



White Paper

Virtuozzo and Citrix: A Great Team

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Why virtualisation?

Today's IT systems are increasingly critical to the business, and need to operate around the clock without fail. This increases the need for central management and control over the IT infrastructure.

As a result of this and modern technological advances, virtualisation is one of the hottest topics in enterprise computing today. Virtualisation technology, first seen on IBM mainframes in the 1960s, has now come of age due to advances in both software and hardware.

The vast majority of organisations of every size are either using virtualisation or planning to use it according to Gartner. The reason is simple: it offers IT organisations numerous benefits that outweigh the disadvantages by a considerable margin.

They include the following:

1. Increase the return on infrastructure investment by improving resource utilisation through hardware consolidation
2. Provide higher levels of service to users by improving availability
3. Decrease complexity and improve manageability by reducing the numbers of physical systems, or 'server sprawl'
4. Increase flexibility and responsiveness by dramatically cutting provisioning and tear-down time

Virtualisation and Citrix Presentation Server

Citrix Presentation Server – an application found throughout the enterprise – benefits hugely from virtualisation.

Most enterprises have instances of Citrix Presentation Server running all over their organisation. Its advantages are that organisations can centralise applications and data in secure data centres, reduce the costs of management and support, increase data security, and ensure fast, reliable performance. Citrix Presentation Server also allows IT to deliver applications as a service, providing on-demand access to users while affording IT the flexibility to leverage future application architectures.

Add SWsoft Virtuozzo's virtualisation technology to Citrix Presentation Server and you multiply hugely the power and potential of both technologies to reduce operational expenditure.

One server per application?

The traditional technique for decreasing the likelihood of downtime is to run each critical application on a separate piece of server hardware. In this way, if a hardware component fails, only one application is affected.

Fortunately, today's hardware is more reliable than ever, and sufficient reliability for most situations can be obtained by deploying fault-tolerant hardware. Instead, the biggest problems when running multiple applications on a single server are caused by unpredictable interactions between different pieces of software running under one operating system.

This reduces reliability and can manifest itself in a number of ways, such as:

1. High demands by one hard-working application can starve other applications of operating system resources, causing unacceptably low performance.
2. Applications such as database or mail servers often require that the operating system be configured and optimised to suit that one application, but which may be sub-optimal for other applications.
3. If one application fails, it can cause the operating system and other applications to react in unpredictable ways.
4. Some applications, such as fax servers, require the installation of specific hardware, whose drivers can again generate unpredictable errors.

In short, it is hard to ensure isolation between applications when sharing an operating system. It is also cost-ineffective in these energy- and cost-conscious times for a number of other reasons, including the following:

1. Over time, it leads to a sprawl of under-utilised servers with huge numbers of machines, each of which requires management by IT staff
2. Management of numerous operating systems and applications can spiral as organisations become more and more dependent on IT
3. Each server consumes as much energy in cooling as it does performing useful work, increasing costs in a world where energy use needs to be contained
4. Each server needs its own power supply and connectivity hardware, each of which adds to the list of potential points of failure
5. Even if rack-mounted, each server requires increasingly expensive floor space

The cost-effective solution for a growing number of enterprises is to use virtualisation technology to consolidate their servers.

Why consolidate?

Server consolidation uses virtualisation technology to reduce the number of physical servers. This brings with it a number of advantages:

1. With fewer servers running at higher utilisation levels than the many they replaced, the return on investment in IT is increased.
2. Consolidation reduces the management overhead by cutting the number of physical machines that need tending.
3. Consolidation cuts data centre costs by reducing the physical footprint of the IT infrastructure.
4. Consolidation cuts energy usage by reducing heat generation and the consequential load on data centre cooling systems.
5. Consolidation allows you to provision and replicate servers easily and quickly.
6. Consolidation allows fast disaster recovery using techniques such as snapshot restore, live migration to other machines or data centres, and clustering.

Server consolidation has few downsides and many upsides – not least of which is that it allows your organisation to help play its part in reducing its carbon footprint. There can be fewer better reasons.

Virtuozzo and Citrix Presentation Server

Virtuozzo and Citrix Presentation Server together combine the benefits of a highly scalable system for delivering end user application with the most cost-effective high performance virtualisation technology.

