

Why KVM is Winning Over VMware vSphere – Updated 2024

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Introduction

It's hard to believe that it wasn't all that long in the past that most IT applications were run directly on physical servers. Those physical servers predictably ran about 85% idle most of the time, especially x86 servers. Data centers and server rooms were becoming overrun with server sprawl. Focus was on putting more physical servers in less space. Blade servers were all the rage. Data center power was becoming a major issue. Seems like a lifetime ago.

All that changed during the 2000s. Server virtualization enabled oversubscription of hardware. It became common to oversubscribe the hardware more than 100% because it was statistically rare for all or even most virtual machines (VM) to be demanding resources concurrently. The cost savings proved to be compelling making server virtualization an industry standard practice.

VMware vSphere has been the on-premises server virtualization leader since the beginning of the x86 server virtualization market. This is mostly because VMware created the x86 server virtualization market. Its popularity grew thanks to advanced capabilities VMware introduced such as application isolation, enhanced workload portability, augmented scalability, top of rack networking virtualization, storage virtualization, simple high availability options, integration with backup applications, and disaster recovery options. These advances enabled IT businesses to deploy faster, greatly improve application availability, while operating and managing more efficiently with lower capital expenditures (CapEx).

The Broadcom acquisition of VMware in November 2023 changed everything. That is not hyperbole. Broadcom made changes quickly to reduce their costs by laying off 3,000 in Dec 2023 and another 1,200 in Jan 2024. Broadcom made massive changes to their partner programs and more importantly VMware licensing to increase their revenues.

Major VMware partner program changes implemented:

- Terminated the cloud service provider (CSP) program except for specific major hyperscalers.
 - Those CSPs failing to make the cut lose their perks and discounts.
- Terminated the general partner program.
 - Replacement program forbids partners from selling to top 2,000 accounts.

Significant increase in VMware vSphere licensing:

- All perpetual licenses converted to annual subscriptions.
 - No exceptions.
- They consolidated SKUs into a few bundles licensed by core.

Based on a 3-year contract, the following are their Annualized Contract Value (ACV) and what's included.

Broadcom VMware Software	ACV
vSphere Cloud Foundation	\$350 / core / yr
<i>vSphere Enterprise Plus, vSAN Enterprise, Aria Suite Enterprise, NSX Networking for VCF, HCX Enterprise, Aria Operations for Networks Enterprise, SDDC Manager</i>	
<i>vSAN Enterprise 1 TiB free per-core licensed included in vSphere Cloud Foundation software release</i>	
vSphere Foundation	\$135 / core / yr

vSphere Enterprise Plus, vCenter Server Standard, Tanzu Kubernetes Grid, Aria Suite Standard	
<i>vSAN Enterprise 100 GiB free per-core licensed included in vSphere Cloud Foundation software release</i>	
vSphere Standard	\$50 / core / yr
<i>vSphere Standard</i>	
<i>vCenter Server Standard</i>	
vSphere Essentials Plus Kit	\$35 / core / yr
<i>vSphere Essentials Plus, vCenter Server Essentials – sold / 96-core kit, max 3 hosts</i>	

Table 1: Current Broadcom VMware Licensing

These are not trivial price increases. Broadcom wanted to raise their revenues, and they have. Numerous VMware customers have quite loudly complained about the price hikes which range from 200% to more than 2,000%. Many are angry. Some have even resorted to litigation. And all are looking for ways to reduce their hypervisor spend.

It is not unusual for VMware customers to look at other proprietary hypervisors such as Microsoft Hyper-V, Nutanix, or even Verge.io. But that again puts them in the same kind of lock-in “box” they already experienced with VMware. And although these alternatives are considerably cheaper than the latest VMware pricing, they are by no means inexpensive.

More IT organizations than ever are exploring open-source KVM that comes as part of open-source Linux. KVM has rocketed up the hypervisor popularity charts. A very important reason for that is there are no license costs for KVM just as there are no license costs for Linux. The only direct costs of KVM are support costs available from several KVM distribution vendors. Either way, KVM is orders of magnitude less expensive than VMware today. Those are not the only savings either.

There are also indirect KVM cost savings that can be more than just the license savings. These are explored in this paper’s research. This combination gives KVM a substantial total cost of ownership advantage over VMware without any need for qualification. That’s an important reason KVM is winning right now in the market.

There are also several other additional weighty factors as to why KVM is growing so rapidly. This research takes a deep dive into those factors. Specifically, where KVM has the advantage and how the additional advantages of Oracle Linux KVM distribution plays a significant role in why KVM is winning over VMware.

