Kernel-based Virtual Machine

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KVM (**Kernel-based Virtual Machine**) is a virtualization infrastructure for the Linux kernel that turns it into a hypervisor. It was merged into the Linux kernel mainline in kernel version 2.6.20, which was released on February 5, 2007.[1] KVM requires a processor with hardware virtualization extension.[2] KVM has also been ported to FreeBSD[3] and Illumos[4] in the form of loadable kernel modules.

KVM originally supported x86 processors and has been ported to S/390,[5] PowerPC,[6] and IA-64. An ARM port was merged during the 3.9 kernel merge window.[7]

A wide variety of guest operating systems work with KVM, including many flavours and versions of Linux, BSD, Solaris, Windows, Haiku, ReactOS, Plan 9, AROS Research Operating System[8] and OS X.[9] In addition, Android 2.2, GNU/Hurd[10] (Debian K16), Minix 3.1.2a, Solaris 10 U3 and Darwin 8.0.1, together with other operating systems and some newer versions of these listed, are known to work with certain limitations.[11]

Paravirtualization support for certain devices is available for Linux, OpenBSD,[12] FreeBSD,[13] NetBSD,[14] Plan 9[15] and Windows guests using the *VirtIO*[16] API. This supports a paravirtual Ethernet card, a paravirtual disk I/O controller,[17] a balloon device for adjusting guest memory usage, and a VGA graphics interface using SPICE or VMware drivers.
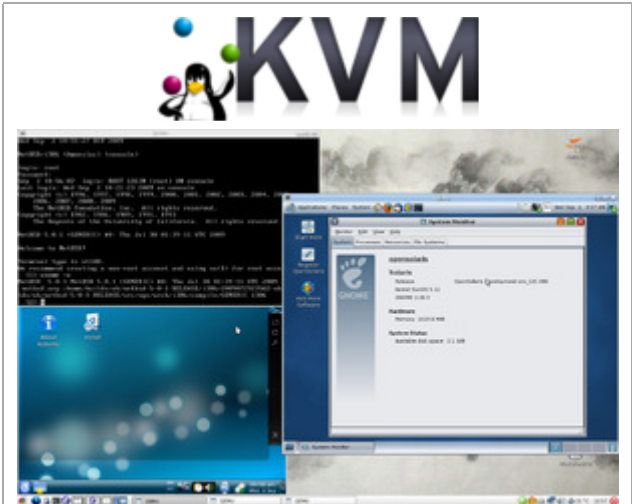
KVM	
Screenshot of QEMU/KVM running NetBSD, OpenSolaris and Kubuntu guests on an Arch Linux host.	
Original author(s)	Qumranet
Developer(s)	Open Virtualization Alliance (OVA)
Stable release	1.2.0 / September 5, 2012
Written in	C
Operating system	Unix-like
Platform	ARM, IA-64, PowerPC, S/390, x86, x86-64
Type	Hypervisor
License	GNU GPL or LGPL
Website	www.linux-kvm.org (http://www.linux-kvm.org)

Contents

Internals

By itself, KVM does not perform any emulation. Instead, it exposes the `/dev/kvm` interface, which a userspace host can then use to:

- Set up the guest VM's address space. The host must also supply a firmware image (usually a custom BIOS when emulating PCs) that the guest can use to bootstrap into its main OS.
- Feed the guest simulated I/O.
- Map the guest's video display back onto the host.

On Linux, QEMU versions 0.10.1 and later is one such userspace host. QEMU uses KVM when available to virtualize guests at near-native speeds, but otherwise falls back to software-only emulation.

