



Migrating from VMware to OpenNebula

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Abstract

Migrating a cloud deployment requires careful planning, execution, and consideration of various factors. A migration typically includes tasks such as assessing existing infrastructure and workloads, evaluating compatibility and interoperability between platforms, and developing a migration plan that minimizes disruption to operations. Additionally, data migration, application compatibility, and networking considerations are essential aspects of the migration process.

By leveraging best migration practices, OpenNebula can guide organizations to successfully transition from a VMware environment to an OpenNebula cloud ecosystem, unlocking benefits such as increased flexibility and technology agnosticism, helping them to avoid vendor lock-in, and achieving cost savings and scalability for their cloud infrastructure.

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Glossary

| | |
|-------|---|
| AD | Active Directory |
| CMDB | Configuration Management Database |
| CPU | Central Processing Unit |
| DC | Datacenter |
| DPDK | Data Plane Development Kit |
| GPU | Graphics Processing Unit |
| HA | High Availability |
| HCI | Hyper Converged Infrastructure |
| LUN | Logical Unit Number |
| NAS | Network Attached Storage |
| NFS | Network File System |
| NIC | Network Interface Card |
| NUMA | Non-Uniform Memory Access |
| RADOS | Reliable Autonomic Distributed Object Storage |
| SAN | Storage Area Network |
| VDC | Virtual Datacenter |
| VM | Virtual Machine |
| VNC | Virtual Network Computing |
| VNF | Virtual Network Functions |

1. What is OpenNebula?

OpenNebula¹ is a simple, but powerful, open source solution to build and manage Enterprise Clouds and Edge environments. It combines existing virtualization technologies with advanced features for multi-tenancy, automatic provision, and elasticity to offer on-demand applications and services. OpenNebula provides a single, feature-rich and flexible platform with **unified management of IT infrastructure and applications that avoids vendor lock-in and reduces complexity, resource consumption and operational costs.** OpenNebula manages:

- **Any Application:** Combine containerized applications from Kubernetes with Virtual Machine workloads in a common shared environment to offer the best of both worlds: mature virtualization technology and orchestration of application containers.
- **Any Infrastructure:** Open cloud architecture to orchestrate compute, storage, and networking driven by software.
- **Any Cloud:** Unlock the power of a true hybrid, edge and multi-cloud platform by combining your private cloud with infrastructure resources from third-party virtual and bare-metal cloud providers such as AWS and Equinix Metal, and manage all cloud operations under a single control panel and interoperable layer.
- **Any Time:** Add and remove new clusters automatically in order to meet peaks in demand, or to implement fault tolerance strategies or latency requirements.

Have a look at our [Case Studies](#) and [Success Stories](#) to learn more from our users and customers about how they are putting OpenNebula to work.

2. How to Transition Your Cloud to OpenNebula

Migrating a cloud environment from one platform to another can be a complex and very challenging endeavor. Compatibility issues may arise due to differences in infrastructure, services, and configurations between the source and target platforms. Adapting existing applications, data, and workflows to fit the new environment—at the same time ensuring compatibility with dependencies and integrations—requires meticulous planning and execution.

OpenNebula offers a comprehensive set of tools and services to guide you in the process of adapting OpenNebula Cloud Orchestration software to your migration project. OpenNebula has developed [OneSwap](#), a migration tool designed to provide a smooth VM Migration path from vCenter to OpenNebula KVM. OneSwap has been used in the field with a 96% success rate in converting VMs automatically, simplifying and speeding up the migration process.

Moreover, OpenNebula has recently launched its [VMware Migration Service](#), a complete, exhaustive guidance and support offering conceived to help organizations define and execute their migration plan, adapting to each specific case and minimizing disruption to business operations. OpenNebula's highly skilled cross-functional team can guide you through the migration by leveraging expertise in cloud architecture and VMWare deployments, applying a combined set of migration strategies, methodologies and tools to navigate the complexities and effectively overcome the challenges to a successful migration.

¹ <https://support.opennebula.pro/hc/en-us/articles/360036935791-OpenNebula-Overview-Datasheet>

2.1. Virtual Machine Operations

In a cloud infrastructure, virtual machine operations are essential for efficiently managing and maintaining the virtualized environment. These operations include tasks such as provisioning virtual machines, which involves creating instances of virtual machines from predefined templates or images. OpenNebula enables cloud administrators to perform tasks such as starting, stopping, pausing, and restarting virtual machines to manage their lifecycle according to workload requirements.

