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ENTERPRISE
VIRTUALIZATION®

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RED HAT ENTERPRISE VIRTUALIZATION: VMWARE MIGRATION

COMPETITIVE REVIEW

INTRODUCTION

The virtualization market is maturing, and alternate virtualization platforms have emerged. A recent 2013 IDC study[1] found that, bolstered by a strong interest in OpenStack®,"KVM deployments grew 50%" in 2012. VMware customers see the advantage of deploying open source solutions like Red Hat® Enterprise Virtualization, which is based on Kernel-based Virtual Machine (KVM), as either a second virtualization platform to co-exist with VMware vSphere, or as complete replacement.

Open source gives you the flexibility to choose the solutions that are right for you.

There are a number of tools to help enterprises migrate to Red Hat Enterprise Virtualization, and third-party vendors can help automate the virtual-to-virtual migration of virtual machines (VMs) from VMware to Red Hat Enterprise Virtualization. And, because Red Hat Enterprise Virtualization management features look similar to VMware's vCenter, system administrators who use VMware find the transition to Red Hat Enterprise Virtualization is straightforward.

Red Hat Enterprise Virtualization customers enjoy the benefits of greater choice through open source, better performance and security, improved workload density, and lower cost of ownership. In this paper, we summarize the benefits of our approach, and provide an overview of the steps required to move your Linux® and Windows VMs from VMware to Red Hat Enterprise Virtualization.

BENEFITS

There are several benefits to adding Red Hat Enterprise Virtualization to your environment:

OPEN SOURCE IS A STRATEGIC ALTERNATIVE

Customers often choose a single vendor to manage their entire virtual infrastructure. If they choose a proprietary, closed-source hypervisor and management solution, they are totally dependent on a single vendor. Red Hat Enterprise Virtualization is a true strategic alternative because it gives customers choice and flexibility and lets them avoid vendor lock-in.

In business, software flexibility is about being able to choose solutions that work for you. As business requirements change, solutions and other infrastructure components should not be limited by software. Other proprietary vendors, including VMware, Oracle, and Microsoft, can limit choice and flexibility, and increase dependence on a single vendor. Open source software is designed to work well with other software, allowing buyers to choose the solution that meets their requirements. The value of their investments is preserved, and they aren't locked in to using a single vendor or product. Red Hat Enterprise Virtualization does not limit you to what one company believes customers need. Red Hat Enterprise Virtualization enables customers to choose the best solutions for their specific needs.

In 2013, Red Hat Enterprise Virtualization received the seven highest virtualization benchmark results.

SOURCE: SPECVIRT_SC2010 BENCHMARK REPORT.

PERFORMANCE AND SCALABILITY

In a recent SPECvirt_sc2010 industry benchmark report by non-profit Standard Performance Evaluation Corporation (SPEC) organization, Red Hat Enterprise Virtualization KVM-based hypervisor provides excellent performance and scalability features capable of supporting large numbers of VMs on a single host[2].

The SPECvirt_sc20102 benchmark results for Red Hat Enterprise Linux with KVM are shown in red, below, and are published at **www.spec.org**. The metric along the vertical axis is the SPECvirt_sc2010 result[2].

INDUSTRY LEADING VIRTUALIZATION PERFORMANCE

"We now understand virtualization standardization, security and efficiency, which makes us confident in Red Hat Enterprise Virtualization".

