



OpenNebula 5.4 Integration Guide

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OpenNebula Systems

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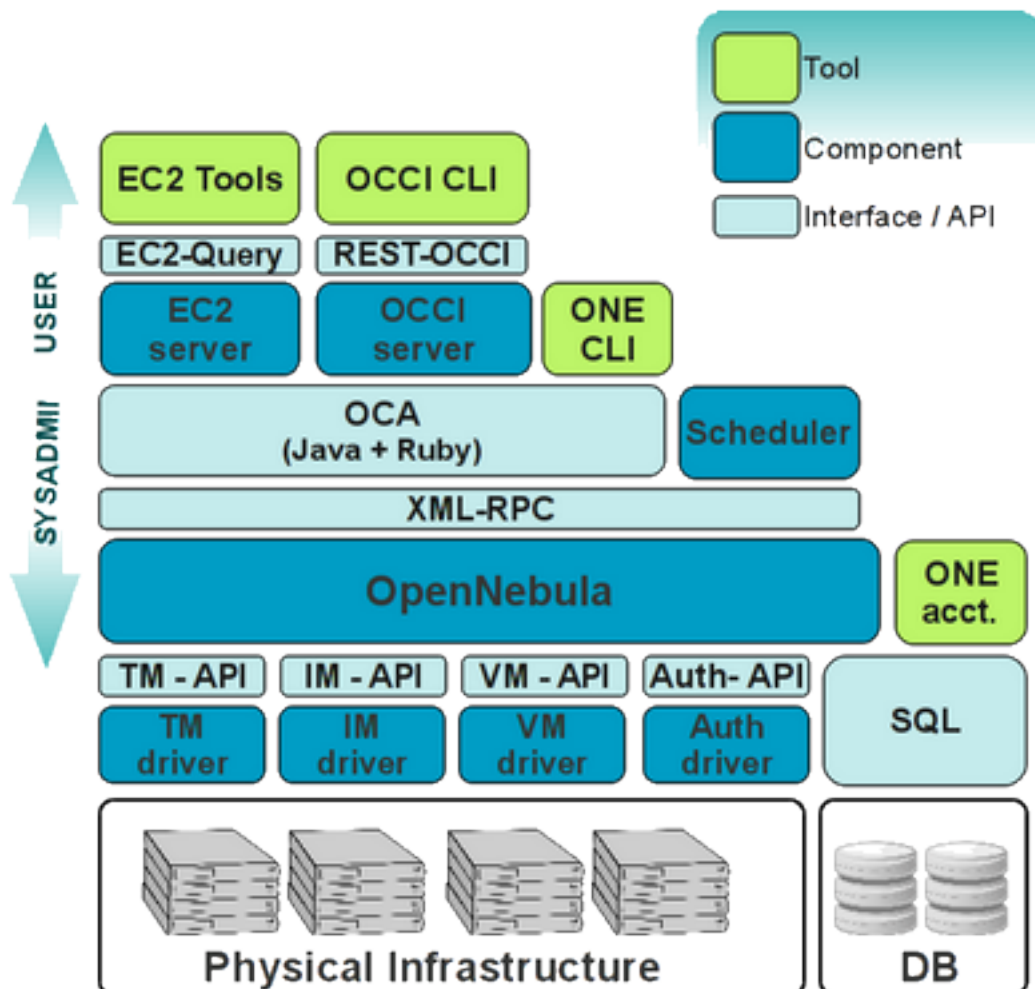
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SYSTEM INTERFACES

1.1 Overview

OpenNebula has been designed to be easily adapted to any infrastructure and easily extended with new components. The result is a modular system that can implement a variety of Cloud architectures and can interface with multiple data-center services. In this Guide we review the main interfaces of OpenNebula, their use and give pointers to additional documentation for each one.

We have classified the interfaces in two categories: end-user cloud and system interfaces.



1.1.1 How Should I Read This Chapter

You should be reading this Chapter if you are trying to automate tasks in your deployed OpenNebula cloud, and you have already read all of the previous guides.