OpenNebula's capabilities for machine monitoring address another critical aspect: the need for continuous tracking of performance metrics—such as CPU and memory usage, disk I/O and network traffic—in order to ensure optimal performance and allocation of resources. Tasks like resizing virtual machines, adjusting resource allocation, managing snapshots, and performing cold or live migrations of virtual machines between hosts, are carried out to optimize the use of available resources, enhance scalability, and maintain high-availability workloads.

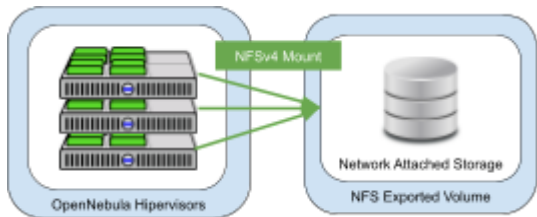
| VMware Setup | OpenNebula Setup | OpenNebula Features |
|---|---|--|
| VMware Resource Management and Monitoring | OpenNebula VM Management and Monitoring | Stateless and Persistent VM deployments are supported. Complete VM Life Cycle states and fail-over recovery. Full VM built-in monitoring and Prometheus exporter |
| VMware vMotion | VM Advanced Ops | Cold and Live migrations, snapshots, cloning, and thin provisioning are available |
| Guest VM OS Interaction | OpenNebula FireEdge VNC Console | Securely accessing and managing a guest's operating system running within the VM |
| VMware Tools | OpenNebula Contextualization | VM contextualization scripts are available for Linux, Windows and FreeBSD |

2.2. Storage

As organizations seek to migrate from VMware to OpenNebula, they encounter a variety of VMware storage setups, each posing its own challenges and demands. However, OpenNebula offers a world of storage solutions, which together comprise a robust response to these diverse VMware configurations. What sets OpenNebula apart is its comprehensive array of storage scheduling policies, which empower administrators with fine-grained control over resource allocation.

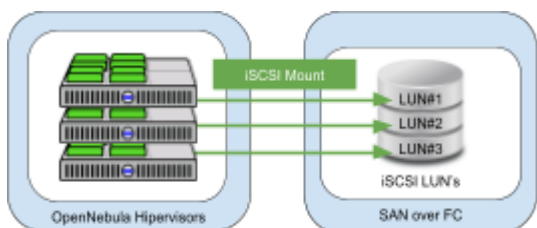
OpenNebula allows assigning multiple datastores to each cluster, fostering flexibility and scalability. This makes it possible to create separate storage tiers, which can be conveniently assigned to different tenants and simultaneously consumed by Virtual Machines.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|--------------|--------------------------------|--|
| NAS over NFS | NAS datastores | Hypervisor hosts will mount one (or more) shared volumes located on a NAS (Network Attached Storage) server over NFS. OpenNebula shared drivers with qcow2 image format support provide full storage functionalities, including |



Host High Availability, cold and live migration, VM system snapshots, and thin provisioning.

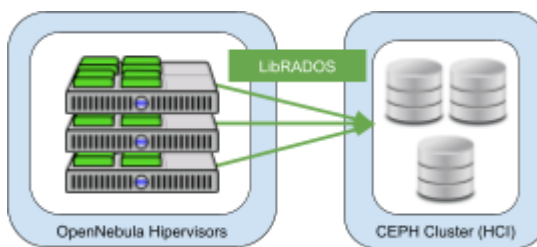
SAN over FC **iSCSI Local Storage**



Hypervisor hosts will locally mount an independent LUN device exported by SAN using the iSCSI protocol. OpenNebula local storage drivers with qcow2 image format support provide full storage functionalities, including cold/live migration, system snapshots, and thin provisioning.

* Host High Availability is not available

VSAN **Ceph datastores, using dedicated HW or HCI**



Hypervisor hosts will use the CEPH RADOS protocol to access the VM disk images stored in a CEPH Cluster (deployed in a dedicated HW or in a HCI configuration). CEPH Datastores provide excellent redundancy and resilience, avoiding a single point of failure. Additionally, OpenNebula CEPH datastore drivers provide full storage functionalities, including Host High Availability, cold and live migration, disk image snapshots, and thin provisioning.

* VM system snapshots are not available

2.3. Networking

Cloud network operations are essential for ensuring seamless communication and connectivity within the cloud infrastructure and services. These operations play a crucial role in ensuring reliable, secure, and high-performance connectivity in cloud environments.

