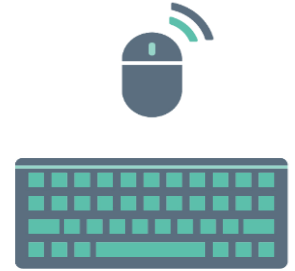
- 步骤6：安装KVM
- 步骤7：启动libvirtd服务
- 步骤8：查看KVM运行信息
- 步骤9：配置libvirtd服务为开机自启动
- 步骤10：验证KVM安装的正确性：加载+服务自身检测



- 设备名称的明确：
  - 本地主机：
    - 安装有VirtualBox软件的Windows 10操作系统，是物理计算机
  - 宿主机：
    - 安装有KVM软件的CentOS操作系统，是VirtualBox中创建的虚拟机
  - KVM虚拟机：
    - 在宿主机CentOS操作系统中使用KVM创建的虚拟机

操作视频 / 现场演示

- 任务1：安装KVM
  - 任务目标：
    - 实现KVM软件的安装配置
    - 实现KVM服务的测试与管理
    - 在CentOS上实现KVM



命令指南 / 操作引导

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#查看/proc/cpuinfo文件确定CPU是否支持VT技术
[root@Project-09-Task-01 ~]# cat /proc/cpuinfo | egrep 'vmx|svm'

#使用yum工具安装KVM软件及相关管理工具
[root@Project-09-Task-01 ~]# yum install -y qemu-kvm virt-manager virt-viewer libvirt virt-install acpid

#使用systemctl start命令启动libvirtd服务
[root@Project-09-Task-01 ~]# systemctl start libvirtd

#使用systemctl status查看libvirtd服务
[root@Project-09-Task-01 ~]# systemctl status libvirtd

#使用systemctl list-unit-files命令验证libvirtd服务是否已配置为开机自启动
[root@Project-03-Task-01 ~]# systemctl list-unit-files | grep libvirtd.service

