What is KVM?

Published May 11, 2022 • 4-minute read

Copy URL

Overview

Kernel-based Virtual Machine (KVM) is an open source virtualization technology built into Linux®. Specifically, KVM lets you turn Linux into a hypervisor that allows a host machine to run multiple, isolated virtual environments called guests or virtual machines (VMs).

KVM is part of Linux. If you've got Linux 2.6.20 or newer, you've got KVM. KVM was first announced in 2006 and merged into the mainline Linux kernel version a year later. Because KVM is part of existing Linux code, it immediately benefits from every new Linux feature, fix, and advancement without additional engineering.

Try Linux—and KVM—for free

How does KVM work?

KVM converts Linux into a type-1 (bare-metal) hypervisor. All hypervisors need some operating system-level components—such as a memory manager, process scheduler, input/output (I/O) stack, device drivers, security manager, a network stack, and more—to run VMs. KVM has all these components because it's part of the Linux kernel. Every VM is implemented as a regular Linux process, scheduled by the standard Linux scheduler, with dedicated virtual hardware like a network card, graphics adapter, CPU(s), memory, and disks.

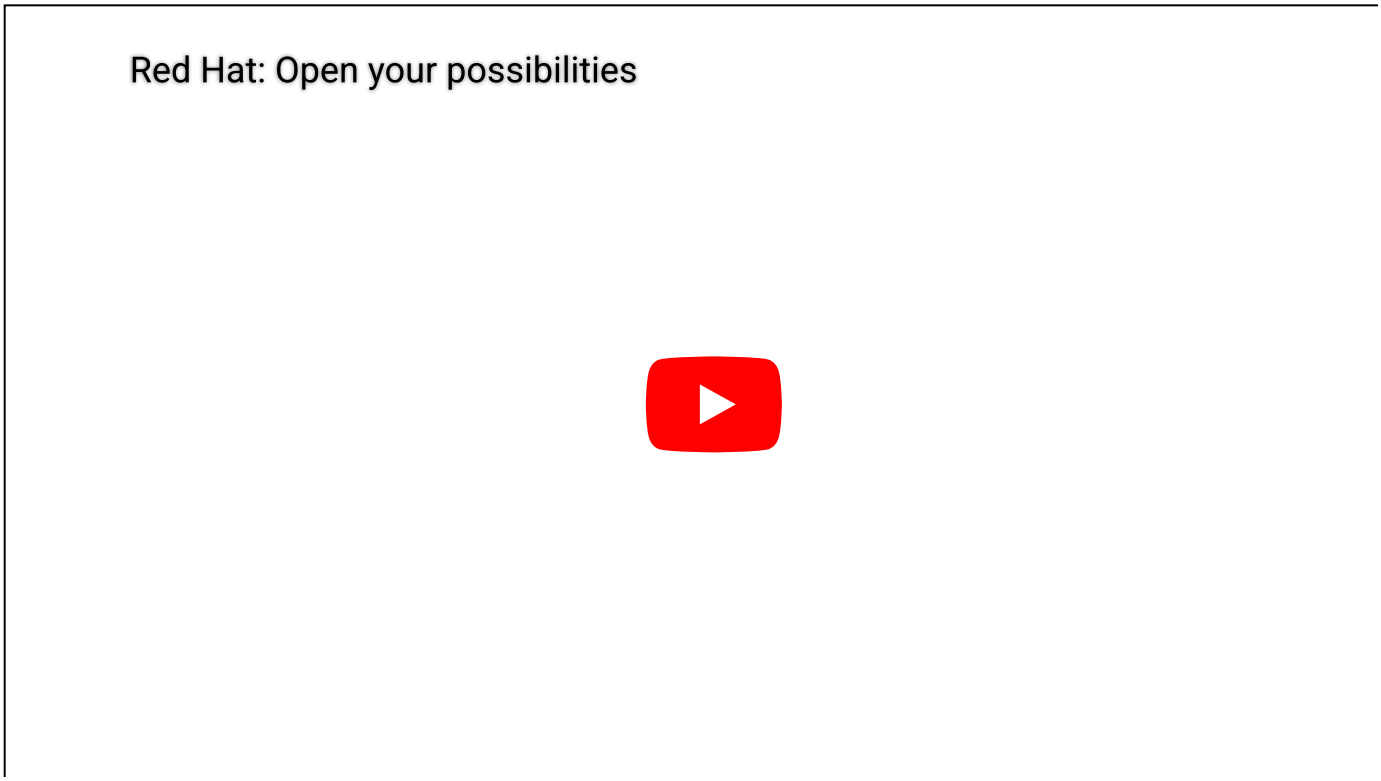
Implementing KVM

Long story short, you have to run a version of Linux that was released after 2007 and it needs to be installed on x86 hardware that supports virtualization capabilities. If both of those boxes are checked, then all you have to do is load 2 existing modules (a host kernel module and a processor-specific module), an emulator, and any drivers that will help you run additional systems.

