OpenNebula 5.0 Introduction and Release Notes

Release 5.0.0

OpenNebula Systems

Jun 15, 2016

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CHAPTER

ONE

CONCEPTS AND TERMINOLOGY

1.1 Start Here: OpenNebula Overview

Welcome to OpenNebula documentation!

OpenNebula is an open-source management platform to build IaaS private, public and hybrid clouds. Installing a cloud from scratch could be a complex process, in the sense that many components and concepts are involved. The degree of familiarity with these concepts (system administration, infrastructure planning, virtualization management...) will determine the difficulty of the installation process.

If you are new to OpenNebula you should go through this short introduction before proceeding to the deployment and administration guides.

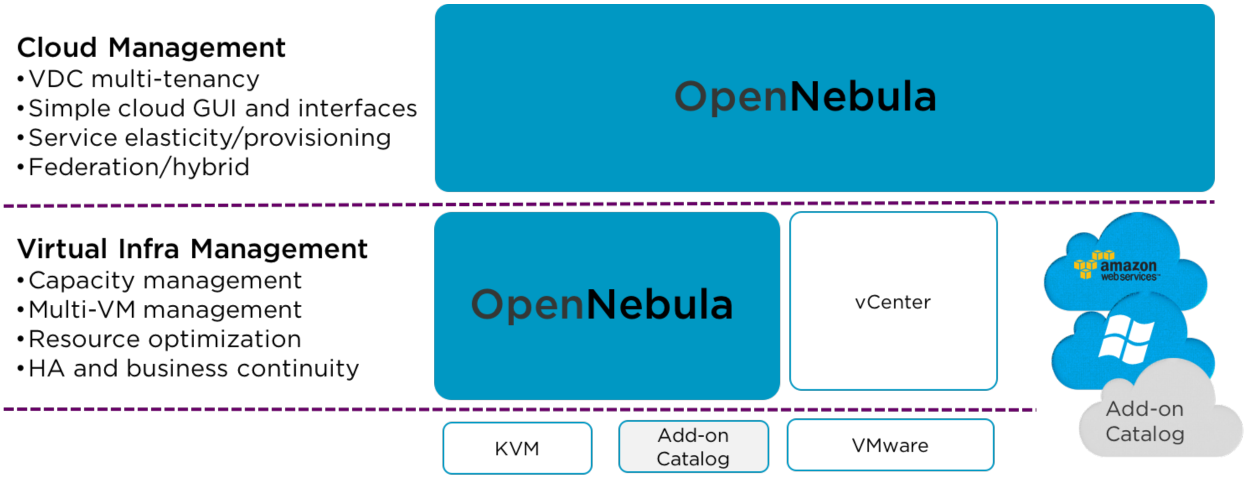
1.1.1 Step 1. Choose Your Hypervisor

The first step is to decide on the hypervisor that you will use in your cloud infrastructure. The main OpenNebula distribution provides full support for the two most widely used hypervisors, KVM and VMware (through vCenter), at different levels of functionality.

- **Virtualization and Cloud Management on KVM**. Many companies use OpenNebula to manage data center virtualization, consolidate servers, and integrate existing IT assets for computing, storage, and networking. In this deployment model, OpenNebula directly integrates with KVM and has complete control over virtual and physical resources, providing advanced features for capacity management, resource optimization, high availability and business continuity. Some of these deployments additionally use OpenNebula's **Cloud Management and Provisioning** features when they want to federate data centers, implement cloudbursting, or offer self-service portals for end users.
- **Cloud Management on VMware vCenter**. Other companies use OpenNebula to provide a multi-tenant, cloud-like provisioning layer on top of VMware vCenter. These deployments are looking for provisioning, elasticity and multi-tenancy cloud features like virtual data centers provisioning, datacenter federation or hybrid cloud computing to connect in-house infrastructures with public clouds, while the infrastructure is managed by already familiar tools for infrastructure management and operation, such as vSphere and vCenter Operations Manager.

After having installed the cloud with one hypervisor you may add another hypervisors. You can deploy heterogeneous multi-hypervisor environments managed by a single OpenNebula instance. An advantage of using OpenNebula on VMware is the strategic path to openness as companies move beyond virtualization toward a private cloud. OpenNebula can leverage existing VMware infrastructure, protecting IT investments, and at the same time gradually integrate other open-source hypervisors, therefore avoiding future vendor lock-in and strengthening the negotiating position of the company.

There are other virtualization technologies, like LXC or Xen, supported by the community. Please refer to the OpenNebula Add-ons Catalog.



1.1.2 Step 2. Design and Install the Cloud

2.1. Design the Cloud Architecture

In order to get the most out of a OpenNebula Cloud, we recommend that you create a plan with the features, performance, scalability, and high availability characteristics you want in your deployment. We have prepared **Cloud Architecture Design guides** for KVM and vCenter to help you plan an OpenNebula installation, so you can easily architect your deployment and understand the technologies involved in the management of virtualized resources and their relationship. These guides have been created from the collective information and experiences from hundreds of users and cloud client engagements. Besides main logical components and interrelationships, this guides document software products, configurations, and requirements of infrastructure platforms recommended for a smooth OpenNebula installation.

2.2. Install the Front-end

Next step is the **installation of OpenNebula in the cloud front-end**. This installation process is the same for any underlying hypervisor.

Optionally you can setup a high available cluster for OpenNebula for OpenNebula to reduce downtime of core OpenNebula services, and configure a MySQL backend as an alternative to the default Sqlite backend if you are planning a large-scale infrastructure.

2.3. Install the Virtualization hosts

Now you are ready to **add the virtualization nodes**. The OpenNebula packages bring support for KVM and vCenter nodes. In the case of vCenter, a host represents a vCenter cluster with all its ESX hosts. You can add different hypervisors to the same OpenNebula instance, or any other virtualization technology, like LXC or Xen, supported by the community. Please refer to the OpenNebula Add-ons Catalog.

1.1.3 Step 3. Set-up Infrastructure and Services

3.1. Integrate with Data Center Infrastructure

Now you should have an OpenNebula cloud up and running with at least one virtualization node. The next step is, if needed, to perform the integration of OpenNebula with your infrastructure platform and define the configuration of its components. When using the vCenter driver, no additional integration is required because the interaction with the underlying networking, storage and compute infrastructure is performed through vCenter.

However when using KVM, in the open cloud architecture, OpenNebula directly manages the hypervisor, networking and storage platforms, and you may need additional configuration:

- **Networking setup** with 802.1Q VLANs, ebtables, Open vSwitch or VXLAN.
- **Storage setup** with filesystem datastore, LVM datastore, Ceph, Dev, or iSCSI datastore.
- **Host setup** with the configuration options for the KVM hosts, Monitoring subsystem, Virtual Machine HA or PCI Passthrough.

3.2. Configure Cloud Services

OpenNebula comes by default with an internal **user/password authentication system**. Optionally you can enable an external Authentication driver like ssh, x509, ldap or Active Directory.

Sunstone, the OpenNebula GUI, brings by default a pre-defined configuration of views. Optionally it can be customized and extended to meet your needs. You can customize the roles and views, improve security with x509 authentication and SSL or improve scalability for large deployments.

We also provide **references** with a detailed description of the different configuration files, and logging and debugging reports of the OpenNebula services.

1.1.4 Step 4. Operate your Cloud

4.1. Define a Provisioning Model

Before configuring multi-tenancy and defining the provisioning model of your cloud, we recommend you go through this introduction to the OpenNebula provisioning model. In a small installation with a few hosts, you can skip this guide and use OpenNebula without giving much thought to infrastructure partitioning and provisioning. But for medium and large deployments you will probably want to provide some level of isolation and structure.

- Regarding the **underlying infrastructure**, OpenNebula provides complete functionality for the management of the physical hosts and clusters in the cloud. A Cluster is a group of Hosts that can have associated Datastores and Virtual Networks.
- Regarding **user management**, OpenNebula features advanced multi-tenancy with powerful users and groups management, a Access Control List mechanism allowing different role management with fine grain permission granting over any resource, resource quota management to track and limit computing, storage and networking utilization, and a configurable accounting and showback systems to visualize and report resource usage data and to allow their integration with chargeback and billing platforms, or to guarantee fair share of resources among users.
- Last but not least, you can define VDCs (Virtual Data Center) as assignments of one or several user groups to a pool of physical resources. While clusters are used to group physical resources according to common characteristics such as networking topology or physical location, Virtual Data Centers (VDCs) allow to create "logical" pools of resources (which could belong to different clusters and cones) and allocate them to user groups.

4.2. Manage Virtual Resources

Now everything is ready for operation. OpenNebula provides full control to manage virtual resources.

- **Virtual machine image management** that allows to store disk images in catalogs (termed datastores), that can be then used to define VMs or shared with other users. The images can be OS installations, persistent data sets or empty data blocks that are created within the datastore.
- **Virtual network management** of Virtual networks that can be organized in network catalogs, and provide means to interconnect virtual machines. This kind of resources can be defined as IPv4, IPv6, or mixed networks, and can be used to achieve full isolation between virtual networks. Networks can be easily interconnected by using virtual routers and KVM users can also dynamically configure security groups
- **Virtual machine template management** with template catalog system that allows to register virtual machine definitions in the system, to be instantiated later as virtual machine instances.
- **Virtual machine instance management** with a number of operations that can be performed to control lifecycle of the virtual machine instances, such as migration (live and cold), stop, resume, cancel, power-off, etc.

Several reference guides are provided for more information about definition files, templates and CLI.

4.3. Create Virtual Machines

One of the most important aspects of teh cloud is the **preparation of the images** for our users. OpenNebula uses a method called contextualization to send information to the VM at boot time. Its most basic usage is to share networking configuration and login credentials with the VM so it can be configured. More advanced cases can be starting a custom script on VM boot or preparing configuration to use OpenNebula Gate.

1.1.5 Step 5. Install Advanced Components

This step is optional and only for advanced users. We recommend you familiarize with OpenNebula before installing these components.

OpenNebula brings the following advanced components:

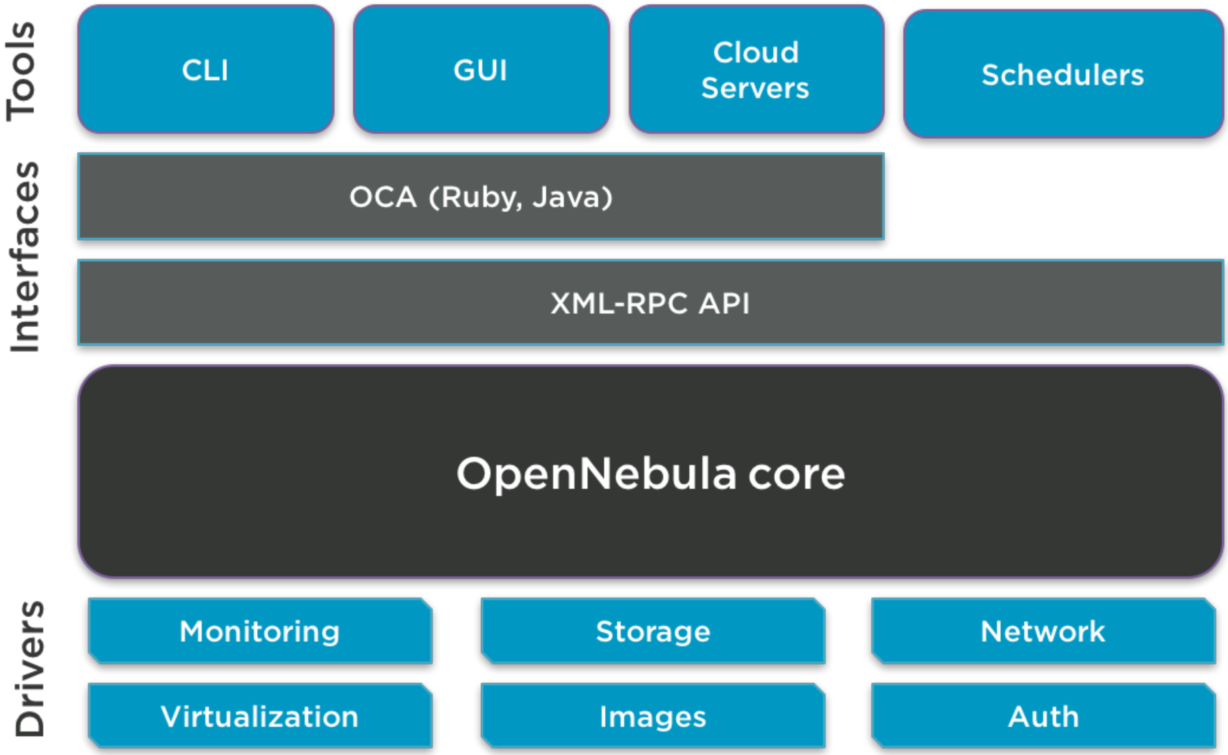
- Implementation of the EC2 Query and EBS **public cloud** interfaces.
- OneFlow allows **multi-VM application and auto-scaling** to define, execute and manage multi-tiered elastic applications, or services composed of interconnected Virtual Machines with deployment dependencies between them and auto-scaling rules.
- The datacenter federation functionality allows for the **centralized management of multiple instances of OpenNebula for scalability, isolation and multiple-site support**.
- **Application insight** with OneGate allows Virtual Machine guests to pull and push VM information from OpenNebula. Users and administrators can use it to gather metrics, detect problems in their applications, and trigger OneFlow elasticity rules from inside the VM.
- Marketplaces for sharing, provisioning and consuming cloud images. They can be seen as external datastores, where images can be easily imported, exported and shared by a federation of OpenNebula instances.
- **Cloud bursting** gives support to build a hybrid cloud, an extension of a private cloud to combine local resources with resources from remote cloud providers. A whole public cloud provider can be encapsulated as a local resource to be able to use extra computational capacity to satisfy peak demands. Out of the box connectors are shipped to support Amazon EC2 and Microsoft Azure cloudbursting.

