Canonical

From VMware to OpenStack

Lower your TCO by 40% with your own open source cloud

Executive summary

Cloud computing is now a central piece of enterprise IT estates. According to Gartner, overall spending on cloud infrastructure will approach the 50% mark by 2025 [1]. As IT estates grow and become more complex, the total cost of ownership (TCO) can increase substantially, serving as a catalyst for an ongoing challenge businesses face - to optimise infrastructure expenditure.

This is especially relevant for organisations that have been historically using traditional proprietary solutions. Those solutions not only tend to be overly expensive due to licence costs but often also lead to lock-in through layers of interdependent services and lengthy contractual obligations. In light of these shortcomings, it is no surprise that following the acquisition of VMware by Broadcom, companies are now re-evaluating their IT strategies.

One strategy companies can adopt to optimise infrastructure costs and reduce vendor lock-in is to move from legacy solutions to modern open source platforms. This enables them to rein in costs and gain significantly more control over their infrastructure. Even though such migration usually results in some operational challenges, it can be executed smoothly in cooperation with a trusted partner [2].

This paper explores the benefits of moving from VMware to one of its open source alternatives: OpenStack. It also compares OpenStack with the VMware vSphere Enterprise Plus suite. By looking at the similarities and differences of both platforms, we demonstrate how organisations can perform a successful migration while achieving feature parity. Moreover, this paper provides a detailed analysis of VMware's and Canonical's commercial offerings, outlining how moving from VMware to Canonical OpenStack can result in up to 40% cost savings.

Canonical OpenStack is an enterprise cloud platform optimised for price-performance with ten years of maturity in the cloud computing field. Throughout this period, it has been successfully adopted by organisations of all sizes across various market segments, from the public sector to telcos and from large enterprises to small businesses.

Key takeaways

- A successful migration from VMware to OpenStack leads to a TCO reduction of 40%.
- Canonical OpenStack's pricing model is competitive thanks to zero licences and relatively low support subscription costs.
- In most cases, feature parity between VMware and OpenStack can be preserved, allowing for a smooth lift-and-shift migration.
- Switching to Ubuntu-based infrastructure unlocks additional capabilities, including bare metal automation, cloud-native storage concepts, on-demand Kubernetes clusters and Software-as-a-Service (SaaS) extensions.
- Organisations can get started with OpenStack quickly in five simple steps.

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Other open source alternatives

It is important to mention that OpenStack is just one of the alternatives when considering a migration from VMware to open source. Other solutions, such as public clouds, Canonical LXD and MicroCloud, are viable options, too.

- In our "From VMware to Open Source" whitepaper and webinar, we discussed generic benefits resulting from migrating to open source, such as cost savings, increased flexibility and higher quality and demonstrated the entire landscape of an Ubuntu-based infrastructure.

- In the "How to migrate from VMware to Ubuntu-based infrastructure" whitepaper and webinar, we focused more on evaluating various options available and showcased two migration scenarios: a large-scale using Canonical OpenStack and a small-scale one with MicroCloud. We also discussed how to approach a successful migration by following a proven five-step process.

- More information on this topic can be found on the Ubuntu blog and other Canonical resources.

For the purpose of this paper, we're going to focus entirely on Canonical OpenStack. Organisations should always evaluate what makes the most sense for them based on their use cases and requirements. Involving a trusted partner might be a smart decision. Canonical's team of cloud experts is always happy to provide guidance for these critical decisions

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The business case

Cost optimisation is the primary reason why organisations constantly consider migrating away from their existing VMware estate. In the following section, we will demonstrate how much businesses can realistically save by picking up Canonical OpenStack as an alternative and where exactly those savings are coming from.

Reducing TCO

The TCO is a sum of two ingredients: CapEx and OpEx. While CapEx represents initial costs that organisations need to bear, OpEx represents ongoing costs (e.g. monthly or annual) that are spread across a period of time. Bringing any of those ingredients down results in TCO reduction.