Ten reasons, among many, why Virtuozzo and Citrix Presentation Server make excellent partners:

1. Run multiple Citrix Presentation Server instances on a single server. Consolidate multiple Citrix Presentation Servers scattered around the organisation and return control to the centre, in addition to all the other consolidation advantages detailed above.
2. Hosting of full unrestricted desktops. Users see no differences in applications or performance when running off a virtualised Citrix Presentation Server. The IT organisation and the business will notice the added flexibility and cost savings.
3. Centralised application management. Virtuozzo holds all applications in a central application template repository. Applications can be provisioned in any or all environments, without physically copying the files and in a matter of few seconds per environment.
4. Advanced resource management. Virtuozzo provides sophisticated resource management, including limits and guarantees for CPU, memory, network and disk bandwidth. Resource management is dynamic (no restart of OS, application or VE is required) and real-time – it takes effect immediately). As a result, a VE cannot bog down the machine due to a buggy or malicious application.
5. Fast machine-to-machine migration. Each VE is encapsulated in a small disk image and this small footprint allows migration of a VE from one Windows machine to another in a matter of seconds. Virtuozzo for Windows will get the “Zero Down-Time Migration” feature that is already available for Linux.
6. Efficient backup/restore. Because of on-disk encapsulation, online and offline backups are easy and efficient. Virtuozzo excludes the physical host OS image and the same set of application binaries from the backup image, significantly reducing time to backup and restore. Also, full desktops of power users can be backed up and restored individually.
7. Virtuozzo uses the same approach as Citrix Application Isolation Environments. It creates Virtual Environments on top of single OS instance, provides them with a virtual view of OS resources, and maps those to the corresponding real resources. The main difference between Virtuozzo and Citrix is that Virtuozzo handles more system namespaces – user names, IP addresses and ports, process IDs, etc.
8. Performance overheads are negligible. Tests have shown that the performance hit when running Citrix Presentation Server under Virtuozzo is almost native – about 1% – as a result of Virtuozzo’s OS-level virtualisation technology.
9. It’s easy to do. Using Virtuozzo’s Physical to Virtual Migration (VZP2V) Management Tool, you can bring standalone Citrix servers inside the Virtuozzo Virtual Environment. As a result, the Citrix Presentation Server will perform the same or better when moved to Virtuozzo, while allowing you to monitor server usage. The tool will also automatically create a Virtuozzo configuration specifically tailored for the Citrix Presentation Server requirements, easing the transition from a physical to a virtual server.
10. Virtuozzo is tailored for Citrix Presentation Server. With the latest service pack installed, Virtuozzo now allows you to install Citrix Presentation Server alongside another database or other application. SWsoft’s engineers worked alongside their Citrix counterparts to ensure the overall solution works well, and makes efficient use of resources. Citrix Presentation Server is certified to work under Virtuozzo.

Scenarios

CITRIX CONSOLIDATION

Typical scenarios include a bunch of Citrix Presentation Servers scattered around the organisation, some at HQ, others in different branches, some may be running off blades in remote locations. Some will be at the limit of their capabilities but, more likely, most will be characterised by single digit utilisation.

All or most of these instances of Citrix Presentation Server can be consolidated onto virtual servers at centralised points through the organisation, under a single management umbrella, while reducing the number of physical machines required to run them by a factor of 10 to 15.

AGILITY COMPUTING

- **Flexible desktop strategy:** Virtuozzo allows you to host full unrestricted desktops on the same server as locked-down Citrix environments. This means that power users, knowledge workers and decision makers can at last be migrated to a thin client model. In addition, Virtuozzo allows power users to download and run a copy of the hosted environment locally on a laptop, take it on a road and then synchronise it back when reconnected to the corporate network. While only a small percentage of Citrix users would need this capability, those power users are typically the most influential ones. Since power users reside on the same servers as other workers, all Citrix servers can be upgraded.
- **Dynamic resource management:** Virtuozzo provides flexible resource management mechanisms that allows users to set minimum, maximum, share and burst values for CPU, memory, disk space and I/O bandwidth. The most important characteristic of Virtuozzo resource management is that all changes take effect immediately, in real time. Advanced administrators have access to over 40 kernel parameters, enabling a fine-grained approach to performance tuning. In a Citrix environment, this means that a positive user experience can be maintained for all users.
- **Faster connectivity:** Virtuozzo now provides a new secure connection using its own transport encrypted by SSL, which enables faster backup and migration, providing greater security for Citrix desktops.
- **Systems management:** With Virtuozzo, software management operations, such as provisioning and patching, only need to be performed once per physical machine, regardless of the number of VEs on the machine, dramatically reducing operational costs compared to virtual machines that need the same operation to be performed in all VMs independently.