OpenNebula network operations encompass feature-rich tasks conceived for configuring, managing, and optimizing network resources for a cloud deployment: assigning and managing IP subnets and addresses, configuring virtual networks and adapters, and setting up policies for traffic shaping and Quality of Service (QoS), which in turn serve to monitor, prioritize and distribute network traffic, and to manage firewall rules in order to establish secure and efficient network connections for virtual machines and cloud deployments.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|-----------------|--|---|
| VMware dvSwitch | VLAN 802.1Q Networks VxLAN Networks OpenvSwitch Networks | Network isolation is provided for each OpenNebula Virtual Network by creating a Linux bridge and attaching it to a VLAN/VxLAN tagged network interface. The OpenvSwitch network driver provides network isolation using VLANs and basic network filtering using OpenFlow. |

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| VMware NSX-T NSX-V | OpenNebula VNF app OpenNebula Security Groups | The OpenNebula VNF app solves most common use cases in Virtual Network management, such as: Keepalive, Failover and High-Availability for VNF apps; IPv4 Routing functions and SNAT+DNAT IPv4 features; HAProxy for robust layer4 (TCP) reverse-proxy and load-balancing; DNS server and recursor; and DHCP4 services. OpenNebula Security Groups provide fine-grained firewall rules to control Inbound/Outbound network traffic for Virtual Networks and VM instances. |
|-----------------------|--|--|

2.4. Authorization and Access Control

In a cloud infrastructure, authorization and access control operations involve implementing policies and mechanisms to manage user access and permissions effectively. Cloud administrators define user roles and privileges, specifying who can access which resources and perform which specific actions within the cloud environment.

OpenNebula enables the use of fine-grained Access Control Policies—based on attributes such as user roles, groups, or resources—to enforce least-privilege principles and limit access to sensitive data and critical resources. Robust and efficient authorization and access control operations are essential for maintaining the confidentiality, integrity, and availability of resources in a cloud infrastructure.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|----------------------|--|---|
| Active Directory | LDAP Authentication Active Directory | OpenNebula Active Directory allows centralized authentication and group mapping. |
| Quotas Resource Pool | Quota Control | User and Group quotas for system resources allow the system administrator to set limits on cloud resources usage. |

2.5. Capacity Planning

In a cloud infrastructure, capacity planning entails the strategic management of resources in order to efficiently meet current and future demands. This is achieved by assessing existing resources and adapting cloud deployments on the basis of usage patterns and resource consumption. With this information, organizations can develop scaling strategies to handle service fluctuations on demand, balancing performance and cost considerations. Continuous monitoring of resource utilization and performance metrics is crucial for identifying bottlenecks, optimizing resource allocation and provisioning tools to enable rapid deployment of resources, enhancing agility and scalability. An efficient capacity planning ensures that cloud infrastructure meets Service Level Agreements (SLAs) for performance, availability, and reliability in order to guarantee business continuity.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|-----------------------------|---|---|
| vSphere Resource Monitoring | OpenNebula Monitoring and Alerting Services | Built-in VM, hypervisor, and virtual network monitoring Prometheus and Alerting exporters and Grafana dashboards , to visualize Virtual Machine and Host information and the overall status of the OpenNebula |

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| | | cloud. By using Prometheus Alert Manager , it is possible to supervise OpenNebula Cloud Services and establish alerts based on cloud resource metrics. |
| VM Deployment | OpenNebula Scheduler | During initial deployment, OpenNebula Scheduler ranks available resources (compute, hosts, datastores, and virtual networks) to balance cloud infrastructure. |
| Affinity and Anti-Affinity Rules | OpenNebula VM Groups and VM Roles | Through VM Groups and VM Roles, it is possible to assign affinity or anti-affinity rules based on compute resources and/or service constraints, to ensure SLA compliance and cloud availability. |
| vSphere AutoScaler | OpenNebula OneFlow | OneFlow orchestrates multi-VM services to enable elasticity and service-aware deployments based on VM Roles and fine-grained customizable scale conditions, through OneGate VM Host communication. |
| Quotas Resource Pool | Quota Control Use cgroups & vCPU | User and Group quotas for system resources allow the system administrator to set limits on cloud resources usage. OpenNebula will compute the shares assigned to the Virtual Machine using Linux <i>cgroups</i> , in order to control usage of compute resources in the hypervisor. |

2.6. Backups

Backup strategies in cloud environments are essential for ensuring the safety, availability, and integrity of data and services. Designing backup strategies involves identifying critical data, determining backup frequency, and selecting appropriate methods such as full, incremental, or differential backups. By implementing robust backup strategies tailored to their needs, organizations can minimize data loss, mitigate risks, and maintain business continuity in cloud environments.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|--------------|---|--|
| Veeam | OpenNebula Restic Veeam Agent on Guest | OpenNebula Restic is an open source (BSD 2-Clause License) backup tool designed for speed, security and efficiency. Restic offers interesting features for backup storage such as deduplication, efficient compression, and backup I/O Throttling to reduce backup execution impact on the hypervisor. Single or multiple VM backup jobs are supported, to provide customizable backup policies. |

2.7. Container Management

OpenNebula offers a comprehensive platform designed to simplify the deployment, operation, and scaling of containerized applications across hybrid cloud environments.