YOA CHUNYANG, ASSISTANT GENERAL MANAGER OF IT OPERATION ASSURANCE, RURAL CREDIT BANKS FUNDS CLEARING CENTER

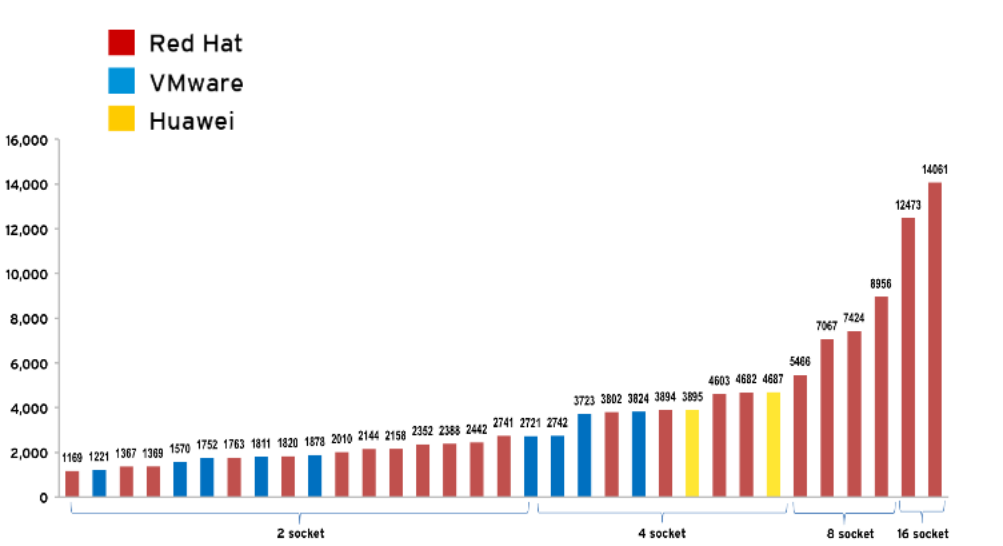

Figure 1. SPECvirt_sc2010: As of November 15, 2013 RHEV claims top 7 results and the only 8-socket and 16-socket server scores.

As indicated in Figure 1, KVM not only achieved the highest performance result, but also attained the seven highest results to date. Also, KVM had the highest result for each server class for two-socket, four-socket, and eight-socket servers, and the only published scores for 8-socket and 16-socket servers.

The SPECvirt_sc2010[2] virtualization benchmark measures a system's ability to host VMs running a set of typical server applications, and is modeled to look like a customer's real environment. The SPECvirt_sc2010 metric is derived from a combination of the performance of virtualized applications, noting the number of VMs used in the test and a Quality of Service (QoS) requirement. Red Hat Enterprise Linux established new leading results—14061@864VMs and 144 tiles—setting the best virtual performance mark and highest number of tiles of any published SPECvirt result as of November 15, 2013[2].

"Red Hat Enterprise Virtualization is certified with leading hardware and software manufacturers and offers the best security guarantees for our critical environments."

ROBERTO MORENO DÍAZ, GENERAL MANAGER OF TELECOMMUNICATIONS AND NEW TECHNOLOGIES, GOVERNMENT OF THE CANARY ISLANDS

ENTERPRISE FUNCTIONALITY

"KVM gets the most out of the hardware it is placed on, which means cheaper infrastructure costs." Tech Radar, May 2013[3].

The table, below, provides a high-level feature comparison between Red Hat Enterprise Virtualization and VMware vSphere[4].

RED HAT VS VMWARE

ENTITLEMENTS PER LICENSE OR SUBSCRIPTION	RED HAT ENTERPRISE VIRTUALIZATION	VMWARE VSPHERE 5.5 ENTERPRISE EDITION
Max vCPUs per VM	160 vCPU/VM	32 vCPUs/VM (64 with Enterprise Plus)
Management features		
Single-view for centralized control	Y	Y
High availability	Y	Y
Storage live migration	Y	Y
System scheduler: Cluster policies to automatically distribute workload evenly across cluster host servers	Y	Y
Power saver: During off-peak hours, concentrates VMs on fewer hosts	Y	Y
Thin provisioning	Y	Y
Templates: VMs can be deployed from master installations	Y	Y
Import/Export of VMs in the standard OVF format	Y	Y
Self-service user portal: Provides administrative access to users for creating/running VMs and managing environments	Y	N
API: Programmatic access to all management commands	Y	Y
Customizable reporting engine: Reporting of historic usage, trending, and QoS	Y	N, Requires VMware Operations Manager Standard Edition

"The existing virtualized IT environment at LetterGen was simply not capable of meeting the company's long-term scalability requirements…After an initial demonstration and various internal tests, we were able to demonstrate that all of the functions LetterGen required were available in one package by using Red Hat Enterprise Virtualization. It also helped that Red Hat Enterprise Virtualization offered this high level of functionality at a lower price than competitive solutions."