#命令lsmod | grep kvm可检测KVM是否加载成功。
[root@Project-09-Task-01 ~]# lsmod | grep kvm

#命令virsh list查看KVM虚拟机列表。
[root@Project-09-Task-01 ~]# virsh list
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(225/225): nfs-utils-2.3.3-35.el8.x86_64.rpm  99% [=========================================-] 148 kB/s | 113 MB     00:03 ETA
下载的软件包保存在缓存中，直到下次成功执行事务。
您可以通过执行 'yum clean packages' 删除软件包缓存。
错误：下载软件包出错
  Cannot download Packages/systemd-container-239-41.el8_3.2.x86_64.rpm: All mirrors were tried
[root@Project-09-Task-01 ~]#
```

2.使用KVM实现虚拟化

任务2：配置宿主机网络

- 步骤1：查看宿主机网络情况
- 步骤2：创建bridge

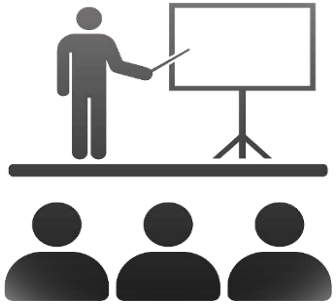
操作视频 / 现场演示

- 任务2：配置宿主机网络
  - 任务目标：
    - 实现宿主机网桥配置
    - 实现宿主机的连通性测试
    - 实现宿主机和KVM虚拟机保持同一网络

2.使用KVM实现虚拟化

任务3：创建KVM虚拟机

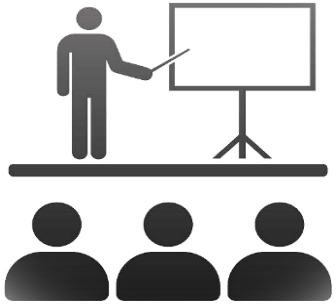
- 步骤1：创建存储池
- 步骤2：获取CentOS 7
- 步骤3：安装CentOS 7
- 步骤4：使用KVM虚拟机并远程管理



- KVM的存储虚拟化通过存储池（Storage Pool）和卷（Volume）来管理。
- 存储池是宿主机可以管理的存储空间，拥有多种类型。卷是在存储池中划分出的一块空间，宿主机将卷分配给虚拟机，卷在虚拟机中就是一块硬盘。

表 9-3-3 存储池类型

存储模式	存储池类型	类型说明
基于文件系统的存储	dir	使用文件系统目录来存储
	fs	使用预格式化分区来存储
	netfs	使用 NFS 等网络共享存储来存储
基于设备的存储	disk	使用物理硬盘来存储
	iscsi	使用网络共享的 ISCSI 存储来存储
	scsi	使用本地 SCSI 存储来存储
虚拟磁盘文件	lvm	取决于 LVM 卷组来存储



- KVM支持多种类型的卷格式。

表 9-3-4 常用卷格式

虚拟磁盘格式	格式说明
raw	KVM 默认的磁盘格式，移植性好，性能好，但大小固定，不能节省磁盘空间
qcow2	KVM 推荐的磁盘格式，支持按需分配磁盘空间，支持快照，支持 zlib 磁盘压缩，支持 AES 磁盘加密
vmdk	VMware 默认使用的磁盘格式，性能与功能较为出色

操作视频 / 现场演示

- 任务3：创建KVM虚拟机
  - 任务目标：
    - 实现KVM虚拟机的创建
    - 实现KVM虚拟机的操作系统安装
    - 实现KVM虚拟机的远程管理

2.使用KVM实现虚拟化

任务4：管理KVM虚拟机

- 步骤1：查看KVM虚拟机列表
- 步骤2：设置KVM虚拟机为自动启动
- 步骤3：修改KVM虚拟机的硬件配置
- 步骤4：KVM虚拟机的挂起、开启、关闭
- 步骤5：KVM虚拟机的克隆、快照

操作视频 / 现场演示

- 任务3：管理KVM虚拟机
  - 任务目标：
    - 掌握virsh管理工具
    - 通过virsh管理KVM虚拟机

3.管理KVM虚拟化平台

- KVM自身实现了虚拟化核心的监视工具，由于KVM开源特性，其管理工具非常丰富，比较典型的管理工具有virsh、virt-manager、ovirt等。
  - virsh：命令行管理工具，功能强大，能完成几乎所有虚拟机管理任务，包括在线迁移，虚拟机快照，创建和转换虚拟机磁盘文件格式等，适合以脚本的形式自动管理虚拟机
  - virt-manager：桌面应用管理工具，提供了方便与性能兼具的高效率管理，支持多节点管理，可以完全一样的方式管理多个节点
  - Ovirt：Web方式管理工具，实现KVM绝大部分的管理，可方便随时访问虚拟机状态，获取虚拟机监视器界面，使虚拟机管理可跨越地域限制，也实现了云计算雏形。

KVM

There are a several options available to manage kvm virtual machines:

(Please keep this list in alphabetical order)

Name/URL	Description	UI Type	Last Updated	Notes	License
Abiquo	Abiquo is a technology-agnostic solution for enterprises and service providers who want to quickly and simply build, manage and develop public and private clouds based on their existing heterogeneous environments.	Web, REST	Active	KVM, Xen, VirtualBox, VMware, Hyper-V & XenServer support; uses libvirt	Commercial
Archipel	Archipel is an Open Source project that aims to bring push notifications to virtualization orchestration using XMPP.	Web	Active	KVM, Xen, Virtual Box & OpenVZ support; uses libvirt	AGPL v3
AQemu	a Qt4 user interface for KVM	Desktop	2013-05-30		GPL v2
cloonix	cloonix is a virtualization management framework aimed at virtual networks building based on kvm.	Gui/cli	Active	KVM	RPL Licence
CloudStack	Cloudstack is an open source project that enables the deployment, management, and configuration of multi-tier and multi-tenant infrastructure cloud services using Xen, KVM and VMware hypervisors.	Web	Active	KVM, Xen & VMware support	Apache License v2
ConVirt	ConVirt 2.0 Open Source is the leading open source product for managing Xen and KVM, enabling you to standardize and proactively manage your virtualized environment in a centralized fashion.	Web	Active	Xen & KVM; formerly known as xenman	GPL v2
Enomaly	a programmable virtual cloud infrastructure for small, medium and large businesses	Web, REST	Not available as of 2010-02-08	they have commercial and open source editions	Commercial/AGPL v3
Eucalyptus	Eucalyptus is open source software for building AWS-compatible private and hybrid clouds. Eucalyptus allows IT organizations to build an on-premises Infrastructure as a Service (IaaS) cloud that pools together compute, storage, and network resources. With Eucalyptus, developers can leverage knowledge and tools around AWS APIs, including EC2, S3, EBS, IAM, Auto Scaling, Elastic Load Balancing, and CloudWatch. IT can create a flexible hybrid cloud environment so that developers can develop sooner, test more, and deploy faster while giving IT and cloud admins greater control of cloud performance, scale, and security.	Web, CLI, REST, SOAP	Active	Supports KVM and VMware. Uses libvirt. View the Eucalyptus Compatibility Matrix: http://bit.ly/QfH4Iv	GPL v3
Foreman	Foreman is aimed to be a Single Address For All Machines Life Cycle Management including bare metal / vm / cloud provisioning, configuration managememnt and configureation reports/auditing using puppet	Web, REST, CLI	Active	KVM, VMWare, oVirt RHEV-M, EC2, OpenStack	GPL v3
Ganeti	Ganeti is a cluster virtual server management software tool built on top of existing virtualization technologies	CLI	Active	KVM support added in Ganeti 2.0	GPL v2
GKVM	A Gnome user interface for KVM.	Desktop	2007-08-01		GPL v2
