

A Deep Dive Into The Cost Benefits of KVM and Open Virtualization

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IBM Linux and Open Virtualization



Why KVM?

An Open Alternative

- Most recent step in the **evolution of x86 virtualization technology**
- An **open source alternative** to other hypervisors for both Windows and Linux workloads



A Smarter Choice

- Lower total **cost** of ownership compared to other providers
- **Enterprise-class** performance, scalability and security
- Technical leadership and business agility through **open source development community**
- **Open**: avoids vendor lock-in
- **Ecosystem** of Virtualization Management tools and ISV applications



How to get KVM

As part of a Linux distribution

- Full Linux including virtualization

Available as

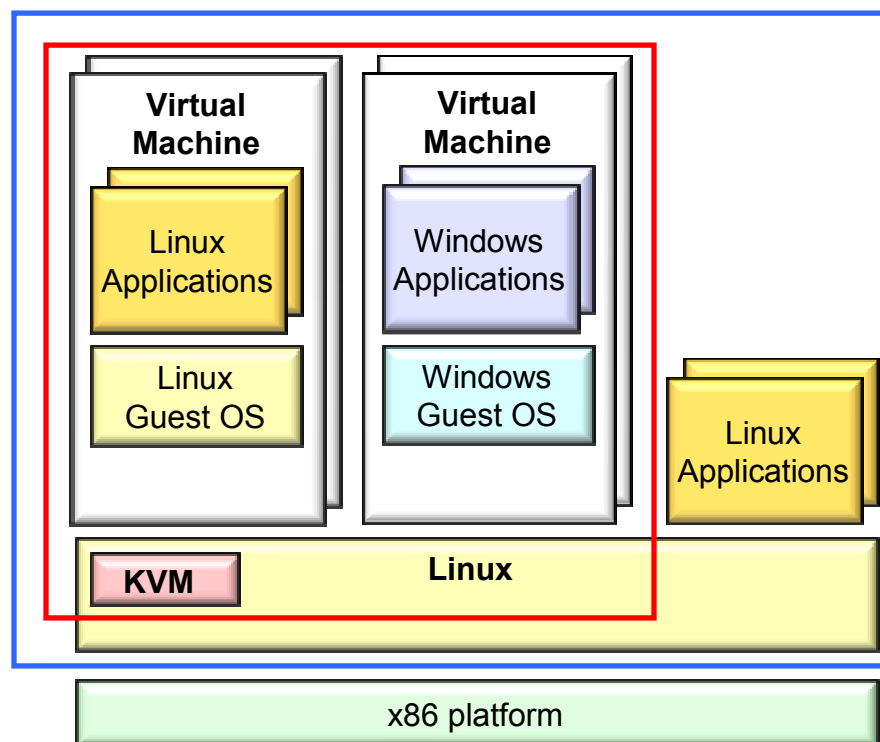
- Red Hat Enterprise Linux
 - RHEL 5.4 and above
- SUSE Linux Enterprise Server
 - SLES 11 SP1 and above
- Canonical Ubuntu
 - Ubuntu 10.04 LTS and above

As a standalone hypervisor

- Optimized, stripped-down hypervisor

Available as

- Red Hat Enterprise Virtualization – Hypervisor
- RHEV-H 2.2 and above



IBM and KVM

IBM Products Supporting KVM

IBM PureSystems

PureFlex and PureApplication Systems support KVM, delivering hypervisor choice and flexibility in next generation integrated systems

IBM Software Group Portfolio

KVM is a tier 1 virtualization technology for SWG with majority of SWG products supporting KVM today. Tivoli system management solutions manage KVM

IBM SmartCloud Enterprise

Agile cloud computing **infrastructure as a service (IaaS)** designed to provide rapid access to security-rich, enterprise-class virtual server environments, well suited for development and test activities and other dynamic workloads uses KVM.