The CapEx associated with the IT infrastructure setup (either VMware or OpenStack) is high. This stems from the need to purchase hardware, software licences and solution delivery fees. However, when it comes to the OpEx, it can differ substantially based on the support subscription cost.

In the next subsection, we will demonstrate how VMware customers can reduce their TCO by optimising their CapEx and OpEx with Canonical OpenStack.

VMware vs OpenStack: TCO analysis

Let's consider the following scenario as we typically see it in the field. A customer in the public sector is currently running 150 nodes across 3 data centres in production on VMware and is considering a migration to OpenStack. They are also going to use this opportunity to refresh their hardware as the one they have is already three years old, and as per their internal policy, they have to refresh it every three years. The specs of the considered hardware are based on the reference architecture for Canonical OpenStack implementation [3].

What's presented in Tab. 1 are individual TCO ingredients of the same infrastructure built with VMware vSphere and Canonical OpenStack platforms. This analysis assumes:

- hardware pricing from a leading original equipment manufacturer (OEM), including servers, network devices and rack equipment (cabinets, cables, etc.),
- licence and subscription costs as obtained from one of VMware's resellers,
- typical delivery, training and migration costs associated with Canonical OpenStack deployment and VMware to OpenStack migration,
- maximum available discounts for both the hardware and the VMware software.

The data from Tab. 1 are also represented in Fig. 1. Not included in this analysis are:

- hardware OpEx costs, including maintenance and power consumption, as those usually differ significantly across the world,
- staff salary, as we assume the same team will be operating the OpenStack cloud as it was operating the VMware vSphere cluster in the past.

TCO ingredient	Component group	Component	VMware vSphere [USD]	Canonical OpenStack [USD]
CapEx	Hardware	Cloud nodes	4,403,136	4,403,136
		Infrastructure nodes	0	119,136
		Network devices	749,180	749,180
		Data centre equipment	36,000	36,000
	Software	Licences	3,093,750	0
		Delivery	120,000	215,000
		Migration	0	234,000
		Training	0	61,500
OpEx	Software	Support subscriptions	1,721,303	238,500
		TOTAL	**10,123,369**	**6,056,452**

Tab. 1. TCO ingredients: VMware vSphere vs Canonical OpenStack

Based on the presented model, which takes into account a typical deployment scenario and common cost ingredients, Canonical OpenStack appears to be up to 40% more cost-effective than VMware vSphere.

