OpenNebula.org

OpenNebula 4.12 Release Notes

Release 4.12.1

OpenNebula Project

April 08, 2015

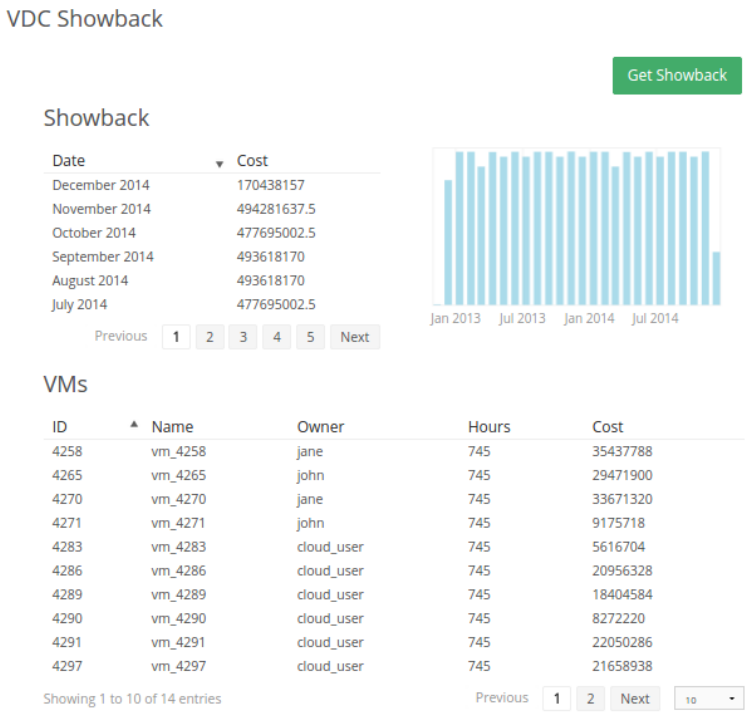
CHAPTER

ONE

RELEASE NOTES 4.12.1

1.1 What's New in 4.12

OpenNebula 4.12 (Cotton Candy) ships with several improvements in different subsystems and components. For the first time, OpenNebula will be able to generate cost reports that can be integrated with chargeback and billing platforms, and also presented to both the administrators and the end users. Each VM Template defined by the Cloud administrator can define a cost per cpu and per memory per hour.



Starting with Cotton Candy, Virtual Datacenters are a new kind of OpenNebula resource with its own ID, name, etc. and the term Resource Provider disappears. Making VDCs a separate resource has several advantages over the previous Group/VDC concept, since they can have one or more Groups added to them. This gives the Cloud Admin greater resource assignment flexibility.

In addition to the well known VNC support in Sunstone, OpenNebula 4.12 will include support to interact with Virtual Machines using the SPICE protocol. This feature can be enabled for any Virtual Machine just checking the option in the input/output section of the Template creation form.

Networking has been vastly improved in 4.12, with the addition of Security Groups, allowing administrators to define

the firewall rules and apply them to the Virtual Machines. Also, Virtual Extensible LAN (VXLAN) is a network virtualization technology aimed to solve large cloud deployments problems, encapsulating Ethernet frames within UDP packets, and thus solving the 4096 VLAN limit problem. Cotton Candy is fully capable of managing VXLANs using the linux kernel integration.

Important new features related to the newly introduced vCenter support are available in OpenNebula 4.12: the ability to import running VMs and networks, including the attach/detach NIC functionality, a new cloud view tailored for vCenter, VM contextualization support and reacquire VM Templates with their logo and description.

Finally, several improvements are scattered across every other OpenNebula component: the possibility to flush and disable a system datastore, improvements in Sunstone for better user workflow, and many other bugfixes that stabilized features introduced in Fox Fur.

As usual OpenNebula releases are named after a Nebula. The Cotton Candy Nebula (IRAS 17150-3224) is located in the constellation of Ara.

Want to take OpenNebula 4.12 for a test drive? Use one of the SandBoxes to try out OpenNebula in no time, or proceed to the *Quick Start guides*.