IBM zEnterprise

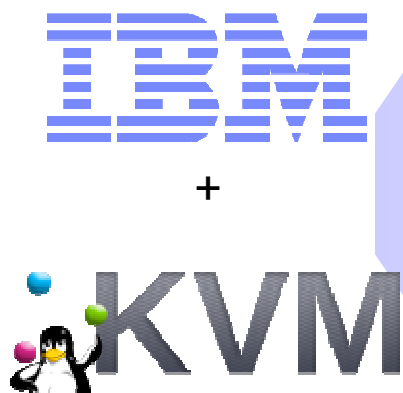
IBM System x Blades in the zEnterprise BladeCenter Extension (zBX) and Unified Resource Manager support KVM.

IBM System x

IBM x86 servers for Windows, Linux and Virtualization support KVM

IBM System Director VMControl

Automated virtualization management now also supported for KVM environments.



KVM Pricing Analysis - Overview

■ Methodology:

- Isolated the cost comparison to the hypervisor and hypervisor related management tools to create an apples-to-apples comparison
- Analysis based on **retail prices** through publically available information
- Terms and conditions for each product were configured to a standardized IBM System x server (x3550 M3, 2-socket, 48GB)
- Reference pricing comparison whitepapers from VMware and Red Hat

■ Pricing Scenarios/Inputs

Products Compared	Operating Systems	Quantities	Time Frame
<ul style="list-style-type: none"> ■ IBM Systems Director Std. Ed. + VM Control Enterprise Ed. + Red Hat KVM ■ VMWare VCenter 5 Server Standard + VMWare VSphere 5 Enterprise Edition ■ Microsoft Systems Center Data Center + Microsoft Hyper-V 	<ul style="list-style-type: none"> ■ Red Hat Enterprise Linux ■ Microsoft Windows ■ Mixed Environment (Red Hat Enterprise Linux + Microsoft Windows) 	<ul style="list-style-type: none"> ■ 20 Servers ■ 100 Workloads (performance-based analysis utilizing virtualization density to estimate # of required servers) 	<ul style="list-style-type: none"> ■ 1-year TCO ■ 3-year TCO

KVM Pricing Analysis – Components

	KVM (IBM + Red Hat)	VMware	Microsoft
Systems Management	IBM Systems Director <ul style="list-style-type: none"> ▪ Priced per server ▪ License + Service/Support 	VMware vCenter <ul style="list-style-type: none"> ▪ 1 Standard License 	Windows 2008 Server Data Center <ul style="list-style-type: none"> ▪ Priced per socket ▪ License + Service/Support
Virtualization Management	IBM Systems Director VMControl: <ul style="list-style-type: none"> ▪ Priced per server ▪ License + Service/Support 	ESXi via VMware vSphere <ul style="list-style-type: none"> ▪ Priced per socket 	
Hypervisor	KVM via Red Hat Enterprise Linux <ul style="list-style-type: none"> ▪ Priced per 2-socket server ▪ Subscription/Support 		Microsoft Hyper-v via Windows 2008 Server <ul style="list-style-type: none"> ▪ Priced per server ▪ License + Service/Support
Operating System		Red Hat Enterprise Linux <ul style="list-style-type: none"> ▪ Priced per 2-socket server ▪ Subscription/Support Microsoft Windows 2008 Server Std. <ul style="list-style-type: none"> ▪ Priced per server ▪ License + Service/Support 	Windows Server 2008 R2 CAL Pack <ul style="list-style-type: none"> ▪ 20 CALs per pack
Hardware / Server	IBM x3550 M3 server: <ul style="list-style-type: none"> ▪ 48GB RAM ▪ 2-socket 	IBM x3550 M3 server: <ul style="list-style-type: none"> ▪ 48GB RAM ▪ 2-socket 	IBM x3550 M3 server: <ul style="list-style-type: none"> ▪ 48GB RAM ▪ 2-socket

KVM Pricing Analysis – Summary View

3-Year Cost Analysis (<i>list prices</i>)		
Pricing Scenario	Vs. VMware	Vs. Microsoft
Linux Guests Only (100% Linux OS)		
20 Servers	+++	++
100 Workloads	++	++
Mixed Guests (50% Linux and 50% Windows)		
20 Servers	++	+
100 Workloads	++	+
Windows Guests Only (100% Windows OS)		
20 Servers	++	-
100 Workloads	+	+

