

Parallels® Virtuozzo Containers

White Paper

Deploying Application and OS Virtualization Together: Citrix and Parallels Virtuozzo Containers

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The Virtualization Continuum: Deploying Virtualization Together

There are many types of virtualization technologies and the lines are becoming blurred between the different types. When is it appropriate to use one type of technology? Is it beneficial to use two types of virtualization technologies together? As virtualization becomes more pervasive in the datacenter, organizations are deploying multiple technologies and a significant trend is using complimentary types of virtualization technologies together to provide an even stronger and more robust solution and ROI for the IT organization.

This whitepaper defines the different types of virtualization and explores the relationship and potential benefits of blending two types of virtualization together in particular: application and OS virtualization using Citrix and Parallels Virtuozzo Containers.

VIRTUALIZATION TECHNOLOGIES

This is not an exhaustive list, but arguably, the most important types of virtualization being deployed today are: hardware virtualization, para-virtualization, OS virtualization and application virtualization.

Hardware Virtualization

Hardware Virtualization, or Virtual Machine Monitor or Hypervisor are different names for essentially the same technology. The most common examples of hardware virtualization are VMware, Microsoft Virtual Server and Parallels. This technology is known as hardware virtualization because everything from the hardware up is virtualized. In this diagram, building from the server up, you see they hypervisor layer (which is a modified Linux kernel) and then the VMM layer. The virtual machine monitor virtualizes every piece of hardware on the server, from CPU to memory to video cards. In the virtual machine, there is a guest OS, and finally the application or workload.

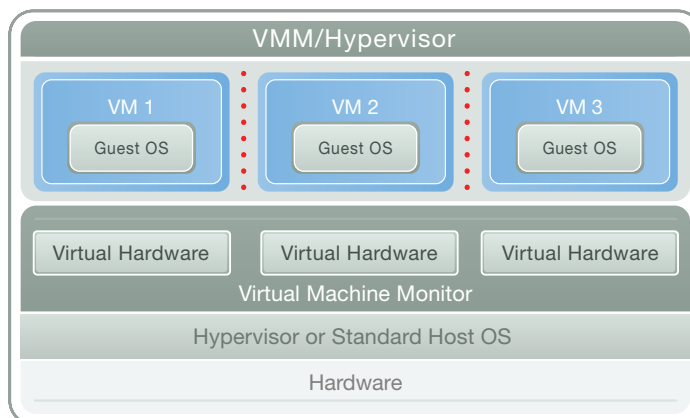


Figure 1: Hardware Virtualization

Hardware virtualization is powerful because it enables any operating system to run side by side on the same server. The flexibility of this architecture comes with some drawbacks, it has duplicate layers of processing: two layers of OS (the hypervisor and the Guest OS). It has two layers of hardware: the real hardware and the virtual hardware. These duplicate layers add additional processing and make it difficult to run production high I/O applications. Another drawback is manageability. With hardware virtualization, you're actually increasing the number of OSs that you manage. In the pictured example the IT administrator manages four OSs: the three guest OSs and the hypervisor layer. Many organizations that have deployed this type of technology have noticed that over time their issue of hardware sprawl hasn't been resolved, it has been replaced with a new issue OS or VM sprawl. It is so easy to deploy a new virtual machine, they are deployed more rapidly with more configuration variations and the resulting datacenter becomes an even bigger challenge to manage.

Paravirtualization

Paravirtualization is a variation on the hardware virtualization concept. The technology itself is intended to accomplish the same outcome as hardware virtualization: the ability to load multiple operating systems on the same physical server. Paravirtualization recognizes the inherent

challenges for performance that hardware virtualization has and to overcome. To address the performance limitations, Xen uses modified OSs on top of a hypervisor, or virtual machine monitor. Paravirtualization has better performance compared to emulation, but the disadvantage is that the “guest” OS needs to be modified. The most well-known example of paravirtualization is Xen.

OS Virtualization

OS Virtualization creates multiple isolated partitions or virtual environments (VEs) on a single physical server and OS instance. Building from the bottom up on the diagram on the right, the hardware and the OS are standard.