In the following list you can check the highlights of OpenNebula 4.12. (a detailed list of changes can be found here):

1.1.1 OpenNebula Core

New features include:

- **Showback support**, the core maintains the cost schema defined as **cost per cpu per hour**, and **cost per memory MB per hour** in order to provide *showback functionality*.
- **Datastore maintenance feature**, the *system datastore can now be disabled* so OpenNebula won't schedule VMs in it.

Virtual Network improvements include:

- **Leases visibility**, users with manage rights on a *network and address ranges* should see leases on HOLD.

VDC management improvements also in the core:

- **VDC are now first class citizens**, with a *VDC core pool* and their own ID.
- **Management of groups administrators** using the group template, to be able to add and remove *group administrators* dynamically.

1.1.2 OpenNebula Drivers :: Virtualization

Several improvements in the vCenter drivers:

- **Running VMs support** , ability to import *that allows to automatically import an existing infrastructure*
- **Reacquire VM templates**, after the *vCenter host has been created*, with their logo and description.

1.1.3 OpenNebula Drivers :: Networking

Important new features in Networking, including:

- **Ability to define Security Groups** to *define access to Virtual Machines* (inbound and outbound)
- **Enable Network isolation provided through the VXLAN**, create a *bridge for each OpenNebula Virtual Network and attach a VXLAN tagged network interface to the bridge*

Improvements specific to vCenter networking:

- **Manage vCenter networks**, including the ability to *import them* as well as distributed vSwitches.
- **Attach/detach NIC** to *running Virtual Machines* in vCenter

1.1.4 OpenNebula Drivers :: Storage

As usual, storage drivers were improved for the different supported backends:

- **Better Ceph support**, *ceph drivers* now come with the ability to use the CEPH "MAX AVAIL" attribute.
- **Support for BRIDGE_LIST**, in *fs/share and fs/ssh drivers*.

1.1.5 Sunstone

Sunstone is the all encompasing access to OpenNebula, so it reflects all the improvements and some of its own:

- **Support for SPICE protocol**, access your *VMs through the powerful remote access protocol*, as well as using VNC.
- **Cloud vCenter View**, tailored to *provision resources to end user from vCenter based infrastructures*.
- **Improvements in networking information**, for *hybrid* and *vcenter* based VMs.
- **Support for VXLAN**, in the *network tab*.
- **Support for Showback** capabilities, for *both users and cloud administrators*.
- **Search for any attribute in the VM template**, useful to searh for organization specific attributes.
- **Proxy capabilities** for the *commercial support integration with Zendesk*. (TODO documentation?)
- **Suport IO Tune parameters for templates**

1.1.6 Contextualization

Contextualization improvements are related to the vCenter support:

- **vCenter VM contextualization support**, with the ability to *contextualize both windows and linux VMs*

1.2 Resolved Issues in 4.12.1

- Issues in OpenNebula 4.12.1
- Besides the the bug fixes listed above, 4.12.1 includes several improvements: - xmlrpc-c / scheduler problems with big XML-Sets - Ability to have VNC capabilities for imported VMs from vCenter - Logrotate Script for OpenNebula Logs

1.3 Features

This section describes the **detailed features and functionality of OpenNebula** for the management of private clouds and datacenter virtualization(*). It includes links to the different parts of the documentation and the web site that provide extended information about each feature. We also provide a summarized table of key features.

1.3.1 Powerful User Security Management

- Secure and efficient *Users and Groups Subsystem* for authentication and authorization of requests with complete functionality for user management: create, delete, show...
- *Pluggable authentication and authorization* based on *passwords*, *ssh rsa keypairs*, *X509 certificates*, *LDAP* or *Active Directory*
- Special authentication mechanisms for *SunStone (OpenNebula GUI)* and the *Cloud Services (EC2)*
- *Login token* functionality to password based logins
- Authorization framework with *fine-grained ACLs* that allows multiple-role support for different types of users and administrators, delegated control to authorized users, secure isolated multi-tenant environments, and easy resource (VM template, VM image, VM instance, virtual network and host) sharing

1.3.2 Advanced Multi-tenancy with Group Management

- Administrators can *groups users* into organizations that can represent different projects, division...
- Each group have *configurable access to shared resources* so enabling a multi-tenant environment with multiple groups sharing the same infrastructure
- Configuration of special *users that are restricted to public cloud APIs* (EC2)
- Complete functionality for management of groups: create, delete, show...
- Multiple group support, with the ability to define *primary and secondary groups*.