Key

- +** Indicates **KVM price advantage**
- Indicates **KVM price disadvantage**
- +++** 50%+
- ++** 20%-49%
- +** 1%-19%
- - 1%-19%

Note: For 100 Workloads, the analysis looked at how many servers were required to host 100 workloads based on hypervisor performance – the number of servers required varies between vendors resulting in different hardware costs

Products compared:

- IBM Systems Director Std. Ed. + VM Control Enterprise Ed. + Red Hat KVM
- VMware vCenter 5 Server Standard + VMware vSphere 5 Enterprise Edition
- Microsoft Systems Center Data Center + Microsoft Hyper-V

KVM Cost Comparison - Linux Guests (20 Servers)

Item	List Price	Qty	IBM + RH KVM	VMware	Microsoft
Hardware (for reference only - not included in costs)					
x3550 M3, 2x6C, 2x500GB HDD, 48GB RAM, 2x 6Gb HBA, ServerRA	\$ 7,184	20	\$ 143,680	\$ 143,680	\$ 143,680
TOTAL			\$ 143,680	\$ 143,680	\$ 143,680
Software Licenses and one year SnS					
IBM Systems Director Standard Ed. X86 Support (w/virt media key)	\$ 450	20	\$ 9,000	-	-
IBM VMControl Enterprise Edition x86 (w/1 YR SWMA)	\$ 1,400	20	\$ 28,000	-	-
VMware vSphere 5 Enterprise Edition (License)	\$ 3,594	40	-	\$ 143,760	-
VMware vCenter Server 5 Standard (License)	\$ 6,244	1	-	\$ 6,244	-
Microsoft Systems Center Management Suite Data Center (SMSD)	\$ 1,310	40	-	-	\$ 52,400
Windows 2008 Server Standard (1 VM with 5 CALs)	\$ 1,029	20	-	-	\$ 20,580
RH Ent. Linux 2-sockets (unlmted. VMs, 1 YR Premium subscription)	\$ 3,249	20	\$ 64,980	\$ 64,980	\$ 64,980
TOTAL			\$ 101,980	\$ 214,984	\$ 137,960
Software Year 2 & 3 SnS					
IBM Systems Director Standard Ed. X86 Support (20% of License)	\$ 90	40	\$ 3,600	-	-
IBM VMControl Enterprise Edition x86 (20% of License)	\$ 280	40	\$ 11,200	-	-
VMware vSphere Enterprise Edition (Production SnS)	\$ 719	80	-	\$ 57,520	-
VMware vCenter Server Standard (Production SnS)	\$ 1,249	2	-	\$ 2,498	-
Microsoft Systems Center Management Suite Data Center (SMSD)	\$ 510	80	-	-	\$ 40,800
Windows 2008 Server Standard (1 VM with 5 CALs)	\$ 356	40	-	-	\$ 14,240
RH Ent. Linux 2-sockets (unlmted. VMs, 3 YR Premium subscription)*	\$ 3,006	40	\$ 120,220	\$ 120,220	\$ 120,220
TOTAL			\$ 135,020	\$ 180,238	\$ 175,260
1 Year Software License and SnS			\$ 101,980	\$ 214,984	\$ 137,960
Competition is more expensive by:				111%	35%
3 Year Software License and SnS			\$ 237,000	\$ 395,222	\$ 313,220
Competition is more expensive by:				67%	32%

*Note: RH offers 3 year discounted SnS options, for total 3-year TCO calculation the discount is applied

**Note: It is unlikely that a customer would utilize a Windows hypervisor management tool for a 100% Linux-based system

KVM Cost Comparison - Linux Guests (100 Workloads)