Karesansui	Karesansui is an open-source virtualization management application. It's smart graphical user interface lowers your management cost, and brings a total management/audit solution for both physical and virtual servers.	Web, REST	November 2013	KVM & Xen support; uses libvirt	LGPL v2.1/GPL v2
kimchi	Kimchi is an HTML5 based management tool for KVM. It is designed to make it as easy as possible to get started with KVM and create your first guest.	WEB	Active	KVM	LGPL,Apache License v2
Kubevirt	Virtualization API for Kubernetes	CLI, API	Active	Run VMs in Kubernetes	Apache License v2
kvmadm	a minimalistic set of command-line tools to control multi-user utilization of KVM	CLI	2007-09-25		GPL v2

Management Tools - KVM
不安全 | www.linux-kvm.org/page/Management_Tools

kvmupdown	simple, robust and no-bloat management interface.	CLI	Link broken, probably terminated project	KVM	public domain
kvm-admin	Python scripts for managing the guests (boot, shutdown ...) and include a commandline monitor .	CLI	Active	kvm support	GPL v2
kvm-wrapper	kvm-wrapper is a lightweight, simple and intended to be hackable set of shell scripts that help manage kvm virtual machines a great deal.	CLI	Active	KVM support	WTFPL (v2)
Mist.io	Mist.io provides a unifed dashboard / API for managing your entire infrastructure - public and private clouds, KVM and VMware hypervisors, bare metal, and containers. You can install the open-source version or use the freemium service. Try it out	Web, Mobile, REST API, CLI	Active	Uses libvirt and libcloud for VM management. Supports KVM, several public cloud providers, OpenStack, Docker and bare metal servers.	AGPL v3 for the open source version, Commercial for the service
Morpheus	Morpheus provides a single dashboard for managing hybrid infrastructure - KVM, Xen, VMware hypervisors, public clouds, bare metal, and containers. Learn more.	UI, API, and CLI	Active		Commercial (community licensing for testing and lab environments; up to 25 workloads and 3 clouds)
nbsvm	No Bullshit VMs. No setup required. No dependencies but sudo, and LVM or ZFS. Start, stop, create and clone images and view VMs using simple chained commands. Basically applies sane (overridden by cli or file) defaults to the kvm invocation and gets out of the way. Sudo invocation is designed to allow user access controls.	CLI	February 2014		WTFPL 2
Nimbula Director	Nimbula Director is a Cloud Operating System that enables Infrastructure as a Service using the KVM.	Web, CLI, REST	Active	KVM support	Commercial (Freemium)
op5	op5 develops and delivers op5 Monitor a enterprise-class software for IT monitoring and administration of the whole IT. op5 developed a KVM plug-in to monitor KVM virtualization infrastructure that allows organizations to have better capacity planning, which enables the provisioning of usage of resources such as storage, CPU, and memory more proactively.	Web, REST	Active	Uses libvirt	GPL v2
OpenNebula	an open source virtual infrastructure engine	CLI, XML-RPC	Active	cloud computing managment; uses libvirt	Apache License v2
OpenNode	RHEL/CentOS based open-source server virtualization and management solution - simple bare-metal installer, providing KVM+OpenVZ host and standard libvirt, func management interfaces together with standard cli tools like virsh and vzctl. OpenNode Management Server with ajax web-based management console available - as is RPC-JSON API interface.	Web, CLI, API	Active	Bare-metal installer, KVM, OpenVZ hypervizors and variety of management tools	Unknown
openQRM	openQRM is the next generation, open-source Data-center management platform.	Web	Active	KVM, Xen, VMware and Linux V-Server support	GPL v2
oVirt	oVirt is a virtualization management framework constisting of a small host image, the oVirt Node, that provides the libvirt service to host virtual machines, and a robust vm management software stack, controlled by a web-based management interface, the oVirt Server.	Web	Active	uses libvirt	Apache License v2
Platform9 Managed OpenStack	Platform9 makes it very easy to manage a KVM environment with resource pooling and automation. Platform9's Openstack service easily integrates with any new or existing Linux servers. KVM expertise is helpful but not required. The OpenStack service supports major Linux distributions including CentOS, RHEL & Ubuntu. See the demos for KVM.	UI, OpenStack CLI, OpenStack API & integrations (puppet, ansible, chef,	Active	Fast, Easy & Affordable for anyone familiar with Linux. See KVM Management w/ OpenStack.	Commercial. A free trial is available.

Platform9 Managed OpenStack	Platform9 makes it very easy to manage a KVM environment with resource pooling and automation. Platform9's Openstack service easily integrates with any new or existing Linux servers. KVM expertise is helpful but not required. The OpenStack service supports major Linux distributions including CentOS, RHEL & Ubuntu. See the demos for KVM.	UI, OpenStack CLI, OpenStack API & integrations (puppet, ansible, chef, vagrant, etc).	Active	Fast, Easy & Affordable for anyone familiar with Linux. See KVM Management w/ OpenStack.	Commercial. A free trial is available.