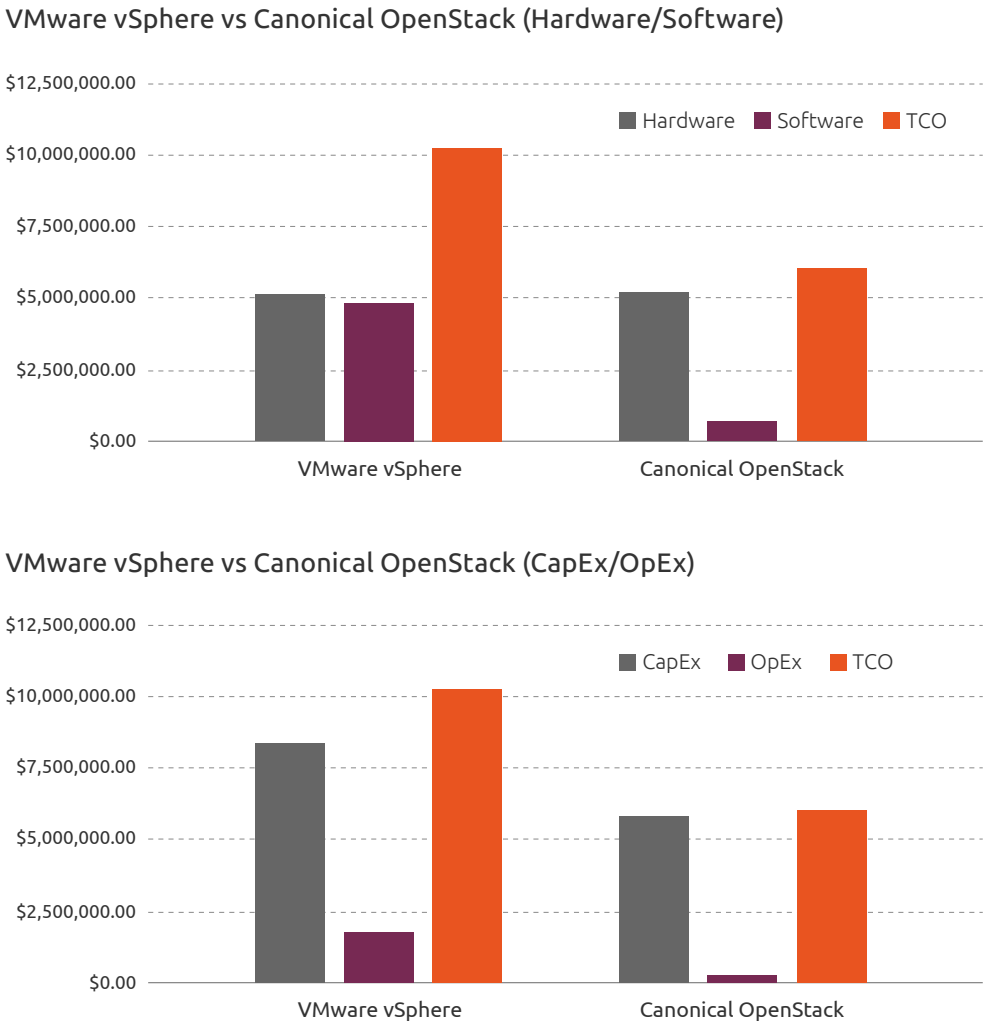

Fig. 1. TCO ingredients: VMware vSphere vs Canonical OpenStack

Based on the presented results, Canonical OpenStack appears to be way more cost-effective than VMware vSphere (up to 40%). Even though this proves to be true on any scale, it is important to remember that a certain model has been used in this analysis. Organisations should always try to estimate costs and potential savings themselves based on their detailed requirements. This is something that Canonical can also help with, demonstrating years of experience in data centre price-performance analysis.

Comparing VMware and OpenStack

In essence, both VMware and OpenStack can be used for the same purposes: to host traditional and cloud-native workloads and manage them from a self-service portal using virtualisation and containerisation technologies underneath. At the same time, they differ significantly in their architecture and the way they work. In the following section, we will take a closer look at both platforms in search of their similarities and differences.

Similarities and differences

When comparing VMware and OpenStack, the biggest difference between the two lies in their software development model. While the entire vSphere suite is developed by a single company - VMware - OpenStack is created by the OpenInfra community consisting of 450+ organisations and 8,900+ developers in total. This

helps the project stay at the forefront of the technology. Individual contributors always represent the voice of their users and customers, and organisations ensure their priorities are taken into account as reflected by current market needs.

Another difference is the overall approach to ensuring desired functionality across the entire stack. While VMware develops all the required components, such as NSX and vSAN themselves, OpenStack uses other open source projects and integrates with them smoothly. Such a modular approach enables organisations to select the best-of-breed technologies that are currently available on the market and design the cloud tailored to their needs.

Even though all the aforementioned differences are visible to infrastructure engineers, end users do not necessarily care about them. What usually matters the most for this group is whether the overall functionality of the platform can be preserved, avoiding costly refactoring of existing applications. In most cases, this can be easily achieved. OpenStack allows for lift-and-shift migration from VMware and provides a visual dashboard for managing the entire VM estate of individual users, departments or an entire organisation.

Achieving feature parity

Even though certain equivalents of VMware's features usually exist in Canonical OpenStack and its ecosystem (see Appendix), organisations should always expect slightly different behaviours when moving their existing workloads and data to a cloud platform like OpenStack.