This is one of the benefits of the technology, all of the software, hardware, driver technology and advances are merely leveraged by the virtualization layer rather than recreated. Using existing technology enables fast support for technologies such as multi-core, and it also ensures that there is no performance degradation through rewriting drivers and other proprietary information.

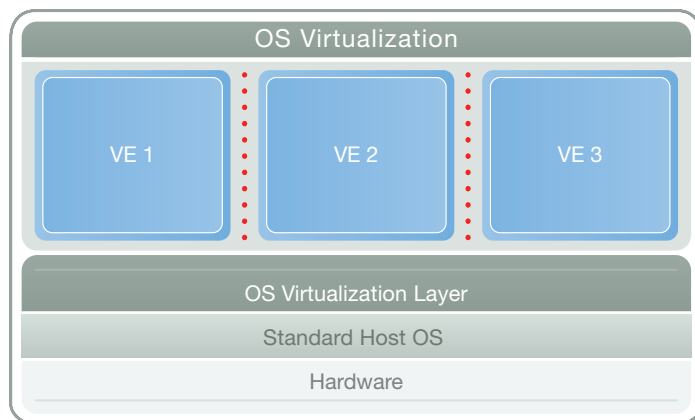


Figure 2: OS Virtualization

Next the virtualization layer controls the resource management, scheduling and isolation required by the virtual environments. Finally, the virtual environments themselves contain mere links back the standard OS, and just contain the application or workload. This architecture is unique in that it does not introduce multiple layers of processing (rather than using real and virtualized hardware) and it only uses a single OS (rather than a hypervisor modified Linux and a guest OS). The architecture does not add additional layers of processing so it can be the closest to native server performance of any virtualization technology. Because of the single OS and memory usage, OS virtualization also has the highest density (most VEs) on a single server.

Obviously the single OS makes it extremely simple to manage, and with toolsets and other enhancements, OS Virtualization is making big gains in improving virtualized server management in comparison to virtual machines or hypervisor deployments. The only two productized types of OS virtualization are Virtuozzo on Linux and Windows and Sun’s Solaris containers.

Application Virtualization

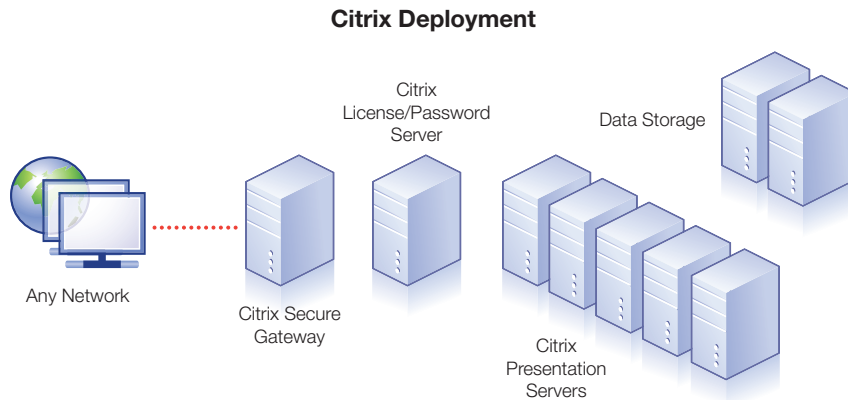
There are different ways that application virtualization is defined. For the purposes of this paper, the Citrix implementation will be used, specifically for client-server applications, although the same concepts will apply to Citrix desktop applications. Citrix application virtualization removes the application from the hardware. An application can run in the datacenter and the clients accessed securely remotely.

The end user experience for a virtualized application is the same as if the client were loaded locally, including all of the interactions such as printing. Since the client is actual held and maintained in the datacenter, it is much more consolidated and easier for the administrators to update and manage. The improved manageability results in fewer administration hours and tremendous cost savings. Additional benefits include increased security, by maintaining data in the datacenter, it is backed up regularly and held in a more secure location than various laptops and computers. Lastly, it improves flexibility, because the application is not housed locally a full laptop is not required; a terminal or PDA can access the application. Most importantly, Citrix applications are only viable to the end-users because their performance is good, in many cases better than retaining the application locally.

