# " System Performance Evaluation of

# Para Virtualization,

# Container Virtualization,

# and Full Virtualization

# using Xen, OpenVZ, and XenServer "

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The purpose of this article is to evaluate the performance of three virtualization technics. Those technics provide a virtual environnement running on hardware environnement.

What virtualization technologies should we use and why ?

First we will summarize the given conference paper next we will talk about virtualization technics and technologies state then we will give an opinion, a conclusion and finally we will present used references.

First of all, authors present virtualization technics : « para-virtualisation » one, identified with an hypervisor that acts as a virtualization layer, guest make the system calls trought it for hardware resource utilization. « container virtualization » one, described as using kernel that acts like an hypervisor while providing the ability to manage the underlying resource. The last one, « full virtualization », is presented as working just over the underlying hardware. Accordingly each guest OS will be fully ran like if they operate directly on the previous layer. That is why guests will have their own management console. For this to happen, hypervisor will interact with the memory layer, the disk layer and so one, while the activities between guest will be isolated.

Next, authors present the experiment phase that uses a similar hardware setup for testing environnement : Debian wheezy as operating system, UnixBench bench marking tool to evaluate the system performance and therefore, each hypervisor performance. Then they conduct several tests, for instance « string handling capability », « pipe throughtput » or « Piped based context switching ».

At the end, they conclude XenServer is globally far more effective than the others.

Regarding virtualization technics and virtualization product,  we have to add some essential informations to understand the problematic.

It is important to know that an hypervizor acts like the orchestral conductor that manage guests.

In one hand, para-virtualization presents an interface to VM which is not fully similar to hardware. For example it reduces the guest's execution time by running some critical task on the host. Para-virtualization only works if the guest operating system is ported for the para-API.

Hence, the use of Xen-PV that is now part of Linux kernel as well as other operating systems.

On other hand, OS-lvl virtualization uses the kernel to provide multiple isolated user space instances called containers. Limits are that host and container should run the same kernel to work.

Hence, the use of OpenVZ, based on virtuozzo product, that is restricted to linux kernel and offers better performances close to host performance.

Moreover to be exhaustive we have to know that full virtualization replicates a target environment including the full instruction set like I/O or memory access. Any software capable of execution on raw hardware can be run in the VM, for instance operating systems. It needs Intel VT-x or AMD-V.

Consequently, they use Xen-Server (open source from Citrix) based on the Xen hypervisor that provides full a virtualisation infrastructure.

To conclude, we will ask ourself what virtualization technologies should we use and why ?

Independently of virtualization technics, it serves many purposes : it makes the infrastructure and the resources more profitable with a more intelligent usage, it allow to run different operating system, it reduces hardware cost (hardware itself, electricity, cooling etc …), it centralizes the physical and logical administration, it permits fast and effective deployment, it allows scalable resource and load-balancing, jails and security.

Moreover, the conference paper does not take into account some specifities (not to mention changes in technologies) like different hardware configuration more or less efficient or GPU use to unload processor operations.

Another point is the deployment and configuration time of the product and their related cost.

In the same vein, using a solution like container with less performance result could be more efficient for a movement like the devops.

Given that the conference paper is dated 2014, i would clarify a number of issues : hardware performance and virtualization technics have evolved and been improved since then.

Virtualization had become a standard, container technics as much as the other.

In addition, virtualization product tends to be used like a specific product for a specific virtualization need (server, OS, vdi, applicative, network, storage).

We can mention flash technologies(cache memory layer for storage), or separated environnements for each application.

Now, the virtualization technics have been improved and have new goals : those related to performance : speed the provisionning, balance the read and write flow etc.. those related global monitoring and those related to security improvements or HCI solution.

Henceforth, ou should be able to make an enlightened choice when you'll have to chose a virtualization solution, considering the different virtualisation technics available, their pros and cons, their current state and some other perks  that weren't taken into account on the conference article.

The actual competitive challenge is the graphic operation management in virtualized environnement that evolves day after day.

On account of my interest for the suject, i have done some reading on these links :

System performance vs virtualization types :
source : ieeexplore.ieee.org
type : document
date : 2014
subject: System Performance Evaluation of Para Virtualization, Container Virtualization, and Full Virtualization Using Xen, OpenVZ, and XenServer
url : https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6906035

Evolution de la virtualisation :
source : cnam.fr
type : video
date : 2015
subject: general virtualization
url : http://mdcvideos.cnam.fr/videos/?video=MEDIA150212142309947

Para-virtulization :
source : wikipedia.org
type : document
date : 2019
subject: para-virtualization
url : https://en.wikipedia.org/wiki/Paravirtualization

OS-lvl virtualization :
source : wikipedia.org
type : document
date : 2019
subject: jails and container virtualisation
url : https://en.wikipedia.org/wiki/OS-level_virtualization

Container virtualization :
source : redhat.com
type : document
date : 2019
subject: container virtualization
url : https://www.redhat.com/fr/topics/containers/whats-a-linux-container

Full virtualisation :
source : CNAM
type : document
date : 2019
subject: Citrix/XEN virtualization
url : https://www.citrix.com/products/citrix-hypervisor