1.3.3 On-demand Provision of Virtual Data Centers

- A VDC is a fully-isolated virtual infrastructure environment where a Group of users, optionally under the control of the VDC admin, can create and manage compute and storage capacity.
- User Groups can be assigned one or more resource providers. Resource providers are defined as a cluster of servers, virtual networks, datastores and public clouds for cloud bursting in an OpenNebula zone. Read more in the *Users and Groups Management Guide*.
- A special administration group can be defined to manage specific aspects of the group like user management or appliances definition. Read more in the *Managing Users and Groups* guide.
- Sunstone views for new groups can be dynamically defined without the need of modifying the Sunstone configuration files. More information in the *Sunstone Views* guide.
- Groups can now be tagged with custom attributes. Read more in the *Managing Users and Groups* guide.

1.3.4 Advanced Control and Monitoring of Virtual Infrastructure

- *Image Repository Subsystem* with catalog and complete functionality for VM image management: list, publish, unpublish, show, enable, disable, register, update, saveas, delete, clone...
- *Template Repository Subsystem* with catalog and complete functionality for VM template management: add, delete, list, duplicate...
- *Full control of VM instance life-cycle* and complete functionality for VM instance management: submit, deploy, migrate, livemigrate, reschedule, stop, save, resume, cancel, shutdown, restart, reboot, delete, monitor, list, power-on, power-off,...

- Advanced functionality for VM dynamic management like *system and disk snapshotting*, *capacity resizing*, or *NIC hotplugging*
- *Programmable VM operations*, so allowing users to schedule actions
- Volume hotplugging to easily hot plug a volatile disk created on-the-fly or an existing image from a Datastore to a running VM
- *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 consisting of groups of inter-connected VMs, and complete functionality for virtual network management to interconnect VM instances: create, delete, monitor, list...
- *IPv6 support* with definition site and global unicast addresses
- Configurable *system accounting statistics* to visualize and report resource usage data, to allow their integration with chargeback and billing platforms, or to guarantee fair share of resources among users
- *Showback* capabilities to define cost associated to CPU/hours and MEMORY/hours per VM Template.
- Tagging of users, VM images and virtual networks with arbitrary metadata that can be later used by other components
- *User defined VM tags* to simplify VM management and to store application specific data
- *Plain files datastore* to store kernels, ramdisks and files to be used in context. The whole set of OpenNebula features applies, e.g. ACLs, ownership...

1.3.5 Complete Virtual Machine Configuration

- Complete *definition of VM attributes and requirements*
- VM attributes can be provided by the user when the template is instantiated
- Support for automatic configuration of VMs with advanced *contextualization mechanisms*
- *Cloud-init* support
- *Hook Manager* to trigger administration scripts upon VM state change
- Wide range of guest operating system including Microsoft Windows and Linux
- *Flexible network defintion*
- *Security Groups* to define firewall rules and apply them to Virtual Machines

1.3.6 Advanced Control and Monitoring of Physical Infrastructure

- *Configurable to deploy public, private and hybrid clouds*
- *Host Management Subsystem* with complete functionality for management of physical hosts: create, delete, enable, disable, monitor, list...
- Dynamic creation of *clusters* as a logical set of physical resources, namely: hosts, networks and data stores, within each zone
- Highly scalable and extensible built-in *monitoring subsystem*