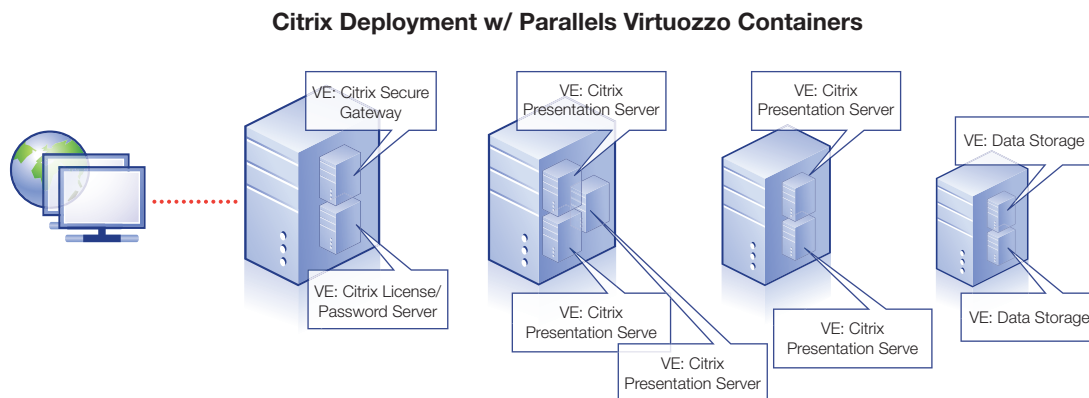
WHY PARALLELS VIRTUOZZO CONTAINERS AND CITRIX?

As stated, this whitepaper will focus on the deployment of Virtuozzo and the Citrix client-server application, Citrix Presentation Server (full Citrix Access Suite).

The Citrix Presentation Server has a base installation of several applications; a typical deployment is pictured below:



As you can see, several different applications are required; applications could be each loaded on different servers, but in this case, pairing the application virtualization with OS virtualization could be substantially more powerful. Each of the servers could be deployed in virtual environments. With Virtuozzo, that same environment could look like:



IT organizations are finding many reasons why pairing Citrix and Virtuozzo can be very beneficial.

Consolidation Benefits

The straightforward consolidation benefits include:

- Each server has associated power and cooling costs, consolidation reduces these costs.
- Each server requires network connectivity (hubs, routers and switches all have limited connections), consolidation makes the best use of each network connection.
- Each server takes datacenter space; space is expensive and has set power capacity. Consolidation makes the best use of space and power grids.
- Typically single use servers are only utilized at 10-15% of capacity, consolidation increases utilization to the desired level.

- Deploying each separate application on a different server increases the number of physical servers that must be maintained, monitored and managed. Consolidation minimizes the number of servers to manage.
- For Microsoft applications, the new licensing considerations allow up to four virtualized instances on a single server per server license. Because the Citrix configurations tend to be very resource intense, most servers will consolidate within this ratio. If higher densities are achieved, the datacenter license allows unlimited virtual environments and generally becomes attractive when consolidating 9 or more instances on a single server. Consolidation makes the best use of Microsoft licenses.

Management Benefits

Administration is often difficult to quantify, but often becomes the most compelling gain that IT organizations have after deployment. Some benefits include:

- **Agility:** Each Citrix Presentation Server supports a certain number of users, depending on many factors including application, workload and hardware configuration. How fast can an organization respond if they discover that their current infrastructure is not sufficient to support end-user demand? With Virtuozzo, the VE can be configured in a couple of minutes- a fully functional virtual environment complete with Operating System and potentially a pre-set Citrix Presentation Server configuration (including a specific resource allocation).
- **Capacity Planning:** How do you know when your Citrix Presentation Server is being taxed too heavily? The monitoring and management in the Virtuozzo management tools alert the administrator to adjust available resources. In the same regard, if an application is not being used as heavily, resources can be re-assigned to other virtual environments. All resources can be changed in real-time without affecting performance.
- **Flexibility:** Virtual environments are abstracted from the hardware. Any VE can be moved from one physical server to another, without requiring shared storage. An impending hardware failure can be avoided, a software or hardware update outage can be avoided. Virtuozzo can eliminate planned, and in some cases unplanned downtime.
- **Customizable:** One of the most important things to the Citrix administrator is maintaining a secure, locked-down application. The reality is that there are super-users in every organization that require a different level of application control and access. Creating a presentation server that servers 5 users is expensive on a dedicated server, while more acceptable in a virtual environment.