Infrastructure

Most of VMware's infrastructure components and features can be found in Canonical OpenStack itself and its underlying technologies for compute, network and storage virtualisation. This includes Kernel-based Virtual Machine (KVM), Open Virtual Network (OVN) and Ceph. All those technologies get deployed as a single, bundled solution and do not require any further integration unless a specific customisation is required.

Applications

In the VMware world, the application space is covered by the Tanzu platform and its corresponding components and features. This enables VMware users to benefit from containerised, cloud-native workloads powered by Kubernetes. An equivalent of that on the Ubuntu side is Canonical Kubernetes with its own ecosystem. Canonical Kubernetes can be deployed either on the top of OpenStack or standalone, directly on the bare metal layer.

Management

VMware's answer to infrastructure and application management challenges is the Aria platform. It includes automation, orchestration, observability, chargeback, billing, migration-as-a-service and cloud platform management (CPM) capabilities and more. No single equivalent to VMware Aria exists in Canonical's product portfolio. However, most of these functionalities can be either found directly in Juju (Canonical's open source orchestration engine) or can be achieved through a smooth integration with a tested and validated third-party software.

Security

Advanced security features, such as vulnerability scans, hardening or certified crypto modules, can be found in a handful of VMware components. On the Canonical side, all extra security advantages are available under a single, comprehensive subscription - Ubuntu Pro.

Telco

A bunch of additional services, such as Telco Cloud Automation, for example, exist exclusively for telco customers in the VMware product portfolio. This is not any different on the Canonical side. Private mobile networks based on Magma and OpenRAN are just examples of Canonical's solutions dedicated to service providers.

Edge and IoT

Likewise, specialised services exist on the VMware side to cover edge and IoT use cases. Canonical is also very much present in this space, offering a full gamut of products and services targeted towards the edge and IoT.

Additional capabilities of an Ubuntu-based infrastructure

In contrast to the previous section, migrating to an Ubuntu-based infrastructure unlocks an array of additional capabilities that do not exist in VMware's world at all. Those result from OpenStack's built-in cloud computing principles as well as Canonical's tooling for infrastructure delivery and operations.

Bare metal automation

Canonical OpenStack deployments are fully automated from the bottom up. This applies to all layers of the stack, including bare metal. Canonical enables bare metal automation with Metal-as-a-Service (MAAS), a super fast server provisioning tool. Thanks to MAAS, data centre engineers no longer need to provision hypervisors manually, which saves them a lot of time and energy during the initial deployment phase and when scaling the cluster out.

Cloud-native storage concepts

OpenStack uses cloud-native storage concepts by default, making it an ideal candidate for hosting the software of today and tomorrow. While traditional, monolithic applications can benefit from standard block storage capabilities as those provided by VMware VMDK Virtual Disks, modern applications can also use ephemeral storage and object storage concepts for a full cloud-native experience. All storage types are backed by Ceph by default for high availability and data durability.

On-demand Kubernetes clusters with an optional Kata runtime

Kubernetes is, without a doubt, the de facto standard for running modern cloud-native applications. Therefore, getting a fully functional Kubernetes cluster up and running on top of the cloud platform is a priority for cloud engineers. Canonical makes it simple by enabling an on-demand Kubernetes cluster

provisioning functionality, addressing the multi-tenancy concern. As a result, each user of the cloud can spin up their own K8s cluster quickly and decommission it when no longer needed. An optional Kata runtime can be used for better resource isolation and enhanced security.

SaaS extensions

Likewise, Canonical OpenStack users can also benefit from various types of SaaS extensions. This enables them to quickly provision on-demand not just VMs, not just K8s clusters, but even whole production-ready applications, such as Kubeflow MLOps frameworks, Apache Kafka clusters and data fabrics.