A high-level overview of the KVM/QEMU virtualization environment[18]:3

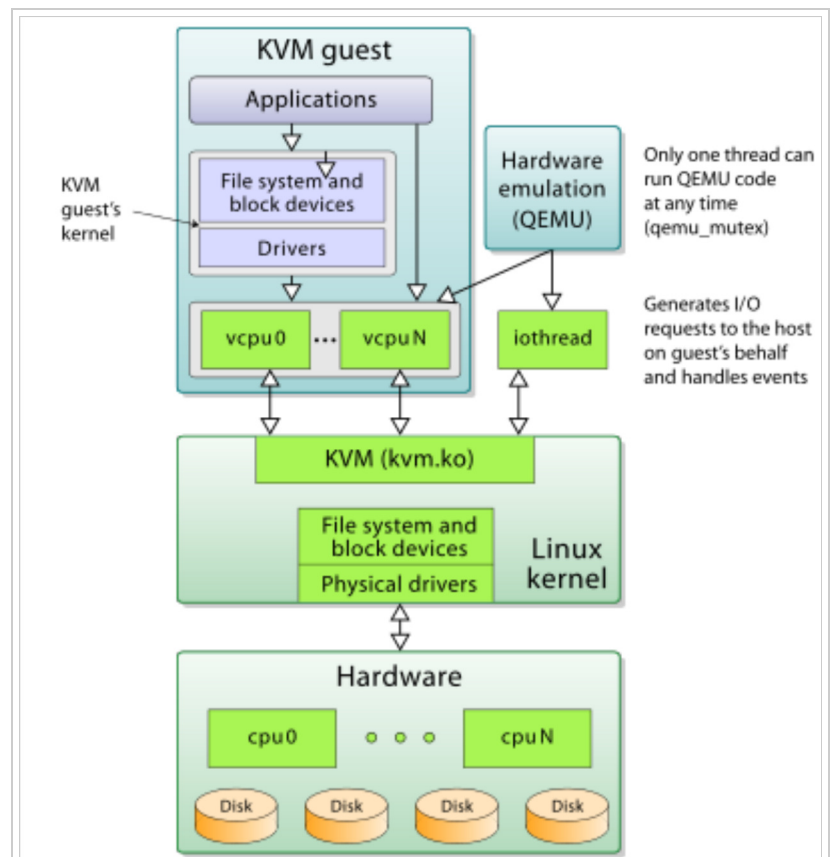Internally, KVM uses SeaBIOS as an open source implementation of a 16-bit x86 BIOS.[19]

Licensing

KVM's parts are licensed under various GNU licenses:[20]

- KVM kernel module: GPL v2
- KVM user module: LGPL v2
- QEMU virtual CPU core library (libqemu.a) and QEMU PC system emulator: LGPL
- Linux user mode QEMU emulator: GPL
- BIOS files (bios.bin, vgabios.bin and vgabios-cirrus.bin): LGPL v2 or later

History

Avi Kivity began the development of KVM at Qumranet, a technology startup company[21]

that was acquired by Red Hat in 2008.[22]

KVM was merged into the Linux kernel mainline in kernel version 2.6.20, which was released on 5 February 2007.[1]

KVM is maintained by Paolo Bonzini.[23]

Graphical management tools

- Kimchi – web-based virtualization management tool for KVM
- UCS Virtual Machine Manager (https://www.univention.com/products /ucs/functions/virtualization-uvmm/) – web-based virtualization management tool for different virtualization technologies like KVM and Xen under Microsoft Windows and numerous Linux distributions; Integrated by default in the Enterprise Linux solution Univention Corporate Server.

KVM is supported by libvirt.