DISASTER RECOVERY AND BUSINESS CONTINUITY

Virtualisation is becoming a key enabling technology for providing efficient and cost-effective ways to keep data available and recover data.

Virtuozzo's continuity features include:

- Cross-platform backups
- Online volume shadow copies
- Online cloning
- Efficient patching
- Fast start-up
- Live migration

By enabling upgrade testing and deployment, among others, this combination of efficient patching, fast start-up and live migration dramatically reduces and often eliminates planned downtime required to update and reboot machines after applying OS patches.

Specifically, security patches for every virtual environment (VE) only need to be installed once per machine compared to once per virtual machine (VM) in a hardware virtualisation environment. Starting and stopping a VE is about 10 times faster compared to a VM. Typically, a Virtuozzo environment is 10-100 times smaller than a VM virtual disk image, which makes backup and restore of VEs much more efficient compared to VMs.

Combined, these advantages lead to dramatically lower maintenance downtime by a factor of five or better. Provisioning a new VE is also several times faster than for a VM.

These are critical issues when one physical server may be supporting dozens of end users running Citrix Presentation Server desktops.

EASE OF IMPLEMENTATION

SWsoft's Virtuozzo Physical to Virtual (VZP2V) tool – now expanded to upgrade Windows 2000 servers to Windows 2003 servers – is an easy-to-use tool that assists with a successful server migration from a standalone physical server to a Virtuozzo server.

The tool helps you assess and evaluate your physical server, as well as migrate it and configure the VE. It makes a copy of an environment and migrates it seamlessly into the VE with no alteration of the environment.

VZP2V features include:

- Ensuring that your physical server performs the same or better when moved to Virtuozzo
- Monitoring physical server usage at any point in time or monitor for peaks and valleys in processing
- Automatically creating a Virtuozzo configuration specifically tailored for your physical server's requirements
- Easing the transition from a physical to a virtual server, leaving the physical server intact initially for a back-up

Summary

As we have seen, Virtuozzo is ideal for a Citrix environment because:

- Virtuozzo allows you to consolidate Citrix servers
- Virtuozzo offers agile computing by enabling the hosting of unrestricted desktops, dynamic resource management, faster connectivity and high-efficiency systems management.
- Virtuozzo provides in-built features that offer high availability and business continuity
- Virtuozzo is easy to implement, use and manage

Many organisations have been cautious about implementing virtualisation technology, preferring to let others sit on the bleeding edge. No longer: big organisations such as banks and telecoms providers are using Virtuozzo to consolidate their Citrix Presentation Server farms.

Is it time you joined them?

Virtualisation technologies at a glance

Three main types of virtualisation technology are in common use today: hardware virtualisation, paravirtualisation, and operating system virtualisation.

HARDWARE VIRTUALISATION

This type of virtualisation uses software called a hypervisor that abstracts the operating system from the underlying hardware.

Running on the bare hardware, the hypervisor is effectively the host operating system. This means that, when an OS, such as Linux or Windows, thinks it's addressing the hardware, in fact it's addressing the hypervisor which traps calls made to the processor and other components of the server's hardware.

Above the hypervisor run the real OS and the applications. Any OS can be installed on top of the hypervisor, but there is a processor overhead associated with this method of virtualisation, which can be as high as ten per cent.

PARA-VIRTUALISATION

One way to reduce the processor overhead is to modify the guest OS so that it 'knows' it is running in a virtualised environment and can co-operate with the hypervisor. This approach is known as paravirtualisation.

This technology is good for performance because the OS does not attempt to address the hardware directly. As a result, the virtualisation layer does not have to trap those calls, which reduces the performance overhead.

However, this technique works well for OSes that can easily be modified, in particular open source software such as Linux or Solaris, because changes need to be made to the OS kernel. Proprietary systems such as Windows cannot be modified and don't suit this style of virtualisation.