Unique Parallels Virtuozzo Containers Benefits

There are several choices for virtualization technologies, why choose Virtuozzo?

- It is critical that end users do not get frustrated with the performance of virtualized solutions. Citrix is popular in part because its performance is as good if not better than what end users expect. Virtuozzo has the lowest overhead of any virtualization solution, and will not negatively affect the user experience.
- Virtuozzo is OS virtualization which has the unique benefit of a single OS on a server. Along with OS templating (which mimics the Operating System in the virtual environment) Virtuozzo servers are the simplest to manage. One OS to maintain, a single task to update the virtual environments.
- Virtuozzo also has unique memory management capabilities; memory tends to be the constraining resource with virtualized deployments. With the single OS, there is only a single instance in memory and there are other memory usage enhancements that make Virtuozzo the best memory performance.
- The memory usage, the lack of software duplication (single OS and templating), efficient caching and an architecture built for performance enable the Virtuozzo deployments to have a higher density (number of VEs on a single server) of any virtualization solution.

- Virtuozzo leverages the technology already created by hardware and OS vendors. It does not recreate chip or other technologies and is able to scale to use all of the available resources on a server. The 64bit implementation is particularly powerful because it gives theoretically no boundaries to memory usage and the architecture provides a very efficient use of this very powerful server.
- Unique backup and recovery options. Virtuozzo supports many of the same backup software packages that IT organizations use today, so deploying Virtuozzo doesn't have to change the backup deployment process. With Virtuozzo, the VE footprint is small without the entire OS which makes it faster to backup and restore. Virtuozzo backup comes with complete backup functionality including incremental backups, single file restore and an intuitive scheduler.
- Virtuozzo has the ability to support high performance computing configurations with Microsoft Network Load Balancing Support. Configure multiple Presentation Servers to balance the large workloads amongst multiple Presentation Servers.
- Virtuozzo has a unique virtualized architecture, at its base it still looks like a single server, rather than emulating multiple full servers. That reduces some of the standard single server requirements such as anti-virus software. A single anti-virus agent can protect a server with many VEs. Using the single agent reduces overall system drag (versus several agents on a server) in addition to licensing benefits .
- Create highly available services. Virtuozzo supports several configurations of Microsoft Clustering Services and Red Hat Clustering. The server itself or VEs can be clustered in an Active/Passive role to failover to another server in the event of an outage.
- Virtualize every server resource, when deploying some virtualization solutions it is not wise to virtualize every server- these servers tend to be either on the low end or the high end. With Virtuozzo, the overhead is low enough to virtualize the highest I/O server. On the other hand, the cost is reasonable enough to virtualize simple file servers- the management improvements and flexibility are enough to justify virtualizing even a simple data store.

PARALLELS VIRTUOZZO CONTAINERS AND CITRIX BEST PRACTICES

Several organizations have already deployed the Citrix Virtuozzo combination and the following are some best practices.

- Create a sample VE in the Virtuozzo management toolset for each type of Citrix server. The sample VE contains the appropriate OS and the resources (CPU, bandwidth, memory, etc.) that produces a predictable amount of users. For example, a 50 User SQL Presentation Server. Provisioning a fully functional VE takes less than two minutes for a Windows VE and less than a minute for Linux VEs.
- Use the VZP2V tool. VZP2V is a physical to virtual tool that takes a snapshot of the current server load (peaks over time) and helps estimate the resource requirements in a VE. The standalone server remains intact until the VE has been deployed and tested.
- Through testing Citrix administrators determine the expected number of users a server can support. Leverage the unique resource capabilities of Virtuozzo and allow a presentation server to burst and use unused resources on the server. The other VEs on the server will retain their guaranteed resources while producing the best possible utilization of the server.
- If applicable, deploy VLANs to provide a secure, custom path for application access.