MAAS automatically discovers all physical machines available on the network, configures them and enables on-demand provisioning with an operating system (OS) of your choice, effectively turning your data centre into a bare metal cloud.

Juju is an open source orchestration engine that enables the deployment, integration and lifecycle management of applications at any scale, on any infrastructure.

Get started with OpenStack

A successful migration from VMware to OpenStack is a multi-stage process that usually starts with evaluating the capabilities of the target platform through real hands-on experience. This is why getting started with OpenStack quickly is essential in every project like that. In order to help engineers break the ice with the world's leading open source cloud platform, Canonical maintains a dedicated project - Sunbeam - which serves as an entry point and provides a full set of professional services for bigger and more demanding customers. Both options are fully supported and suitable for production, depending on the exact needs.

Self-deployed OpenStack

With the Sunbeam project, organisations can deploy OpenStack themselves. Since OpenStack is entirely open source, businesses can use it free of charge for testing and experimentation purposes. No licence is required to get started. In turn, an optional, paid Ubuntu Pro subscription can later be attached for expanded security maintenance and full commercial 24/7 phone/ticket support from Canonical. This option is most suitable for small organisations that can't afford to spend money on costly professional services.

In order to bootstrap a simple single-node OpenStack installation, grab a fresh physical or virtual machine with 4+ core amd64 CPU, 16 GB of RAM, 50 GB of storage and the latest Ubuntu Server LTS installed. Then follow the short instructions below.

Install OpenStack

In order to install OpenStack, execute the following command:

```
$ sudo snap install openstack
```

Install dependencies

In order to install all necessary dependencies, execute the following command:

```
$ sunbeam prepare-node-script | bash -x && newgrp snap_daemon
```

Bootstrap the cloud

In order to bootstrap the cloud, execute the following command:

```
$ sunbeam cluster bootstrap --accept-defaults
```

This command takes a while to finish. Be patient.

Configure the cloud

In order to configure the cloud with default options, execute the following command:

```
$ sunbeam configure --accept-defaults --openrc demo-openrc
```

For more advanced scenarios, refer to guided installation instructions.

Launch a VM

In order to launch your first VM, execute the following command:

```
$ sunbeam launch ubuntu --name test
```

Sample output:

```
Access instance with `ssh -i /home/ubuntu/.config/openstack/sunbeam
ubuntu@10.20.20.16`
```

At this point, the VM should be accessible over the SSH protocol. In order to connect to it, execute the command from the output:

```
$ ssh -i /home/ubuntu/.config/openstack/sunbeam ubuntu@10.20.20.16
```

That's it. You're connected to the VM. You can use regular shell commands to execute various tasks.

```
$ uptime
11:08:36 up 2 min,  1 users,  load average: 0.05, 0.05, 0.01
```

For more information about Canonical OpenStack, refer to the "Learn more" section of this paper.

Enable Ubuntu Pro

An optional Ubuntu Pro subscription can be further attached to your newly installed OpenStack cloud to benefit from full commercial support by Canonical.

In order to enable the Ubuntu Pro plugin, execute the following command:

```
$ sunbeam enable pro --token <ubuntu pro token>
```

Ubuntu Pro is an optional enterprise subscription for Ubuntu that covers all layers of the infrastructure, including ten years of security updates, phone and ticket support, production-grade service level agreements (SLAs) and regulatory compliance programmes.

OpenStack Fundamentals and **OpenStack Operations** are multi-day hands-on courses for up to 15 people that provide the best introduction for setting up and operating Canonical OpenStack in production.

Canonical-deployed OpenStack

Alternatively, businesses can rely on Canonical's professional services to get their first OpenStack proof-of-concept (PoC) environment delivered. This option is most relevant for governments, telcos, companies in the energy sector, factories, banks and big enterprises planning to migrate large VMware estates, seeking guidance and ongoing support throughout all stages of the migration process. Moreover, Canonical partners with global system integrators (GSIs) and independent software vendors (ISVs) who provide software and services required to perform a seamless migration.