1.1.6 Step 6. Integrate with other Components

This step is optional and only for integrators and builders.

Because no two clouds are the same, OpenNebula provides many different interfaces that can be used to interact with the functionality offered to manage physical and virtual resources.

- **Modular and extensible architecture** with customizable plug-ins for integration with any third-party data center infrastructure platform for storage, monitoring, networking, authentication, virtualziation, cloud bursting and market.
- **API for integration** with higher level tools such as billing, self-service portals... that offers all the rich functionality of the OpenNebula core, with bindings for ruby and java and XMLRPC API,
- **OneFlow API** to create, control and monitor multi-tier applications or services composed of interconnected Virtual Machines.
- **Sunstone custom routes and tabs** to extend the sunstone server.
- **Hook Manager** to trigger administration scripts upon VM state change.



1.2 OpenNebula Key Features

OpenNebula offers a **simple but feature-rich and flexible solution** to build and manage data center virtualization and enterprise clouds. This guide summarizes its key features(*). You can also refer to the *Platform Notes* included in the documentation of each version to know about the infrastructure platforms and services supported by OpenNebula.

INTERFACES FOR CLOUD CONSUMERS

- De-facto standard cloud APIs with compatibility with cloud ecosystem tools
- Simple, clean, intuitive GUI for cloud consumers to allow non-IT end users to easily create, deploy and manage compute, storage and network resources

VIRTUAL MACHINE MANAGEMENT

- Virtual infrastructure management adjusted to enterprise data centers with full control, monitoring and accounting of virtual resources

- Virtual machine image management through catalogs of disk images (termed datastores) with OS installations, persistent data sets or empty data blocks that are created within the datastore
- Virtual machine template management through catalogs of templates that allow to register virtual machine definitions in the system to be instantiated later as virtual machine instances
- Virtual machine instance management with full control of virtual machine lifecycle
- Programmable VM operations allowing users to schedule actions
- Volume hotplugging and disk snapshot capabilities and disk resizing for KVM virtual machines

VIRTUAL NETWORK MANAGEMENT

- Advanced network virtualization capabilities with traffic isolation, address reservation, flexible defintion of address ranges to accommodate any address distribution, definition of generic attributes to define multi-tier services...
- IPv6 support with definition site and global unicast addresses
- Virtual routers
- Security Groups to define firewall rules and apply them to KVM Virtual Machines

APPLICATION CONFIGURATION AND INSIGHT

- Automatic installation and configuration of application environments
- VM attributes can be provided by the user when the template is instantiated
- Wide range of guest operating system including Microsoft Windows and Linux
- Gain insight cloud applications so their status and metrics can be easily queried through OpenNebula interfaces and used in auto-scaling rules

MULTI-VM APPLICATION MANAGEMENT

- Automatic execution of multi-tiered (multi-VM) applications and their provision from a catalog and self-service portal
- Automatic scaling of multi-tiered applications according to performance metrics and time schedule

INTERFACES FOR ADMINISTRATORS AND ADVANCED USERS

- Powerful Command Line Interface that resembles typical UNIX commands applications
- Easy-to-use Sunstone Graphical Interface providing usage graphics and statistics with cloudwatch-like functionality, remote acccess through VNC or SPICE, different system views for different roles, catalog access, multiple-zone management...
- Sunstone is easily customizable to define multiple cloud views for different user groups

APPLIANCE MARKETPLACE

- Access to the public OpenNebula Systems Marketplace with a catalog of OpenNebula-ready cloud images
- Create your private centralized catalog (external satastore) of cloud applications (images and templates)
- Move VM images and templates across different types of datastores within the same OpenNebula instance
- Share VM images in Federation environments across several OpenNebula instances

ACCOUNTING AND SHOWBACK

- Configurable accounting system to report resource usage data and guarantee fair share of resources among users
- Easy integration with chargeback and billing platforms
- Showback capabilities to define cost associated to CPU/hours and MEMORY/hours per VM Template

MULTI-TENANCY AND SECURITY

- Fine-grained ACLs for resource allocation
- Powerful user and role management
- Administrators can groups users into organizations that can represent different projects, division...
- Integration with external identity management services
- Special authentication mechanisms for SunStone (OpenNebula GUI) and the Cloud Services (EC2)
- Login token functionality to password based logins
- Fine-grained auditing
- Support for isolation at different levels

ON-DEMAND PROVISION OF VIRTUAL DATA CENTERS

- A VDC (Virtual Data Center) is a fully-isolated virtual infrastructure environment where a Group of users, optionally under the control of the group admin, can create and manage compute and storage capacity
- There is a pre-configured Sunstone view for group admins

CAPACITY AND PERFORMANCE MANAGEMENT

- Host management with complete functionality for the management of the virtualziation nodes in the cloud
- Dynamic creation of Clusters as pools of hosts that share datastores and virtual networks for load balancing, high availability, and high performance computing
- ref:*customizable and highly scalable monitoring system <mon>* and also can be integrated with external data center monitoring tools.
- Powerful and flexible scheduler for the definition of workload and resource-aware allocation policies such as packing, striping, load-aware, affinity-aware…
- Resource quota management to track and limit computing, storage and networking resource utilization
- Support for multiple data stores to balance I/O operations between storage servers, or to define different SLA policies (e.g. backup) and performance features for different KVM VM types or users
- PCI passthrough available for KVM VMs that need consumption of raw GPU devices

FEDERATED CLOUD ENVIRONMENTS

- Federation of multiple OpenNebula Zones for scalability, isolation or multiple-site support
- Users can seamlessly provision virtual machines from multiple zones with an integrated interface both in Sunstone and CLI

HIGH AVAILABILITY AND BUSINESS CONTINUITY

- High availability architecture in active-passive configuration
- Persistent database backend with support for high availability configurations
- Configurable behavior in the event of host or KVM VM failure to provide easy to use and cost-effective failover solutions

CLOUD BURSTING

- Build a hybrid cloud to combine your local resources with resources from remote cloud provider and use extra computational capacity to satisfy peak demands

PLATFORM

- Fully platform independent

- Hypervisor agnostic with broad hypervisor support (KVM and VMware vCenter) and centralized management of environments with multiple hypervisors
- *Broad support for commodity and enterprise-grade hypervisor, monitoring, storage, networking and user management services*
- Packages for major Linux distributions

CUSTOMIZATION AND INTEGRATION

- Modular and extensible architecture to fit into any existing datacenter
- Customizable drivers for the main subsystems to easily leverage existing IT infrastructure and system management products: storage, monitoring, networking, authentication, virtualziation, cloud bursting and market
- API for integration with higher level tools such as billing, self-service portals…
- Hook manager to trigger administration scripts upon VM state change
- Sunstone custom routes and tabs to extend the sunstone server
- OneFlow API to create, control and monitor multi-tier applications or services composed of interconnected Virtual Machines.
- OpenNebula Add-on Catalog with components enhancing the functionality provided by OpenNebula
- Configuration and tuning parameters to adjust behavior of the cloud management instance to the requirements of the environment and use cases

LICENSING

- Fully open-source software released under Apache license

INSTALLATION AND UPGRADE PROCESS

- *Configurable to deploy public, private and hybrid clouds*
- All key functionalities for enterprise cloud computing, storage and networking in a single install
- Long term stability and performance through a *single integrated patching and upgrade process*
- Automatic import of existing VMs running in local hypervisors and public clouds for hybrid cloud computing
- Optional building from source code
- System features a small footprint, less than 10Mb

QUALITY ASSURANCE

- Internal quality assurance process for functionality, scalability, performance, robustness and stability
- Technology matured through an active and engaged large community
- Scalability, reliability and performance tested on many massive scalable production deployments consisting of hundreds of thousands of cores and VMs

PRODUCT SUPPORT

- Best-effort community support
- SLA-based commercial support directly from the developers
- Integrated tab in Sunstone to access OpenNebula Systems professional support

(*) *Because OpenNebula leverages the functionality exposed by the underlying platform services, its functionality and performance may be affected by the limitations imposed by those services.*

- *The list of features may change on the different platform configurations*

- *Not all platform configurations exhibit a similar performance and stability*
- *The features may change to offer users more features and integration with other virtualization and cloud components*
- *The features may change due to changes in the functionality provided by underlying virtualization services*

1.3 Glossary

1.3.1 OpenNebula Components

- **Front-end**: Machine running the OpenNebula services.
- **Host**: Physical machine running a supported hypervisor. See the Host subsystem.
- **Cluster**: Pool of hosts that share datastores and virtual networks. Clusters are used for load balancing, high availability, and high performance computing.
- **Datastore**: Storage medium used as disk images repository or to hold images for running VMs.
- **Sunstone**: OpenNebula web interface. Learn more about Sunstone
- **Self-Service** OpenNebula web interfaced towards the end user. It is implemented by configuring a user view of the Sunstone Portal.
- **EC2 Service**: Server that enables the management of OpenNebula with EC2 interface. Learn more about EC2 Service.
- **OCA**: OpenNebula Cloud API. It is a set of libraries that ease the communication with the XML-RPC management interface. Learn more about ruby and java APIs.

1.3.2 OpenNebula Resources

- **Template**: Virtual Machine definition. These definitions are managed with the onetemplate command.
- **Image**: Virtual Machine disk image, created and managed with the oneimage command.
- **Virtual Machine**: Instantiated Template. A Virtual Machine represents one life-cycle, and several Virtual Machines can be created from a single Template. Check out the VM management guide.
- **Virtual Network**: A group of IP leases that VMs can use to automatically obtain IP addresses. See the Networking subsystem.
- **Virtual Data Center (VDC)**: Defines an assignment of one or several Groups to a pool of Physical Resources. Typically this pool of Physical Resources consists of resources from one or several Clusters that could belong to different Zones or public external clouds for hybrid cloud computing.
- **Zone**: A group of interconnected physical hosts with hypervisors controlled by the same OpenNebula.

1.3.3 OpenNebula Management

- **ACL**: Access Control List. Check the managing ACL rules guide.
- **oneadmin**: Special administrative account. See the Users and Groups guide.
- **User**: An OpenNebula user account.
- **Group**: A group of Users.

- **Federation**: Several OpenNebula instances can be configured as zones.

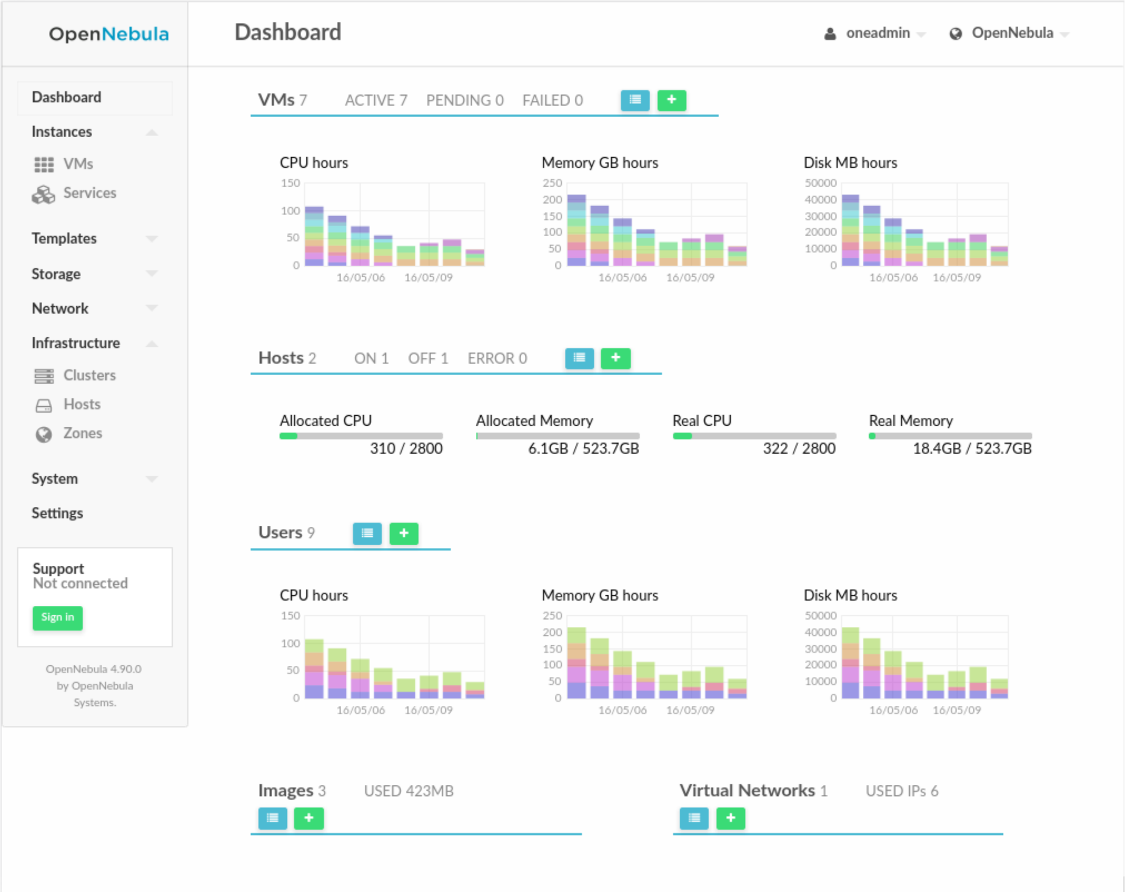
CHAPTER

TWO

RELEASE NOTES 5.0

2.1 What's New in 5.0

OpenNebula 5.0 (Wizard) is the first release of the major 5.0 update. As such, it comes with several improvements in different subsystems and components, with minimal changes in the API and the VM life-cycle states which embodies long overdue changes but implemented to minimize the impact and ensure backwards compatibility as far as possible. Sunstone never stops evolving, and this is the look and feel the team is most proud of to date.