Proxmox VE	Proxmox Virtual Environment (Proxmox VE) is an open-source server virtualization management platform to manage VMs and containers. The Debian-based platform uses KVM as hypervisor and also provides OS-level virtualization using LXC containers. It provides enterprise-class features like clustering, high availability, networking, live migration, backup/restore, integrates a built-in firewall and come with various storage plugins such as LVM, LVM-thin, iSCSI/kernel, iSCSI/libiscsi, Ceph/RBD, Sheepdog, ZFS over iSCSI, ZFS (local), directory, NFS, CIFS, and GlusterFS.	Web, CLI, API	Active	Bare-metall ISO installer including KVM and LXC management tools	AGPL v3
PVM	(PDNSoft Virtual Machine Management System) is a hypervisor based on KVM.It provides new application stack to manage KVM virtual machines instead of using Libvirt with it's own considerations.Cluster and user awareness is specific features in PVM design, so managing of HA and other features is done by PVM application stack that is placed directly on KVM.	Desktop,CLI	Active	Bar-metall installer	Commercial
Plain qemu/kvm	You can run qemu/kvm straight from the command line	CLI	Active	See man (qemu-system-x86_64 or kvm or qemu-kvm) for more info	GPL v2
Red Hat Virtualization / RHV	Commercial management solution for RHEL / KVM.	Web	Active		Commercial
SolusVM	The most popular control panel for commercial use.	Web	Active	KVM, Xen & OpenVZ support	Commercial
Stackops Openstack Distro	Stackops is an Openstack Nova distribution verified and tested for KVM. You only need to download the ISO image with the distro and install it on one or more servers.	CLI, REST	Active	KVM & QEMU (libvirt based)	Apache License v2
UVMM	UCS Virtual Machine Manager (UVMM) is an easy-to-use and powerful administration tool for KVM. It virtualizes Microsoft Windows, Univention Corporate Server and other Linux distributions by providing all the necessary functions for creating and managing virtual instances (also OpenStack and Amazon EC2-based resources) and hard drives on physical servers centrally via a web-based modern interface. On AWS it also manages Virtual Private Clouds (VPC). UVMM is included in Univention Corporate Server by default, an easy-to-use and scalable Enterprise distribution with an integrated management system for the central management of heterogeneous environments.	Web, CLI	Active	Supports KVM, Uses libvirt	Free for use, AGPL v3
virsh	A minimal shell around libvirt for managing VMs	CLI	Active	Uses libvirt	LGPL
Virtualbricks	Python-gtk GUI to manage guest and hybrid (host/guest) networks.	CLI	2011-11-23	kvm, qemu, ksm & VDE support	GPL v2
VMM / Virtual Machine Manager	Also known as virt-manager. A desktop user interface for managing virtual machines.	Desktop	Active	Uses libvirt	GPL v2
VMM's supporting tools virt-install/clone/convert	Command line tools for provisioning new VMs, cloning existing VMs and importing / converting appliance images.	CLI	Active	Uses libvirt	GPL v2
VMmanager	Software solution for virtualization management that can be used both for hosting virtual machines and building a cloud. With VMmanager you can manage not only one server, but a large cluster of hypervisors. It delivers a number of functions, such as live migration that allows for load balancing between cluster nodes, monitoring CPU, memory and I/O operation enabling to detect problematic nodes, use of local and networks storages, and many tools for efficient management.	Web, CLI, REST	Active	KVM, uses libvirt	Commercial
vmmaestro	vmmaestro is a tiny shell script which can start/stop/monitor KVM guests.	CLI	Active	KVM	MIT License
	VM-King is an Android App that allows you to manage your hypervisior remotely				

	iSCSI/kernel, iSCSI/libiscsi, Ceph/RBD, Sheepdog, ZFS over iSCSI, ZFS (local), directory, NFS, CIFS, and GlusterFS.				
PVM	(PDNSoft Virtual Machine Management System) is a hypervisor based on KVM.It provides new application stack to manage KVM virtual machines instead of using Libvirt with it's own considerations.Cluster and user awareness is specific features in PVM design, so managing of HA and other features is done by PVM application stack that is placed directly on KVM.	Desktop,CLI	Active	Bar-metall installer	Commercial
Plain qemu/kvm	You can run qemu/kvm straight from the command line	CLI	Active	See man (qemu-system-x86_64 or kvm or qemu-kvm) for more info	GPL v2
Red Hat Virtualization / RHV	Commercial management solution for RHEL / KVM.	Web	Active		Commercial
SolusVM	The most popular control panel for commercial use.	Web	Active	KVM, Xen & OpenVZ support	Commercial
Stackops Openstack Distro	Stackops is an Openstack Nova distribution verified and tested for KVM. You only need to download the ISO image with the distro and install it on one or more servers.	CLI, REST	Active	KVM & QEMU (libvirt based)	Apache License v2
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virsh	A minimal shell around libvirt for managing VMs	CLI	Active	Uses libvirt	LGPL