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Significant KVM Advantages over VMware

KVM has several advantages including being open source, performance, scalability, hardware resources utilized, and total cost of ownership (TCO).

KVM Open Source Advantage

Most IT organizations today rely on open-source Linux. There are many Linux open-source advantages.

The first and the one most referenced is its cost-effectiveness. There is no purchase or subscription cost, only optional support costs. Even the support costs run less than commercial equivalent software. Other advantages include community collaboration, multi-vendor/multi-support options, freedom to change support vendors or self-support – no lock in, leverages large vendor R&D, modular design, reduced development duplication, open standards, flexible customization, transparency, stability, reliability, and most importantly security. Open-source Linux transparency enables more rigorous code inspection. The fact that there are numerous community eyes on the Linux codebase generally leads to faster identification and resolution of security vulnerabilities.

By the beginning of the 2020s, with the exception of desktops, laptops, and tablets, Linux has become the dominant operating system in the world. Per [HostingTribunal.com](https://hostingtribunal.com), Linux runs:

- All major space programs
 - SpaceX Falcon 9, their primary launch vehicle – 1st reusable rocket, runs on Linux
- 100% of the world's top 500 supercomputers
- 96.3% of the world's top 1 million servers
- 90% of all cloud infrastructure
- 90% of all Hollywood's special effects
- 23 of the top 25 world websites
- US Department of Defense since 2007 because of better security and lighter load
- US Navy warships
- And more than 85% of the world's smartphones – Android is a modified version of Linux
- Linux is the largest and most successful open-source project

KVM has become ubiquitous in the cloud. Oracle Cloud Infrastructure (OCI), AWS, Alibaba, GCP, IBM and most other clouds utilize some variation of the KVM hypervisor. Even Nutanix hyperconverged infrastructure Acropolis™ hypervisor is a variation of KVM. Oracle KVM is in addition, a true hybrid in that on-premises implementations can be configured identically to what Oracle utilizes in its own Cloud Infrastructure. More on this later.

In contrast, the VMware hypervisors are proprietary closed systems completely under the control of Broadcom/VMware, locking in users.

KVM Performance Advantage

Both KVM¹ and VMware are type 1 hypervisors and outperform any type 2 hypervisor. There are a few published performance comparisons of the two hypervisors with [SPECvirt_sc2013](https://www.specvirt.org/sc2013). Based on this standard benchmark, KVM runs applications faster than any other hypervisor including VMware, at near native speeds.

In addition, KVM takes much less time to start a virtual server than VMware hypervisors. It also has lower overhead because it is relatively light with approximately tens of thousands of lines of code whereas VMware hypervisors are believed to have more than 6 million lines of code. This is unverifiable since VMware does not publish the source code for vSphere because it is proprietary. The vSphere performance is only marginally affected because of the use of hardware extensions to virtualize VMs.

One of the reasons for KVM's better performance comes from the Linux kernel real-time extensions. These extensions enable VM applications to run at lower latency with higher prioritization as compared to bare metal. The

¹ KVM has been part of the Linux kernel since 2007 and is part of the Linux distribution. Some say that makes KVM a type 2 hypervisor that runs on the OS. That's incorrect. It can fool administrators because a Linux user can start KVM from a command line or Linux launches KVM establishing a co-processing relationship in which KVM shares physical hardware control with the Linux kernel. But KVM uses the x86's virtualization instructions to allow KVM and its guests to run directly on the bare metal. Thus, making KVM a type "1" hypervisor. Close integration with Linux is a key reason Linux developers generally prefer KVM.

Linux kernel also divides long compute time processes into smaller components, that are then scheduled and processed faster.

The KVM performance advantage is evident in all hardware. However, it is even more noticeable when run on the latest generation of AMD EPYC processors that have more and faster cores.

KVM Scalability Advantage

KVM has a significant scalability advantage over VMware vSphere. It’s one of the reasons why it’s the hypervisor of choice for hyperscalers and cloud service providers.

Scale Limits	Oracle Linux/KVM Virtualization	VMware vSphere ESXi 8 U3b
Max hosts/cluster	128	64
VMs/host	600 Tested, but real limit is significantly higher	1,024
vCPUs/VM	256	128

Table 2: Oracle Linux/KVM vs. VMware vSphere Scalability Comparison

KVM TCO Advantage

KVM has several cost advantages over VMware vSphere. It obviously starts with licensing. Starting with zero cost for Linux licensing. The only cost comes from optional vendor support whether from the KVM distributor or internal administrators. Those support costs are substantially less than any of the latest VMware subscriptions. Now that VMware has eliminated perpetual licensing there are no more separate maintenance or support costs. Those subscription costs are orders of magnitude higher.