VMs 7 ACTIVE 7 PENDING 0 FAILED 0

Hosts 2 ON 1 OFF 1 ERROR 0

Allocated CPU 310 / 2800

Allocated Memory 6.1GB / 523.7GB

Real CPU 322 / 2800

Real Memory 18.4GB / 523.7GB

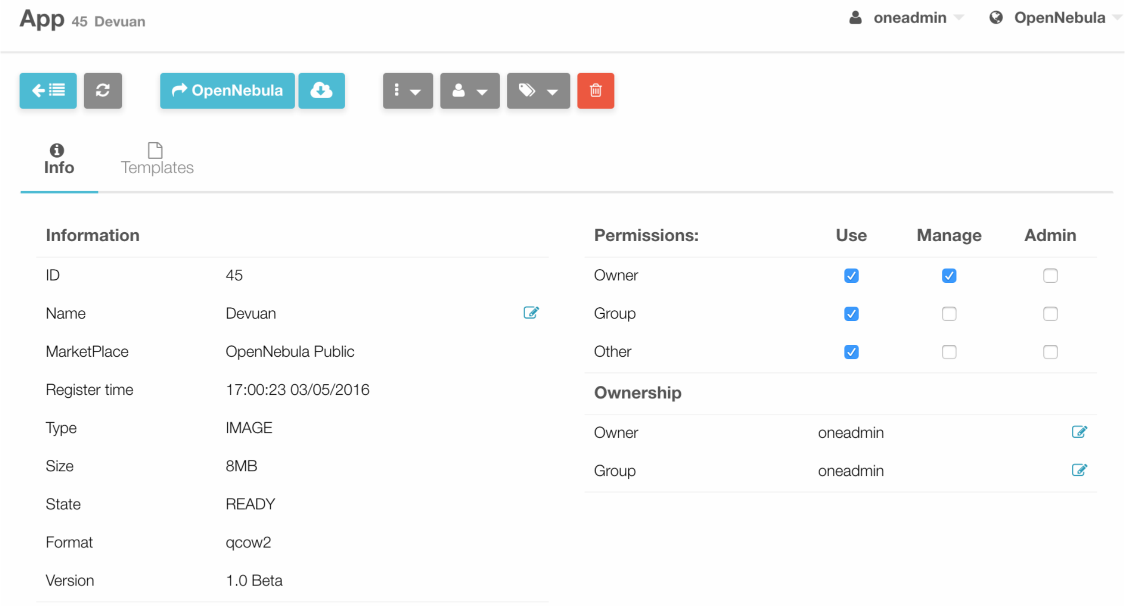
Users 9

Images 3 USED 423MB

Virtual Networks 1 USED IPs 6

A myriad of outstanding new features make their debut in Wizard. Since sharing, provisioning and consuming cloud images is one of the main concerns when using Cloud, one of the most important new features is the new revamped Marketplaces. They can be seen as external datastores, where images from OpenNebula datastores can be imported and exported. One benefit from the new Marketplace architecture is the ability to share images between different OpenNebula instances if they are in a federation: a MarketPlace can be either Public, accessible universally by all

OpenNebula's, or Private: local within an organization and specific for a single OpenNebula (a single zone) or shared by a federation (a collection of zones). A MarketPlace is a repository of MarketPlaceApps. A MarketPlaceApp can be thought of as an external image optionally associated to a Virtual Machine Template.

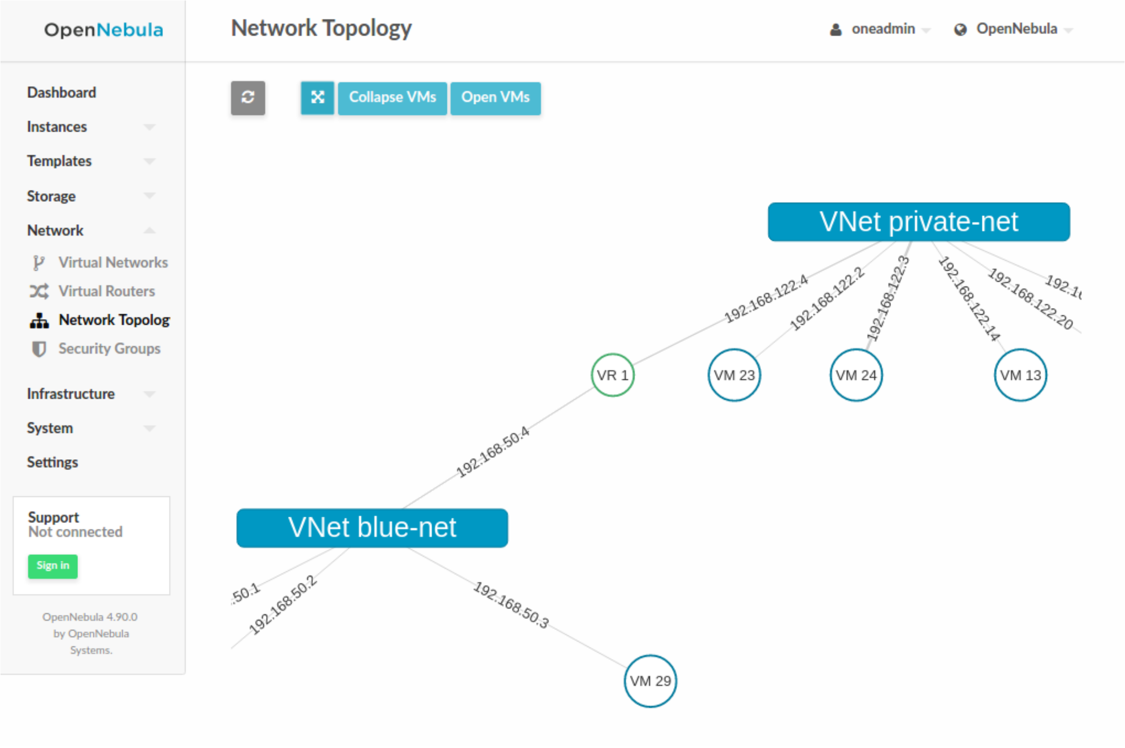


Information	
ID	45
Name	Devuan
MarketPlace	OpenNebula Public
Register time	17:00:23 03/05/2016
Type	IMAGE
Size	8MB
State	READY
Format	qcow2
Version	1.0 Beta

Permissions:	Use	Manage	Admin
Owner	☑	☑	□
Group	☑	□	□
Other	☑	□	□

Ownership	
Owner	oneadmin
Group	oneadmin

Native support for Virtual Routers is also great news in 5.0. Virtual Routers are an OpenNebula resource that provide routing across virtual networks. The routing itself is implemented with a VM appliance provided by the OpenNebula installation, which can be seamlessly deployed in high availability mode. This functionality is available for the VDC administrator, which can then join together virtual networks within her VDC.



For large scale deployments, a long overdue feature is the ability to group resources using labels, which is now present in Wizard's Sunstone. This new feature will enable the possibility to group the different resources under a given label and filter them in the admin and cloud views.

For vCenter based OpenNebula clouds, 5.0 is good news! Support for vCenter storage resources like Datastores and VMDKs enable a wealth of new functionality, like for instance VMDK upload, cloning and deleting, VM disk hotplug, choose Datastore for newly launched VMs and many more. Also, support for resource pools comes in this new major update, as well as the ability to instantiate to persistent (also available for KVM), all packed in an optimized driver.

There are many other improvements in 5.0 like dynamic context regeneration, new host offline mode, cluster resource sharing, VM configuration update, renamed VM life-cycle, support for DB change, improved KVM, vCenter, and datastore monitoring, better VNC port number assignment, dynamic security groups (this is a very nice to have!), support for qemu guest agent, improved VM life-cycle naming and operations, updated instance types for the supported public clouds, improved LVM drivers, enabling use of Ceph without a shared filesystem for system datastore, a humongous number of improvements in all areas and dialogs in Sunstone, enhanced OneGate component to report application metrics, and much much more. Also, and as usual, great effort was put in this release to help build and maintain robust private, hybrid and public clouds with OpenNebula, fixing reported bugs and improving general usability.

This OpenNebula release is named after NGC 7380 (also known as the Wizard Nebula), an open cluster also known as 142 in the 1959 Sharpless catalog (Sh2-142). This reasonably large nebula is located in Cepheus. It is extremely difficult to observe visually, usually requiring very dark skies and an O-III filter.

OpenNebula 5.0 Wizard is considered to be a stable release and as such, and update is available in production environments.

In the following list you can check the highlights of OpenNebula 5.0 Beta (a detailed list of changes can be found here):

2.1.1 OpenNebula Core

- **New offline mode** for host maintenance, OpenNebula keeps monitoring the host but the scheduler won't deploy new VMs
- **Instantiate to persistent**, new mechanism to clone a public template to a private template, with private copies of each image
- **Resource sharing** in clusters is now possible, so for instance a virtual network can be shared among different clusters.
- **Dynamic VM configuration**, VMs in poweroff can have their boot order, features lie ACPI, VNC access, and so on updated with the new "onevm updateconf" command.
- **Support for DB change**, with a new onedb sqlite2myql command.
- **Renamed VM life-cycle**, with renamed states like for instance terminate instead of shutdown in order to avoid confusion.
- **Revisited VM delete operation**, now part of the onevm recover family and only available for admins.
- **Improved VNC port handling**, also with the ability to reserve VNC ports.
- **Attach NIC operations** now check cluster constrains.

2.1.2 OpenNebula Drivers :: Networking

- **Network drivers definition** now in the Virtual Network, in previous versions the network driver was defined in the host.
- **Virtual Router** as a new OpenNebula resource. Virtual Networks can be joined together using HA deployed Virtual Routers.
- **Improved network interface naming**, to avoid problems with libvirt and security groups.

- **Dynamic security groups**, now changes to security groups will dynamically apply to VMs.
- **Improved spoofing features** in security groups.

2.1.3 OpenNebula Drivers :: Monitoring

- **Improved KVM monitoring**, to skip failed checks in the poll script.
- **Improved DS monitoring**, with smarter System DS monitoring.

2.1.4 OpenNebula Drivers :: Storage

- **iSCSI support** in the Devices datastore.
- **Improved LVM drivers**, now FS LVM driver do not need cLVM.
- **Ceph as a system DS**, removing the need of a shared filesystem for Ceph based deployments.
- **Cloning options for qcow2**, with a variable called QCOW2_OPTIONS that can be used to set the parameters.

2.1.5 OpenNebula Drivers :: KVM Virtualization

- **VM Template recursive cloning**, the VM Template clone operation now also clones the VM Template images. This also applies to the delete operation.
- **Additional information in the metadata field**, new element in the VM XML document.
- **Support for qemu guest agent**, a new option GUEST available in the VM template.
- **Generic disk polling for block devices**, as part of a general improvement in the system datastore monitoring.

2.1.6 OpenNebula Drivers :: vCenter Virtualization

- **vCenter VM name configurable** using a configurable vCenter name suffix.
- **Support for Resource Pools**, with the ability to select one for a launched VM or delegate the choice to the user.
- **Support for vCenter storage**, with storage functionality like for instance VMDK upload, cloning and deleting, VM disk hotplug and choose Datastore for newly launched VMs.
- **Improved VM import**, with the ability to import powered off VMs.
- **Instantiate to persistent**, for VMs creating a new VM Template in vCenter.
- **Control VM disk deletion** on VM shutdown with a new VM Template attribute.

2.1.7 OpenNebula Drivers :: Hybrid Virtualization

- **Updated instance types**, for both ec2 and azure.

2.1.8 OpenNebula Drivers :: Marketplace

- **New Marketplace resource**, a first class citizen in OpenNebula to export an import MarketplaceApps, which can be images with associated VM templates.

2.1.9 Scheduler

- **Secondary groups**, now used to schedule VMs.
- **oned XMLRPC endpoint**, now configurable.

2.1.10 Sunstone

- **Upgrade Foundation** from version 5 to version 6
- **Dynamic configuration inputs**, based on the OpenNebula core active configuration. For instance, show KVM drivers in host creation dialog only if they are active.
- **Resource labels**, to better organize and search for any resource, like for instance VM Templates and OneFlow templates and services.
- **Refactored left menu**, to present resources in a more organize manner.
- **Improved wizard descriptions and usability**.
- **Improved user tab**, to allow graphical edit of secondary groups.
- **Updated default listen address**, for Sunstone server.
- **Better string escape handling** that prevents resource template mangling.
- **Overcommitment better presented**, in the host creation dialog.
- **Ability to select IP for NIC** at instantiation time.
- **Add custom template logos**, to support other logos than the ones shipped out of the box.

2.1.11 OneFlow

- **Clone support**, for OneFlow Templates.
- **Rename available**, for OneFlow Templates.

2.1.12 OneGate

- **Support for network information** in EC2 instances.
- **Secure configuration supported** for the OneGate service.
- **Support for operations** for VMs that are not part of a service.
- **Honor restructured attribute**, to avoid modifying critical attributes from VM templates.

2.1.13 Contextualization

- **Context generated when a VM is started** or when a NIC is attached/detached from the VM. The context will be updated with any change in the network attributes, and those changes will be reflected in the context ISO.

2.1.14 Components Moved to the Add-ons Catalog

Some of the infrastructure drivers that were available in OpenNebula 4.x have been moved to the add-ons catalog. This decision has been made based on user demands and with the aim of delivering an OpenNebula distribution supporting the most widely used cloud environments.