1.3.7 Broad Commodity and Enterprise Platform Support

- Hypervisor agnostic *Virtualization Subsystem* with broad hypervisor support (*Xen*, *KVM*, *VMware ESX* and *VMware vCenter*), centralized management of environments with multiple hypervisors, and support for multiple hypervisors within the same physical box
- *vCenter* support with *automatic import tool of existing VMware resources*, including existing running VMs, network management and awareness of the presence of ESX hosts behind vCenter
- *Storage Subsystem* with 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 VM types or users
- *Storage Subsystem* supporting any backend configuration with different datastore types: *file system datastore*, to store disk images in a file form and with image transferring using ssh or shared file systems (NFS, GlusterFS, Lustre...), *LVM* to store disk images in a block device form, *Ceph* for distributed block device including RBD format 2, and *VMware datastore* specialized for the VMware hypervisor that handle the vmdk format and with support for VMFS
- Flexible *Network Subsystem* with integration with *Ebtable*, *Open vSwitch*, *802.1Q tagging* and *VXLAN*
- *Virtual Router* fully integrated with OpenNebula to provide basic L3 services like NATing, DHCP, DNS...

1.3.8 Distributed Resource Optimization

- Powerful and flexible *requirement/rank matchmaker scheduler* providing automatic initial VM placement for the definition of workload and resource-aware allocation policies such as packing, striping, load-aware, affinity-aware...
- *Advanced requirement expressions* with cluster attributes for VM placement, affinity policies, any host attribute for scheduling expressions, and scheduler feedback through VM tags
- Powerful and flexible *requirement/rank matchmaker scheduler* for storage load balancing to distribute efficiently the I/O of the VMs across different disks, LUNs or several storage backends
- *Resource quota management* to allocate, track and limit computing, storage and networking resource utilization
- Support for *cgroups* on KVM to enforce VM CPU usage as described in the VM Template

1.3.9 Centralized Management of Multiple Zones

- *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.
- A new tool set has been developed to upgrade, integrate new zones and import existing zones into an OpenNebula federation. Read more in the *Federation Configuration* guide.
- Integrated zone management in OpenNebula core. Read more about this in the *Data Center Federation* guide.
- Redesigned data model to minimize replication data across zones and to tolerate large latencies. Read more about this in the *Data Center Federation* guide.
- Complete functionality for management of zones: create, delete, show, list...

1.3.10 High Availability

- Persistent database backend with support for high availability configurations
- *Configurable behavior in the event of host, VM, or OpenNebula instance failure to provide an easy to use and cost-effective failover solution*
- Support for *high availability architectures*

1.3.11 Community Virtual Appliance Marketplace

- Marketplace with an online catalog where individuals and organizations can quickly distribute and deploy virtual appliances ready-to-run on OpenNebula cloud environments
- *Marketplace is fully integrated with OpenNebula* so any user of an OpenNebula cloud can find and deploy virtual appliances in a single click through familiar tools like the SunStone GUI or the OpenNebula CLI
- Support for importing OVAs processed by the AppMarket Worker. Read more here.

1.3.12 Management of Multi-tier Applications

- *Automatic execution of multi-tiered applications* with complete functionality for the management of groups of virtual machines as a single entity: list, delete, scale up, scale down, shutdown... and the management of Service Templates: create, show, delete, instantiate...
- *Automatic deployment and undeployment of Virtual Machines* according to their dependencies in the Service Template
- Provide configurable services from a catalog and self-service portal
- Enable tight, efficient administrative control
- Complete integration with the OpenNebula's User Security Management system
- Computing resources can be tracked and limited using OpenNebula's *Resource Quota Management*
- *Automatic scaling of multi-tiered applications* according to performance metrics and time schedule
- Dynamic information sharing where information can be passed across nodes in the service
- Network configuration can be defined for a service template
- OpenNebula Flow has been integrated in the Cloud and VDC Admin Sunstone views, so users can instantiate new services and monitor groups of Virtual Machines

1.3.13 Gain Insight into Cloud Applications

- *OneGate allows Virtual Machine guests to push monitoring information to OpenNebula*
- With a security token the VMs can call back home and report guest and/or application status in a simple way, that can be easily queried through OpenNebula interfaces (Sunstone, CLI or API).
- Users and administrators can use it to gather metrics, detect problems in their applications, and trigger *OneFlow auto-scaling rules*

1.3.14 Hybrid Cloud Computing and Cloud Bursting

- *Extension of the local private infrastructure with resources from remote clouds*
- *Support for Amazon EC2* with most of the EC2 features like tags, security groups or VPC; and simultaneous access to multiple remote clouds
- Support to outsource Virtual Machines to *Microsoft Azure cloud provider*
- Support to outsource Virtual Machines to *IBM SoftLayer cloud provider*