VMware no longer provides a free variation of ESXi that just has the cost of support. It was meant for low end users and devops to provide a competitive option to KVM. Even though the free ESXi was functional it was stripped of the most useful and commonly utilized features. It doesn’t matter anymore since Broadcom has terminated it.

Other potential KVM cost savings – depending on configuration – comes from reduced hardware, supporting infrastructure hardware, power, cooling, management, operations, and troubleshooting time costs.

Oracle Linux KVM Matches or Exceeds VMware vSphere’s Most Popular Functionality

Many VMware vSphere users perceive they’re stuck because of specific functionality. It’s not true.

Functionality	Oracle Linux/KVM Virtualization	VMware
Live virtual machine snapshots	Yes	Yes
Live virtual machine migration	Yes <i>Secure live migration</i>	Yes <i>vMotion</i>
Live storage migration	Yes	Yes <i>Storage vMotion</i>
Virtual machine high availability <i>VM automatically moved & restarted if host becomes inoperable</i>	Yes	Yes
Active/Active disaster recovery	Yes	Yes
Active/Passive disaster recovery	Yes	Yes
Scheduling policies	Yes	Yes <i>Distributed resource scheduler</i>
Role-based access <i>For granular, user-level controls</i>	Yes	Yes

Table 3: Oracle Linux/KVM vs. VMware vSphere Sophisticated Functionality Comparison

Oracle Linux KVM Unique Enterprise Functionality not Available on VMware vSphere

Functionality	Oracle Linux/KVM Virtualization	VMware
Hard Partitioning <i>Save on app licensing by CPU pinning system resources</i>	Yes Bind vCPU to physical CPU threads or cores Oracle Apps may be able to take advantage of per core licensing	No
Security updates without downtime	Yes Hypervisor can be updated and patched w/Ksplice while running	No

Table 4: Oracle Linux KVM Advanced Enterprise Features Not Available on VMware vSphere

Oracle Linux KVM TCO is a Fraction of VMware vSphere

Oracle Linux KVM Substantial Pricing Advantage

Oracle Linux KVM is up to 20 times lower in price than VMware vSphere. Easy to see based on MSRP in table 5.

	Oracle Linux/KVM	VMware vSphere		
	Premier Support	Cloud Foundation	Foundation	Standard
Annual Base Pricing	Support only	License & Support		
	\$1,399 / CPU pair	\$350 / core	\$135 / core	\$50 / core
	2 CPU, 48 cores ea			
Per Server Pricing	\$1,399	\$33,600	\$12,960	\$4,800
100 Server Pricing	\$139,900	\$3,360,000	\$1,296,000	\$480,000
What's Included	OLVM, OL KVM, Oracle Linux guest OS, OCNE, OLAM	vSphere Enterprise Plus, vSAN Enterprise, Aria Suite Enterprise, NSX Networking for VCF, HCX Enterprise, Aria Operations for Networks Enterprise, SDDC Manager	vSphere Enterprise Plus, Tanzu Kubernetes Grid, Aria Suite Standard, available Add-On's	vSphere Standard, vCenter Server Standard
	% > expensive than Oracle Linux KVM	2402%	926%	343%

Table 5: Oracle Linux KVM Massive Pricing Advantage

Oracle Linux KVM Immense TCO Advantage

In addition to the Oracle Linux KVM pricing advantage, it has an even bigger TCO advantage based on several highly useful and meaningful cost savings that come from its unique Enterprise functionality.

Hard Partitioning

[Hard partitioning](#) enables a VM application to be CPU pinned. Hard partitioning means binding virtual CPUs (vCPU) to physical CPU threads or cores and preventing these vCPUs from being scheduled on physical CPUs - threads or cores other than the ones specified. This is crucially important when it comes to minimizing application licensing. Application licensing or subscriptions are commonly based on vCPUs. For Oracle software and several other Enterprise applications, those costs are based on all potentially available vCPUs and not just the ones the application is running on. If that application can be shifted to other vCPUs via policy, the license costs go up. This applies to the Oracle Database, Oracle Fusion Middleware, and Oracle’s applications. Hard partitioning reduces those license costs by multiple factors.

Neither VMware vSphere nor any other KVM distribution is recognized by Oracle for delivering valid hard partitioning. Oracle Linux KVM uniquely creates value by managing and reducing Oracle software license costs.

