

Parallels® Virtuozzo Containers

White Paper

Virtuozzo for Windows 4.0 VDI sizing

www.parallels.com

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Overview

IT organizations find incredible value in benchmarks and the ability to provide side by side comparisons

Key findings

The VMware had some very specific use cases, a heavy and light workload. Those workloads and testing criteria were replicated and produced these findings:

- Parallels Virtuozzo Containers can support up to **140** Desktops under the «Light Worker Load». The VMware tests show a result of just **42** Desktops¹. Because the VMware tests were performed on older hardware, it is possible to assume VMware could attain more desktops, a generous estimation could be as many as 60
- Parallels Virtuozzo Containers can support up to **130** Desktops² under the «Heavy Worker Load». The hypervisor tests show just **26** desktops³ but again should be slightly more with the newer hardware, a generous estimation could be as many as 35
- Virtuozzo OS Containers technology uses systems resource more effectively
- Parallels Virtuozzo Container application template technology helps save on disk activity and memory consumption

¹ http://www.vmware.com/pdf/vdi_sizing_vi3.pdf

² We think results can be improved by improving storage type or adding more memory. It will be definitely done in next versions of the whitepaper

³ http://www.vmware.com/pdf/vdi_sizing_vi3.pdf

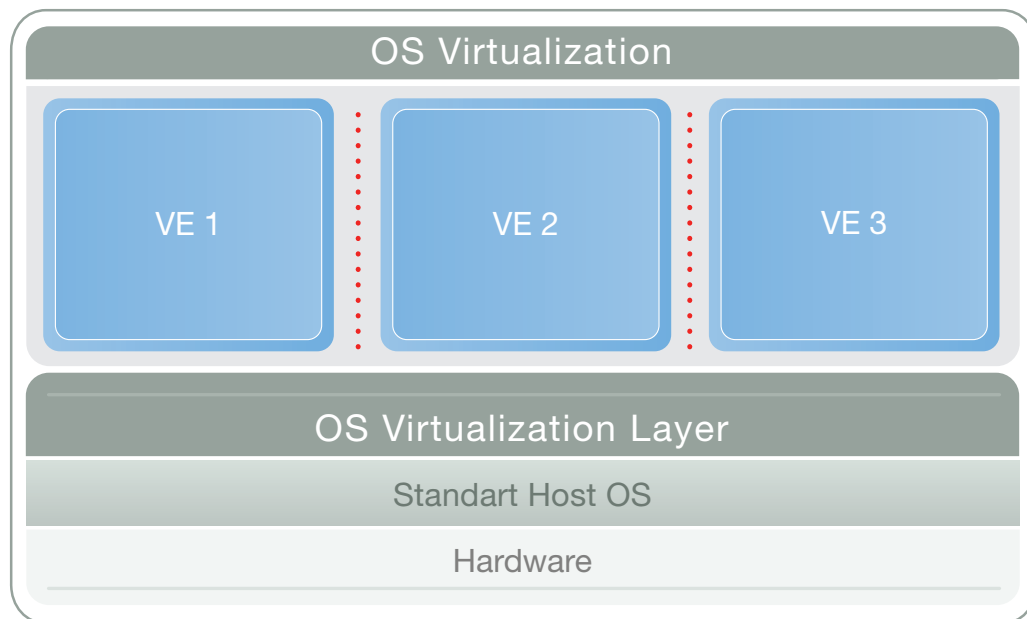
Parallels Virtuozzo Container Overview

Before going into detail on the tests themselves, it is important to understand the difference in the architecture and technologies so that the test results make sense. OS virtualization is extremely well suited for a VDI deployment, as it deploys a single OS. *For VDI, a single OS across desktops is preferred as desktops are almost always a like version, and managing them disparately has limited or no benefit.*

The benefits increase dramatically when applications are added. It is possible to install an application one time on a server and deploy templates in each virtual environment that link down to the host application.