VINCENT VAN DER KUSSEN,
SYSTEM ENGINEER, OPEN SYSTEMS
AT BTR SERVICES

Red Hat Enterprise Virtualization offers a feature-rich server virtualization management system with advanced capabilities for hosts and guests, including high availability, live migration, storage live migration, storage management, system scheduler, and more. Unlike the beginning of the x86 virtualization technology, VMware is no longer the only leader in the virtualization market.

VMware customers have to upgrade to more costly versions if they want to deploy advanced features. Red Hat Enterprise Virtualization eliminates this problem by delivering a comprehensive enterprise management system in a single SKU without stripped versions.

SECURITY

Red Hat Enterprise Virtualization uses the hardened Red Hat Enterprise Linux kernel as its security foundation, inheriting all of the security architecture of Red Hat Enterprise Linux. Both products use kernel-level security (such as with SELinux and sVirt), which was developed in conjunction with the United States Department of Defense, National Security Agency, and vendors such as IBM, HP, and MITRE. SELinux ensures isolation between virtual machines, and between each machine and the Red Hat Enterprise Virtualization hypervisor, providing your organization with military grade, unmatched enterprise security.

Rather than layering security on top of the hypervisor or the base operating system image, SELinux adds a security policy inside the kernel itself, effectively placing a wrapper around every process and preventing a compromised virtual machine from breaking out and attacking the hosts or other virtual machines.

Proprietary virtualization products are not engineered with the same level of security baked into the kernel; instead, they include layers that are added to the hypervisor and/or operating system. And with a layered product, a rogue program can do more harm before it is detected.

COST ADVANTAGE

Because Red Hat Enterprise Virtualization is open source software, and is offered through a subscription model, it often costs less than proprietary solutions. The example, below, demonstrates that Red Hat Enterprise Virtualization costs 60–80% less than VMware vSphere 5.5. This analysis only considers the hypervisor host and enterprise management system, and factors in licensing and support costs. Server hardware costs and virtual server operating system costs are not included, because they would be identical for both solutions.

The following table compares costs for Red Hat Enterprise Virtualization and VMware vSphere 5.5 Enterprise Edition. In this scenario, 100 virtual machines on 10 physical machines are configured to support workloads ranging from IT and web infrastructure services to business applications.

3-YEAR TCO ANALYSIS	RHEV	VMWARE
Number servers	10	10
Number servers	20	20
Initial license cost per unit	$0.00	$3,495
Premium support per unit	$1,499	$874
Total license costs	$0.00	$69,900
Total premium support cost	$14,990	$17,480

SELinux with sVirt provides unmatched, kernel-level, military-grade security.

3-YEAR TCO ANALYSIS	RHEV	VMWARE
Cost for 3 years	$44,970	$122,340
Management server per unit	$0.00	$4995
Management server premium support per unit	$0.00	$1249
Total management server cost	$0.00	$8,742
Total cost for 3 years	$44,970	$131,082

** VMware prices are current as of December 2013 - **www.vmware.com/products/vsphere/pricing.html***

MIGRATING FROM VMWARE TO RED HAT ENTERPRISE VIRTUALIZATION

MIGRATION OVERVIEW

The process of migrating virtual server workloads (operating system, application, and data) from one virtualization platform to another is called a virtual-to-virtual (V2V) migration. Each virtualization hypervisor (e.g., Red Hat Enterprise Virtualization Hypervisor and VMware ESX/ESXi) uses a different file format for the VM and there are two methods for V2V migration:

1. Manually recreate the new VMs from scratch
2. Migrate the VMs using V2V migration tools

Virtualization customers typically use the second method, because 1) they have already installed a guest operating system, and 2) there are excellent tools available to accomplish V2V migrations. But manually recreating the VMs in the new environment lets you optimize the configuration for the workload and separate applications into separate virtual servers if necessary. In general, most V2V projects include a flexible approach using automation when possible, and a manual or semi-automated approach for the most strategic and resource-intensive server workloads. In almost all cases, these projects consist of assessment, preparation, evaluation, execution, and testing phases.