Oracle Linux Ksplice Zero-Downtime Patching

[Ksplice](#) solves a major costly problem. Patching a hypervisor is non-trivial because it's frequently disruptive to all of the VMs and applications that it is supporting. Disruptive processes require scheduling. Few applications can tolerate an outage during business hours. Most IT organizations schedule vulnerability patching disruptive processes for a weekend sometime within a 90-120-day timeframe² per the Verizon "[2023 Data Breach Investigations Report](#)". Patching is put off so the different stakeholders, applications, servers, hypervisors, storage, networking, etc., have time to coordinate their efforts. When that scheduled date rolls around, assuming it hasn't been deferred, the first 24 hours is when all disruptive patch processes are implemented. The next 24 hours is reserved to back out the patches that didn't work or caused problems. These processes are labor intensive and error prone.

Until those vulnerabilities are patched, they are subject to exploitation. Make no mistake, cybercriminals are doing their best to exploit them. The potential costs of exploitation can be enormous in lost productivity, lost data, lost revenue, lost income, lost customers, lost reputation, and potential non-compliance fines.

Oracle's unique³ Ksplice technology and service updates the kernels, KVM, and critical user space libraries without requiring a reboot or interruption. This means when a patch is released, including patches for exploitable vulnerabilities, Ksplice enables those patches to be implemented quickly, without having to be scheduled or coordinated with anyone.

As previously mentioned, the Oracle Cloud Infrastructure (OCI) utilizes Oracle Linux KVM. When Oracle upgraded the KVM hypervisors, they took full advantage of Ksplice. Disrupting thousands of applications in the cloud would be disastrous. Oracle documented that they were able to implement 150 million patches – some for the Spectre and Meltdown CPU vulnerabilities to more than 1.5 million CPU cores without disruption. It was all done online in approximately 4 hours with zero downtime.

Neither VMware vSphere nor any other KVM distribution, not IBM Red Hat, not SUSE, nor Ubuntu, have Ksplice. Oracle is the only KVM distribution that solves this patching problem. And the cost savings are enormous in time, people, disruptions, and potential malware/ransomware exploitations.

Native Bi-directional Cloud Migration

Oracle Linux KVM users can choose to [configure](#) on-premises virtualization the same way it's configured within the Oracle Cloud Infrastructure or Oracle engineered systems that use KVM. This makes it incredibly simple to move VMs between on-prem and the cloud or vice versa. Configuring this way eliminates a major devops headache when developing in the cloud for on-prem deployments. The developers can be assured that how they see their application run in the Oracle Cloud Infrastructure will run the same on-prem without changing their code.

It's important to note that with the exception of Oracle, no other current major public cloud provider shares their hypervisor for on-prem usage. Similarly, with the exception again of Oracle, no other Linux KVM distributor vendor, including IBM Red Hat, have been utilized by major public cloud providers to deliver cloud services.

Accelerated Application Deployments

Oracle offers an innovative approach to deploying a fully configured software stack with pre-installed and pre-configured software images. Use of these virtual machine templates significantly reduces admin time to install, configure, implement, and manage. Time is money. Reduced admin time equates into much reduced costs. Saved time can be repurposed for more strategic developments that help accelerate application development as well.

² [Verizon](#) only half of the vulnerabilities are patched within three months after discovery.

³ Red Hat has Kpatch and SUSE has KGraft which are somewhat similar to Ksplice, but only for the kernel and a small patch subset. Ksplice has a much broader range of patches including the ability to patch hypervisors and critical user space bits non-disruptively.

Faster application deployments mean faster time to market which helps generate additional revenues in addition to the lower operational costs.

Comprehensive Management Tools

The [Oracle Linux Virtualization Manager](#) (OLVM) is based on the open source oVirt project. Oracle Linux Virtualization Manager is easily deployed and makes it incredibly simple to configure, monitor, and manage Oracle Linux KVM environments with enterprise-grade performance.

[Grafana](#) is the very popular, incredibly simple and easy to use observability platform and it connects directly into OLVM. This enables Grafana to display extensive metrics data KVM. It's very easy to create custom OLVM-based Grafana dashboards simply by browsing and selecting the metrics of interest.

Oracle Clusterware

[Oracle Clusterware](#) is software that enables servers to operate together as if they are one server. Each server looks like any standalone server. However, each server has additional processes that communicate with each other making the separate servers appear as if they are one server to applications and end users. Oracle Clusterware makes it easy to scale applications, increase performance, reduce total cost of ownership (TCO), while providing high availability (HA), reduced unplanned and planned downtime. It's also a requirement for using Oracle Database Real Application Clusters (RAC).

Oracle DTrace.