1.3.15 Standard Cloud Interfaces and Simple Provisioning Portal for Cloud Consumers

- *Transform your local infrastructure into a public cloud by exposing REST-based interfaces*
- *AWS EC2 API service*, the de facto cloud API standard, with *compatibility with EC2 ecosystem tools* and *client tools*
- Support for simultaneously exposing multiple cloud APIs
- *Provisioning portal implemented as a user Cloud View of Sunstone* to allow non-IT end users to easily create, deploy and manage compute, storage and network resources
- VDCAdmin Sunstone view where VDC admins are able to create new users and manage the resources of the VDC.

1.3.16 Rich Command Line and Web Interfaces for Cloud Administrators

- *Unix-like Command Line Interface* to manage all resources: users, VM images, VM templates, VM instances, virtual networks, zones, VDCs, physical hosts, accounting, authentication, authorization...
- *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
- *Integrated tab in Sunstone* to access OpenNebula Systems (the company behind OpenNebula, formerly C12G) professional support

1.3.17 Multiple Deployment Options

- *Easy to install and update* with packages for most common Linux distributions
- Available in most popular Linux distributions
- *Optional building from source code*
- *System features a small footprint*, less than 10Mb
- *Detailed log files* with *syslog support* for the different components that maintain a record of significant changes

1.3.18 Easy Extension 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: *Virtualization*, *Storage*, *Monitoring*, *Network*, *Auth* and *Hybrid Cloud*
- New drivers can be easily written in any language
- Plugin support to easily extend SunStone Graphical Interface with additional tabs to better integrate Cloud and VM management with each site own operations and tools
- Easily customizable self-service portal for cloud consumers
- *Configuration and tuning parameters* to adjust behavior of the cloud management instance to the requirements of the environment and use cases
- Fully open-source technology available under Apache license
- Powerful and extensible low-level cloud API in *Ruby* and *JAVA* and *XMLRPC API*
- OpenNebula Add-on Catalog with components enhancing the functionality provided by OpenNebula

1.3.19 Reliability, Efficiency and Massive Scalability

- Automated testing process for functionality, scalability, performance, robustness and stability
- Technology matured through an active and engaged community
- Proven on large scale infrastructures consisting of tens of thousands of cores and VMs
- Highly scalable database back-end with support for *MySQL* and SQLite
- Virtualization drivers adjusted for maximum scalability
- Very efficient core developed in C++ language

(*) *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*

1.4 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.

Certified Platform Component	Version		
RedHat Enterprise Linux	6.5, 7.0		
Ubuntu Server	14.04 (LTS)		
CentOS	6.5, 7.0		
Debian	7.1		
VMware	ESX 5.5 & vCenter 5.5		
XEN	3.2 & 4.2		
KVM	Supported version that is included in the kernel for the Linux distribution		
Amazon Web Service	Current API version		
Microsoft Azure	Current API version		
IBM SoftLayer	Current API version		

1.4.1 All Front-Ends

- xmlrpc 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
```

- also for **cloud bursting**, precisely for Microsoft Azure and IBM SoftLayer, those supported distros with ruby versions <= 1.9.3 (like Centos 6.x) please update the ruby installation or use rvm to run a newer (>= 1.9.3) version (remember to run `install_gems` after the ruby upgrade is done to reinstall all gems)

ESX 5.5 as VMware Node

- to accomplish disk hotplugging and nic hotplugging (ignore the first bullet for the latter)
  - disks need to be attached through SCSI, so their images should have a DEV_PREFIX="sd"
  - VM template that will permit SCSI disk attaches afterwards needs to have an explicitly defined SCSI controller:

```
RAW=[TYPE = "vmware",
     DATA = "<devices><controller type='scsi' index='0' model='lsilogic'/></devices>"]
```

- to use SCSI disk based VMs, it is usually a good idea to explicitly declare the PCI bridges. This can be accomplished with the following added to the VM template:

```
FEATURES=[PCIBRIDGE="1"]
```

- to accomplish hot migration (through vMotion)
  - VM needs to have all network card model with model "E1000"

CentOS 6.5 as KVM Node

- to accomplish disk hotplugging:
  - disks need to be attached through SCSI, so their images should have a DEV_PREFIX="sd"
  - 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 libvrit/qemu attac/detach nic functionality that prevents the reuse of net IDs. This means that after a successful attach/detach NIC, a new attach will fail.

Ubuntu 14.04 with Cloud Bursting

The aws-sdk gem is needed for the hybrid model in OpenNebula to access Amazon EC2, but it is tricky to compile in Ubuntu 14.04. To install the dependency:

```
$ sudo gem install nokogiri --version 1.6.1 -- --use-system-libraries
$ sudo gem install aws-sdk
```

1.4.2 CentOS 6.5 Usage Platform Notes

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`.

1.4.3 CentOS 7.0 Platform Notes

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

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

The `qemu-kvm` package does not include support for `RBD` therefore it's not possible to use it in combination with Ceph.

1.4.4 RedHat 6.5 & 7.0 Platform Notes

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 6.5 or 7 repositories to install ruby dependencies.

1.4.5 Debian Platform Notes

Debian Lenny as Xen 3 Node

- The xen packages on Debian Lenny seem to be broken, and they don't work with the tap:aio interface. A workaround for this problem is the following:

```
# ln -s /usr/lib/xen-3.2-1/bin/tapdisk /usr/sbin
# echo xenblktap >> /etc/modules
# reboot
```

1.4.6 Ubuntu 14.04 Platform Notes

- Limited startup scripts → only for OpenNebula service

1.4.7 Unsupported Platforms Notes

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
```

1.5 Compatibility Guide

This guide is aimed at OpenNebula 4.10.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 *guide*

Visit the *Features list* and the Release Notes for a comprehensive list of what's new in OpenNebula 4.12.

1.5.1 OpenNebula Administrators

Virtual Data Centers

- The previous Group Resoure Providers functionality has been moved to a new entity, VDCs. You can read more in the *Understanding OpenNebula guide* and the *VDCs guide*.

Security Groups

Previous versions supported firewall management through special attributes in the VM templates *WHITE_PORTS_TCP*, etc. This has been deprecated in favour of the the new *Security Groups*, which are a new entity in OpenNebula. Security Groups can be created and updated, consisting of one or more rules, where each rule is either INBOUND or OUTBOUND, global or for a specific protocol, within each protocol it can be global or for specific subtype of the protocol or ports. Furthermore, the rule can be adjusted to be applied only for a specific source or target, custom defined or an OpenNebula Network.

Backwards compatibility will be kept. If a Virtual Machine template contains one of the following attributes it will ignore security groups and continue to work as before:

- `WHITE_PORTS_TCP`
- `BLACK_PORTS_TCP`
- `WHITE_PORTS_UDP`
- `BLACK_PORTS_UDP`
- `ICMP`

Note that Open vSwitch is **not** affected by this change, as it still works with the old firewall management style. In particular, only these network drivers are affected:

- `802.1Q`
- `ebtables`
- `fw`
- `vxlan`

It is also worth noting that new networks will be assigned the default security group, which allows all outbound traffic but **blocks all inbound traffic**. Change the `default` security group for your infrastructure if you want it to be different.

Group Administrators

Previous versions allowed to create one special group administrator when the group was created. Now any user can be made an administrator at any moment. The main difference with the previous mechanism is that now the administrators don't have a separate set of resources they are allowed to create, i.e. the `--admin_resources` option is not present in the `onegroup create` command.

Virtual Networks

When a Virtual Network is shown to a user, it only includes the leases to his objects. This way, they can see the IPs given to their VMs, but not to other user's VMs. For 4.12, all the leases are included (leases on hold and other user's VMs) if the user requesting the Virtual Network is the owner (has `MANAGE` rights).

Restricted Attributes for VMs

The *VM restricted attributes* are now checked when a VM Template is created (or updated), as opposed to when it is instantiated. This means that users will know inmediately if they are creating a restricted template. It also enables administrators to create VM Templates with restributed attributes and later change the owner to a normal user, that will be able to instantiate it without problems.

