

Xen and OpenVirtuozzo: two different approaches to server and services virtualization

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Introduction

Virtualization is a methodology of dividing the resources of a computer into multiple execution environments, by applying one or more concepts or technologies such as hardware and software partitioning, time-sharing, partial or complete machine simulation, emulation, quality of service, and many others.

These techniques can be used to consolidate the workloads of several under-utilized server to fewer machines, to run legacy applications which might simply not run on newer hardware, to provide secure and isolated sandboxes for running untrusted or potentially insecure applications, to provide powerful debugging environments and test scenarios.

Xen is an hypervisor which runs multiple guest operating systems with kernels ported to a special arch very close to normal x86, with strong isolation between virtual machines and execution performance close to native processors.

OpenVirtuozzo is an operating system-level virtualization solution based on Linux. Any OpenVZ virtual server behaves like a regular Linux system, isolated from each other (file system, processes, IPC), but shares a single OS image and process space ensuring that applications do not conflict.

We also include some **VMware GSX Server** benchmark data. This is a powerful virtualization product (now released for free as VMware Server) which fully emulate a functional x86 or x86_64 server, permitting to run an unmodified OS, but with some performance issues.

Testbed and Methods

During the tests we used an old dual processor server, with the following components:

- CPU: Intel Pentium III @ 800 MHz, 256 KB cache L2
- Memory : 1 GB (2x512 MB) PC133
- HDD : Maxtor 40 GB, 2 MB cache, 7200 rpm
- MB : Tyan Tiger 230T

The BIOS Setup was adjusted for maximum performance.

This is a rather old server, but is still usable for light server tasks or as a test platform.

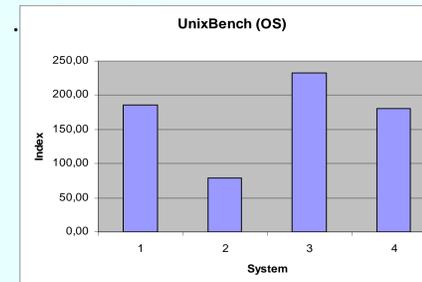
The operating system used both on the host (hardware) machine and on the guest (virtual) machines was Scientific Linux 4.2, with variable kernel version based on the virtualization software used.

- Xen : 3.0.1 – kernel 2.6.12-xen
- OpenVZ : Stable branch – kernel 2.6.8-022stab064
- VMware : GSX 3.1 build 9089 – kernel 2.6.9-22 (from SL4)

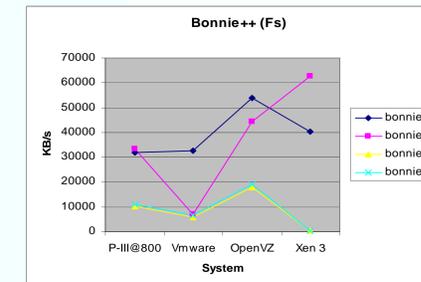
The benchmark procedure was very simple but quite complete for a server which offer network services, like a web or mail server. We also want to evaluate the installation procedure, the virtual machines creation process and management tools and their performance.

Tools: **UnixBench**, a fundamental high-level Linux benchmark suite, that integrates CPU and file I/O tests, as well as system behaviour under various user loads; **Bonnie++**, an IO throughput benchmark; **“openssl speed”** to test the performance of cryptographic algorithms; **ab**, the Apache Benchmark; **Postal**, an SMTP mail delivery test and POP mail reception test.

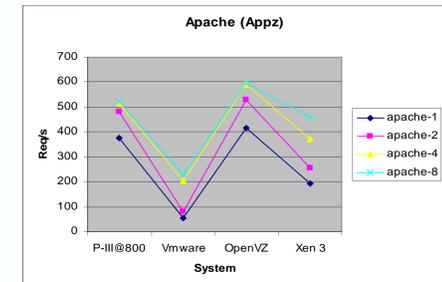
Some results



UnixBench show that VMware guest is 57% slower than the host machine, OpenVZ guest is 25% faster (!!!) and Xen guest is only 2.5% slower. Perhaps the OpenVZ custom kernel has some specific optimizations. Xen is very close to the hardware platform performance values. Other tests required.



VMware guest achieves good results in reading. The OpenVZ kernel is very speedy in disk related operations while the Xen guest, installed in a loopback mounted filesystem, has serious problems operating with large number of small files. This problem can be solved installing Xen guests on real partitions.



Using the Apache benchmark, the OpenVZ guest is over 12% faster than the host machine with the stock kernel, while VMware and Xen are 70% and 32% slower. OpenVZ architecture is optimized for these type of tasks, but VMware and Xen guests installed on real partitions can give better results.

Installation, VM creation and management

Xen and OpenVZ require to install a custom kernel, not always suitable for the hosting hardware (but customizing and recompiling them is not too hard), while VMware can be installed on almost every distribution kernel. VM creation approaches are very different. VMware has a graphical tool to create and customize the emulated hardware. In the second step is possible to install every kind of OS, even MS Windows or Sun Solaris, using their standard tools (cd or dvd, pxe).

Xen and OpenVZ only have command line tools, but they are very powerful. You can create a VM using a single command or a simple configuration file (pure text) and assign them only a fraction of the CPU time or system memory. The VM OS can be installed with some specific tools, based on yum or apt.

Xen also offer a “live migration” feature, like the expensive VMotion add-on for VMware.

Conclusions

In Naples we have two production Xen servers, with 4 VM each, installed in January 2005 and hosting all backup services: secondary DNS, secondary MX, a list server, a print server for 40 printers, some webservers.

This solution has proven its strengths and benefits. We can move the VM disks from server to server with only some minutes of downtime, copy these VMs to a more powerful server to have a faster web or mail server, clone a VM to have a test environment before critical upgrades, try new software and tools with no interference with working production systems, “fire up” a new server in minutes and not in days.