Item	List Price	Qty	IBM + RH KVM	VMware	Microsoft
Workloads					
# servers required for 100 Workloads		100	15	15	20
Hardware					
x3550 M3, 2x6C, 2x500GB HDD, 48GB RAM, 2x 6Gb HBA, ServerRA	\$ 7,184	N/A	\$ 107,760	\$ 107,760	\$ 143,680
TOTAL			\$ 107,760	\$ 107,760	\$ 143,680
Software Licenses and one year SnS					
IBM Systems Director Standard Ed. X86 Support (w/virt media key)	\$ 450	15	\$ 6,750	-	-
IBM VMControl Enterprise Edition x86 (w/1 YR SWMA)	\$ 1,400	15	\$ 21,000	-	-
VMware vSphere 5 Enterprise Edition (License)	\$ 3,594	30	-	\$ 107,820	-
VMware vCenter Server 5 Standard (License)	\$ 6,244	1	-	\$ 6,244	-
Microsoft Systems Center Management Suite Data Center (SMSD)	\$ 1,310	40	-	-	\$ 52,400
Windows 2008 Server Standard (1 VM with 5 CALs)	\$ 1,029	20	-	-	\$ 20,580
RH Ent. Linux 2-sockets (unlmted. VMs, 1 YR Premium subscription)	\$ 3,249	15	\$ 48,735	\$ 48,735	\$ 48,735
TOTAL			\$ 76,485	\$ 162,799	\$ 121,715
Software Year 2 & 3 SnS					
IBM Systems Director Standard Ed. X86 Support (20% of License)	\$ 90	30	\$ 2,700	-	-
IBM VMControl Enterprise Edition x86 (20% of License)	\$ 280	30	\$ 8,400	-	-
VMware vSphere Enterprise Edition (Production SnS)	\$ 719	60	-	\$ 43,140	-
VMware vCenter Server Standard (Production SnS)	\$ 1,249	2	-	\$ 2,498	-
Microsoft Systems Center Management Suite Data Center (SMSD)	\$ 510	80	-	-	\$ 40,800
Windows 2008 Server Standard (1 VM with 5 CALs)	\$ 356	40	-	-	\$ 14,240
RH Ent. Linux 2-sockets (unlmted. VMs, 3 YR Premium subscription)*	\$ 3,006	30	\$ 90,165	\$ 90,165	\$ 90,165
TOTAL			\$ 101,265	\$ 135,803	\$ 145,205
1 Year License and SnS with Hardware			\$ 184,245	\$ 270,559	\$ 265,395
Competition is more expensive by:				47%	44%
3 Year License and SnS with Hardware			\$ 285,510	\$ 406,362	\$ 410,600
Competition is more expensive by:				42%	44%

