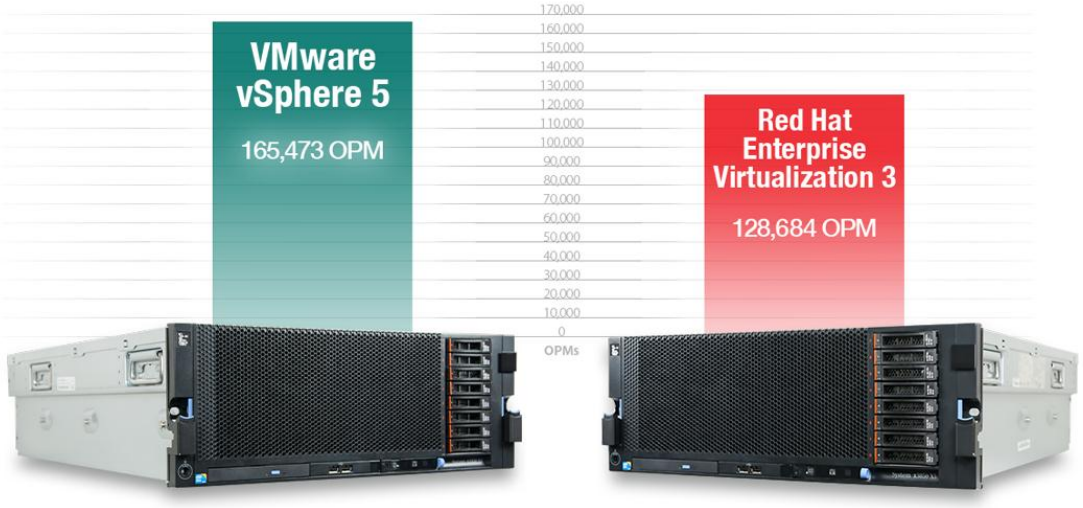
VIRTUALIZATION PERFORMANCE: VMWARE VSPHERE 5 VS. RED HAT ENTERPRISE VIRTUALIZATION 3

VMware® vSphere® 5 outperformed Red Hat® Enterprise Virtualization 3 by up to 28.6%



on a highly utilized host with 42 virtual machines running a database workload

When you invest in a virtualization platform, you can maximize the performance of your applications and the overall infrastructure by fully utilizing physical resources as much as a hypervisor allows. Planning for scenarios with greater virtual machine (VM) densities, such as during maintenance periods or during high availability (HA) events where a server must host additional VMs from a failed server, is critical to an organization's overall IT strategy. A hypervisor that excels at resource management allows for greater virtual machine (VM) density and better application performance.

We tested two hypervisors—VMware vSphere 5, and Red Hat Enterprise Virtualization 3 (RHEV)—to compare their performance and ability to manage resources at high levels of RAM utilization. When running a heavily loaded host with 39 virtual machines, VMware vSphere 5 outperformed RHEV 3 by 16.2 percent; after adding a few more virtual machines to the host, VMware's advantage increased to 28.6 percent. Additionally, VMware vSphere 5 continued to scale from 39 VMs up to 42 VMs with our workload: Overall server performance increased by 2.8 percent with VMware vSphere 5, whereas performance *decreased* by 7.2 percent with RHEV 3.

These results show that VMware vSphere 5 can deliver superior performance in a densely virtualized environment over RHEV 3. When you fully utilize your servers, you need fewer systems to perform the same amount of work during normal operations, and you do not need excessive server capacity to handle workload peaks. This results in overall savings for your organization.

MAY 2012
A PRINCIPLED TECHNOLOGIES TEST SUMMARY
Commissioned by VMware, Inc.

ADVANCED RESOURCE MANAGEMENT MAXIMIZES PERFORMANCE

A hypervisor with exceptional resource management lets you optimize virtual machine performance across your entire infrastructure. The result? Greater density, scalability, and performance. VMware offers several unique features that enable vSphere 5 to utilize system resources better than competing hypervisors.

Direct driver model. The VMware approach is to install device drivers directly onto the hypervisor, effectively making the hypervisor an intermediary between the physical hardware and VMs that run on the server. The direct driver model improves performance and scalability as the number of VMs on a host increases.

High-performance "gang" scheduler. This feature allows VMware vSphere 5 to handle the challenging CPU and I/O needs of VMs. vSphere 5 is thus able to allocate resources and processor time slices to the VMs that most need it.