- Xen hypervisor
- LVM storage backend
- SoftLayer public cloud

OpenNebula users interested in using these components can install them from the add-ons catalog after installing OpenNebula 5.0.

2.2 Platform Notes

This page will show you the specific considerations at the time of using an OpenNebula cloud, according to the different supported platforms.

This is the list of the individual platform components that have been through the complete OpenNebula Quality Assurance and Certification Process.

2.2.1 Certified Components Version

Front-End Components

Component	Version	More information
RedHat Enterprise Linux	7.0	Front-End Installation
Ubuntu Server	14.04 (LTS) , 16.04	Front-End Installation
CentOS	7.0	Front-End Installation
Debian	8	Front-End Installation
MariaDB or MySQL	Version included in the Linux distribution	MySQL Setup
SQLite	Version included in the Linux distribution	Default DB, no configuration needed
Ruby Gems	Versions installed by packages and install_gems utility	front-end installation
Corosync+Pacemaker	Version included in the Linux distribution	Front-end HA Setup

vCenter Nodes

Component	Version	More information
vCenter	5.5/6.0, managing ESX 5.5/5.0	vCenter Node Installation

KVM Nodes

Component	Version	More information
RedHat Enterprise Linux	7.0	KVM Driver
Ubuntu Server	14.04 (LTS) , 16.04	KVM Driver
CentOS/RHEL	7.0	KVM Driver
Debian	8	KVM Driver
KVM/Libvirt	Support for version included in the Linux distribution. For CentOS the packages from `qemu-ev` are used.	KVM Node Installation

Open Cloud Networking Infrastructure

Component	Version	More information
ebtables	Version included in the Linux distribution	Ebtables
8021q kernel module	Version included in the Linux distribution	802.1Q VLAN
Open vSwitch	Version included in the Linux distribution	Open vSwitch
iproute2	Version included in the Linux distribution	VXLAN

Open Cloud Storage Infrastructure

Component	Version	More information
iSCSI	Version included in the Linux distribution	LVM Drivers
LVM2	Version included in the Linux distribution	LVM Drivers
Ceph	Hammer (LTS) v0.94	The Ceph Datastore

Authentication

Component	Version	More information
net-ldap ruby library	0.12.1	LDAP Authentication
openssl	Version included in the Linux distribution	x509 Authentication

Cloud Bursting

Component	Version	More information
aws-sdk	1.66	Amazon EC2 Driver
azure	0.6.4	Azure Driver

Note: Generally for all Linux platforms, it is worth noting that gems should be installed with the install_gems, avoiding the platform's package version.

2.2.2 Frontend Platform Notes

The following applies to all Front-Ends:

- XML-RPC tuning parameters (MAX_CONN, MAX_CONN_BACKLOG, KEEPALIVE_TIMEOUT, KEEPALIVE_MAX_CONN and TIMEOUT) are only available with packages distributed by us as they are compiled with a newer xmlrpc-c library.
- For **cloud bursting**, a newer nokogiri gem than the one packed by current distros is required. If you are planning to use cloud bursting, you need to install nokogiri >= 1.4.4 prior to run install_gems: # sudo gem install nokogiri -v 1.4.4.
- Only **ruby versions >= 1.9.3 are supported**.

CentOS 7.0 Platform Notes

This distribution lacks some packaged ruby libraries. This makes some components unusable until they are installed. In the front-end, just after package installation these commands should be executed as root to install extra dependencies:

```
# /usr/share/one/install_gems
```

When using Apache to serve Sunstone, it is required that you disable or comment the PrivateTMP=yes directive in /usr/lib/systemd/system/httpd.service.

There is an automatic job that removes all data from /var/tmp/, in order to disable this, please edit the /usr/lib/tmpfiles.d/tmp.conf and remove the line that removes /var/tmp.

There is a bug in libvirt that the prevents the use of the save/restore mechanism if cpu_model is set to 'host-passthrough' via RAW. The work around if needed is described in this issue.

Ubuntu 14.04 Platform Notes

Package ruby-ox shouldn't be installed as it contains a version of the gem incompatible with the CLI

Debian 8

Make sure that the packages ruby-treetop and treetop are not installed before running install_gems, as the version of treetop that comes packaged in Debian 8 is incompatible with OpenNebula. **OneFlow** requires a version >= 1.6.3 for treetop, packages distributed with Debian 8 includes an older version (1.4.5).

2.2.3 Nodes Platform Notes

The following items apply to all distributions:

- Since OpenNebula 4.14 there is a new monitoring probe that gets information about PCI devices. By default it retrieves all the PCI devices in a host. To limit the PCI devices that it gets info and appear in onehost show refer to kvm_pci_passthrough.
- When using qcow2 storage drivers you can make sure that the data is written to disk when doing snapshots setting its cache parameter to writethrough. This change will make writes slower than other cache modes but safer. To do this edit the file /etc/one/vmm_exec/vmm_exec_kvm.conf and change the line for DISK:

```
DISK = [ driver = "qcow2", cache = "writethrough" ]
```

CentOS/RedHat 7.0 Platform Notes

Ruby Dependencies

In order to install ruby dependencies, the Server Optional channel needs to be enabled. Please refer to RedHat documentation to enable the channel.

Alternatively, use CentOS 7 repositories to install ruby dependencies.

Libvirt Version

The libvirt/qemu packages used in the testing infrastructure are the ones in the `qemu-ev` repository. To add this repository you can install the following packages:

```
# yum install centos-release-qemu-ev
# yum install qemu-kvm-ev
```

Disable PolicyKit for Libvirt

It is recommended that you disable PolicyKit for Libvirt:

```
$ cat /etc/libvirt/libvirtd.conf
...
auth_unix_ro = "none"
auth_unix_rw = "none"
unix_sock_group = "oneadmin"
unix_sock_ro_perms = "0770"
unix_sock_rw_perms = "0770"
...
```

2.2.4 Unsupported Platforms Notes

Warning: Use the following distributions at your own risk. They are not officially supported by OpenNebula.

CentOS 6.5 Usage Platform Notes

- As a front-end, because home directory of oneadmin is located in /var, it violates SELinux default policy. So in ssh passwordless configuration you should disable SELinux by setting SELINUX=disabled in /etc/selinux/config.
- As a node, to accomplish disk hotplugging:
  - to accomplish disk hotplugging, disks need to be attached through SCSI, so their images should have a DEV_PREFIX="sd"
  - to accomplish disk hotplugging, VM template that will permit SCSI disk attaches afterwards needs to have an explicitly defined SCSI controller:

```
 RAW=[TYPE = "kvm",
      DATA = "<devices><controller type='scsi' index='0' model='virtio-scsi'></
↪controller></devices>"]
```

```
* due to libvirt version < = 0.10.2, there is a bug in libvirt/qemu attach/detach nic␣
↪functionality that prevents the reuse of net IDs. This means that after a␣
↪successful attach/detach NIC, a new attach will fail.
```

Installing on ArchLinux

OpenNebula is available at the Arch User Repository (AUR), please check the opennebula package page.

Installing on Gentoo

There is an ebuild contributed by Thomas Stein in the following repository:

https://github.com/himbeere/opennebula

Still, if you want to compile it manually you need to install the xmlrpc-c package with threads support, as:

```
USE="threads" emerge xmlrpc-c
```

2.3 Compatibility Guide

This guide is aimed at OpenNebula 4.14.x users and administrators who want to upgrade to the latest version. The following sections summarize the new features and usage changes that should be taken into account, or prone to cause confusion. You can check the upgrade process in the following *section*

Visit the *Features list* and the Release Notes for a comprehensive list of what's new in OpenNebula 5.0.

2.3.1 Deprecated Components

The **Xen** hypervisor is no longer included in the main distribution. It can be however manually installed through the Xen Add-on.

The **VMware** hypervisor is no longer included in the main distribution. Users are encourage to migrate to the more robust and enterprise-ready VMware vCenter Drivers.

The **SoftLayer** Hybrid driver is no longer included in the main distribution. It can be however manually installed through the SoftLayer Add-on.

The **Block LVM** Storage driver is no longer included in the main distribution. It can be however manually installed through the LVM Add-on.

2.3.2 OpenNebula Administrators and Users

OpenNebula Daemon

The logging facilities have been updated to get rid of the log4cpp dependencies. Although the format of the messages has been preserved you may need to double check any tool parsing directly syslog messages. Also a new log facility has been included (std) that uses the stderr stream. Follow this link to the Log and Debug section for more information.

Virtual Machine Management

Disk Snapshots

Virtual Machines in RUNNING state can now take disk snapshots if the drivers support it (kvm with ceph or qcow2), otherwise the VM needs to be manually powered off or suspended. Similarly, the disk snapshot revert operation requires the VM to be powered off or suspended. The strategy option has been removed from the VMM drivers, as well as the DISK_SNAPSHOT_REVERT state (for VMs doing a snapshot operation while RUNNING).

VNC Ports

VNC port assignment has been improved in 5.0 to support TCP port reservations and to better reuse the port pool. The VNC port is checked now at the cluster level and not zone-wise, so a VM can be deployed/migrated in/to any host in the selected cluster. The automatic port selection assignment will first try `VNC_PORTS[START] + VMID` as in previous versions. Moreover, in this new version if the user sets a port its availability is first checked. `VNC_BASE_PORT` attribute in `oned.conf` has been changed to `VNC_PORTS` to include also a set of reserved ports. See the oned.conf reference for more information.

Context

Context is now generated whenever a VirtualMachine is started in a host, i.e. when the deploy or restore action is invoked or when a NIC is attached/detached from the VM. This means that a new attached NIC will have the IP properly configured.

Shutdown and Delete actions

The `onevm shutdown (--hard)` action has been renamed to `onevm terminate (--hard)`. This action can be executed from almost any state, except those where the VM is waiting for a driver operation to finish.

The `onevm delete (--recreate)` action has been removed. End-users can execute the new `onevm terminate --hard` action to remove the VM completely from any state. When a VM is stuck in a state where `terminate` is not available, the cloud administrator can perform an immediate delete with the new `onevm recover --delete/--recreate` options.

For more information, read the Managing Virtual Machines section.

Instantiate a Persistent Copy

OpenNebula 4.14 had the `onevm save` command to save a VM instance into a new VM Template. In the 5.0 release we have added the possibility to instantiate as persistent with the `onetemplate instantiate --persistent` command. This creates a Template copy (plus a persistent copy of each disk image) and instantiates that copy.

Description & Features

OpenNebula now allows to set an arbitrary boot order from any device. The `BOOT` attribute semantic has been updated to implement this new feature. The previous `hd,net,cdrom` will be ignored.

Moreover, the boot order as well as other configuration attributes can be updated now in poweroff state, so easing the workflow for new VM installation and recovery.

A shortcut option to automatically include support for the qemu guest agent has been added to OpenNebula. There is no need to add RAW attributes to add agent support to a VM.

Cloud Bursting

The following valid syntax in 4.14 EC2 VM Templates has been deprecated:

```
EC2=[AMI="xxx", ...]
```

In 5.0 Wizard the only valid syntax is using PUBLIC_CLOUD with the attributes defined in the Amazon EC2 Driver Section.

The existing VM Templates with the old EC2 Section will be automatically modified with the new syntax by the onedb upgrade command.

Scheduler

The scheduler now considers secondary groups to schedule VMs for both hosts and datastores (see feature #4156). This feature enable users to effectively use multiple VDCs. This may **only** affect to installations using multiple groups per user.

Clusters

In 5.0 we have introduced to possibility to add Datastores and VNets to more than one cluster. At the same time, we have eliminated the 'none' (-1) cluster.

In OpenNebula 4.14 this special cluster none was used to share Datastores and VNets across all clusters. In 5.0 the resources outside of any cluster are "disabled for new deployments" from the scheduler's point of view. You will need to explicitly add your resources to all the clusters that are configured to use those Datastores and VNets.

Hosts

A new state offline has been added to manage a host life-cycle. This new state completely sets the host offline. It differs from disable state, where hosts are still monitored.

Storage and Datastores

BASE_PATH has been deprecated

The attribute `BASE_PATH` has been deprecated and removed from the interface. If it was defined in the Datastore templates, it has now been removed. This means, that everything is now built on `DATASTORE_LOCATION` as defined in `oned.conf`, which defaults to `/var/lib/one/datastores`. If you were using a different `BASE_PATH`, you will need to create a symbolic link in your nodes to fix that mountpoint. Something along the lines of: `ln -s <BASE_PATH> /var/lib/one/datastores`.

FSTYPE has been deprecated

Datablocks and Volatile Disks can now only be `raw` or `qcow2` (and `swap` for volatile disks). They will be created as blocks and no filesystem will be created inside. The options like `ext3, ext4, vfat, etc` are not supported any more. Furthermore, the attribute `FSTYPE` has been deprecated. The logic is the following:

- New Empty Datablock:
  - `if DRIVER == qcow2` => The block will be created as `qcow2`.
  - `if DRIVER != qcow2` => The block will be created as `raw`.
  - `if DRIVER is empty && TM_MAD == qcow2` => The block will be created as `qcow2`.
  - `if DRIVER is empty && TM_MAD != qcow2` => The block will be created as `raw`.
- Volatile Disk:
  - Same logic as above, except if `TYPE == swap`.
  - `if TYPE == swap` => The block will be created as `raw` and formatted as `swap` (regardless if the `TM_MAD == qcow2`).

SOURCE does not support the http protocol

Before 5.0, it was possible to register images without a `PATH` attribute, by manually setting the `SOURCE` attribute instead. This could only be defined by oneadmin, and it was a restricted attribute. This `SOURCE` attribute could be an http link, instead of a path. In 5.0, having an http link as a source for an image is not supported anymore. If you run `oneimage list -x|grep SOURCE|grep http` and you see something displayed, the image with that `SOURCE` will not work.