OPERATING SYSTEM VIRTUALISATION

A third type of virtualisation is to add virtualisation capabilities into the OS using a layer of software that sits between the OS and each application. The application is effectively isolated and 'believes' it is running on its own, with OS's full resources at its disposal.

With no hypervisor layer, the host OS divides hardware resources, such as CPU, disk and network I/O between a number of virtual environments (VE) while keeping the them separate from each another.

While all VEs must run the same OS kernel, the gains are found in added performance, with an overhead as low as one or two per cent. Additionally, because there's only one OS kernel to maintain, OS-level virtualisation is simpler, so it lowers the management overhead, making ownership a less costly proposition. And because VEs tend to use less disk space, they lower storage costs. VEs are not VMs. Unlike Virtual Machines, each requiring a completely separate instance of the OS, all Virtuozzo VEs share the same instance of OS (and applications, if configured) both on disk and in memory. Sharing is copy-on-write, so any VE can safely alter shared files, memory pages and other shared objects, if needed.

Yet Virtuozzo completely isolates VEs, while sharing that single OS instance:

1. Namespace isolation. Each VE appears to have its own file system, registry, processes, users, etc. Each VE has its own IP addresses, port numbers, routing rules and firewall.
2. Functional isolation. Each VE and the applications it hosts can be configured independently from other VEs and applications. Copy-on-write isolation allows VEs to safely modify shared files and resources, system libraries and even OS components.
3. Security isolation. Each VE has an independent set of local users with full local admin access.
4. Isolation ensures a compromised application or VE cannot affect other VEs.
5. Performance isolation. Each VE is managed according to an SLA that defines guarantees and limits on CPU, disk space, network bandwidth, user and kernel memory, disk bandwidth and other critical system resources. A VE is prevented from monopolising resources of the entire machine, yet guaranteed to get what it needs.
6. Fault isolation. A fault in one VE will affect neither other VEs nor the host OS, even if the fault happened in an application or system component with full admin privileges.
7. Storage isolation. A VE's persistent state is kept in a single folder and can be easily transportable from one server to another as a single-file image with minimal overhead.
8. VEs are fully compatible. All applications run unmodified inside VEs. No special packaging, installation, configuration or performance tuning is needed – applications will run equally well in VEs as they run in a native OS environment.

Introducing Virtuozzo

Virtuozzo from SWsoft is operating system (OS)-level server virtualisation software that virtualises environments on top of a single operating system.

The technology and tools provision, update, monitor, migrate and manage every task associated with a virtual server environment. Virtuozzo is available for Microsoft Windows Server 2003 and multiple Linux distributions, and operates on platforms based on Intel Xeon and Intel Itanium 2 processors.

Virtuozzo supports multi-processor configurations of up to 16 processors and 64 GB of memory on both the host and virtual environment (VE) levels.

The virtualisation technique employed by Virtuozzo uses a single, unmodified image of the OS to host all VE sessions. This approach offers several additional advantages when compared to other approaches to virtualisation, including:

1. **Rapid provisioning:** Virtuozzo instantiates a VE session in several seconds because the underlying OS is already operating – the VE does not need an additional copy of the operating system. Therefore, the footprint for the VE consists only of the application, workload and data, and makes operations such as provisioning, backing up and migrating very fast.
2. **More efficient:** Virtuozzo Virtual Environments are smaller on disk, use less memory and have a smaller hardware footprint than virtual machines in implementations of hardware virtualisation technology by other vendors. With a typical ratio of 15 or 20 VEs on a single server, Virtuozzo can make five times more efficient use of hardware resources.
3. **Cost-effective disaster recovery:** several options are available for cost-effective disaster recovery and high availability, including: creating small footprint, passive-mode VEs stored on a single server; deploying VEs using a storage area network (SAN) to ensure high availability; employing scheduled and as-needed backups to maintain data integrity; and using live migration for any planned or unplanned outages to increase business flexibility.

4. **Comprehensive dynamic control:** Virtuozzo includes a full set of management tools that provide real-time capabilities, monitoring and control of any Virtuozzo VEs, all from a single console. These management capabilities enable administrators to rapidly respond to business needs or opportunities, shifting resources dynamically on a flexible infrastructure made possible by Virtuozzo.

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