- Archipel (http://archipelproject.org/) – An opensource libvirt-based Web UI, which uses XMPP to communicate with its "agents" installed on servers
- Witsbits (http://witsbits.com/) – Simplified SaaS based centralized management with web UI.
- Virtual Machine Manager – Supports creating, editing, starting, and stopping KVM-based virtual machines, as well as live or cold drag-and-drop migration of VMs between hosts.
- ConVirt (http://convirture.com/) – Manages creating, editing, starting, and stopping KVM-based virtual machines, as well as live or cold drag-and-drop migration of VMs between hosts.
- Proxmox Virtual Environment (http://proxmox.com/) – Open source virtualization management package including KVM and OpenVZ. It has a bare-metal installer, a web-based remote management GUI, and optional commercial support.
- OpenNode (http://opennodecloud.com/) – RHEL/CentOS-based open-source server virtualization and management solution with a simple bare-metal installer, providing KVM+OpenVZ host and standard libvirt, func management interfaces together with standard CLI tools like `virsh` and `vzctl`.
- OpenQRM – Management platform for managing heterogeneous data center infrastructures.
- SolusVM (http://solusvm.com/) – Supports the management of KVM-based virtual machines as well as Xen and OpenVZ.
- Virtualizor (http://www.virtualizor.com/) – Supports the management of KVM-based virtual machines as well as Xen and OpenVZ.
- GNOME Boxes – Gnome interface for managing libvirt guests on Linux.
- oVirt – open-source virtualization management tool for KVM built on top of libvirt
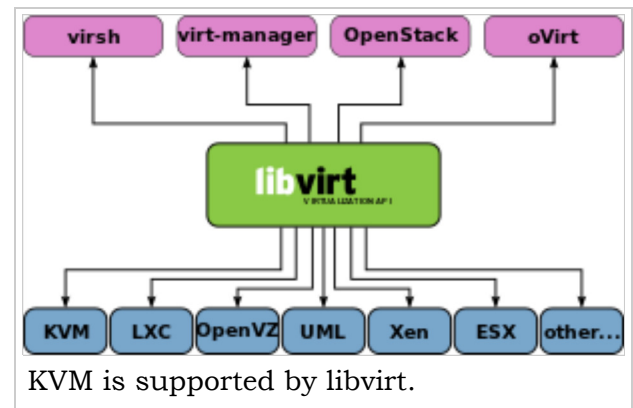
Emulated hardware

Class	Device
Video card	Cirrus CLGD 5446 PCI VGA card, dummy VGA card with Bochs VESA extensions,[24] or Virgil as a virtual 3D GPU[25]
PCI	i440FX host PCI bridge and PIIX3 PCI to ISA bridge[24]
Input device	PS/2 Mouse and Keyboard[24]
Sound card	Sound Blaster 16, ENSONIQ AudioPCI ES1370, Gravis Ultrasound GF1, CS4231A compatible[24]
Ethernet Network card	AMD Am79C970A (Am7990), E1000 (Intel 82540EM, 82573L, 82544GC), NE2000, and Realtek RTL8139
Watchdog timer	Intel 6300ESB or IB700
RAM	between 50 MB and 32 TB
CPU	1 – 160 CPUs

Implementations

- Debian 5.0 and above
- Gentoo Linux
- illumos-based distributions
- OpenIndiana
- Red Hat Enterprise Linux (RHEL) 5.4 and above
- SmartOS
- SUSE Linux Enterprise Server (SLES) 11 SP1 and above
- Ubuntu 10.04 LTS and above
- Univention Corporate Server

See also

- CloudStack
- Comparison of platform virtualization software
- Kernel same-page merging (KSM)
- Lguest
- libguestfs
- libvirt
- Open Virtualization Alliance
- OpenNebula
- OpenStack
- oVirt
- Vx32
- Xen

References

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2. KVM FAQ: What do I need to use KVM? (http://www.linux-kvm.org/page/FAQ#What_do_I_need_to_use_KVM.3F)
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External links

- Official website (http://www.linux-kvm.org)
- Best practices for the Kernel-based Virtual Machine (http://www-01.ibm.com /support/knowledgecenter/api/content/nl/en-us/linuxonibm/liaat /liaatbestpractices_pdf.pdf#navpanes=0&toolbar=0), IBM, second edition, April 2012
- Virtio-blk Performance Improvement (http://www.linux-kvm.org/wiki/images /f/f9/2012-forum-virtio-blk-performance-improvement.pdf), KVM Forum 2012, November 8, 2012, by Asias He
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