Disk Templates

Any attribute defined explicitly in the `DISK` section of a Template or of a Virtual Machine template, will **not** be overwritten by the same attribute defined in the Image template or in the Datastore template, even if the attribute is marked as `INHERIT` in `oned.conf`. The precedence of the attributes is evaluated in this order (most important to least important):

- `DISK` section of the Template
- Image template
- Datastore template

Virtual Networks

Before OpenNebula 5.0, when doing reservations of Virtual Networks with VLAN isolation, but without the VLAN_ID parameter, the VLAN_ID of the reservation and the parent network where not in the same space; meaning that they were isolated from one another. This behavior has been fixed in OpenNebula >= 5.0: the reservation will inherit the same VLAN_ID as the parent. Note that this will affect only newly created Virtual Machines, the old ones will exhibit the old behavior.

The old `fw` driver has been removed from OpenNebula (it was deprecated in OpenNebula 4.12). If you are still using it, we recommended that you remove those VMs. After the upgrade to 5.0, OpenNebula will not create/modify/remove any of the iptables rules related to the `fw` driver. The database migration utility `onedb` will detect if you still have any VMs using this functionality. In any case, please switch to Security Groups which deliver more functionality than the old `fw` driver.

The Security Group update action now automatically triggers the update of the rules for all the VMs in the security group. This operation can be also manually triggered at any time with the `onesecgroup commit` command.

Virtual Network drivers are now defined per vnet. This allow to implement multiple vnet types from the same host. The migration process should take care of this automatically, although it may request manual input on some corner cases. Any third-party tool that creates hosts or virtual networks must be updated accordingly.

The previous change makes the `VLAN` attribute useless and it will be removed from any virtual network. Third-party network drivers using this attribute should be updated.

Sunstone

Groupadmin View

Sunstone's 4.14 'groupadmin' view was similar to the 'cloud' view, but with added functionality to manage users and quotas. In 5.0 we have decided to redesign the 'groupadmin' view, and now its layout is based on the advanced 'admin' view.

Group administrators still have a limited set of available actions and a limited view of the cloud, restricted to their group's resources. The main difference in terms of what they can do is the access to the virtual network information and virtual routers creation.

Group admin users can also access the simplified 'cloud' view, but only to manage VMs and Services. The administrative features are only available in the 'groupadmin' view.

Read more about the different Sunstone views following this link.

Instance Types

Instance types, not available anymore in OpenNebula 5.0, allowed the administrators to define different VM capacity sizes. In 5.0 the capacity can be edited, but each VM Template defines the modification allowed.

While instance types were only available to users of the Sunstone 'cloud' view, the new modification is made available when the VM Template is instantiated from any of the Sunstone views and the CLI. Read more in the Virtual Machine Templates documentation.

2.3.3 Developers and Integrators

Transfer Manager

The monitoring process of the storage resources has been greatly improved and optimized: System datastores are now monitored as any other datastore. Third-party datastore drivers needs to implement the monitor script to return this value to oned. Also disk usage monitoring from VMs has been also improved to allow thrid-party TM drivers to include their own monitor scripts, see the storage integration section for details

Virtual Machine Manager

Context is now generated whenever a VirtualMachine is started in a host, i.e. when the deploy or restore action is invoked or when a NIC is attached/detached from the VM. Driver integrators may want to implement the reconfigure VMM driver action. This new action notifies a running VM that the context has changed and needs to reconfigure its NICs.

Sunstone

All the SUNSTONE specific information in VM Template, Group, User and other object templates has been arranged in a vector attribute like:

USER

4.14 Attribute	5.0 Attribute
TEMPLATE/SUNSTONE_DISPLAY_NAME	TEMPLATE/SUNSTONE/DISPLAY_NAME
TEMPLATE/LANG	TEMPLATE/SUNSTONE/LANG
TEMPLATE/TABLE_DEFAULT_PAGE_LENGTH	TEMPLATE/SUNSTONE/TABLE_DEFAULT_PAGE_LENGTH
TEMPLATE/TABLE_ORDER	TEMPLATE/SUNSTONE/TABLE_ORDER
TEMPLATE/DEFAULT_VIEW	TEMPLATE/SUNSTONE/DEFAULT_VIEW
TEMPLATE/GROUP_ADMIN_DEFAULT_VIEW	TEMPLATE/SUNSTONE/GROUP_ADMIN_DEFAULT_VIEW

GROUP

4.14 Attribute	5.0 Attribute
TEMPLATE/SUNSTONE_VIEWS	TEMPLATE/SUNSTONE/VIEWS
TEMPLATE/DEFAULT_VIEW	TEMPLATE/SUNSTONE/DEFAULT_VIEW
TEMPLATE/GROUP_ADMIN_VIEWS	TEMPLATE/SUNSTONE/GROUP_ADMIN_VIEWS
TEMPLATE/GROUP_ADMIN_DEFAULT_VIEW	TEMPLATE/SUNSTONE/GROUP_ADMIN_DEFAULT_VIEW

VMTEMPLATE

4.14 Attribute	5.0 Attribute
TEMPLATE/SUNSTONE_CAPACITY_SELECT	TEMPLATE/SUNSTONE/CAPACITY_SELECT
TEMPLATE/SUNSTONE_NETWORK_SELECT	TEMPLATE/SUNSTONE/NETWORK_SELECT

2.4 Known Issues

2.4.1 CLI

- #3037 Different ruby versions need different time formats
- #3337 Wrong headers when output is piped for oneacct and oneshowback

2.4.2 Core & System

- #3020 OpenNebula should check the available space in the frontend before doing an undeploy
- #2880 Unicode chars in VM name are truncated
- #2502 deleting image in locked state leaves current operation in progress and files not cleaned
- #3139 Drivers do not work with rbenv
- #3888 An image can be used twice by a VM, but this breaks the used/ready logic
- #4563 onetemplate instantiate –persistent uses always the same name
- #4154 after cold migration custom vnc password is lost
- #4015 Showback records authorization relies on current VM ownership, instead of Showback record owner
- #3020 OpenNebula should check the available space in the frontend before doing an undeploy
- #2998 Deleting an image deletes the record from the database even if the delete fails
- #1927 VM Context does not fill the right values when a VM has two NICs in the same network
- #1494 Newlines wrongly interpreted in multiline context variables with template variables

2.4.3 Drivers - Network

- #3093 Review the Open vSwitch flows
- #2961 review nic attach with 802.1Q
- #3250 WHITE_PORTS_TCP Network Filtering with Open vSwitch does not work
- #4005 NIC defaults not honoured in attach NIC

2.4.4 Drivers - Storage

- #1573 If an image download fails, the file is never deleted from the datastore
- #3929 CEPH_HOST not IPv6 friendly
- #3727 Downloads can fail, but still not return in error
- #3705 Images downloaded from the Marketplace to Ceph are left with DRIVER=qcow2

2.4.5 Drivers - VM

- #3590 Delete operation leaves a poweroff instance registered in vCenter
- #3060 Trim/discard. In order to use this functionality, KVM requires the virtio-scsi controller. This controller is not (yet) supported. In order to add it, you need to add this RAW snippet to your template: `<controller type=’scsi’ index=’0’ model=’virtio-scsi’></controller>`
- #3590 Delete operation leaves a poweroff instance registered in vCenter
- #4550 Attach Disk operation in vCenter for CDROM does not add a new drive, but rather replaces the ISO of an existing one
- #4540 Import vCenter images size may be 0
- #4335 vCenter password cannot be longer than 22 characters
- #4514 Spaces not allowed in SOURCE image attribute

2.4.6 OneFlow

- #3134 Service Templates with dynamic networks cannot be instantiated from the CLI, unless the a template file with the required attributes is merged
- #3797 oneflow and oneflow-template ignore the no_proxy environment variable
- #2155 Scheduled policy start_time cannot be defined as a POSIX time number

2.4.7 OneGate

- #3819 Missing commits for secure configuration.
- #4209 EC2 IPs are not shown in the VM information

2.4.8 Scheduler

- #1811 If more than one scheduled actions fit in a scheduler cycle, the behaviour is unexpected

2.4.9 Sunstone

- #2292 sunstone novnc send ctrl-alt-del not working in Firefox
- #1877 if syslog enabled disable the logs tab in the VM detailed view
- #3796 sunstone ignores the no_proxy environment variable
- #4567 VM Template create wizard: vCenter option should not allow to create volatile disks
- #4544 vCenter import applies to all the datatable objects, not just the ones in the visible page
- #4343 encode_user_password is not compatible with core auth non ASCII password
- #3902 LIMIT_MB is not used to calculate the available DS storage
- #3692 Sunstone image upload - not enough space
- #2867 Sunstone template update does not select images without User Name
- #2801 Template update: placement does not select the hosts/clusters

2.4.10 Context

- #2292 sunstone novnc send ctrl-alt-del not working in Firefox
- #1877 if syslog enabled disable the logs tab in the VM detailed view
- #3796 sunstone ignores the no_proxy environment variable
- #4568 Context is not regenerated for vCenter

2.5 Acknowledgements

The OpenNebula project would like to thank the community members and users who have contributed to this software release by being active with the discussions, answering user questions, or providing patches for bugfixes, features and documentation.

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Host offline mode, Marketplace, cluster resource sharing and Ceph as system datastore functionality was funded by BlackBerry in the context of the Fund a Feature Program.

CHAPTER

THREE

UPGRADING

3.1 Overview

Keeping your OpenNebula up-to-date is very important, as you will receive the latest functionality and more importantly, the latest security patches. It is possible to upgrade to the latest OpenNebula release from earlier versions.

3.1.1 Hypervisor Compatibility

The upgrade procedure can be followed regardless of the hypervisor.

3.1.2 How Should I Read This Chapter

You only need to read this chapter if you are upgrading OpenNebula to a newer release. Make sure you have read the *Release Notes* and particularly the *Compatibility* section first.

Upgrading is a sequential procedure. The system will upgrade from the currently installed release to the latest release going through each release (if any). Therefore it's important to read each section.

After the upgrade procedure you can continue using your upgraded OpenNebula Cloud.

3.2 Upgrading from OpenNebula 4.14.x

This section describes the installation procedure for systems that are already running a 4.14.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the *Compatibility Guide* and Release Notes to know what is new in OpenNebula 5.0.

3.2.1 Upgrading a Federation

If you have two or more 4.14.x OpenNebulas working as a Federation, you need to upgrade all of them. The upgrade does not have to be simultaneous, the slaves can be kept running while the master is upgraded.

The steps to follow are:

1. Stop the MySQL replication in all the slaves
2. Upgrade the **master** OpenNebula
3. Upgrade each **slave**
4. Resume the replication

During the time between steps 1 and 4 the slave OpenNebulas can be running, and users can keep accessing them if each zone has a local Sunstone instance. There is however an important limitation to note: all the shared database tables will not be updated in the slaves zones. This means that new user accounts, password changes, new ACL rules, etc. will not have any effect in the slaves. Read the federation architecture documentation for more details.

It is recommended to upgrade all the slave zones as soon as possible.

To perform the first step, pause the replication in each **slave MySQL**:

```
mysql> STOP SLAVE;

mysql> SHOW SLAVE STATUS\G

 Slave_IO_Running: No
Slave_SQL_Running: No
```

Then follow this section for the **master zone**. After the master has been updated to 5.0, upgrade each **slave zone** following this same section.

3.2.2 Upgrading from a High Availability deployment

The recommended procedure to upgrade two OpenNebulas configured in HA is to follow the upgrade procedure in a specific order. Some steps need to be executed in both servers, and others in just the active node. For the purpose of this section, we will still refer to the *active node* as such even after stopping the cluster, so we run the single node steps always in the same node:

- *Preparation* in the active node.
- *Backup* in the active node.
- Stop the cluster in the active node: `pcs cluster stop`.
- *Installation* in both nodes. Before running `install_gems`, run `gem list > previous_gems.txt` so we can go back to those specific `sinatra` and `rack` gems if the `pcsd` refuses to start.
- *Configuration Files Upgrade* in the active node.
- *Database Upgrade* in the active node.
- *Check DB Consistency* in the active node.
- *Reload Start Scripts in CentOS 7* in both nodes.
- Start the cluster in the active node.

3.2.3 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: OneFlow, EC2, and Sunstone. Use preferably the system tools, like *systemctl* or *service* as *root* in order to stop the services.

3.2.4 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

```
# cp -r /etc/one /etc/one.$(date +'%Y-%m-%d')
```

3.2.5 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

Note: If executing `install_gems` you get a message asking to overwrite files for aws executables you can safely answer "yes".

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.14 and 5.0 versions.

3.2.6 Configuration Files Upgrade

If you haven't modified any configuration files, the package managers will replace the configuration files with their newer versions and no manual intervention is required.

If you have customized **any** configuration files under `/etc/one` we recommend you to follow these steps regardless of the platform/linux distribution.

1. Backup `/etc/one` (already performed)
2. Install the new packages (already performed)
3. Compare the old and new configuration files: `diff -ur /etc/one.YYYY-MM-DD /etc/one`. Or you can use graphical diff-tools like `meld` to compare both directories, which are very useful in this step.
4. Edit the **new** files and port all the customizations from the previous version.
5. You should **never** overwrite the configuration files with older versions.

3.2.7 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Warning: For environments in a Federation: Before upgrading the **master**, make sure that all the slaves have the MySQL replication paused.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.11.80 : OpenNebula 4.12.1 daemon bootstrap

MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file


>>> Running migrators for shared tables
  ...

>>> Running migrators for local tables
  ...
  > Done in 41.93s

Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.80) by onedb command.