But implementing KVM on a supported Linux distribution—like Red Hat Enterprise Linux—expands KVM's capabilities, letting you swap resources among guests, share common libraries, optimize system performance, and a lot more.

Red Hat Enterprise Linux 8 →

Migrating to a KVM-based virtual infrastructure



Building a virtual infrastructure on a platform you're contractually tied to may limit your access to the source code. That means your IT developments are probably going to be more workarounds than innovations, and the next contract could keep you from investing in clouds, containers, and automation. Migrating to a KVM-based virtualization platform means being able to inspect, modify, and enhance the source code behind your hypervisor. And there's no enterprise-license agreement because there's no source code to protect. It's yours.

Learn why migrating makes sense →

KVM features

KVM is part of Linux. Linux is part of KVM. Everything Linux has, KVM has too. But there are specific features that make KVM an enterprise's preferred hypervisor.

Security

KVM uses a combination of security-enhanced Linux (SELinux) and secure virtualization (sVirt) for enhanced VM security and isolation. SELinux establishes security boundaries around VMs. sVirt extends SELinux's capabilities, allowing Mandatory Access Control (MAC) security to be applied to guest VMs and preventing manual labeling errors.

Storage

KVM is able to use any storage supported by Linux, including some local disks and network-attached storage (NAS). Multipath I/O may be used to improve storage and provide redundancy. KVM also supports shared file systems so VM images may be shared by multiple hosts. Disk images support thin provisioning, allocating storage on demand rather than all up front.

Hardware support

KVM can use a wide variety of certified Linux-supported hardware platforms. Because hardware vendors regularly contribute to kernel development, the latest hardware features are often rapidly adopted in the Linux kernel.

Memory management

KVM inherits the memory management features of Linux, including non-uniform memory access and kernel same-page merging. The memory of a VM can be swapped, backed by large volumes for better performance, and shared or backed by a disk file.

Live migration

KVM supports live migration, which is the ability to move a running VM between physical hosts with no service interruption. The VM remains powered on, network connections remain active, and applications continue to run while the VM is relocated. KVM also saves a VM's current state so it can be stored and resumed later.

Performance and scalability

KVM inherits the performance of Linux, scaling to match demand load if the number of guest machines and requests increases. KVM allows the most demanding application workloads to be virtualized and is the basis for many enterprise virtualization setups, such as datacenters and private clouds (via OpenStack®).

Scheduling and resource control

In the KVM model, a VM is a Linux process, scheduled and managed by the kernel. The Linux scheduler allows fine-grained control of the resources allocated to a Linux process and guarantees a quality of service for a particular process. In KVM, this includes the completely fair scheduler, control groups, network name spaces, and real-time extensions.

Lower latency and higher prioritization

The Linux kernel features real-time extensions that allow VM-based apps to run at lower latency with better prioritization (compared to bare metal). The kernel also divides processes that require long computing times into smaller components, which are then scheduled and processed accordingly.

Managing KVM

It's possible to manually manage a handful of VM fired up on a single workstation without a management tool. Large enterprises use virtualization management software that interfaces with virtual environments and the underlying physical hardware to simplify resource administration, enhance data analyses, and streamline operations. Red Hat created Red Hat Virtualization for exactly this purpose.

Learn more about virtualization management →

KVM and Red Hat

We believe in KVM so much that it's the sole hypervisor for all of our virtualization products, and we're continually improving the kernel code with contributions to the KVM community. But since KVM is part of Linux, it's already included in Red Hat Enterprise Linux.

Keep reading

ARTICLE

Containers vs VMs

Linux containers and virtual machines (VMs) are packaged computing environments that combine various IT components and isolate them from the rest of the system.

Read more →

ARTICLE

What is a virtual machine (VM)?

A virtual machine (VM) is an isolated computing environment created by abstracting resources from a physical machine.

Read more →

ARTICLE

What is KVM?

Kernel-based virtual machines (KVM) are an open source virtualization technology that turns Linux into a hypervisor.

Read more →

More about virtualization

- Products >
- Related articles >
- Resources >

Training

* The OpenStack® Word Mark and OpenStack Logo are either registered trademarks / service marks or trademarks / service marks of the OpenStack Foundation, in the United States and other countries and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation or the OpenStack community.

Products

Tools

Try, buy, & sell

Communicate

About Red Hat

We're the world's leading provider of enterprise open source solutions—including Linux, cloud, container, and Kubernetes. We deliver hardened solutions that make it easier for enterprises to work across platforms and environments, from the core datacenter to the network edge.

Select a language

English

Cool Stuff Store

Red Hat Summit

Privacy statement

Terms of use

All policies and guidelines

Digital accessibility

Cookie preferences