This Chapter introduces the OpenNebula interfaces:

- **Cloud interfaces** are primarily used to develop tools targeted to the end-user, and they provide a high level abstraction of the functionality provided by the Cloud. They are designed to manage virtual machines, networks and images through a simple and easy-to-use REST API. The Cloud interfaces hide most of the complexity of a Cloud and are specially suited for end-users. OpenNebula features a EC2 interface, implementing the functionality offered by the [Amazon's EC2 API](#), mainly those related to virtual machine management. In this way, you can use any EC2 Query tool to access your OpenNebula Cloud. Use the cloud interface if you are developing portals, tools or specialized solutions for end-users. You can find more information at [EC2-Query reference](#).
- **System interfaces** expose the full functionality of OpenNebula and are mainly used to adapt and tune the behavior of OpenNebula to the target infrastructure:
 - The XML-RPC interface is the primary interface for OpenNebula, exposing all the functionality to interface the OpenNebula daemon. Through the XML-RPC interface you can control and manage any OpenNebula resource, including VMs, Virtual Networks, Images, Users, Hosts and Clusters. Use the XML-RPC interface if you are developing specialized libraries for Cloud applications or you need a low-level interface with the OpenNebula core. A full reference in the [XML-RPC reference Section](#).
 - The OpenNebula Cloud API provides a simplified and convenient way to interface with the OpenNebula core XMLRPC API. The OCA interfaces exposes the same functionality as that of the XML-RPC interface. OpenNebula includes two language bindings for OCA: [Ruby](#) and [JAVA](#).
 - The [OpenNebula OneFlow API](#) is a RESTful service to create, control and monitor services composed of interconnected Virtual Machines with deployment dependencies between them.

After this Chapter, if you are interested in extending the OpenNebula functionality, you need to read the [Infrastructure Integration Chapter](#) to understand how OpenNebula relates with the different datacenter components.

1.1.2 Hypervisor Compatibility

All the Sections of this Chapter applies to both KVM and vCenter hypervisors.

1.2 XML-RPC API

This reference documentation describes the xml-rpc methods exposed by OpenNebula. Each description consists of the method name and the input and output values.

All xml-rpc responses share a common structure.

| Type | Data Type | Description |
|------|-----------|---|
| OUT | Boolean | True or false whenever is successful or not. |
| OUT | String | If an error occurs this is the error message. |
| OUT | Int | Error code. |

The output will always consist of three values. The first and third ones are fixed, but the second one will contain the String error message only in case of failure. If the method is successful, the returned value may be of another Data Type.

The Error Code will contain one of the following values:

| Value | Code | Meaning |
|--------|----------------|---|
| 0x0000 | SUCCESS | Success response. |
| 0x0100 | AUTHENTICATION | User could not be authenticated. |
| 0x0200 | AUTHORIZATION | User is not authorized to perform the requested action. |
| 0x0400 | NO_EXISTS | The requested resource does not exist. |
| 0x0800 | ACTION | Wrong state to perform action. |
| 0x1000 | XML_RPC_API | Wrong parameters, e.g. param should be -1 or -2, but -3 was received. |
| 0x2000 | INTERNAL | Internal error, e.g. the resource could not be loaded from the DB. |

Note: All methods expect a session string associated to the connected user as the first parameter. It has to be formed with the contents of the ONE_AUTH file, which will be <username>:<password> with the default 'core' auth driver.

Note: Each XML-RPC request has to be authenticated and authorized. See the Auth Subsystem documentation for more information.

The information strings returned by the `one.*.info` methods are XML-formatted. The complete XML Schemas (XSD) reference is included at the end of this page. We encourage you to use the `-x` option of the command line interface to collect sample outputs from your own infrastructure.