Total time: 41.93s
```

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.2.8 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.14 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.2.9 Resume the Federation

This section applies only to environments working in a Federation.

For the **master zone**: This step is not necessary.

For a **slave zone**: The MySQL replication must be resumed now.

- First, add two new tables, `marketplace_pool` and `marketplaceapp_pool`, to the replication configuration.

> **Warning:** Do not copy the server-id from this example, each slave should already have a unique ID.

```
# vi /etc/my.cnf
[mysqld]
server-id           = 100
replicate-do-table  = opennebula.user_pool
replicate-do-table  = opennebula.group_pool
replicate-do-table  = opennebula.vdc_pool
replicate-do-table  = opennebula.zone_pool
replicate-do-table  = opennebula.db_versioning
replicate-do-table  = opennebula.acl
replicate-do-table  = opennebula.marketplace_pool
replicate-do-table  = opennebula.marketplaceapp_pool

# service mysqld restart
```

- Start the **slave MySQL** process and check its status. It may take a while to copy and apply all the pending commands.

```
mysql> START SLAVE;
mysql> SHOW SLAVE STATUS\G
```

The `SHOW SLAVE STATUS` output will provide detailed information, but to confirm that the slave is connected to the master MySQL, take a look at these columns:

```
   Slave_IO_State: Waiting for master to send event
 Slave_IO_Running: Yes
Slave_SQL_Running: Yes
```

3.2.10 Reload Start Scripts in CentOS 7

In order for the system to re-read the configuration files you should issue the following command after the installation of the new packages:

```
# systemctl daemon-reload
```

3.2.11 Update the Drivers

You should be able now to start OpenNebula as usual, running `service opennebula start` as `root`. At this point, as `oneadmin` user, execute `onehost sync` to update the new drivers in the hosts.

> **Warning:** Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.2.12 Default Auth

If you are using LDAP as default auth driver, you will need to update `/etc/one/oned.conf` and set the new `DEFAULT_AUTH` variable:

```
DEFAULT_AUTH = "ldap"
```

3.2.13 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

> **Note:** For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.2.14 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.2.15 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.2.16 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.3 Upgrading from OpenNebula 4.12.x

This section describes the installation procedure for systems that are already running a 4.12.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

3.3.1 Upgrading a Federation

If you have two or more 4.12.x OpenNebulas working as a Federation, you need to upgrade all of them. The upgrade does not have to be simultaneous, the slaves can be kept running while the master is upgraded.

The steps to follow are:

1. Stop the MySQL replication in all the slaves
2. Upgrade the **master** OpenNebula
3. Upgrade each **slave**
4. Resume the replication

During the time between steps 1 and 4 the slave OpenNebulas can be running, and users can keep accessing them if each zone has a local Sunstone instance. There is however an important limitation to note: all the shared database tables will not be updated in the slaves zones. This means that new user accounts, password changes, new ACL rules, etc. will not have any effect in the slaves. Read the federation architecture documentation for more details.

It is recommended to upgrade all the slave zones as soon as possible.

To perform the first step, pause the replication in each **slave MySQL**:

```
mysql> STOP SLAVE;

mysql> SHOW SLAVE STATUS\G
```

```
 Slave_IO_Running: No
Slave_SQL_Running: No
```

Then follow this section for the **master zone**. After the master has been updated to 5.0, upgrade each **slave zone** following this same section.

3.3.2 Upgrading from a High Availability deployment

The recommended procedure to upgrade two OpenNebulas configured in HA is to follow the upgrade procedure in a specific order. Some steps need to be executed in both servers, and others in just the active node. For the purpose of this section, we will still refer to the *active node* as such even after stopping the cluster, so we run the single node steps always in the same node:

- *Preparation* in the active node.
- *Backup* in the active node.
- Stop the cluster in the active node: `pcs cluster stop`.
- *Installation* in both nodes. Before running `install_gems`, run `gem list > previous_gems.txt` so we can go back to those specific `sinatra` and `rack` gems if the `pcsd` refuses to start.
- *Configuration Files Upgrade* in the active node.
- *Database Upgrade* in the active node.
- *Check DB Consistency* in the active node.
- *Reload Start Scripts in CentOS 7* in both nodes.
- Start the cluster in the active node.

3.3.3 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`

- ovswitch
- vxlan

Stop OpenNebula and any other related services you may have running: OneFlow, EC2, and Sunstone. Use preferably the system tools, like *systemctl* or *service* as *root* in order to stop the services.

3.3.4 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

```
# cp -r /etc/one /etc/one.$(date +'%Y-%m-%d')
```

3.3.5 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.12 and 5.0 versions.

3.3.6 Configuration Files Upgrade

If you haven't modified any configuration files, the package managers will replace the configuration files with their newer versions and no manual intervention is required.

If you have customized **any** configuration files under `/etc/one` we recommend you to follow these steps regardless of the platform/linux distribution.

1. Backup `/etc/one` (already performed)
2. Install the new packages (already performed)
3. Compare the old and new configuration files: `diff -ur /etc/one.YYYY-MM-DD /etc/one`. Or you can use graphical diff-tools like `meld` to compare both directories, which are very useful in this step.
4. Edit the **new** files and port all the customizations from the previous version.
5. You should **never** overwrite the configuration files with older versions.

3.3.7 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Warning: For environments in a Federation: Before upgrading the **master**, make sure that all the slaves have the MySQL replication paused.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.11.80 : OpenNebula 4.12.1 daemon bootstrap

MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file


>>> Running migrators for shared tables
Database already uses version 4.11.80

>>> Running migrators for local tables
  > Running migrator /usr/lib/one/ruby/onedb/local/4.11.80_to_4.13.80.rb
**************************************************************
*  WARNING  WARNING WARNING WARNING WARNING WARNING WARNING  *
**************************************************************

OpenNebula 4.13.80 improves the management of FAILED VMs
Please remove (onevm delete) any FAILED VM before continuing.

**************************************************************
*  WARNING  WARNING WARNING WARNING WARNING WARNING WARNING  *
**************************************************************


The scheduler (and oned) has been update to enforce access
rights on system datastores. This new version also checks that
the user can access the System DS.
This *may require* to update system DS rights of your cloud

Do you want to proceed ? [y/N]y
  > Done in 41.93s

Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.80) by onedb command.
```

```
Total time: 41.93s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.3.8 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.12 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.3.9 Resume the Federation

This section applies only to environments working in a Federation.

For the **master zone**: This step is not necessary.

For a **slave zone**: The MySQL replication must be resumed now.

- First, add two new tables, `marketplace_pool` and `marketplaceapp_pool`, to the replication configuration.

Warning: Do not copy the server-id from this example, each slave should already have a unique ID.

```
# vi /etc/my.cnf
[mysqld]
server-id           = 100
replicate-do-table  = opennebula.user_pool
replicate-do-table  = opennebula.group_pool
replicate-do-table  = opennebula.vdc_pool
replicate-do-table  = opennebula.zone_pool
replicate-do-table  = opennebula.db_versioning
replicate-do-table  = opennebula.acl
replicate-do-table  = opennebula.marketplace_pool
replicate-do-table  = opennebula.marketplaceapp_pool

# service mysqld restart
```

- Start the **slave MySQL** process and check its status. It may take a while to copy and apply all the pending commands.

```
mysql> START SLAVE;
mysql> SHOW SLAVE STATUS\G
```

The `SHOW SLAVE STATUS` output will provide detailed information, but to confirm that the slave is connected to the master MySQL, take a look at these columns:

```
   Slave_IO_State: Waiting for master to send event
 Slave_IO_Running: Yes
Slave_SQL_Running: Yes
```

3.3.10 Reload Start Scripts in CentOS 7

In order for the system to re-read the configuration files you should issue the following command after the installation of the new packages:

```
# systemctl daemon-reload
```

3.3.11 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.3.12 Default Auth

If you are using LDAP as default auth driver, you will need to update `/etc/one/oned.conf` and set the new `DEFAULT_AUTH` variable:

```
DEFAULT_AUTH = "ldap"
```

3.3.13 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.3.14 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.3.15 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.3.16 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.4 Upgrading from OpenNebula 4.10.x

This section describes the installation procedure for systems that are already running a 4.10.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

3.4.1 Upgrading a Federation

If you have two or more 4.10.x OpenNebulas working as a Federation, you need to upgrade all of them. The upgrade does not have to be simultaneous, the slaves can be kept running while the master is upgraded.

The steps to follow are:

1. Stop the MySQL replication in all the slaves
2. Upgrade the **master** OpenNebula
3. Upgrade each **slave**
4. Resume the replication

During the time between steps 1 and 4 the slave OpenNebulas can be running, and users can keep accessing them if each zone has a local Sunstone instance. There is however an important limitation to note: all the shared database tables will not be updated in the slaves zones. This means that new user accounts, password changes, new ACL rules, etc. will not have any effect in the slaves. Read the federation architecture documentation for more details.

It is recommended to upgrade all the slave zones as soon as possible.

To perform the first step, pause the replication in each **slave MySQL**:

```
mysql> STOP SLAVE;

mysql> SHOW SLAVE STATUS\G

 Slave_IO_Running: No
Slave_SQL_Running: No
```

Then follow this section for the **master zone**. After the master has been updated to 5.0, upgrade each **slave zone** following this same section.

3.4.2 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

> **Warning:** In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`

- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: OneFlow, EC2, and Sunstone. Use preferably the system tools, like *systemctl* or *service* as *root* in order to stop the services.

3.4.3 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

```
# cp -r /etc/one /etc/one.$(date +'%Y-%m-%d')
```

3.4.4 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.10 and 5.0 versions.

3.4.5 Configuration Files Upgrade

If you haven't modified any configuration files, the package managers will replace the configuration files with their newer versions and no manual intervention is required.

If you have customized **any** configuration files under `/etc/one` we recommend you to follow these steps regardless of the platform/linux distribution.

1. Backup `/etc/one` (already performed)
2. Install the new packages (already performed)
3. Compare the old and new configuration files: `diff -ur /etc/one.YYYY-MM-DD /etc/one`. Or you can use graphical diff-tools like `meld` to compare both directories, which are very useful in this step.
4. Edit the **new** files and port all the customizations from the previous version.
5. You should **never** overwrite the configuration files with older versions.

3.4.6 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Warning: For environments in a Federation: Before upgrading the **master**, make sure that all the slaves have the MySQL replication paused.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.4.7 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.10 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.4.8 Resume the Federation

This section applies only to environments working in a Federation.

For the **master zone**: This step is not necessary.

For a **slave zone**: The MySQL replication must be resumed now.

- First, add 3 new tables, `vdc_pool`, `marketplace_pool` and `marketplaceapp_pool` to the replication configuration.

Warning: Do not copy the server-id from this example, each slave should already have a unique ID.

```
# vi /etc/my.cnf
[mysqld]
server-id           = 100
replicate-do-table  = opennebula.user_pool
replicate-do-table  = opennebula.group_pool
replicate-do-table  = opennebula.vdc_pool
replicate-do-table  = opennebula.zone_pool
replicate-do-table  = opennebula.db_versioning
replicate-do-table  = opennebula.acl
replicate-do-table  = opennebula.marketplace_pool
replicate-do-table  = opennebula.marketplaceapp_pool

# service mysqld restart
```

- Start the **slave MySQL** process and check its status. It may take a while to copy and apply all the pending commands.

```
mysql> START SLAVE;
mysql> SHOW SLAVE STATUS\G
```

The `SHOW SLAVE STATUS` output will provide detailed information, but to confirm that the slave is connected to the master MySQL, take a look at these columns:

```
   Slave_IO_State: Waiting for master to send event
 Slave_IO_Running: Yes
Slave_SQL_Running: Yes
```

3.4.9 Reload Start Scripts in CentOS 7

In order for the system to re-read the configuration files you should issue the following command after the installation of the new packages:

```
# systemctl daemon-reload
```

3.4.10 Enable Start Scripts in CentOS 7

CentOS 7 packages now come with systemd scripts instead of the old systemV ones. You will need to enable the services again so they are started on system boot. The names of the services are the same as the previous one. For example, to enable `opennebula`, `opennebula-sunstone`, `opennebula-flow` and `opennebula-gate` you can issue these commands:

```
# systemctl enable opennebula
# systemctl enable opennebula-sunstone
# systemctl enable opennebula-flow
# systemctl enable opennebula-gate
```

3.4.11 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.4.12 Default Auth

If you are using LDAP as default auth driver, you will need to update `/etc/one/oned.conf` and set the new `DEFAULT_AUTH` variable:

```
DEFAULT_AUTH = "ldap"
```

3.4.13 vCenter Password

Note: This step only applies if you are upgrading from OpenNebula **4.10.0**. If you are already using 4.10.1 or 4.10.2 you can skip this step.

If you already have a host with vCenter drivers you need to update the password as version >4.10.0 expects it to be encrypted. To do so, proceed to Sunstone -> Infrastructure -> Hosts, click on the vCenter host(s) and change the value in `VCENTER_PASSWORD` field. It will be automatically encrypted.

3.4.14 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.4.15 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.4.16 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.4.17 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.4.18 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.5 Upgrading from OpenNebula 4.8.x

This section describes the installation procedure for systems that are already running a 4.8.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

3.5.1 Upgrading a Federation

If you have two or more 4.8 OpenNebulas working as a Federation, you need to upgrade all of them. The upgrade does not have to be simultaneous, the slaves can be kept running while the master is upgraded.

The steps to follow are:

1. Stop the MySQL replication in all the slaves
2. Upgrade the **master** OpenNebula
3. Upgrade each **slave**
4. Resume the replication

During the time between steps 1 and 4 the slave OpenNebulas can be running, and users can keep accessing them if each zone has a local Sunstone instance. There is however an important limitation to note: all the shared database tables will not be updated in the slaves zones. This means that new user accounts, password changes, new ACL rules, etc. will not have any effect in the slaves. Read the federation architecture documentation for more details.

It is recommended to upgrade all the slave zones as soon as possible.

To perform the first step, pause the replication in each **slave MySQL**:

```
mysql> STOP SLAVE;

mysql> SHOW SLAVE STATUS\G

 Slave_IO_Running: No
Slave_SQL_Running: No
```

Then follow this section for the **master zone**. After the master has been updated to 5.0, upgrade each **slave zone** following this same section.

3.5.2 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ one stop
```

3.5.3 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

```
# cp -r /etc/one /etc/one.YYYY-MM-DD
```

Note: Substitute `YYYY-MM-DD` with the date.