Virtualbricks	Python-gtk GUI to manage guest and hybrid (host/guest) networks.	CLI	2011-11-23	kvm, qemu, ksm & VDE support	GPL v2
VMM / Virtual Machine Manager	Also known as virt-manager. A desktop user interface for managing virtual machines.	Desktop	Active	Uses libvirt	GPL v2
VMM's supporting tools virt-install/clone/convert	Command line tools for provisioning new VMs, cloning existing VMs and importing / converting appliance images.	CLI	Active	Uses libvirt	GPL v2
VMmanager	Software solution for virtualization management that can be used both for hosting virtual machines and building a cloud. With VMmanager you can manage not only one server, but a large cluster of hypervisors. It delivers a number of functions, such as live migration that allows for load balancing between cluster nodes, monitoring CPU, memory and I/O operation enabling to detect problematic nodes, use of local and networks storages, and many tools for efficient management.	Web, CLI, REST	Active	KVM, uses libvirt	Commercial
vmmaestro	vmmaestro is a tiny shell script which can start/stop/monitor KVM guests.	CLI	Active	KVM	MIT License
VM-King	VM-King is an Android App that allows you to manage your hypervisior remotely from your Android mobile or tablet. This app supports the following functions: Start/stop/destroy VM, restore and delete snapshots, get screenshot of running VMs, get remote display connection information (VNC/Spice).	mobile, tablet	Active	KVM	free
WebVirtMgr	Web service for managing VMs based on the KVM	WEB	Active	Only KVM; use libvirt	Apache License v2
Witsbits	Witsbits enables you to set up your servers with virtualization and deploy virtual machines faster than ever before. It's a complete virtualization solution with a self-upgrading hypervisor and cloud-based centralized management, reducing time spent on maintenance to a fraction of what other solutions require. The self-configuring hypervisor comes as a Live CD, delivering the fastest time-to-deployment by removing the need for spending time on installation and configuration.	Web	Active	Live CD Hypervisor with SaaS Management System	Free for 5 CPUs (full version)

3.管理KVM虚拟化平台

virt-manager

Apache CloudStack

ZStack

NoKVM

3.管理KVM虚拟化平台

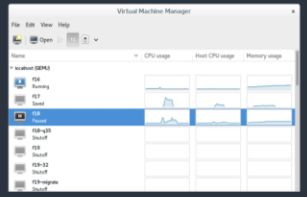
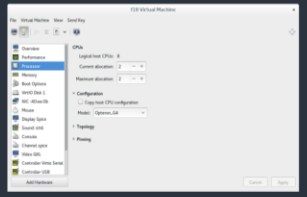
- The virt-manager application is a desktop user interface for managing virtual machines through libvirt.
  - It primarily targets KVM VMs, but also manages Xen and LXC (linux containers). It presents a summary view of running domains, their live performance & resource utilization statistics.
  - Wizards enable the creation of new domains, and configuration & adjustment of a domain's resource allocation & virtual hardware.
  - An embedded VNC and SPICE client viewer presents a full graphical console to the guest domain.

3.管理KVM虚拟化平台

- About virt-manager's supporting tools
  - virt-install is a command line tool which provides an easy way to provision operating systems into virtual machines.
  - virt-viewer is a lightweight UI interface for interacting with the graphical display of virtualized guest OS. It can display VNC or SPICE, and uses libvirt to lookup the graphical connection details.
  - virt-clone is a command line tool for cloning existing inactive guests. It copies the disk images, and defines a config with new name, UUID and MAC address pointing to the copied disks.
  - virt-xml is a command line tool for easily editing libvirt domain XML using virt-install's command line options.
  - virt-bootstrap is a command line tool providing an easy way to setup the root file system for libvirt-based containers.

Manage virtual machines with virt-manager

The **virt-manager** application is a desktop user interface for managing virtual machines through libvirt. It primarily targets **KVM** VMs, but also manages **Xen** and **LXC** (linux containers). It presents a summary view of running domains, their live performance & resource utilization statistics. Wizards enable the creation of new domains, and configuration & adjustment of a domain's resource allocation & virtual hardware. An embedded VNC and SPICE client viewer presents a full graphical console to the guest domain.


About virt-manager's supporting tools

virt-install is a command line tool which provides an easy way to provision operating systems into virtual machines.

virt-viewer is a lightweight UI interface for interacting with the graphical display of virtualized guest OS. It can display VNC or SPICE, and uses libvirt to lookup the graphical connection details.

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virt-xml is a command line tool for easily editing libvirt domain XML using virt-install's command line options.

virt-bootstrap is a command line tool providing an easy way to setup the root file system for libvirt-based containers.

Download

Install it from your OS distribution (others coming soon)