WHAT IS PARALLELS VIRTUOZZO CONTAINERS?

Parallels Virtuozzo Containers is the world's leading OS virtualization solution. Parallels Virtuozzo creates isolated containers on a single physical server and OS instance. Compared to other virtualization technologies, Parallels Virtuozzo offers the highest levels of density, performance and manageability.



The hardware and the OS are standard with OS virtualization. This is one of the benefits of the technology, using existing technology ensures there is no performance degradation through rewriting drivers or technology advances. The OS virtualization layer controls the resource management, scheduling and isolation required by the virtual environments. Finally, the virtual environments (desktops) themselves contain mere links back the standard OS, and potentially applications. The architecture does not add additional layers of processing so it is the closest to native server performance and because of the single OS and memory usage, OS virtualization also has the highest density (most desktops) on a single server.

Obviously the single OS and ability to manage all or many desktops and applications as a single unit, makes it an unbeatable improvement in manageability. One task to update all OSs across the deployment. One task to update applications across the deployment.

Testing Environment

Hardware:

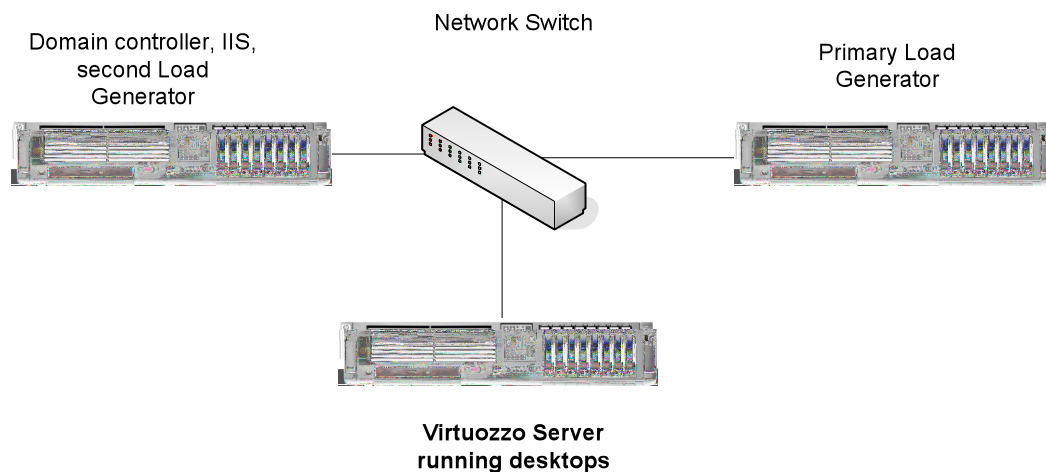
- Server for Virtual desktops – HP DL380/G5, 2 CPU x Quad core Xeon 2.0 GHz, 16 GB of RAM, 2x75 GB SCSI drives in RAID0, Smart Array P400 SCSI controller, 2 x 1 GBit HP NC373i adapters
- Clients (2): HP DL380/G5, 2 CPU x Quad Core Xeon 2.0 Ghz, 4 Gb of RAM

Software:

- OS for the server and clients – Microsoft Windows 2003 SP2 R2, Enterprise x64 Edition. Page file size was set to 4 – 40 Gbytes
- Parallels Virtuozzo Containers 4.0 for Windows without tools. Each container has 1 vCPU. MS Office installed as template
- MS Office 2003 (as application template for the containers)

If not specified, all Windows and Virtuozzo configuration parameters are default. We created an application template of MS Office 2003 by using the standard tool – the Virtuozzo template creation wizard. The template was installed in each container – for the end user it looks like usual MS desktop, but template has many benefits – it can help to get better performance and density of containers.

The server and clients were connected into a single 1 GB network switch:



Methodology

We used Terminal Server scripts and tbscript.exe utility⁴ to generate a load against the tested server. Each client (Terminal User, running on Load Generator server) connects to corresponding desktop (a Virtuozzo container, running on the tested server) and performs some typical actions.