By integrating Kubernetes orchestration capabilities with OpenNebula cloud orchestration and management tools, OpenNebula KE enables organizations to streamline the container life cycle, from development to production. It provides tools for deploying and managing Kubernetes clusters, automating container deployment and scaling, and implementing consistent security and compliance policies.

OpenNebula KE also facilitates seamless integration with existing infrastructure, allowing organizations to leverage their investments in virtualization while embracing modern container technologies.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|--------------|---------------------------------|--|
| Tanzu | OneKE Appliance | OpenNebula supports managing multi-cluster Kubernetes through the OpenNebula Kubernetes Engine. Additionally, OneKE coupled with the OneProvision engine allows managing several Kubernetes clusters in different locations, using a single OpenNebula instance. |

2.8. Elasticity

In cloud environments, elasticity allows dynamic upscaling or downscaling of computing resources in response to changing workload demands. OpenNebula's elasticity features allow organizations to efficiently allocate resources based on current requirements, optimizing performance and cost-effectiveness. By automatically provisioning or deallocating resources as needed, elasticity enables cloud infrastructures to handle sudden spikes in traffic or workload, without the need for manual intervention.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|--------------------------------------|--|---|
| VMware Cloud on AWS VMware Engine | OpenNebula Provision | OpenNebula Provision provides an out-of-the-box, comprehensive bare-metal provisioning mechanism by fully automating the life cycle of OpenNebula clusters using on-prem hardware and bare-metal offerings of various different cloud/edge infrastructure providers. |
| vSphere Auto Scaling | OpenNebula OneFlow OpenNebula OneGate | Based on customizable metrics, OneFlow orchestrates multi-VM services as a whole, providing elastic service-aware cloud deployments capable of scaling on demand. The OneGate service allows Virtual Machines (and therefore OneFlow Services) to pull and push customized information and metrics from/to OpenNebula in order to scale automatically. |

2.9. Resource Organization

Resource organization involves structuring and managing cloud resources such as virtual machines, storage, or networking components into logical groups, on the basis of factors such as department, project, or function. Organizing resources simplifies their allocation, monitoring, and access control, enhancing visibility and control over the environment. Additionally, cloud administrators can manage compute

resources by defining resource pools and using categories such as clusters, data centers and zones, allowing for efficient resource usage and workload distribution.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|--------------|--|--|
| Folders | OpenNebula Labels | OpenNebula Labels enables the possibility of grouping different resources under a given label and filtering them in the Sunstone web interface. The user can easily find templates or select a set of resources to apply a given action. |
| DataCenters | OpenNebula Zones | The OpenNebula Federation is a tightly-coupled integration of several instances of OpenNebula Front-ends, each called a "Zone." Each Zone shares the same configuration for user accounts, groups, and permissions. OpenNebula Federation allows end users to consume the resources no matter where they are, with seamless integration. |
| Profiles | Cloud Access Model and Roles | OpenNebula offers a flexible and powerful cloud provisioning model to efficiently isolate resources for medium and large deployments. OpenNebula's Virtual Data Centers (VDCs) model enables an integrated, comprehensive framework to dynamically provision infrastructure resources in large multi-datacenter and multi-cloud environments to different customers, business units, or groups. |

2.10. Datacenter Components Integration

OpenNebula enables datacenter components integration in cloud deployments, incorporating various tools and systems such as firewalls, Configuration Management Databases (CMDBs), and billing platforms into the cloud infrastructure.