Workload Assumptions

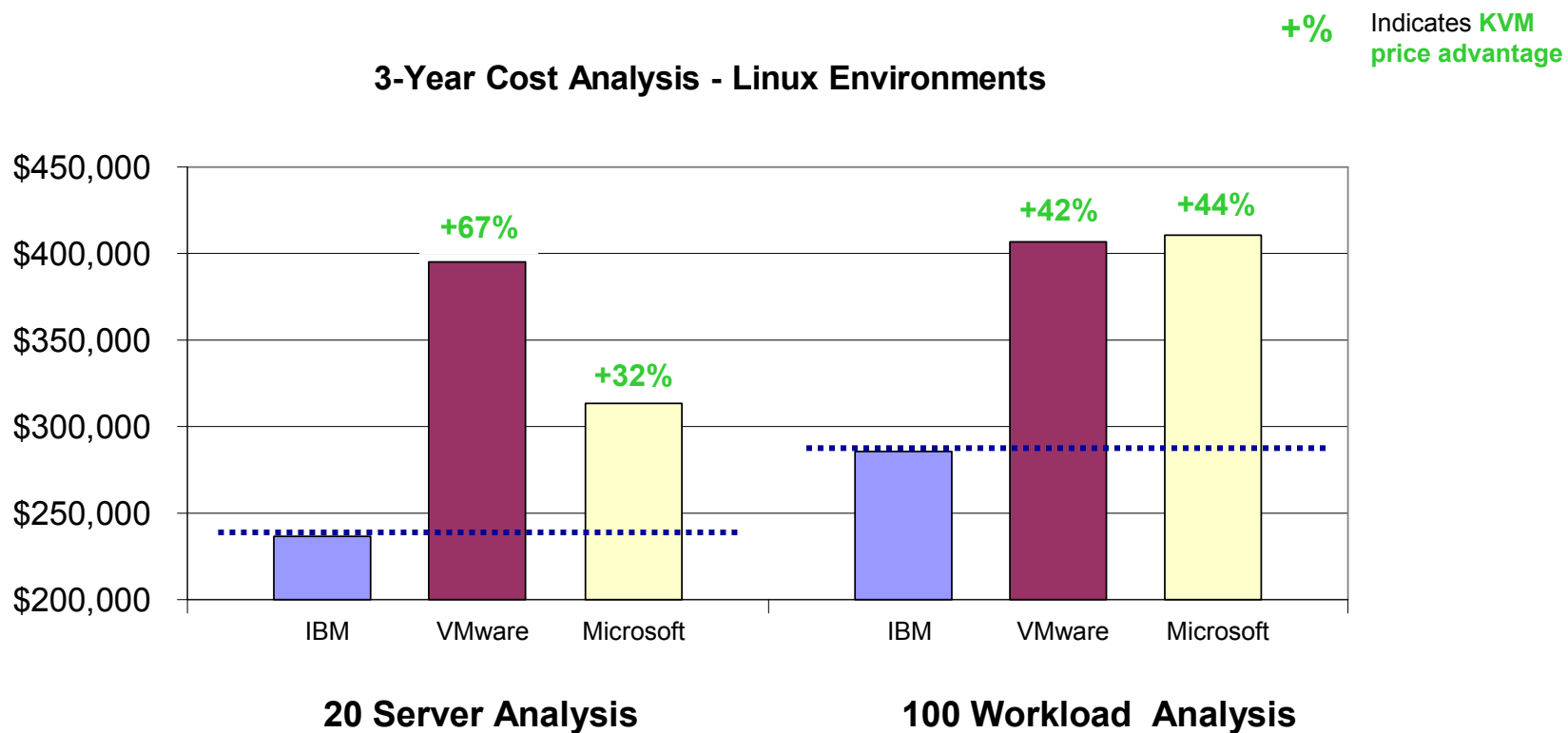
Per IDC Server Virtualization 2010, the average number of VMs on a host in 2012 is 7.3. For our calculations we use 7VMs per host for VMware

Per the VMware website "VMware customers report that they can achieve 50-70% higher VM density per host than with Microsoft Hyper-V" - for these calculations we use 5VMs per host for Microsoft