PROJECT CONSIDERATIONS

V2V migrations are generally less complicated than virtualizing physical servers or physical-to-virtual (P2V) migrations. Unlike physical servers, virtual servers are not configured with a wide range of hardware devices so there are fewer problematic hardware dependencies.

It is important to understand the performance requirements of the VM prior to the migration. A resource assessment of the source VMs is important to ensure project success. Understanding requirements (e.g., RAM, disk, network connection, CPU capacity, etc.) up front will save time and effort later.

One of the more successful paths to a V2V migration is to start with a pilot project. This begins with identifying a group of virtual servers to be moved into the Red Hat Enterprise Virtualization environment. Many customers with Red Hat Enterprise Linux as a guest operating system in their VMware clusters choose to start with a subset of these virtual servers. VMs supporting infrastructure services, internal web portals, or file/print servers are also good candidates. Red Hat offers a downloadable evaluation subscription to help customers launch a pilot. Once complete, the results of the project can be assessed and promoted within the organization.

Red Hat offers a downloadable evaluation subscription to help customers get started.

The next step involves the identification and assessment of all virtual servers to be migrated. The targeted VMs need to be monitored and analyzed for their use of CPU, memory, disk, and networking resources. Both the average and peak levels of use should be measured and tracked. The results will be used in building the new Red Hat Enterprise Virtualization infrastructure and in determining the optimal distribution of VMs across the cluster of hypervisor server hosts. If necessary, Red Hat Consulting can provide a part or all of this service.

VIRTUAL MACHINE PORTABILITY

Because hardware abstraction and independence were early benefits of virtualization, it seems that VMs would be portable across different hypervisor platforms. Unfortunately, each hypervisor uses its own format. All VM formats consist of VM configuration data (CPUs, memory, operating system, etc.) and the binary virtual disk image. V2V tools can convert a VMware ESX or ESXi VM into a Red Hat Enterprise Virtualization VM. And since these tools support automation, the effort to migrate VMs from the VMware format to the Red Hat Enterprise Virtualization format is a straightforward and manageable process. Visit marketplace.redhat.com/rhev for a list of V2V tools.

To facilitate the migration of VMs between environments, there are industry efforts underway to develop standards such as the Open Virtualization Format (OVF). OVF allows for packaging of one or more VMs into a single file for distribution and is supported by many vendors, including Red Hat, VMware, and Citrix. Red Hat Enterprise Virtualization uses OVF for storing VMs. However, OVF implementations from different vendors vary by format and content of the virtual disk, because OVF does not mandate the virtual disk format or the contents of the virtual disk. VMware vSphere uses a disk format called VMDK (virtual hard disk), Microsoft Hyper-V uses a disk format called VHD (virtual hard disk), and Red Hat Enterprise Virtualization uses the RAW format for pre-allocated virtual files and the QCOW format for thin-provisioned virtual disk.

To migrate the VM between hypervisors, the virtual disk image needs to be converted into the native virtual disk image supported by the target hypervisor. In addition, the VMDK virtual disk image includes content such as VMware tools and drivers that are not portable and work only with a VMware hypervisor. These tools and drivers must be removed and replaced with device drivers that are native to the Red Hat Enterprise Virtualization environment. For example, if a Windows VM was configured in the VMware environment, it was likely installed with VMware tools, with a number of paravirtualized drivers, and perhaps sound card emulation. These VMware device drivers are not portable and must be removed and replaced with Red Hat Enterprise Virtualization virtualized drivers.