How VMware manages memory

Additional VMware technologies allow vSphere 5 to optimize physical memory allocation, dynamically shifting this critical resource from less active VMs to VMs that are more active. This is accommodated in vSphere by the following features, working in concert:

Transparent page sharing. Transparent page sharing (TPS) identifies common pages across VMs and stores each in physical memory only once. This is somewhat analogous to deduplication technologies used in storage implementations. All VMs then share only that single copy of the memory page. VMware vSphere 5 determines sharable pages by scanning the content of the virtual machines' physical memory for sharing opportunities. By eliminating these redundant copies, VMware vSphere 5 frees up memory for use by workloads.

Memory ballooning. When the hypervisor needs to give more memory to VMs that are powering on or experiencing a heavy workload, it "asks" the guest operating systems in other VMs to provide memory to a balloon process that runs in the guest. The hypervisor can then temporarily lend that "ballooned" memory to the busy VMs. When the busy VMs no longer need the extra memory, the hypervisor "deflates" the balloon, returning that memory to the original guest OS.

Memory compression. The innovative memory compression capability in VMware vSphere 5 sets aside a small portion of physical RAM as a cache. Compressing unused memory pages avoids hypervisor swapping and is orders of magnitude faster than disk.

Hypervisor swap. If a system's memory resources are experiencing intense pressure, hypervisor swap acts as a safety valve, ensuring reliable operation of the host and all workloads. While this may result in a short-term performance hit, it offers the

hypervisor another option to resolve memory issues. Furthermore, a new feature in vSphere 5, called swap to host cache, can use solid-state disks for swap purposes, reducing the impact on performance. However, we did not use this feature for this testing.

DRS with resource pools. This feature is a safety net of sorts, largely because it ensures that applications receive the resources they need when they need them. It accomplishes this by dynamically load balancing resources throughout a cluster of VMs. This does not apply to standalone hosts such as the one tested for this report, but to vSphere clusters. Using a vSphere-clustered environment with DRS ensures optimization of resources and the ability to accommodate shifting workloads.

PUTTING THE HYPERVISORS TO THE TEST

To compare these two hypervisors, we ran two scenarios on each hypervisor to demonstrate different levels of memory usage. In the first scenario, we ran database workloads against a heavily loaded host, and in the second scenario, we ran the same database workloads and increased the VM count. We first ran these scenarios with our server running VMware vSphere 5 and then ran the same scenarios with our server running Red Hat Enterprise Virtualization 3. Our four-socket server had 80 logical CPUs and 256 GB of RAM. We configured each VM with two virtual CPUs and 8 GB of RAM. For the first scenario, we ran 39 VMs to mimic a highly utilized server scenario. In the second scenario, we ran 42 VMs, taking the utilization higher. While RAM was fully allocated and utilized, CPU utilization was 46 and 51 percent for the two density scenarios on RHEV, and 39 and 41 percent for the two density scenarios on VMware vSphere.

In both scenarios, two-thirds of our guests ran Microsoft® Windows® Server 2008 R2 SP1 with Microsoft SQL Server® 2008 R2 SP1, and one-third of the guests ran Red Hat Enterprise Linux® 6.2 with PostgreSQL 9.1. Independent of platform, each guest VM hosted an 8GB database created with the DVD Store Version 2 (DS2) benchmark tool. We used clients to invoke the DS2 workload on each guest VM using identical workload parameters. DS2 simulates an online store, and reports orders per minute (OPM). We chose this database workload for our testing as it heavily utilizes processor, memory, and I/O to create a broad and demanding load on the system.

For more details about the DS2 tool, see http://www.delltechcenter.com/page/DVD+Store.

VMWARE VSPHERE 5 DELIVERS

As Figure 1 shows, aggregate performance across all VMs in our 39-VM scenario with VMware vSphere 5 was 161,040 OPM, 16 percent higher than RHEV 3, where the total performance of all 39 VMs was 138,603 OPM.