By integrating these components, organizations can enhance security, streamline operations, and optimize resource management.

| VMware Setup | OpenNebula Setup | OpenNebula Features |
|---|---|---|
| NVIDIA GPUs | OpenNebula NVIDIA GPU Support | OpenNebula supports GPU-based workloads on your instances by managing virtual GPU (vGPU) resources according to the available physical GPU devices and the hypervisor type. |
| NUMA Awareness, CPU Passthrough and CPU pinning HugePages | NUMA Awareness CPU Passthrough CPU Pinning HugePages | OpenNebula offers a great deal of flexibility to define virtual NUMA topologies and map them to the physical configuration of the host, including several pinning policies and support for asymmetric configurations. |

| | | |
|-----------------|--|---|
| | | Additionally, OpenNebula enables the use of memory pages larger than the standard size. |
| vSphere DPDK | OpenNebula DPDK | OpenNebula will create and configure OpenvSwitch bridges and ports in combination with NUMA+Hugepages. |
| PCI Passthrough | OpenNebula PCI Passthrough | OpenNebula tracks and allocates devices to guests, and also allows admins to select which devices can be hotplugged. Network devices are also integrated with the Network stack, allowing guests to identify passthrough devices. |
| CMDB | OpenNebula Hooks | The OpenNebula Hook subsystem enables the execution of custom scripts tied to a change in state of a particular resource or API call. For systems administrators, this opens a wide spectrum of integrations, enabling them to tie OpenNebula events to API-capable third-party CMDB solutions and to further tailor their cloud infrastructures. |
| Billing | WHMCS Tenants Module | WHMCS is a web host billing automation platform which can be configured for many uses. OpenNebula provides a WHMCS Module that allows you to automate the creation and management of Users, Groups, and their ACLs within OpenNebula, and also provides billing based on their usage metrics. |

3. Summary

Building clouds with OpenNebula can bring **significant economic benefits** to any enterprise by improving both infrastructure flexibility and business agility. This flexibility, coupled with the **open-source nature of OpenNebula**, translates to **lower costs** compared to VMware's licensed solutions, making OpenNebula an attractive option for organizations aiming to optimize their IT budget.

OpenNebula provides the most in-demand management features to build clouds for companies and service providers, matching the features offered by vCloud Director and vRealize at a fraction of the cost. **OpenNebula's vendor-neutral approach** supports a wide range of hypervisors and storage technologies as well as advanced networking solutions and topologies. **This allows your organization to leverage existing investments**, choose the best technologies for a **successful migration from VMware**, and **avoid present and future vendor lock-in**, granting you greater control over the infrastructure and strengthening the negotiating position of your company. Moreover, OpenNebula's extensive capabilities for integration offer your organization the ability to comprehensively tailor cloud infrastructure to specific needs—without the constraints imposed by proprietary systems—enabling seamless integration with existing IT services, systems and tools.

OpenNebula's user-friendly and customizable cloud views make it easily accessible for users with heterogeneous levels of expertise, from regular cloud users to expert cloud administrators. Additionally, OpenNebula's **comprehensive documentation** reduces the learning curve associated with adopting new technologies, and its **robust APIs and SDKs facilitate automation and integration** with third-party applications and services, further enhancing its versatility and extensibility.

4. Value of an OpenNebula Subscription

An annual OpenNebula subscription opens the gate to stability and excellence within your OpenNebula infrastructure. For starters, subscribers to OpenNebula's Enterprise Edition gain access to the Enterprise repository and Tools, as well as the Enterprise Portal and the exclusive contents of its Knowledge Base. On top of this, Standard and Premium Plans offer the assurance and security of counting on OpenNebula experts, who provide support for your solution according to SLA guidelines. Enterprise Subscriptions provide expert advisory and support for integration and production on supported platforms, and include:

- ✓ Answering questions about migration best practices and product usage and integration
- ✓ Offering tips on best suitable available features and how to adapt to missing features
- ✓ Guidance on tuning for optimal and scalable performance in your migrated environment
- ✓ Solving unexpected problems when using, installing, configuring, or deploying the software
- ✓ Problem diagnosis, resolution, and bug fixing

Customers with an active subscription can rebrand the OpenNebula graphical interface to include their company logo or use the OpenNebula Powered logo to help users quickly identify cloud infrastructures that are powered by OpenNebula and supported by OpenNebula Systems.

5. Ready for a Test Drive?

You can evaluate OpenNebula and build a cloud in just a few minutes by using [miniONE](#), our deployment tool for quickly installing an OpenNebula Front-end inside a Virtual Machine or a physical host, which you can then use to easily add resources such as remote clusters based on KVM, Virtual Machines and Kubernetes Clusters, on multiple cloud providers.

miniONE

LET US HELP YOU DESIGN, BUILD, AND OPERATE YOUR CLOUD



CONSULTING & ENGINEERING

Our experts will help you design, integrate, build, and operate an OpenNebula cloud infrastructure



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