The methods that accept XML templates require the root element to be `TEMPLATE`. For instance, this template:

```
NAME = abc
MEMORY = 1024
ATT1 = value1
```

Can be also given to OpenNebula with the following XML:

```
<TEMPLATE>
  <NAME>abc</NAME>
  <MEMORY>1024</MEMORY>
  <ATT1>value1</ATT1>
</TEMPLATE>
```

1.2.1 Authorization Requests Reference

OpenNebula features a CLI that wraps the XML-RPC requests. For each XML-RPC request, the session token is authenticated, and after that the Request Manager generates an authorization request that can include more than one operation. The following tables document these requests from the different CLI commands.

onevm

| onevm command | XML-RPC Method | Auth. Request |
|---|---------------------------|--|
| deploy | one.vm.deploy | VM:ADMIN HOST:MANAGE |
| terminate suspend hold stop resume release poweroff reboot | one.vm.action | VM:MANAGE |
| resched unresched | one.vm.action | VM:ADMIN |
| migrate | one.vm.migrate | VM:ADMIN HOST:MANAGE |
| disk-saveas | one.vm.disksaveas | VM:MANAGE IMAGE:CREATE |
| disk-snapshot-create | one.vm.disksnapshotcreate | VM:MANAGE IMAGE:MANAGE |
| disk-snapshot-delete | one.vm.disksnapshotdelete | VM:MANAGE IMAGE:MANAGE |
| disk-snapshot-revert | one.vm.disksnapshotrevert | VM:MANAGE |
| disk-attach | one.vm.attach | VM:MANAGE IMAGE:USE |
| disk-detach | one.vm.detach | VM:MANAGE |
| disk-resize | one.vm.diskresize | VM:MANAGE |
| nic-attach | one.vm.attachnic | VM:MANAGE NET:USE |
| nic-detach | one.vm.detachnic | VM:MANAGE |
| create | one.vm.allocate | VM:CREATE IMAGE:USE NET:USE |
| show | one.vm.info | VM:USE |
| chown chgrp | one.vm.chown | VM:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.vm.chmod | VM:<MANAGE/ADMIN> |
| rename | one.vm.rename | VM:MANAGE |
| snapshot-create | one.vm.snapshotcreate | VM:MANAGE |
| snapshot-delete | one.vm.snapshotdelete | VM:MANAGE |
| snapshot-revert | one.vm.snapshotrevert | VM:MANAGE |
| resize | one.vm.resize | VM:MANAGE |
| update | one.vm.update | VM:MANAGE |
| recover | one.vm.recover | VM:ADMIN |
| save | – (ruby method) | VM:MANAGE IMAGE:CREATE TEMPLATE:CREATE |
| updateconf | one.vm.updateconf | VM:MANAGE |
| list top | one.vmpool.info | VM:USE |
| – | one.vm.monitoring | VM:USE |

Note: The **deploy** action requires the user issuing the command to have VM:ADMIN rights. This user will usually be the scheduler with the oneadmin credentials.

The scheduler deploys VMs to the Hosts over which the VM owner has MANAGE rights.

onetemplate

| onetemplate command | XML-RPC Method | Auth. Request |
|---------------------|--------------------------|---|
| update | one.template.update | TEMPLATE:MANAGE |
| instantiate | one.template.instantiate | TEMPLATE:USE [IMAGE:USE] [NET:USE] |
| create | one.template.allocate | TEMPLATE:CREATE |
| clone | one.template.clone | TEMPLATE:CREATE TEMPLATE:USE |
| delete | one.template.delete | TEMPLATE:MANAGE |
| show | one.template.info | TEMPLATE:USE |
| chown chgrp | one.template.chown | TEMPLATE:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.template.chmod | TEMPLATE:<MANAGE/ADMIN> |
| rename | one.template.rename | TEMPLATE:MANAGE |
| list top | one.templatepool.info | TEMPLATE:USE |

onehost

| onehost command | XML-RPC Method | Auth. Request |
|--------------------|-------------------|--------------------------------|
| disable offline | one.host.status | HOST:ADMIN |
| update | one.host.update | HOST:ADMIN |
| create | one.host.allocate | HOST:CREATE [CLUSTER:ADMIN] |
| delete | one.host.delete | HOST:ADMIN |
| rename | one.host.rename | HOST:ADMIN |
| show | one.host.info | HOST:USE |
| list top | one.hostpool.info | HOST:USE |