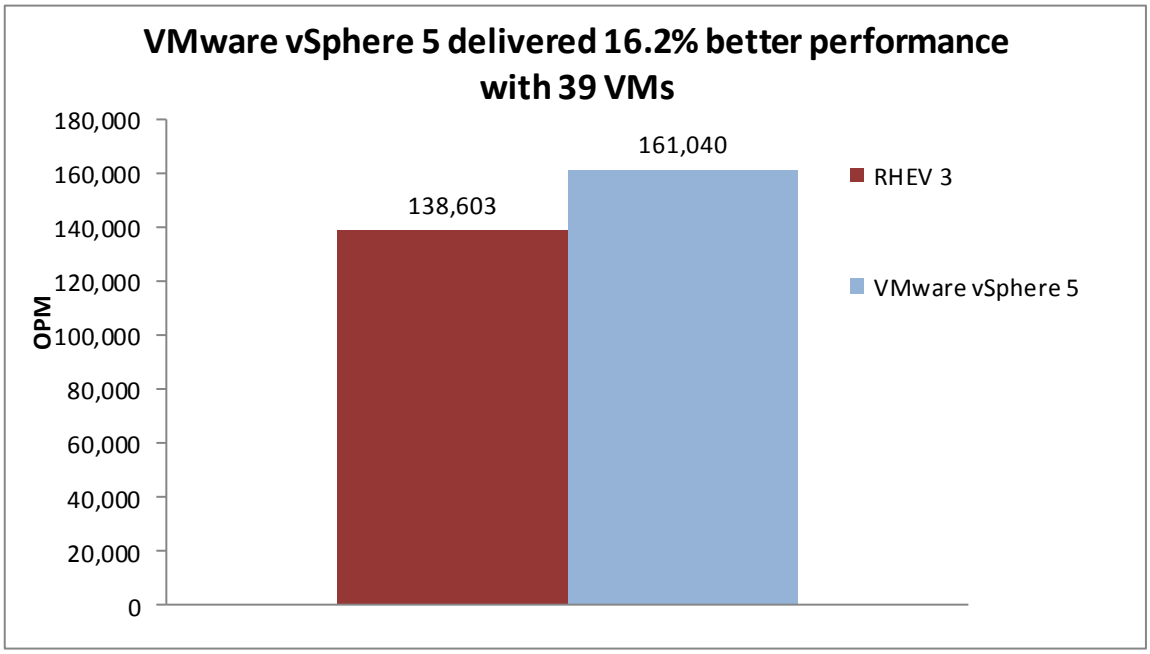


Figure 1. VMware vSphere 5 delivered 16.2 percent better overall performance with 39 VMs.

After increasing the VM density to 42 VMs on our single host, we ran the same test again. As Figure 2 shows, the performance advantage of VMware vSphere 5 increases at the higher density. Aggregate performance across all VMs in our 42-VM scenario with VMware vSphere 5 was 165,473 OPM, 28 percent higher than on the server running RHEV 3, where the total performance of all 42 VMs was 128,684 OPM.

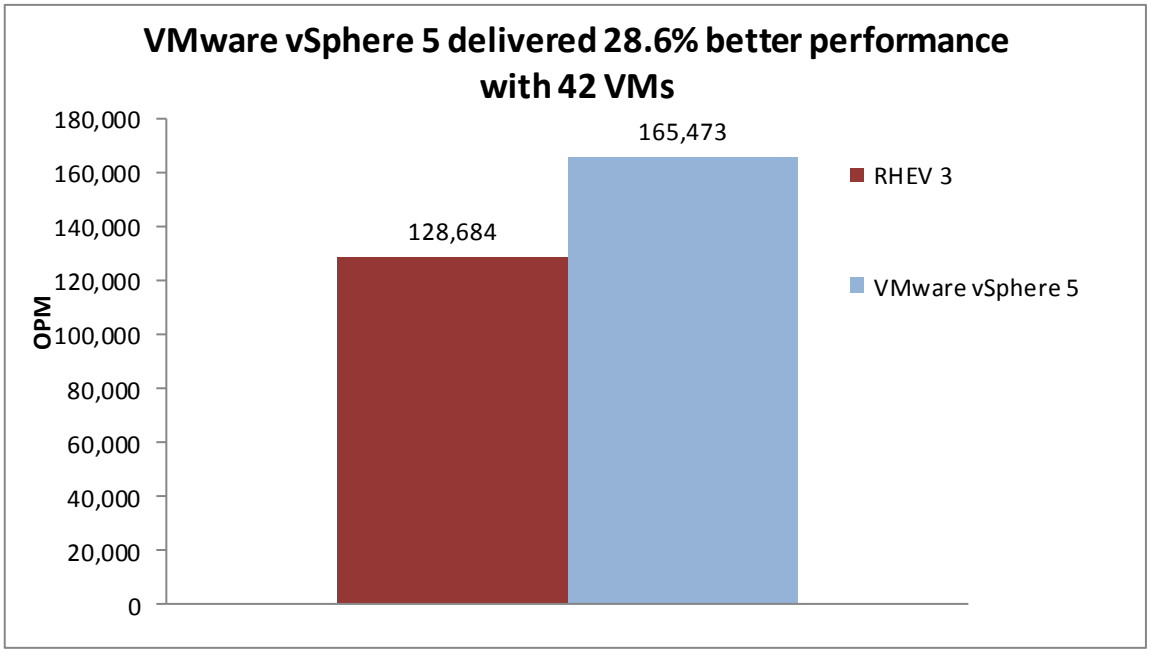


Figure 2. VMware vSphere 5 delivered 28.6 percent better overall performance with 42 VMs.

