KVM and Xen Virtualization

By: Drew Hornischer, Ralph Mancinelli, Andrew Clifton, Jeff DiMarco
Virtualization Techniques

• Full virtualization is a virtual machine environment that completely simulates hardware
  – Slower, but high compatibility

• Paravirtualization is a virtual machine environment that bypasses the virtual interface to run operations directly on hardware
  – Faster, but OS must be compiled for the specific virtual machine manager
  – OS is “aware” it is being virtualized
KVM

• Kernel-based Virtualization Machine (KVM) is virtualization software using normal system calls to Linux’s Kernel

• KVM resides in the Linux kernel as a loadable kernel module.

• Multiple virtual machines running various operating systems can be running at the same time
  – each virtual machine running has its own private emulated hardware
KVM

• Features:
  – Offline and live migration, even between Intel and AMD processors
  – Stable
  – Fast
  – Supports device paravirtualization (but not OS)
KVM

• Support Hosts
  – Linux Only

• Support Guests
  – Windows
  – Linux
  – FreeBSD
  – Solaris
  – Android
KVM

• KVM is called a type 2, or hosted, hypervisor, since it resides within an OS and all guest operating systems are run within a host OS.
• Since KVM is hardware based, the guest OS does not have to be modified to run in a software emulating environment.
• KVM turns the kernel into a hypervisor, so virtualization is faster and more integrated into the Linux environment.
Figure 1. A Type 2 hypervisor runs as an application on a host operating system.
KVM

• The virtualization is seen as a standard process on the host machine
• Since KVM uses the kernel, it is more efficient than other virtualization solutions that use user-space drivers
• To use KVM, one needs a processor that supports Intel or AMD virtualization technology.
KVM

- KVM itself does not perform any emulation
- Instead, a user space program uses /dev/kvm is used to set up the virtual machine
  - Address space
  - I/O requests
  - Maps display back to host
Xen

• Xen is a virtual machine monitor which allows for multiple operating systems to run at the same time using the same computer hardware.

• The system is structured so that the Xen hypervisor remains the lowest and most authoritative level.
Xen

- Xen is considered a type 1 or ‘bare-metal’ hypervisor, which means it resides just above hardware.
- All other operating systems exist above this level, and are managed by the Xen hypervisor.
- Xen instead uses software virtualization to run the guest OS.
Xen

• Features:
  – Paravirtualization
  – hardware-assisted virtualization
  – virtual machine migration
  – version 4.1 supports up to 255 processors
Xen

• Supported Hosts:
  – None, Xen is considered the host OS

• Supported Guests:
  – Unix like systems
  – Windows systems
Xen

• The Xen hypervisor is a layer of code that goes in between the device’s hardware and the operating system.

• The first OS that is booted is called dom0, and boots automatically when the hypervisor loads.

• This guest OS has special privileges and has direct access to all of the hardware.
Xen

• To get the best performance from Xen, you first need to compile a version of the guest operating system that will work with the paravirtualization of Xen.
Xen Vs. KVM Vs. VMware (Commercial)

- VMware is a fully virtualized system
- This means that the guest OS hardware is emulated in software.
- This method does not require a special version of the guest OS.
- However, it suffers from decreased performance since translating hardware to software takes time.
Xen Vs. KVM Vs. VMware(Commercial)

- Xen, uses paravirtualization, which means it directly controls the hardware, and boots all of the operating systems from the hypervisor.
- The first operating system loaded gets direct access to all the hardware, and one can easily switch between operating systems without a reboot.
Xen Vs. KVM Vs. VMware (Commercial)

- KVM uses hardware to virtualize a guest OS. The guest OS is hooked into the Linux kernel, which allows it to directly use the hardware for kernel commands like writing to the disk.