1.5.2 Developers and Integrators

XML-RPC API

This section lists all the changes in the API. Visit the *complete reference* for more information.

- New api calls:
  - `one.vdc.info`
  - `one.vdc.allocate`
  - `one.vdc.update`
  - `one.vdc.rename`
  - `one.vdc.delete`
  - `one.vdc.addgroup`
  - `one.vdc.delgroup`
  - `one.vdc.addcluster`
  - `one.vdc.delcluster`

  - one.vdc.addhost
  - one.vdc.delhost
  - one.vdc.adddatastore
  - one.vdc.deldatastore
  - one.vdc.addvnet
  - one.vdc.delvnet
  - one.vdcpool.info
  - one.secgroup.allocate
  - one.secgroup.clone
  - one.secgroup.delete
  - one.secgroup.chown
  - one.secgroup.chmod
  - one.secgroup.update
  - one.secgroup.rename
  - one.secgroup.info
  - one.secgrouppool.info
  - one.vmpool.showback
  - one.vmpool.calculateshowback
  - one.group.addadmin
  - one.group.deladmin
  - one.datastore.enable
- Deleted api calls:
  - one.group.addprovider: Replaced by VDCs
  - one.group.delprovider: Replaced by VDCs

1.6 Known Issues

1.6.1 CLI

- #3037 Different ruby versions need different time formats

1.6.2 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
- #2488 A failed resume action will destroy and recreate the VM on the next resume
- #3139 Drivers do not work with rbenv

1.6.3 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
- #3349 The Virtual Router is not working

1.6.4 Drivers - Storage

- #1573 If an image download fails, the file is never deleted from the datastore

1.6.5 Drivers - VM

- #2511 EC2 Tags are not correctly formatted before sending them to EC2

1.6.6 OneFlow

- #3134 Service Templates with dynamic networks cannot be instantiated from the CLI, unless the a template file with the required attributes is merged

1.6.7 Scheduler

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

1.6.8 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

1.7 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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1.8 Upgrading from OpenNebula 4.12.0

This guide describes the installation procedure for systems that are already running a 4.12.0 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 4.12.1.

1.8.1 Upgrading a Federation

If you have two or more 4.12.0 OpenNebulas working as a *Federation*, you can upgrade each one independently. Zones with an OpenNebula from the 4.12.x series can be part of the same federation, since the shared portion of the database is compatible.

The rest of the guide applies to both a master or slave Zone. You don't need to stop the federation or the MySQL replication to follow this guide.

1.8.2 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.

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
```

1.8.3 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.

1.8.4 Installation

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

1.8.5 Configuration Files Upgrade

There have not been any changes in the configuration files, so you can keep the existing configuration from your previous 4.12.0 version, including `oned.conf`.

After the update, simply restore from the `/etc/one.YYYY-MM-DD` backup you have made.

1.8.6 Database Upgrade

The upgrade from any previous 4.12.x version does not require a database upgrade, the database schema is compatible.

1.8.7 Check DB Consistency

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

1.8.8 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.

1.8.9 Default Auth

If you are using *LDAP as default auth driver* you will need to update the directory. To do this execute the command:

```
$ cp -R /var/lib/one/remotes/auth/ldap /var/lib/one/remotes/auth/default
```

1.8.10 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.

1.8.11 Restoring the Previous Version

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

- Uninstall OpenNebula 4.12.1, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.8.12 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');
```

1.9 Upgrading from OpenNebula 4.10.x

This guide 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* and Release Notes to know what is new in OpenNebula 4.12.

1.9.1 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 guide for the **master zone**. After the master has been updated to 4.12, upgrade each **slave zone** following this same guide.

1.9.2 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.

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.

1.9.3 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')
```

1.9.4 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.9.5 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.

1.9.6 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
```

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.

1.9.7 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
```

1.9.8 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 a new table, `vdc_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

# 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
```

1.9.9 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
```

1.9.10 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
```

1.9.11 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.