3.5.4 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.8 and 5.0 versions.

3.5.5 Configuration Files Upgrade

If you haven't modified any configuration files, the package managers will replace the configuration files with their newer versions and no manual intervention is required.

If you have customized **any** configuration files under `/etc/one` we recommend you to follow these steps regardless of the platform/linux distribution.

1. Backup `/etc/one` (already performed)
2. Install the new packages (already performed)
3. Compare the old and new configuration files: `diff -ur /etc/one.YYYY-MM-DD /etc/one`. Or you can use graphical diff-tools like `meld` to compare both directories, which are very useful in this step.
4. Edit the **new** files and port all the customizations from the previous version.
5. You should **never** overwrite the configuration files with older versions.

3.5.6 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

> **Warning:** Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

> **Warning:** For environments in a Federation: Before upgrading the **master**, make sure that all the slaves have the MySQL replication paused.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.
```

```
>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.5.7 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.8 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.5.8 Resume the Federation

This section applies only to environments working in a Federation.

For the **master zone**: This step is not necessary.

For a **slave zone**: The MySQL replication must be resumed now.

- First, add 3 new tables, `vdc_pool`, `marketplace_pool` and `marketplaceapp_pool` to the replication configuration.

Warning: Do not copy the server-id from this example, each slave should already have a unique ID.

```
# vi /etc/my.cnf
[mysqld]
server-id           = 100
replicate-do-table  = opennebula.user_pool
replicate-do-table  = opennebula.group_pool
replicate-do-table  = opennebula.vdc_pool
replicate-do-table  = opennebula.zone_pool
replicate-do-table  = opennebula.db_versioning
replicate-do-table  = opennebula.acl
replicate-do-table  = opennebula.marketplace_pool
replicate-do-table  = opennebula.marketplaceapp_pool

# service mysqld restart
```

- Start the **slave MySQL** process and check its status. It may take a while to copy and apply all the pending commands.

```
mysql> START SLAVE;
mysql> SHOW SLAVE STATUS\G
```

The SHOW SLAVE STATUS output will provide detailed information, but to confirm that the slave is connected to the master MySQL, take a look at these columns:

```
   Slave_IO_State: Waiting for master to send event
 Slave_IO_Running: Yes
Slave_SQL_Running: Yes
```

3.5.9 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute onehost sync to update the new drivers in the hosts.

Warning: Doing onehost sync is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.5.10 Default Auth

If you are using LDAP as default auth driver, you will need to update /etc/one/oned.conf and set the new DEFAULT_AUTH variable:

```
DEFAULT_AUTH = "ldap"
```

3.5.11 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.5.12 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.5.13 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.5.14 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.5.15 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.6 Upgrading from OpenNebula 4.6.x

This section describes the installation procedure for systems that are already running a 4.6.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.8, 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

3.6.1 Upgrading a Federation

If you have two or more 4.6 OpenNebulas working as a Federation, you need to upgrade all of them. The upgrade does not have to be simultaneous, the slaves can be kept running while the master is upgraded.

The steps to follow are:

1. Stop the MySQL replication in all the slaves
2. Upgrade the **master** OpenNebula
3. Upgrade each **slave**
4. Resume the replication

During the time between steps 1 and 4 the slave OpenNebulas can be running, and users can keep accessing them if each zone has a local Sunstone instance. There is however an important limitation to note: all the shared database tables will not be updated in the slaves zones. This means that new user accounts, password changes, new ACL rules, etc. will not have any effect in the slaves. Read the federation architecture documentation for more details.

It is recommended to upgrade all the slave zones as soon as possible.

To perform the first step, pause the replication in each **slave MySQL**:

```
mysql> STOP SLAVE;

mysql> SHOW SLAVE STATUS\G

 Slave_IO_Running: No
Slave_SQL_Running: No
```

Then follow this section for the **master zone**. After the master has been updated to 5.0, upgrade each **slave zone** following this same section.

3.6.2 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ occi-server stop
$ one stop
```

3.6.3 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

```
# cp -r /etc/one /etc/one.YYYY-MM-DD
```

Note: Substitute `YYYY-MM-DD` with the date.

3.6.4 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.6 and 5.0 versions.

3.6.5 Configuration Files Upgrade

If you haven't modified any configuration files, the package managers will replace the configuration files with their newer versions and no manual intervention is required.

If you have customized **any** configuration files under `/etc/one` we recommend you to follow these steps regardless of the platform/linux distribution.

1. Backup `/etc/one` (already performed)
2. Install the new packages (already performed)
3. Compare the old and new configuration files: `diff -ur /etc/one.YYYY-MM-DD /etc/one`. Or you can use graphical diff-tools like `meld` to compare both directories, which are very useful in this step.
4. Edit the **new** files and port all the customizations from the previous version.
5. You should **never** overwrite the configuration files with older versions.

3.6.6 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message ‘Database version mismatch’.

You can upgrade the existing DB with the ‘onedb’ command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Warning: For environments in a Federation: Before upgrading the **master**, make sure that all the slaves have the MySQL replication paused.

Note: If you have a MAC_PREFIX in oned.conf different than the default `02:00`, open `/usr/lib/one/ruby/onedb/local/4.5.80_to_4.7.80.rb` and change the value of the `ONEDCONF_MAC_PREFIX` constant.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the ‘onedb upgrade -v’ command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s
```

```

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.6.7 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.6 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.6.8 Resume the Federation

This section applies only to environments working in a Federation.

For the **master zone**: This step is not necessary.

For a **slave zone**: The MySQL replication must be resumed now.

- First, add 3 new tables, `vdc_pool`, `marketplace_pool` and `marketplaceapp_pool` to the replication configuration.

> **Warning:** Do not copy the server-id from this example, each slave should already have a unique ID.

```
# vi /etc/my.cnf
[mysqld]
server-id           = 100
replicate-do-table  = opennebula.user_pool
replicate-do-table  = opennebula.group_pool
replicate-do-table  = opennebula.vdc_pool
replicate-do-table  = opennebula.zone_pool
replicate-do-table  = opennebula.db_versioning
replicate-do-table  = opennebula.acl
replicate-do-table  = opennebula.marketplace_pool
replicate-do-table  = opennebula.marketplaceapp_pool

# service mysqld restart
```

- Start the **slave MySQL** process and check its status. It may take a while to copy and apply all the pending commands.

```
mysql> START SLAVE;
mysql> SHOW SLAVE STATUS\G
```

The `SHOW SLAVE STATUS` output will provide detailed information, but to confirm that the slave is connected to the master MySQL, take a look at these columns:

```
   Slave_IO_State: Waiting for master to send event
 Slave_IO_Running: Yes
Slave_SQL_Running: Yes
```

3.6.9 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

> **Warning:** Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.6.10 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.6.11 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.6.12 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.6.13 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.6.14 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.7 Upgrading from OpenNebula 4.4.x

This section describes the installation procedure for systems that are already running a 4.4.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.6, 4.8, 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

3.7.1 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

> **Warning:** In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ occi-server stop
$ one stop
```

3.7.2 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

3.7.3 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.4 and 5.0 versions.

3.7.4 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Note: If you have a MAC_PREFIX in oned.conf different than the default `02:00`, open `/usr/lib/one/ruby/onedb/local/4.5.80_to_4.7.80.rb` and change the value of the `ONEDCONF_MAC_PREFIX` constant.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.
```

```
  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.7.5 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.4 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.7.6 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.7.7 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

3.7.8 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.7.9 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.7.10 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.7.11 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.8 Upgrading from OpenNebula 4.2

This section describes the installation procedure for systems that are already running a 4.2 OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.4, 4.6, 4.8, 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

Warning: With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

Warning: Two drivers available in 4.0 are now discontinued: **ganglia** and **iscsi**.

- **iscsi** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.
- **ganglia** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.

3.8.1 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ occi-server stop
$ one stop
```

3.8.2 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

3.8.3 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.2 and 5.0 versions.

3.8.4 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Note: If you have a MAC_PREFIX in oned.conf different than the default `02:00`, open `/usr/lib/one/ruby/onedb/local/4.5.80_to_4.7.80.rb` and change the value of the `ONEDCONF_MAC_PREFIX` constant.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

If you receive the message "ATTENTION: manual intervention required", read the section *Manual Intervention Required* below.

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.8.5 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.2 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.8.6 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.8.7 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

3.8.8 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.8.9 Setting new System DS

With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

You will need to have at least one system DS in each cluster. If you don't already, create new system DS with the same definition as the system DS 0 (TM_MAD driver). Depending on your setup this may or may not require additional configuration on the hosts.

You may also try to recover saved VMs (stop, suspend, undeploy) following the steps described in this thread of the users mailing list.

3.8.10 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.8.11 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.8.12 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin's password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.8.13 Manual Intervention Required

If you have a datastore configured to use a tm driver not included in the OpenNebula distribution, the onedb upgrade command will show you this message:

```
ATTENTION: manual intervention required

The Datastore <id> <name> is using the
custom TM MAD '<tm_mad>'. You will need to define new
configuration parameters in oned.conf for this driver, see
http://opennebula.org/documentation:rel4.4:upgrade
```

Since OpenNebula 4.4, each tm_mad driver has a TM_MAD_CONF section in oned.conf. If you developed the driver, it should be fairly easy to define the required information looking at the existing ones:

```
# The  configuration for each driver is defined in TM_MAD_CONF. These
# values are used when creating a new datastore and should not be modified
# since they define the datastore behaviour.
#   name      : name of the transfer driver, listed in the -d option of the
#               TM_MAD section
#   ln_target : determines how the persistent images will be cloned when
#               a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   clone_target : determines how the non persistent images will be
#                  cloned when a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   shared : determines if the storage holding the system datastore is shared
#            among the different hosts or not. Valid values: "yes" or "no"

TM_MAD_CONF = [
    name         = "lvm",
    ln_target    = "NONE",
    clone_target= "SELF",
    shared       = "yes"
]
```

3.9 Upgrading from OpenNebula 4.0.x

This section describes the installation procedure for systems that are already running a 4.0.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.2, 4.4, 4.6, 4.8, 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

Warning: With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

Warning: Two drivers available in 4.0 are now discontinued: **ganglia** and **iscsi**.

- **iscsi** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.
- **ganglia** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.

Warning: There are combinations of **VMware storage** no longer supported (see the VMFS Datastore guide for the supported configurations).

If you want to upgrade and you are using SSH, NFS or VMFS without SSH-mode, you will need to manually migrate your images to a newly created VMFS with SSH-mode datastore. To do so implies powering off all the VMs with images in any of the deprecated datastores, upgrade OpenNebula, create a VMFS datastore and then manually register the images from those deprecated datastores into the new one. Let us know if you have doubts or problems with this process.

3.9.1 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ occi-server stop
$ one stop
```

3.9.2 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

3.9.3 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 4.0 and 5.0 versions.

3.9.4 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Note: If you have a MAC_PREFIX in oned.conf different than the default `02:00`, open `/usr/lib/one/ruby/onedb/local/4.5.80_to_4.7.80.rb` and change the value of the `ONEDCONF_MAC_PREFIX` constant.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 4.4.0 : OpenNebula 4.4.0 daemon bootstrap
Local tables  4.4.0 : OpenNebula 4.4.0 daemon bootstrap

>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.75s

Database migrated from 4.4.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80
Total time: 0.77s
```

If you receive the message "ATTENTION: manual intervention required", read the section *Manual Intervention Required* below.

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

Warning: This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.9.5 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.0 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.9.6 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.9.7 Setting new System DS

With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

You will need to have at least one system DS in each cluster. If you don't already, create new system DS with the same definition as the system DS 0 (TM_MAD driver). Depending on your setup this may or may not require additional configuration on the hosts.

You may also try to recover saved VMs (stop, suspend, undeploy) following the steps described in this thread of the users mailing list.

3.9.8 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

3.9.9 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.9.10 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.9.11 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using ‘onedb restore -f’
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.9.12 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin’s password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```

3.9.13 Manual Intervention Required

If you have a datastore configured to use a tm driver not included in the OpenNebula distribution, the onedb upgrade command will show you this message:

```
ATTENTION: manual intervention required

The Datastore <id> <name> is using the
custom TM MAD '<tm_mad>'. You will need to define new
configuration parameters in oned.conf for this driver, see
http://opennebula.org/documentation:rel4.4:upgrade
```

Since OpenNebula 4.4, each tm_mad driver has a TM_MAD_CONF section in oned.conf. If you developed the driver, it should be fairly easy to define the required information looking at the existing ones:

```
# The  configuration for each driver is defined in TM_MAD_CONF. These
# values are used when creating a new datastore and should not be modified
# since they define the datastore behaviour.
#   name      : name of the transfer driver, listed in the -d option of the
#               TM_MAD section
#   ln_target : determines how the persistent images will be cloned when
#               a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   clone_target : determines how the non persistent images will be
#                  cloned when a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   shared : determines if the storage holding the system datastore is shared
#            among the different hosts or not. Valid values: "yes" or "no"

TM_MAD_CONF = [
    name        = "lvm",
    ln_target   = "NONE",
    clone_target= "SELF",
    shared      = "yes"
]
```

3.10 Upgrading from OpenNebula 3.8.x

This section describes the installation procedure for systems that are already running a 3.8.x OpenNebula. The upgrade will preserve all current users, hosts, resources and configurations; for both Sqlite and MySQL backends.

Read the Compatibility Guide for 4.0, 4.2, 4.4, 4.6, 4.8, 4.10, 4.12, 4.14 and *5.0*, and the Release Notes to know what is new in OpenNebula 5.0.

Warning: With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

Warning: Two drivers available in 3.8 are now discontinued: **ganglia** and **iscsi**.

- **iscsi** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.
- **ganglia** drivers have been moved out of the main OpenNebula distribution and are available (although not supported) as an addon.

Warning: There are combinations of **VMware storage** no longer supported (see the VMFS Datastore guide for the supported configurations).

If you want to upgrade and you are using SSH, NFS or VMFS without SSH-mode, you will need to manually migrate your images to a newly created VMFS with SSH-mode datastore. To do so implies powering off all the VMs with images in any of the deprecated datastores, upgrade OpenNebula, create a VMFS datastore and then manually register the images from those deprecated datastores into the new one. Let us know if you have doubts or problems with this process.

3.10.1 Preparation

Before proceeding, make sure you don't have any VMs in a transient state (prolog, migr, epil, save). Wait until these VMs get to a final state (runn, suspended, stopped, done). Check the Managing Virtual Machines guide for more information on the VM life-cycle.

Warning: In 4.14 the `FAILED` state dissapears. You need to delete all the VMs in this state **before** the new version is installed.

The network drivers in OpenNebula 5.0 are located in the Virtual Network, rather than in the host. The upgrade process may ask you questions about your existing VMs, Virtual Networks and hosts, and as such it is wise to have the following information saved beforehand, since in the upgrade process OpenNebula will be stopped.