As the above results show, and as Figure 3 shows, VMware vSphere 5 better handled the increase in density from 39 to 42 VMs, increasing in total output by almost 3 percent. RHEV 3, however, decreased in performance by over 7 percent at the higher density.

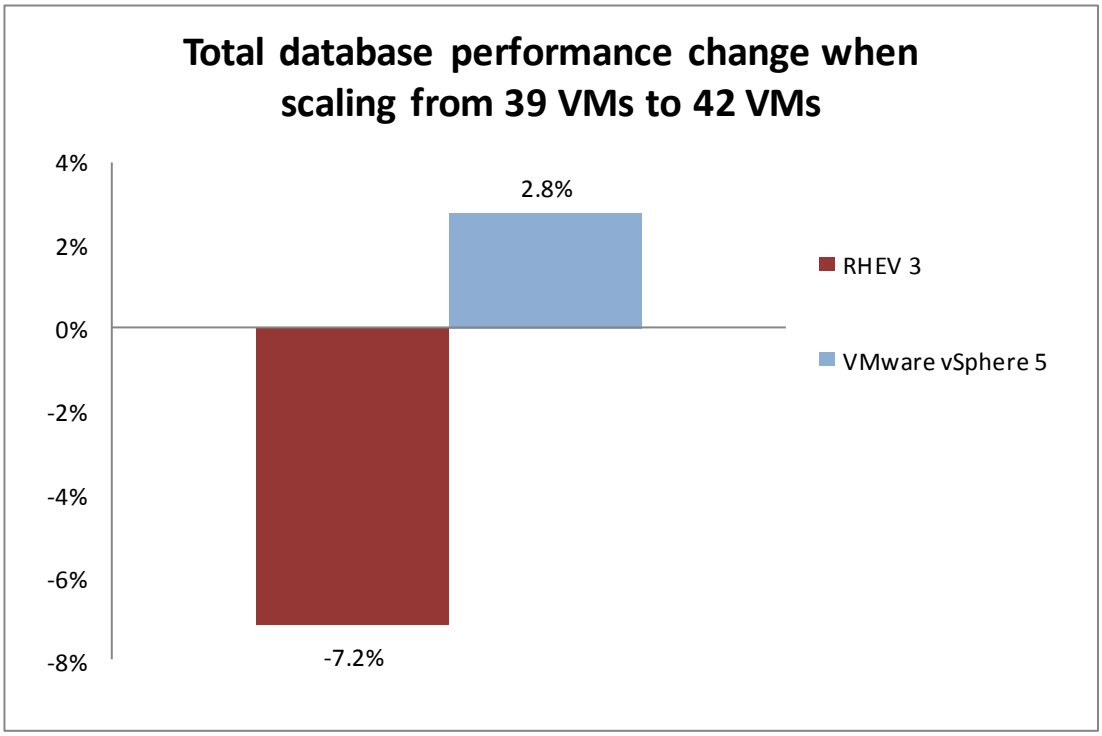


Figure 3. VMware vSphere 5 increases in output with an increase in density, while RHEV 3 performance degraded.

CONCLUSION

Using a hypervisor that offers better resource management and scalability can deliver excellent virtual machine performance on your servers. In our testing, VMware vSphere 5 allowed our host's virtual machines to outperform those running on RHEV 3 by over 28 percent in total OPM performance. Furthermore, VMware vSphere 5 performance continued to improve when going from 39 VMs to 42 VMs: Total performance for VMware vSphere 5 increased by 2.8 percent, whereas it decreased by 7.2 percent with RHEV 3.

With the capabilities and scalability that VMware vSphere 5 offers, you are able to utilize the full capacity of your servers with confidence and purchase fewer servers to handle workload spikes; this can translate to fewer racks in the data center, lower costs for your business, and more consistent overall application performance.

For full details on the test methodologies we used, see the full report at http://www.principledtechnologies.com/clients/reports/VMware/vSphere5_RHEV_0512.pdf.

ABOUT PRINCIPLED TECHNOLOGIES

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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.