One more option to consider that is not natively available in the VMware vSphere offering is a fully-managed cloud service. With this option, Canonical not only takes care of the initial OpenStack design and delivery but also handles its ongoing operations and maintenance tasks. Fully-managed cloud service can significantly accelerate the time-to-market and help to bypass any shortcomings resulting from the lack of knowledge and experience with OpenStack. Customers can transfer out on demand at any time once they gain the required skills to operate Canonical OpenStack themselves.

Private Cloud Build (PCB) and **PCB Plus** are fixed-price consultancy packages for OpenStack implementation on reference architecture and certified hardware, including cloud design and delivery, on-prem workshops, workload analysis and migration plans.

Managed OpenStack is a fully-managed cloud service, including cloud monitoring, maintenance, daily operations, incident and problem resolution, software updates and OpenStack upgrades that enable organisations to fully outsource the management of their OpenStack.

Conclusions

The migration from VMware to OpenStack is by no means a trivial task. However, when managed well, it can result in tangible economic benefits. All of that results from the open source nature of OpenStack, which comes with no hidden licence costs. Even though the presented model indicates a TCO reduction of 40%, organisations should run such calculations themselves, taking all CapEx and OpEx costs into account, and always make a decision that makes the most sense from an economic standpoint.

What matters most when it comes to infrastructure modernisation is to minimise any potential impact on the business. In the case of platform migration, this translates to preserving the existing functionality to avoid any downtimes and costly re-architecture of applications. Fortunately, in most cases, equivalents of certain VMware components and features exist in the Canonical OpenStack ecosystem, enabling smooth lift-and-shift migration while unlocking an array of additional capabilities at the same time.

Learn more

- Learn OpenStack through a series of tutorials for beginners. Explore how to use OpenStack for cloud infrastructure implementation purposes, from a single-node installation to large-scale clusters.
- Explore Sunbeam - a new upstream project created to set the foundations for the next-generation OpenStack, designed based on cloud-native principles to deliver smooth installation and operational experience.
- Get in touch with Canonical experts.

References

1. https://www.gartner.com/en/newsroom/press-releases/2022-02-09-gartner-says-more-than-half-of-enterprise-it-spending
2. https://ubuntu.com/engage/kadokawa-connected-case-study-charmed-openstack
3. https://ubuntu.com/engage/dell-openstack-reference-architecture

Appendix - Feature parity matrix

The following section outlines key components, services and features of the VMware vSphere suite compared to Canonical OpenStack and its ecosystem according to the VMware vSphere datasheet from August 2023.

DevOps services

VMware vSphere	Canonical OpenStack and its ecosystem
Tanzu Kubernetes Grid Service	Canonical Kubernetes
Tanzu Integrated Services	Canonical Juju
Tanzu Mission Control Essentials	Third-party multi-site Kubernetes management solutions
Cloud Consumption Interface	Canonical OpenStack
vSphere Pod Service	Canonical Kubernetes with Kata runtime
Storage Service	Ceph
Network Service	OpenStack Neutron and Octavia services
Container Registry Service	Kubernetes' private container registry functionality
VM Registry Service	OpenStack Glance service
Network Load Balancing	OpenStack Octavia service
VM Service	KubeVirt
Workload Availability Zones	Kubernetes' availability zone functionality
Simplified TKG cluster lifecycle management	Canonical Juju and Kubernetes Charms
TKG cluster package management	Canonical Juju and Kubernetes Charms
Customizable base OS images	Cloud-init, Canonical Juju and Charms

Simplified operations

VMware vSphere	Canonical OpenStack and its ecosystem
Next-Gen Infrastructure Image Management	Canonical MAAS, Canonical Juju and OpenStack Charms
vCenter Server Profiles	Canonical Juju and OpenStack Charms
vCenter Server Update Planner	Canonical Juju and OpenStack Charms
Content Library	OpenStack Glance service
Configuration Profiles	Canonical MAAS, Canonical Juju and OpenStack Charms
Distributed Switch	OVN
Host Profiles and Auto Deploy	Canonical MAAS, Canonical Juju and OpenStack Charms
Virtual Volumes	OpenStack Cinder service
Green Metrics	Third-party power consumption visualisation solutions