```
# yum install virt-manager (Fedora)
# apt-get install virt-manager (Debian)
# emerge virt-manager (Gentoo)
# pkg_add virt-manager (OpenBSD)
```

Or grab the source release

Communicate

Join the virt-manager mailing list or try the IRC channel #virt on OFTC

Documentation

Read the FAQ or view screenshots.

Bug reporting

View known bugs

Report a new bug

Code repository

The code is browsable online.

Get a personal checkout from GIT

```
# git clone \
    https://github.com/virt-manager/virt-manager.git
```

3.管理KVM虚拟化平台

- Apache CloudStack is open source software designed to deploy and manage large networks of virtual machines, as a highly available, highly scalable Infrastructure as a Service (IaaS) cloud computing platform.
  - CloudStack is used by a number of service providers to offer public cloud services, and by many companies to provide an on-premises (private) cloud offering, or as part of a hybrid cloud solution.
  - CloudStack is a turnkey solution that includes the entire "stack" of features most organizations want with an IaaS cloud: compute orchestration, Network-as-a-Service, user and account management, a full and open native API, resource accounting, and a first-class User Interface (UI).
  - CloudStack currently supports the most popular hypervisors: VMware, KVM, Citrix XenServer, Xen Cloud Platform (XCP), Oracle VM server and Microsoft Hyper-V.
  - Users can manage their cloud with an easy to use Web interface, command line tools, and/or a full-featured RESTful API. In addition, CloudStack provides an API that's compatible with AWS EC2 and S3 for organizations that wish to deploy hybrid clouds.

Apache CloudStack™

Open Source Cloud Computing™

About CloudStack

Apache CloudStack is open source software designed to deploy and manage large networks of virtual machines, as a highly available, highly scalable Infrastructure as a Service (IaaS) cloud computing platform. CloudStack is used by a number of service providers to offer public cloud services, and by many companies to provide an on-premises (private) cloud offering, or as part of a hybrid cloud solution.

CloudStack is a turnkey solution that includes the entire "stack" of features most organizations want with an IaaS cloud: compute orchestration, Network-as-a-Service, user and account management, a full and open native API, resource accounting, and a first-class User Interface (UI).

CloudStack currently supports the most popular hypervisors: VMware, KVM, Citrix XenServer, Xen Cloud Platform (XCP), Oracle VM server and Microsoft Hyper-V.

Users can manage their cloud with an easy to use Web interface, command line tools, and/or a full-featured RESTful API. In addition, CloudStack provides an API that's compatible with AWS EC2 and S3 for organizations that wish to deploy hybrid clouds.

Learn More

Latest Announcements

CloudStack Events

Upcoming CloudStack Events

There's always plenty of Cloudstack Events happening in different parts of the world. These range from Meetups, User Groups to CloudStack Collaboration Conference events. Each event will feature a lot of opportunities to learn, collaborate and engage with the CloudStack community. The CloudStack Collaboration Conferences are valuable for both developers and users, and are a great way to get involved with the community.

View videos from previous CloudStack Collaboration Conferences:

- CloudStack Collaboration Conference June 2018 in Montreal
- CloudStack Collaboration Conference June 2016 in Montreal
- CloudStack Collaboration Conference Europe 2015 in Dublin

Get CloudStack

Apache CloudStack 4.15.0.0 is out!

This is current CloudStack LTS release.

Download Documentation

Looking for other versions of Apache CloudStack? You can find them in our archives page as well.

What are people saying?

Tweets by CloudStack

Latest CloudStack Releases

The CloudStack community maintains two types of releases; the main releases and the LTS (Long Term Support) releases. The LTS releases receive bug and security fixes for a period of 18 months after the main release (for more details *click here*). The main releases receive only critical bug fixes for a short period. The general expectation is that the users of the main version will upgrade to a new version in order to receive fixes.

Source Releases

Apache CloudStack's most recent release is 4.15.0.0.

This is current CloudStack LTS release.

Get the 4.15.0.0 Source KEYS PGP SHA512

Full release notes can be found in the version 4.15.0.0 Release Notes website.

Instructions for building from source and installing Apache CloudStack can be found in the Installation Guide. Instructions for building from source and upgrading from a previous version of CloudStack to Apache CloudStack 4.15.0.0 can be found in the upgrade section of the Release Notes (see above).

The latest CloudStack LTS maintenance release is 4.14.1.0 as part of the LTS 4.14.x releases.

Get the 4.14.1.0 Source KEYS PGP SHA512

Full release notes can be found in the version 4.14.1.0 Release Notes website.

Instructions for building from source and installing Apache CloudStack can be found in the Installation Guide. Instructions for building from source and upgrading from a previous version of CloudStack to Apache CloudStack 4.14.1.0 can be found in the upgrade section of the Release Notes (see above).

Verifying Downloads

It's essential that you verify the integrity of the downloaded files using the PGP or SHA512 signatures. The PGP signatures can be verified using PGP or GPG. First download the KEYS as well as the asc signature file for the relevant distribution. Make sure you get these files from the main distribution directory, rather than from a mirror. Then verify the signatures using:

```
% pgpk -a KEYS
% pgpv apache-cloudstack-X.X.X-src.tar.bz2.asc
```

or

```
% pgp -ka KEYS
% pgp apache-cloudstack-X.X.X-src.tar.bz2.asc
```

or

```
% gpg --import KEYS
% gpg --verify apache-cloudstack-X.X.X-src.tar.bz2.asc apache
-cloudstack-X.X.X-src.tar.bz2
```

Please see CheckingSignatures for a more extensive explanation of the pgp verification.

Additionally, you can verify the SHA512 signatures on the files, by performing

```
% sha512sum --check apache-cloudstack-X.X.X-src.tar.bz2.sha51
2
```

Packages

Community Packages

For easier installation or upgrades, the official source code release has been supplemented by community members who have chosen to provide package repositories that also include noredis libraries.

- CentOS/RHEL 7 RPM repository: http://download.cloudstack.org/centos/7/
- CentOS/RHEL 8 RPM repository: http://download.cloudstack.org/centos/8/
- DEB repository: http://download.cloudstack.org/ubuntu
- Old CentOS/RHEL 6 RPM repository (for 4.13 and older releases): http://download.cloudstack.org/centos/6/

Instructions for using these community provided repositories can be found in the Configure Package Repository section of the Installation Guide.

Packages hosted by 3rd Parties

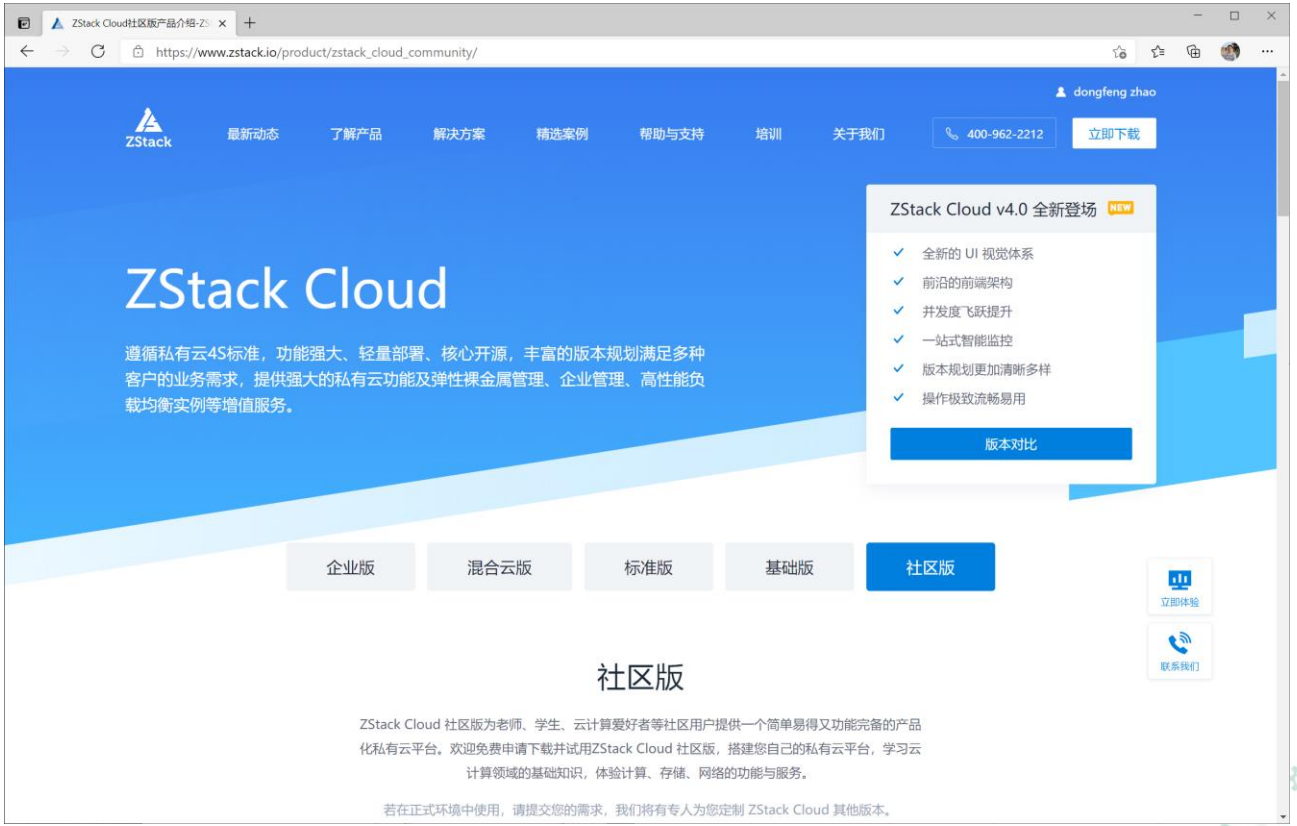
- CloudStack (noredist) packages by ShapeBlue: http://shapeblue.com/packages

Latest CloudMonkey Release

Apache CloudStack's CloudMonkey tool is a CLI and shell environment designed for interacting with CloudStack-based clouds.

Source Release

3.管理KVM虚拟化平台



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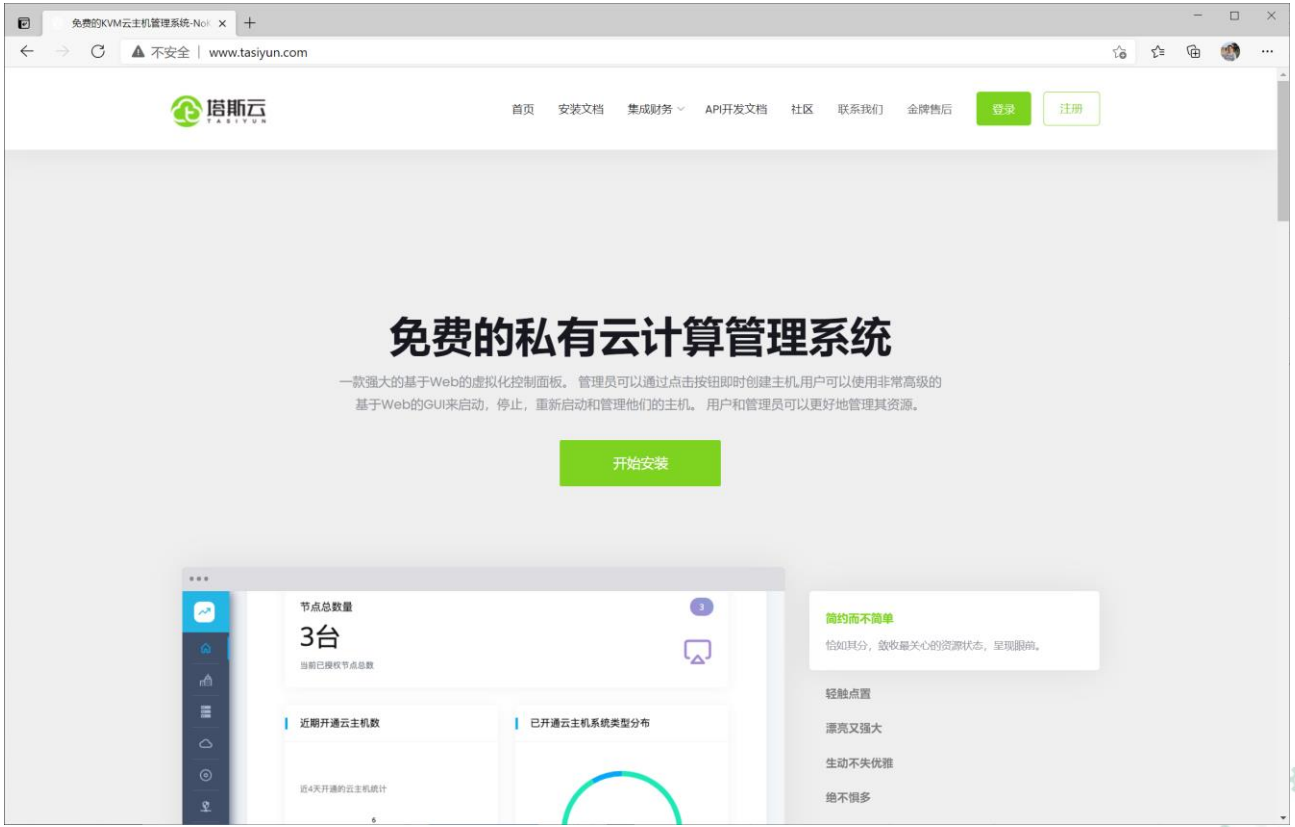


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