1.9.12 Default Auth

If you are using *LDAP as default auth driver* you will need to update the directory. To do this execute the command:

```
$ cp -R /var/lib/one/remotes/auth/ldap /var/lib/one/remotes/auth/default
```

1.9.13 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.

1.9.14 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 4.12.

1.9.15 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.

1.9.16 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.9.17 Known Issues

If you have ruby version 1.9 and your database contains non-ascii characters, the upgrade may fail with the following message:

```
ArgumentError: invalid byte sequence in US-ASCII
```

To fix this, download an updated version of the upgrade files:

```
sudo wget https://gist.githubusercontent.com/carlosms/643d12f2b91c709e7e86/raw/281bcf626121e5b166425
sudo wget https://gist.githubusercontent.com/carlosms/00c5e09bde47a20edc7d/raw/07f0de0592d31f88e3ffbe
```

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');
```

1.10 Upgrading from OpenNebula 4.8.x

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

1.10.1 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 guide for the **master zone**. After the master has been updated to 4.12, upgrade each **slave zone** following this same guide.

1.10.2 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.

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
```

1.10.3 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.

1.10.4 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.10.5 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.

1.10.6 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
```

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.

1.10.7 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
```

1.10.8 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 a new table, `vdc_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

# 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
```

1.10.9 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.

1.10.10 Default Auth

If you are using *LDAP as default auth driver* you will need to update the directory. To do this execute the command:

```
$ cp -R /var/lib/one/remotes/auth/ldap /var/lib/one/remotes/auth/default
```

1.10.11 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 *"
```

Note: For environments in a Federation: This command needs to be executed only once in the master zone, after it is upgraded to 4.12.

1.10.12 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.

1.10.13 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.10.14 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');
```

1.11 Upgrading from OpenNebula 4.6.x

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

1.11.1 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 guide for the **master zone**. After the master has been updated to 4.12, upgrade each **slave zone** following this same guide.

1.11.2 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.

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
```

1.11.3 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.

1.11.4 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.11.5 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.

1.11.6 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
```

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.

1.11.7 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
```

1.11.8 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 a new table, `vdc_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

# 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
```

1.11.9 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.

1.11.10 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 4.12.

1.11.11 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.

1.11.12 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.11.13 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');
```

1.12 Upgrading from OpenNebula 4.4.x

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

1.12.1 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.

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
```

1.12.2 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.

1.12.3 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.12.4 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
```

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.

1.12.5 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
```

1.12.6 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.

1.12.7 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 *"
```

1.12.8 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.

1.12.9 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.12.10 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');
```

1.13 Upgrading from OpenNebula 4.2

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

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.

1.13.1 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.

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
```

1.13.2 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.

1.13.3 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.13.4 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.

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.

1.13.5 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
```

1.13.6 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.

1.13.7 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 *"
```

1.13.8 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.

1.13.9 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.

1.13.10 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.13.11 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');
```

1.13.12 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"
]
```

1.14 Upgrading from OpenNebula 4.0.x

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

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.

1.14.1 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.

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
```

1.14.2 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.

1.14.3 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.14.4 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.

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.

1.14.5 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
```

1.14.6 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.

1.14.7 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.

1.14.8 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 *"
```

1.14.9 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.

1.14.10 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.14.11 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');
```

1.14.12 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"
]
```

1.15 Upgrading from OpenNebula 3.8.x

This guide 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 and *4.12*, and the Release Notes to know what is new in OpenNebula 4.12.

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.

1.15.1 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.

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
```

1.15.2 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.

1.15.3 Installation

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

It is highly recommended **not to keep** your current `oned.conf`, and update the `oned.conf` file shipped with OpenNebula 4.12 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 *4.12* versions.

1.15.4 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
```

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.

1.15.5 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
```

1.15.6 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
```

1.15.7 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" ]
```

1.15.8 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"
]
```

1.15.9 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.

1.15.10 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.

1.15.11 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 *"
```

1.15.12 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.

1.15.13 Restoring the Previous Version

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

- With OpenNebula 4.12 still installed, restore the DB backup using 'onedb restore -f'
- Uninstall OpenNebula 4.12, and install again your previous version.
- Copy back the backup of /etc/one you did to restore your configuration.

1.15.14 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');
```