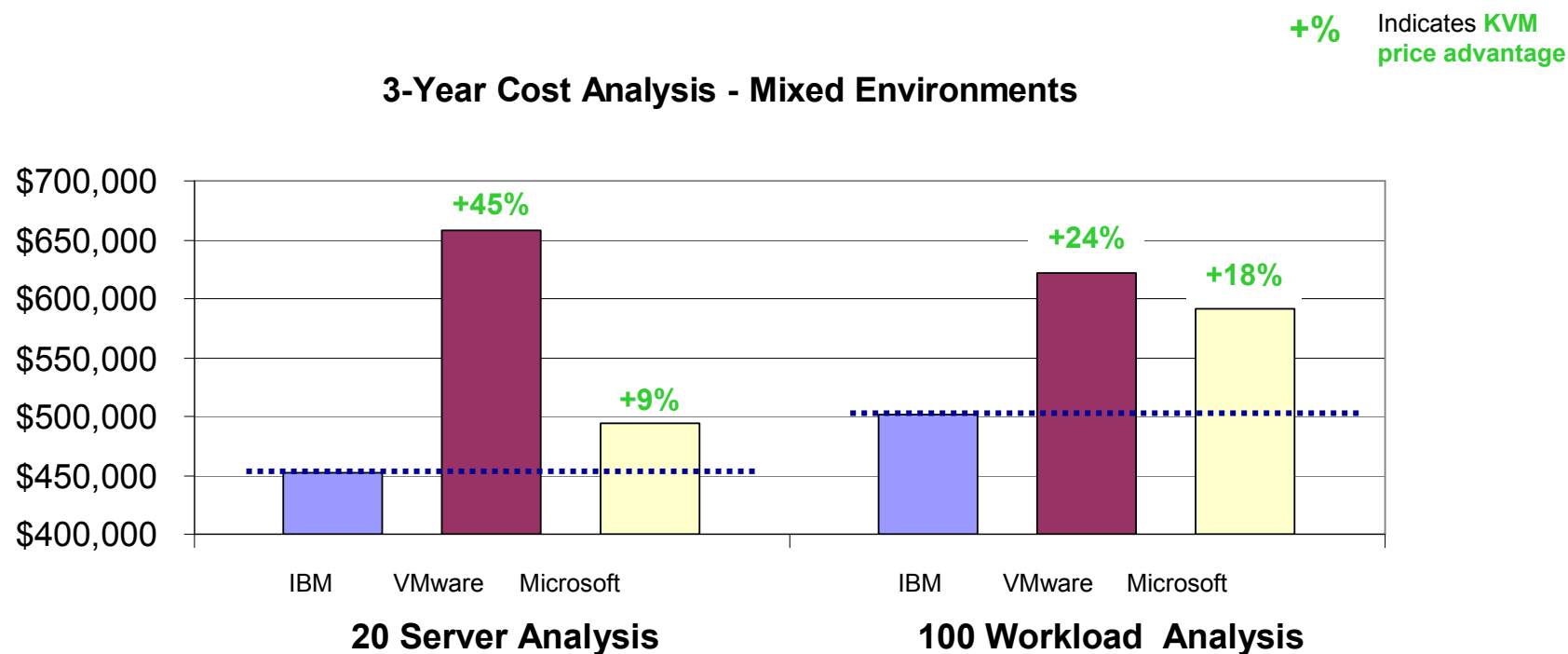
KVM has demonstrated VM consolidation performance parity (+/- 3%) with VMware ESX in published SPECvirt benchmark results from identical system configurations

9 KVM and VMware has the same # of virtual machines consolidation capability (7 VMs used in calculations above)

KVM Pricing Analysis Summary – Linux Guests



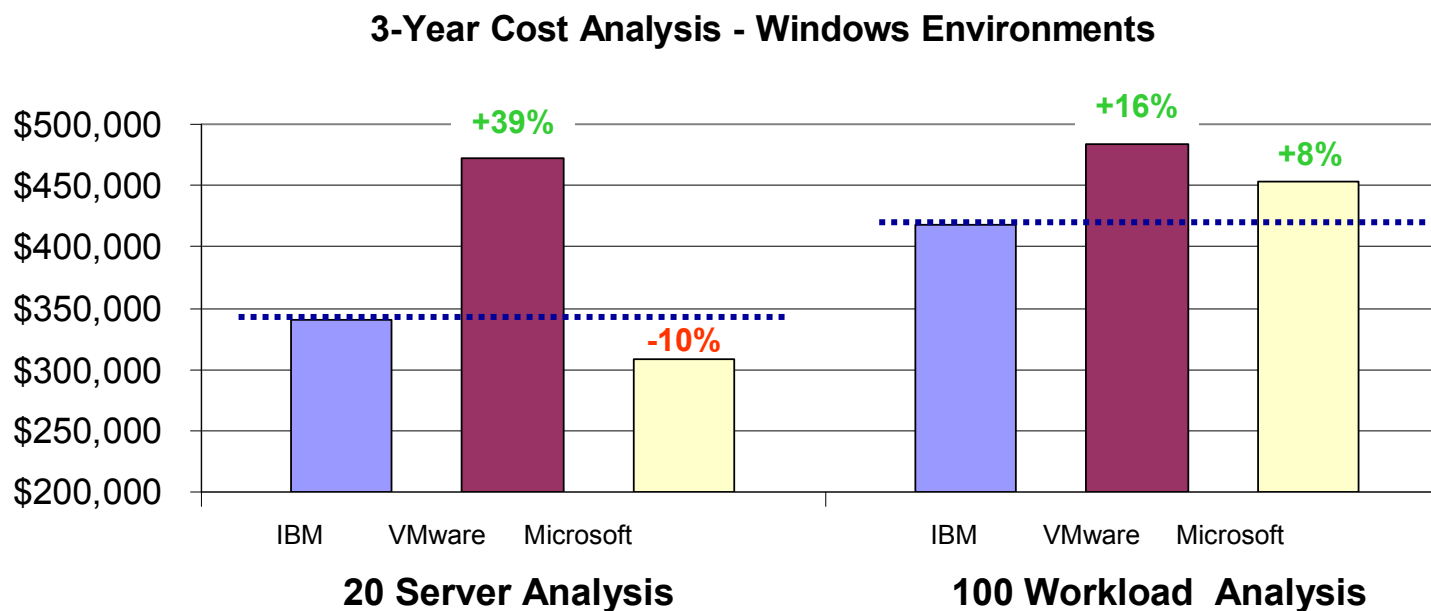
KVM Pricing Analysis Summary – Mixed Guests