DTrace is KVM unique and an Oracle contribution to the code. It is not available on VMware vSphere. [Oracle Linux DTrace](#) is a comprehensive, advanced tracing tool for troubleshooting systematic problems in real time, providing a single view of the software stack, from kernel to application. This provides rapid identification of performance bottlenecks and greatly simplifies troubleshooting. Simpler, faster troubleshooting, and performance tuning saves time while greatly increasing productivity.

Straightforward Oracle Linux KVM Support Pricing

Oracle's [pricing](#) for support is simple and flexible unlike VMware vSphere or other KVM distributions. Simplicity such as per server pricing instead of per socket or core. It's the same for all of the Oracle Linux products. Support pricing is calculated on a per-system basis and customers can choose one of two levels – Premier or Basic – of support on each server in their deployment.

Oracle Support Comparison

	Premier	Basic
24x7 telephone & online support	✓	✓
Oracle Enterprise Manager for Linux Mgmt	✓	✓
Spacewalk support	✓	✓
HA with Oracle Clusterware	✓	✓
Comprehensive tracing w/Dtrace	✓	✓
Oracle Linux load balancer	✓	✓
Comprehensive indemnification	✓	✓
Oracle container runtime for Docker	✓	✓
Oracle Linux Virtualization Manager	✓	X
Zero-downtime patching w/Ksplice	✓	X
Oracle Linux Cloud Native Environment	✓	X
Include Kubernetes, Kata Containers, & more	✓	X
GlusterFS Storage for Oracle Linux	✓	X
Oracle Linux SW collections	✓	X
HA services support (Corosync & Pacemaker)	✓	X
Premier backports	✓	X
Lifetime sustaining support	✓	X

Table 6: Oracle Support Option Comparison

Yeah But, What About Backup?

VMware vSphere set the standard for hypervisor backups with VMware API for Data Protection (VADP) and Changed Block Tracking (CBT). KVM does not currently have an equivalent. However, the Oracle Linux Virtualization Manager (OLVM) does. Many backup data protection vendors including Veeam, VERITAS, Rubrik, Storware, and Asigra, with several others working on OLVM integration.

Conclusion

KVM is winning over VMware vSphere because it has significant advantages. Advantages that include being open source, noticeably better performance, better scalability, significantly better hardware resource utilization, much lower licensing and support costs, and even lower TCO. Oracle Linux KVM has even lower costs because of capabilities such as hard partitioning, Ksplice, native bi-direction cloud migration, accelerated application deployments, Clusterware, DTrace, simple and flexible support pricing.

VMware vSphere is a legacy hypervisor solution with a very large install base. It is not a superior product in any way that matters. IT organizations that have not evaluated KVM and more specifically Oracle Linux KVM, are doing a great disservice to their organization and their budgets.

For More Information on Oracle Linux KVM

Datasheet: [Oracle Linux KVM](#)

Appendix A: More Detailed Function Comparison

Feature	Oracle Linux KVM	VMware vSphere
Mgmt Console	OLVM	vCenter Director
Troubleshooting	Dtrace	vCenter Director
VM Migration	Live Migration	vMotion
Storage Migration	Live Storage Migration	Storage vMotion
HA	Yes	Yes
Resource Mgmt	Cluster scheduler & policies, affinity	DRS
Security	sVirt, SELinux, firewall, & Ksplice	ESXi Firewall, vShield Endpoint
Live Snapshots	Yes	Yes
Backup SW Integration	Yes	VADP & CBT
Native DR	Requires storage vendor integration w/SRM	Requires storage vendor integration w/REST API
Automation & Orchestraion	Ansible® Engine integration included. Additional orchestration is available from 3rd party ISV supports such as from Morpheus Data (HPE).	vRealize
Role-based access control (RBAC), Active Directory (AD) integration, tiered access	Yes	Yes
Over-Commit	Memory ballooning	Memory ballooning
API & SDK	REST API, Python command line (CLI), Hooks, Java SDK, Python SDK	Web services API/ SDK, common information model (CIM), Perl, .NET, Java™ SDKs
Networking	VLAN tagging, QoS, Bonding, Jumbo Frames, IPv6, virtual network interface controller (vNIC) profiles. Additional 3rd party ISV support from vendors such as Zero Networks.	Virtual LAN (VLAN) tagging, quality of service (QoS), Bonding, Jumbo Frames
Container support	Open Source Docker & Kubernetes	Photon & vSphere Integrated Containers
SW Defined Networking	Open Source OpenFlow, Open vSwitch & KVM SDN Lab Installation App	NSX
SW Defined Storage	GlusterFS & 3rd party ISVs	vSAN
Hot add virtual devices	Disk, vCPU, memory, NIC	Disk, vCPU, memory, NIC