CONVERTING VIRTUAL MACHINES

Because of the lack of standardization for the virtual disk format and content, there is no true portability for VMs across different hypervisor hosts. VMs must be converted into the native format of the target hypervisor during the V2V migration. In general, the process of performing a V2V migration between virtualization platforms consists of the following steps:

1. Read the VMs configuration file and create a VM with the same configuration on the target hypervisor platform.
2. Copy the VMs virtual disk (VMDK) and convert it to Red Hat Enterprise Virtualization hypervisor virtual disk format (RAW or QCOW).
3. Replace the VMware tools and virtualized drivers in the guest operating system (inside the virtual disk) with the Red Hat Enterprise Virtualization tools and virtual device drivers.

There are V2V tools available to convert a VMware ESX/ESXi virtual machine into a Red Hat Enterprise Virtualization virtual machine.

Red Hat Enterprise Virtualization provides an open source V2V migration tool that enables customers to automatically convert and import VMs created on other systems, including VMware ESX/ESXi. This tool is available on Red Hat Network (RHN) in the "**Red Hat Enterprise Virt V2V Tool (v5 for x86_64)**" channel. The tool converts VMs from a foreign hypervisor to run on Red Hat Enterprise Virtualization 2.2 and later. It automatically packages the VMs as OVF files and uploads them to a Red Hat Enterprise Virtualization export storage domain. The supported guest operating systems include Red Hat Enterprise Linux (version 3 and later), Fedora, Windows Server 2003, 2003R2, 2008, 2008R2, 2012, Windows XP, Windows 7, and Windows 8.

The Red Hat Enterprise Virtualization V2V tool automatically handles the migration of the VMware VM into Red Hat Enterprise Virtualization. This automated process includes:

- Pulling in the VM configuration
- Changing the format of the disk to be appropriate to the Red Hat Enterprise Virtualization hypervisor
- Making any guest changes (e.g., pulling out the VMware drivers)
- Changing the registry
- Installing paravirtualized drivers for optimal disk and network performance
- Importing the VM into Red Hat Enterprise Virtualization

And because it is a command line tool, the Red Hat Enterprise Virtualization V2V tool can easily run on a large scale, automating a 100 or 200 VM migration with very simple scripting. Note that the V2V tool operates on a copy of the original guest image; therefore, images larger than 10 GB will take longer. However, once the copy is complete, the conversion takes place in less than a minute. The tool then creates the OVF file on the Red Hat Enterprise Virtualization export domain, and the VM will appear in the Red Hat Enterprise Virtualization Manager console as an available VM in the export domain.

RED HAT VIRTUALIZATION SERVICES

Red Hat Consulting offers a range of migration services, from foundation and quick-start offerings to on-site migration planning, project scoping, and project execution support. Also, Red Hat Training and Certification offers online, classroom, and on-site training, as well as a certification program that ensures that your staff members and consultants have advanced Red Hat Enterprise Virtualization knowledge in addition to a basic virtualization skills.

THIRD-PARTY MIGRATION TOOLS

One of the nation's leading health care institutions recently migrated from VMware vSphere and Oracle Virtual Iron to Red Hat Enterprise Virtualization with the help of Acronis Backup & Recovery Virtual Edition software. The software, which is certified for Red Hat Enterprise Virtualization and includes P2V, V2V, and V2P (virtual-to-physical) migration capabilities, was critical to the migration because Red Hat does not support migrations from the older vSphere 3.1. The Acronis Backup & Recovery Virtual Edition solution is platform independent, and took the worry out of platform-specific issues the IT team had previously encountered. After a fast and successful migration, the customer experienced reduced datacenter costs, improved application responsiveness and performance, and significantly increased the stability, reliability, and security of its virtualized infrastructure.[5]

WHAT'S NEXT

For more information, visit www.redhat.com/virtualization or contact your local Red Hat Enterprise Virtualization sales contact.

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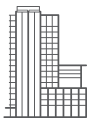

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Red Hat is the world's leading provider of open source solutions, using a community-powered approach to provide reliable and high-performing cloud, virtualization, storage, Linux, and middleware technologies. Red Hat also offers award-winning support, training, and consulting services. Red Hat is an S&P company with more than 70 offices spanning the globe, empowering its customers' businesses.

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