Built-in security

VMware vSphere	Canonical OpenStack and its ecosystem
Identity federation with Microsoft Entra ID (formerly Azure AD), ADFS and Okta	OpenStack Keystone service with OpenID and SAML authentication federation
vSphere Trust Authority	Not available
TPM 2.0 Support & Virtual TPM	OpenStack's vTPM functionality
FIPS 140-2 Compliance & TLS 1.2 Support	Ubuntu Pro
Virtual Machine Encryption	Ceph's native functionality
Support for MSFT VBS	Not available
Per-VM Enhanced vMotion Compatibility	OpenStack's live migration
Instant Clone	Not available
Simplified NSX Security Setup from vSphere Client	Canonical Juju and OVN Charms

Application performance

VMware vSphere	Canonical OpenStack and its ecosystem
NVIDIA AI-Ready Enterprise Platform	Charmed Kubeflow
Distributed Resource Scheduler (DRS)	OpenStack's availability zones
Storage DRS	Ceph's native functionality
Distributed Power Management (DPM)	OpenStack Watcher service
Storage Policy-Based Management	OpenStack Cinder service's native functionality
I/O Controls (Network and Storage)	OpenStack's native functionality
Single Root I/O Virtualization (SR-IOV) Support	OpenStack's SR-IOV functionality
vSphere Persistent Memory	OpenStack's vPMEM feature
NVIDIA GRID vGPU	OpenStack's vGPU functionality
Proactive HA	Not available
Accelerated Graphics for Virtual Machines	OpenStack's GPU passthrough or vGPU functionality
Dynamic DirectPath IO	OpenStack's PCI passthrough functionality
vSphere on DPUs (VMware vSphere Distributed Services Engine)	OVN with hardware offload to SmartNICs and DPUs
Vendor Device Group	NVIDIA NVLink and NVSwitch functionality *

Business continuity

VMware vSphere	Canonical OpenStack and its ecosystem
vSphere Hypervisor	KVM
vMotion	OpenStack's live migration
vSMP	KVM's native functionality
High Availability (HA)	OpenStack Masakari service
Storage vMotion	OpenStack's block live migration
Fault Tolerance	Not available
vShield Endpoint	Not available
vSphere Replication	Ceph's native functionality
Support for 4K Native Storage	Ceph's native functionality
vSphere Quick Boot	Canonical Livepatch
vCenter High Availability	OpenStack's native functionality
vCenter Backup and Restore	Canonical OpenStack's native functionality
vCenter Server Appliance Migration	Not applicable

Hybrid cloud capabilities

VMware vSphere	Canonical OpenStack and its ecosystem
vCenter Hybrid Linked Mode	Not applicable
Cross vCenter Mixed Version Provisioning	Not applicable
Hot and Cold Migration to the Cloud	Third-party migration-as-a-service solutions
Per VM Enhanced vMotion Compatibility	OpenStack's live migration

Additional components (not mentioned in the datasheet)

VMware vSphere	Canonical OpenStack and its ecosystem
vSphere	OpenStack Horizon service
vCenter Server	OpenStack Nova service
vSAN	Ceph
NSX	OVN
NSX Advanced Load Balancer	OpenStack Octavia
VM anti-affinity rules	OpenStack's server groups
VM-Host anti-affinity rules	OpenStack's host aggregates
vSphere Storage APIs	Third-party storage solutions
vSphere Native Key Provider	OpenStack Barbican service
Templates	OpenStack Heat service
Web Console	OpenStack's native feature
Granular RBAC	OpenStack's native feature

** - not supported in Canonical OpenStack at the time of writing this whitepaper.*

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