```
$ onevnet list -x > networks.txt
$ onehost list -x > hosts.txt
$ onevm list -x > vms.txt
```

The list of valid network drivers in 5.0 Wizard are:

- `802.1Q`
- `dummy`
- `ebtables`
- `fw`
- `ovswitch`
- `vxlan`

Stop OpenNebula and any other related services you may have running: EC2, OCCI, and Sunstone. As `oneadmin`, in the front-end:

```
$ sunstone-server stop
$ oneflow-server stop
$ econe-server stop
$ occi-server stop
$ one stop
```

3.10.2 Backup

Backup the configuration files located in **/etc/one**. You don't need to do a manual backup of your database, the onedb command will perform one automatically.

3.10.3 Installation

Follow the *Platform Notes* and the Installation guide, taking into account that you will already have configured the passwordless ssh access for oneadmin.

Make sure to run the `install_gems` tool, as the new OpenNebula version may have different gem requirements.

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 5.0 to your setup. If for any reason you plan to preserve your current `oned.conf` file, read the *Compatibility Guide* and the complete oned.conf reference for 3.8 and 5.0 versions.

3.10.4 Database Upgrade

The database schema and contents are incompatible between versions. The OpenNebula daemon checks the existing DB version, and will fail to start if the version found is not the one expected, with the message 'Database version mismatch'.

You can upgrade the existing DB with the 'onedb' command. You can specify any Sqlite or MySQL database. Check the onedb reference for more information.

Warning: Make sure at this point that OpenNebula is not running. If you installed from packages, the service may have been started automatically.

Note: If you have a MAC_PREFIX in oned.conf different than the default `02:00`, open `/usr/lib/one/ruby/onedb/local/4.5.80_to_4.7.80.rb` and change the value of the `ONEDCONF_MAC_PREFIX` constant.

After you install the latest OpenNebula, and fix any possible conflicts in oned.conf, you can issue the 'onedb upgrade -v' command. The connection parameters have to be supplied with the command line options, see the onedb manpage for more information. Some examples:

```
$ onedb upgrade -v --sqlite /var/lib/one/one.db
```

```
$ onedb upgrade -v -S localhost -u oneadmin -p oneadmin -d opennebula
```

If everything goes well, you should get an output similar to this one:

```
$ onedb upgrade -v -u oneadmin -d opennebula
MySQL Password:
Version read:
Shared tables 3.8.0 : OpenNebula 3.8.0 daemon bootstrap
Local tables  3.8.0 : OpenNebula 3.8.0 daemon bootstrap

MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file


>>> Running migrators for shared tables
  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.0_to_3.8.1.rb
  > Done in 0.36s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.1_to_3.8.2.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.2_to_3.8.3.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.3_to_3.8.4.rb
  > Done in 0.56s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.4_to_3.8.5.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.8.5_to_3.9.80.rb

ATTENTION: manual intervention required
Virtual Machine deployment files have been moved from /var/lib/one to
/var/lib/one/vms. You need to move these files manually:

    $ mv /var/lib/one/[0-9]* /var/lib/one/vms

  > Done in 1.10s

  > Running migrator /usr/lib/one/ruby/onedb/shared/3.9.80_to_3.9.90.rb

ATTENTION: manual intervention required
IM and VM MADS have been renamed in oned.conf. To keep your
existing hosts working, you need to duplicate the drivers with the
old names.

For example, for kvm you will have IM_MAD "kvm" and VM_MAD "kvm", so you
need to add IM_MAD "im_kvm" and VM_MAD "vmm_kvm"

IM_MAD = [
      name       = "kvm",
      executable = "one_im_ssh",
      arguments  = "-r 0 -t 15 kvm" ]


IM_MAD = [
      name       = "im_kvm",
      executable = "one_im_ssh",
      arguments  = "-r 0 -t 15 kvm" ]

VM_MAD = [
    name       = "kvm",
    executable = "one_vmm_exec",
    arguments  = "-t 15 -r 0 kvm",
    default    = "vmm_exec/vmm_exec_kvm.conf",
    type       = "kvm" ]

VM_MAD = [
    name       = "vmm_kvm",
    executable = "one_vmm_exec",
    arguments  = "-t 15 -r 0 kvm",
    default    = "vmm_exec/vmm_exec_kvm.conf",
    type       = "kvm" ]

  > Done in 0.41s
  > Running migrator /usr/lib/one/ruby/onedb/shared/3.9.90_to_4.0.0.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.0.0_to_4.0.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.0.1_to_4.1.80.rb
  > Done in 0.09s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.1.80_to_4.2.0.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.2.0_to_4.3.80.rb
  > Done in 0.68s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.3.80_to_4.3.85.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.3.85_to_4.3.90.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.3.90_to_4.4.0.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.0_to_4.4.1.rb
  > Done in 0.00s

  > Running migrator /usr/lib/one/ruby/onedb/shared/4.4.1_to_4.5.80.rb
  > Done in 0.39s

Database migrated from 3.8.0 to 4.5.80 (OpenNebula 4.5.80) by onedb command.

>>> Running migrators for local tables
Database already uses version 4.5.80

Total time: 3.60s
```

Now execute the following DB patch:

```
$ onedb patch -v -u oneadmin -d opennebula /usr/lib/one/ruby/onedb/patches/4.14_
↪monitoring.rb
Version read:
Shared tables 4.11.80 : OpenNebula 4.12.1 daemon bootstrap
Local tables  4.13.80 : Database migrated from 4.11.80 to 4.13.80 (OpenNebula 4.13.
↪80) by onedb command.

  > Running patch /usr/lib/one/ruby/onedb/patches/4.14_monitoring.rb
  > Done

  > Total time: 0.05s
```

> **Warning:** This DB upgrade is expected to take a long time to complete in large infrastructures. If you have an OpenNebula Systems support subscription, please contact them to study your case and perform the upgrade with the minimum downtime possible.

Note: Make sure you keep the backup file. If you face any issues, the onedb command can restore this backup, but it won't downgrade databases to previous versions.

3.10.5 Check DB Consistency

After the upgrade is completed, you should run the command `onedb fsck`.

First, move the 4.0 backup file created by the upgrade command to a safe place.

```
$ mv /var/lib/one/mysql_localhost_opennebula.sql /path/for/one-backups/
```

Then execute the following command:

```
$ onedb fsck -S localhost -u oneadmin -p oneadmin -d opennebula
MySQL dump stored in /var/lib/one/mysql_localhost_opennebula.sql
Use 'onedb restore' or restore the DB using the mysql command:
mysql -u user -h server -P port db_name < backup_file

Total errors found: 0
```

3.10.6 Virtual Machine Directories

Note: Only for OpenNebula versions < 3.8.3

If you are upgrading from a version **lower than 3.8.3**, you need to move the Virtual Machine deployment files from '/var/lib/one' to '/var/lib/one/vms':

```
$ mv /var/lib/one/[0-9]* /var/lib/one/vms
```

3.10.7 Driver Names

OpenNebula default driver names have changed in the configuration file. Now the names of the vmm and im drivers are not prepended by the type of driver:

- vmm_kvm → kvm
- vmm_xen → xen
- vmm_vmware → vmware
- vmm_ec2 → ec2
- vmm_dummy → dummy
- im_kvm → kvm
- im_xen → xen
- im_vmware → vmware
- im_ec2 → ec2
- im_ganglia → ganglia

- im_dummy → dummy

To keep your existing hosts working, you need to duplicate the drivers with the old names.

For example, for kvm you will have IM_MAD `kvm` and VM_MAD `kvm`, so you need to add IM_MAD `im_kvm` and VM_MAD `vmm_kvm`

```
IM_MAD = [
      name       = "kvm",
      executable = "one_im_ssh",
      arguments  = "-r 3 -t 15 kvm" ]

IM_MAD = [
      name       = "im_kvm",
      executable = "one_im_ssh",
      arguments  = "-r 3 -t 15 kvm" ]

VM_MAD = [
    name       = "kvm",
    executable = "one_vmm_exec",
    arguments  = "-t 15 -r 0 kvm",
    default    = "vmm_exec/vmm_exec_kvm.conf",
    type       = "kvm" ]

VM_MAD = [
    name       = "vmm_kvm",
    executable = "one_vmm_exec",
    arguments  = "-t 15 -r 0 kvm",
    default    = "vmm_exec/vmm_exec_kvm.conf",
    type       = "kvm" ]
```

3.10.8 Manual Intervention Required

Note: Ignore this section if onedb didn't output the following message

If you have a datastore configured to use a tm driver not included in the OpenNebula distribution, the onedb upgrade command will show you this message:

```
ATTENTION: manual intervention required

The Datastore <id> <name> is using the
custom TM MAD '<tm_mad>'. You will need to define new
configuration parameters in oned.conf for this driver, see
http://opennebula.org/documentation:rel4.4:upgrade
```

Since OpenNebula 4.4, each tm_mad driver has a TM_MAD_CONF section in oned.conf. If you developed the driver, it should be fairly easy to define the required information looking at the existing ones:

```
# The  configuration for each driver is defined in TM_MAD_CONF. These
# values are used when creating a new datastore and should not be modified
# since they define the datastore behaviour.
#   name      : name of the transfer driver, listed in the -d option of the
#               TM_MAD section
#   ln_target : determines how the persistent images will be cloned when
#               a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   clone_target : determines how the non persistent images will be
#                  cloned when a new VM is instantiated.
#       NONE: The image will be linked and no more storage capacity will be used
#       SELF: The image will be cloned in the Images datastore
#       SYSTEM: The image will be cloned in the System datastore
#   shared : determines if the storage holding the system datastore is shared
#            among the different hosts or not. Valid values: "yes" or "no"

TM_MAD_CONF = [
    name         = "lvm",
    ln_target    = "NONE",
    clone_target= "SELF",
    shared       = "yes"
]
```

3.10.9 Update the Drivers

You should be able now to start OpenNebula as usual, running 'one start' as oneadmin. At this point, execute `onehost sync` to update the new drivers in the hosts.

Warning: Doing `onehost sync` is important. If the monitorization drivers are not updated, the hosts will behave erratically.

3.10.10 Setting new System DS

With the new multi-system DS functionality, it is now required that the system DS is also part of the cluster. If you are using System DS 0 for Hosts inside a Cluster, any VM saved (stop, suspend, undeploy) **will not be able to be resumed after the upgrade process**.

You will need to have at least one system DS in each cluster. If you don't already, create new system DS with the same definition as the system DS 0 (TM_MAD driver). Depending on your setup this may or may not require additional configuration on the hosts.

You may also try to recover saved VMs (stop, suspend, undeploy) following the steps described in this thread of the users mailing list.

3.10.11 Create the Security Group ACL Rule

There is a new kind of resource introduced in 4.12: Security Groups. If you want your existing users to be able to create their own Security Groups, create the following ACL Rule:

```
$ oneacl create "* SECGROUP/* CREATE *"
```

3.10.12 Create the Virtual Router ACL Rule

There is a new kind of resource introduced in 5.0: Virtual Routers. If you want your existing users to be able to create their own Virtual Routers, create the following ACL Rule:

```
$ oneacl create "* VROUTER/* CREATE *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 5.0.

3.10.13 Testing

OpenNebula will continue the monitoring and management of your previous Hosts and VMs.

As a measure of caution, look for any error messages in oned.log, and check that all drivers are loaded successfully. After that, keep an eye on oned.log while you issue the onevm, onevnet, oneimage, oneuser, onehost **list** commands. Try also using the **show** subcommand for some resources.

3.10.14 Restoring the Previous Version

If for any reason you need to restore your previous OpenNebula, follow these steps:

- With OpenNebula 5.0 still installed, restore the DB backup using ‘onedb restore -f’
- Uninstall OpenNebula 5.0, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

3.10.15 Known Issues

If the MySQL database password contains special characters, such as `@` or `#`, the onedb command will fail to connect to it.

The workaround is to temporarily change the oneadmin’s password to an ASCII string. The set password statement can be used for this:

```
$ mysql -u oneadmin -p

mysql> SET PASSWORD = PASSWORD('newpass');
```