Note: the pricing analysis is not dependent on the ratio of Windows versus Linux guests – we assume 50/50 split.

KVM Pricing Analysis Summary – Windows Guests

+% Indicates **KVM price advantage**
-% Indicates **KVM price disadvantage**



Note: in order to get KVM on a Windows server, the KVM stack requires a purchase of Red Hat Enterprise Linux (RHEL) which drives the increased cost shown above

KVM Cost savings – Case Studies



Webb

- **Software licensing costs reduced by 70%**
- Time to provision a new server reduced by 2 hours.
- Improved capacity planning and VM placement activities, through consolidated shared resource pools, from distinct servers.



LetterGen

- By migrating from VMware to KVM (Red Hat) LetterGen has **reduced costs by 67%**
- Increased the utilization of the IT infrastructure
- Openness of system offers more flexibility to adapt to changing needs of the environment

Pricing Sources

- IBM Pricing:
 - [IBM System x Hardware \(x3550 M3\)](http://www-304.ibm.com/shop/americas/content/home/store_IBMPublicUSA/en_US/evp/3550M3.html)
http://www-304.ibm.com/shop/americas/content/home/store_IBMPublicUSA/en_US/evp/3550M3.html
 - [IBM System x Software License and Support Costs](http://www-304.ibm.com/shop/americas/webapp/wcs/stores/servlet/default/CategoryDisplay?catalogId=-840&storeId=1&langId=-1&dualCurrId=73&categoryId=4611686018425093833)
<http://www-304.ibm.com/shop/americas/webapp/wcs/stores/servlet/default/CategoryDisplay?catalogId=-840&storeId=1&langId=-1&dualCurrId=73&categoryId=4611686018425093833>
- VMware Pricing:
 - <http://www.vmware.com/products/datacenter-virtualization/vsphere/pricing.html>
- Red Hat Pricing:
 - <https://www.redhat.com/wapps/store/catalog.html>
- Microsoft Pricing:
 - [“Windows Server, System Center, and Forefront Licensing Guide”, 2011](http://download.microsoft.com/download/0/D/9/0D9DDF52-A855-487B-9B74-5A09A9389551/Windows%20Server%20System%20Center%20and%20Forefront%20Pricing%20and%20Licensing%20Guide.pdf)
<http://download.microsoft.com/download/0/D/9/0D9DDF52-A855-487B-9B74-5A09A9389551/Windows%20Server%20System%20Center%20and%20Forefront%20Pricing%20and%20Licensing%20Guide.pdf>
 - “Comprehensive Resource for Licensing and Pricing” Fully Packaged Product (FPP) Retail Pricing – Windows Server 2008 R2
 - [Microsoft License Advisor](#): Microsoft® Windows® Server Datacenter Single Software Assurance OPEN Level C 1 Proc
 - “Microsoft Private Cloud A comparative look at Functionality, Benefits, and Economics,” August 2011
- SPECVirt (http://www.spec.org/virt_sc2010/)

Thank you