Of course we can't fully replicate a server's behavior during a business day, but we can estimate the approximate number of containers that can run under some typical workload. Real numbers can be different due to many factors, such as sporadic user activity, applications type, hardware configuration and so on.

According to general guidelines, we choose two load types: light worker workload and heavy worker workload.

Light worker workload description:

Workers that input data into computer systems, for example: transcription, typing, order entry, clerical work, and manufacturing.

Light worker workload details:

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- Connects to the desktop and logs in
- Performs the following actions in a loop:
 - Start Internet Explorer. Load a page with heavy graphics. Close Internet Explorer
 - Start Word. Type a small document. Close Word
 - Start Excel. Open an Excel sheet. Close Excel
 - Start internet Explorer. Load a page with heavy graphics. Close Internet Explorer

Heavy worker workload description:

Workers who gather, add value to, and communicate information in a decision support process. They enter data at a moderate speed. Example job tasks include marketing, project management, sales, desktop publishing, decision support, data mining, financial analysis, executive and supervisory management, design, and authoring.

⁴ The tbscript.exe and script examples are available as a part of Windows 2003 resource kit

Heavy worker workload details:

- Connects to the desktop and logs in
- Performs the following actions in a loop:
 - Start PowerPoint. Load a massive presentation, browse the slides. Close PowerPoint
 - Start Internet Explorer. Browse three different web pages. Close Internet Explorer
 - Start Command Prompt. Do a directory listing
 - Start PowerPoint. Load a massive presentation and browse the slides. Close PowerPoint
 - Start Excel. Open an Excel sheet. Close Excel
 - Start PowerPoint. Load a massive presentation and browse the slides. Close PowerPoint
 - Start Word. Type a small document. Close Word

System parameters and termination point:

To determine maximum number of containers that can run under pre-defined load we performed the following:

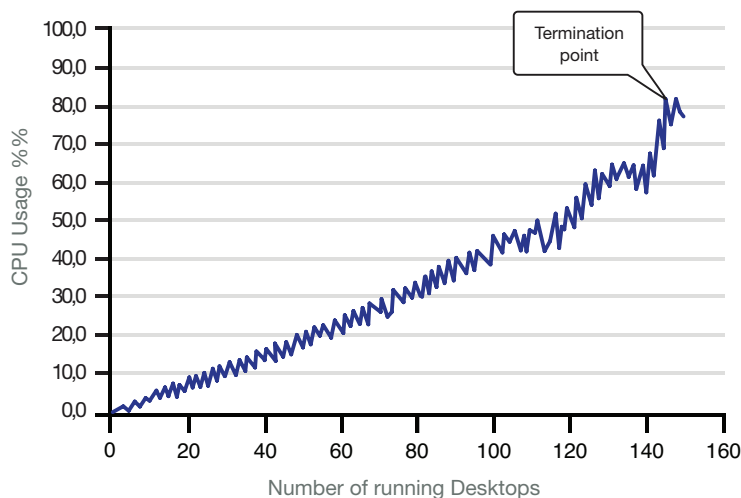
- Start an OS container, wait for two minutes, start corresponding client to simulate load, wait for three (for less than 100 containers) or five (for more than 100 containers) minutes, start next container
- During the p.1 we monitored the basic system parameters – CPU usage, committed memory, disk and network activity, number of context switches, page file usage and some others. Start Command Prompt. Do a directory listing
- We continuously measured the time of a single load cycle inside a “canary” container. The canary container is where the test’s execution times were measured

We consider that termination point is reached if:

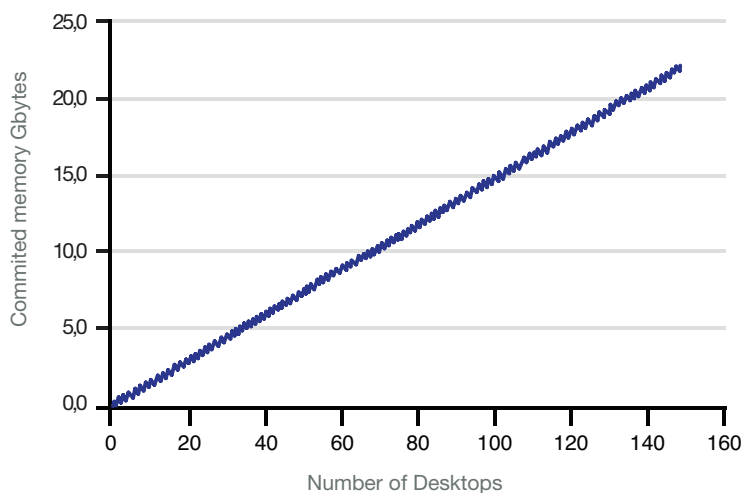
- Client operations terminated by timeout
- We observed a huge (>10%) increasing of load cycle time in the “canary” container
- System behavior becomes unstable and/or system parameters are in critical area – for example, very high CPU load (80% – 90%) or saturated disk/network

Results for the Light Worker Workload

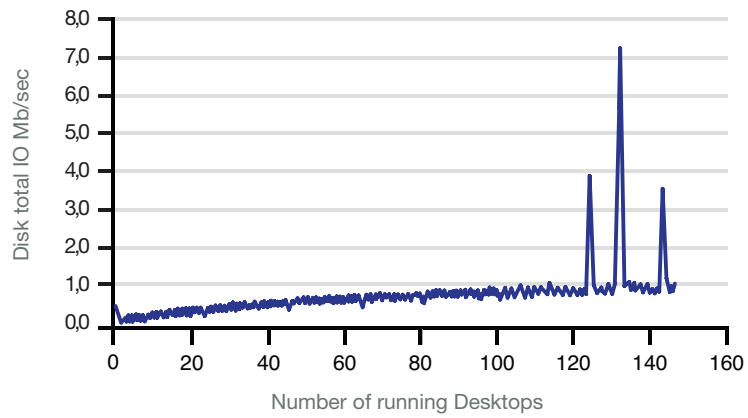
According to the defined methodology we monitor basic system parameters to ensure that the system is stable, working and can support more users.



We found that the system's behavior become unstable and clients have problems with load generation (many clients become idle for some time due to busy server – actually CPU bursts up to 100%) when average CPU load is more than ~80%. As one can see from the above graph, in this case termination point is about 140 Desktops (OS containers).



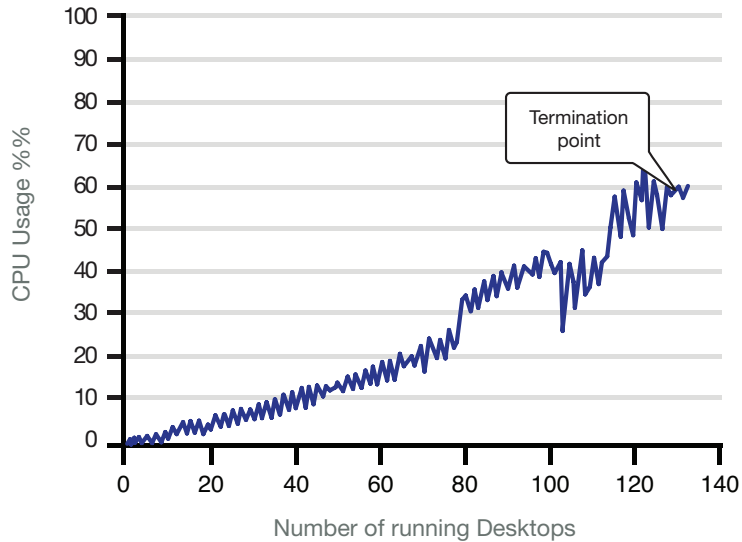
Memory consumption is almost linear. It is important to underline that for 140 Desktops support we need just ~160 Mb per Desktop. Note, that it is total memory size needed for Desktop support, in case of Hypervisors (like VMware or Xen) you need about 256-384 Mb per Windows 2003 VM plus additional memory for virtual machine monitor to support each running VM.



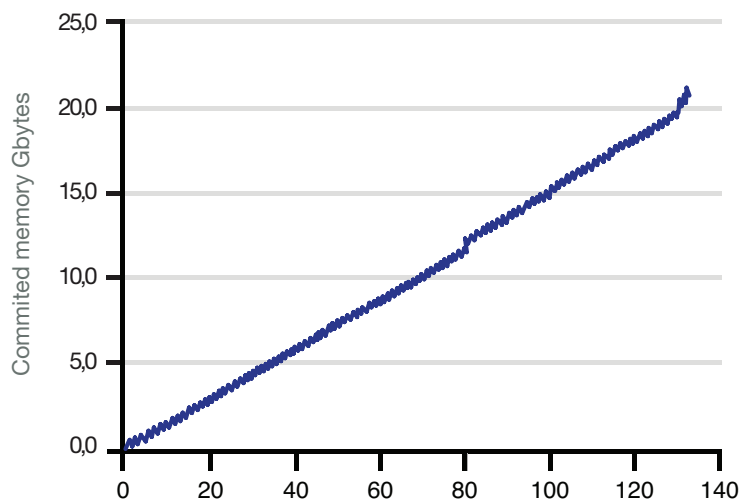
One of the key benefits of Virtuozzo Containers is ability to use application templates. It allows system to save on memory usage – just single copy of executables and libraries in memory. The Windows cache manager puts a single copy of application files into the system cache and it saves much memory and hugely decreases disk activity.

Results for heavy worker workload

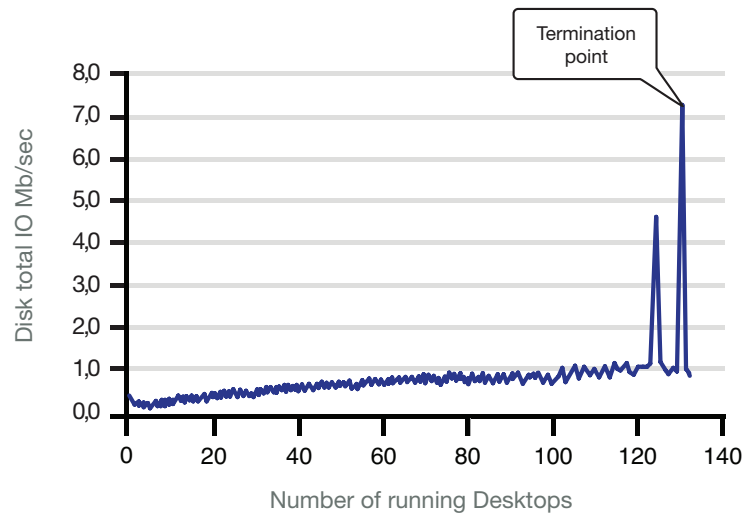
According to the defined methodology we monitored basic system parameters to ensure that the system is stable, working and can support more users. Additional control was performed for clients – we periodically monitored their activity and checked whether they could connect to the system and generate load.



Despite low CPU usage, the system had problems with client connections and load generation at about 130 desktops. It doesn't mean that recommended CPU load for VDI server should be less than 60%, but it means that most probably there is some bottleneck like storage or memory.



Memory consumption is typical – almost linear. All the statements about memory using benefits also apply to the light worker workload.



Disk speed may be a possible bottleneck with the heavy worker thread. The termination point was reached right after burst disk activity. It's possible that with faster disks, the light worker workload results could be hit for this test as well.