Warning: onehost sync is not performed by the core, it is done by the ruby command onehost.

onecluster

| onecluster command | XML-RPC Method | Auth. Request |
|--------------------|--------------------------|----------------------------------|
| create | one.cluster.allocate | CLUSTER:CREATE |
| delete | one.cluster.delete | CLUSTER:ADMIN |
| update | one.cluster.update | CLUSTER:MANAGE |
| addhost | one.cluster.addhost | CLUSTER:ADMIN HOST:ADMIN |
| delhost | one.cluster.delhost | CLUSTER:ADMIN HOST:ADMIN |
| adddatastore | one.cluster.adddatastore | CLUSTER:ADMIN DATASTORE:ADMIN |
| deldatastore | one.cluster.deldatastore | CLUSTER:ADMIN DATASTORE:ADMIN |
| addvnet | one.cluster.addvnet | CLUSTER:ADMIN NET:ADMIN |
| delvnet | one.cluster.delvnet | CLUSTER:ADMIN NET:ADMIN |
| rename | one.cluster.rename | CLUSTER:MANAGE |
| show | one.cluster.info | CLUSTER:USE |
| list | one.clusterpool.info | CLUSTER:USE |

onegroup

| onegroup command | XML-RPC Method | Auth. Request |
|------------------|-----------------------|---|
| create | one.group.allocate | GROUP:CREATE |
| delete | one.group.delete | GROUP:ADMIN |
| show | one.group.info | GROUP:USE |
| update | one.group.update | GROUP:MANAGE |
| addadmin | one.group.addadmin | GROUP:MANAGE USER:MANAGE |
| deladmin | one.group.deladmin | GROUP:MANAGE USER:MANAGE |
| quota | one.group.quota | GROUP:ADMIN |
| list | one.grouppool.info | GROUP:USE |
| - | one.groupquota.info | - |
| defaultquota | one.groupquota.update | Only for users in the <code>oneadmin</code> group |

onevdc

| onevdc command | XML-RPC Method | Auth. Request |
|----------------|----------------------|--|
| create | one.vdc.allocate | VDC:CREATE |
| rename | one.vdc.rename | VDC:MANAGE |
| delete | one.vdc.delete | VDC:ADMIN |
| update | one.vdc.update | VDC:MANAGE |
| show | one.vdc.info | VDC:USE |
| list | one.vdcpool.info | VDC:USE |
| addgroup | one.vdc.addgroup | VDC:ADMIN GROUP:ADMIN |
| delgroup | one.vdc.delgroup | VDC:ADMIN GROUP:ADMIN |
| addcluster | one.vdc.addcluster | VDC:ADMIN CLUSTER:ADMIN ZONE:ADMIN |
| delcluster | one.vdc.delcluster | VDC:ADMIN CLUSTER:ADMIN ZONE:ADMIN |
| addhost | one.vdc.addhost | VDC:ADMIN HOST:ADMIN ZONE:ADMIN |
| delhost | one.vdc.delhost | VDC:ADMIN HOST:ADMIN ZONE:ADMIN |
| adddatastore | one.vdc.adddatastore | VDC:ADMIN DATASTORE:ADMIN ZONE:ADMIN |
| deldatastore | one.vdc.deldatastore | VDC:ADMIN DATASTORE:ADMIN ZONE:ADMIN |
| addvnet | one.vdc.addvnet | VDC:ADMIN NET:ADMIN ZONE:ADMIN |
| delvnet | one.vdc.delvnet | VDC:ADMIN NET:ADMIN ZONE:ADMIN |

onevnet

| onevnet command | XML-RPC Method | Auth. Request |
|-----------------|------------------|--|
| addar | one.vn.add_ar | NET:ADMIN |
| rmar | one.vn.rm_ar | NET:ADMIN |
| free | one.vn.free_ar | NET:MANAGE |
| reserve | one.vn.reserve | NET:USE |
| updatear | one.vn.update_ar | NET:MANAGE |
| hold | one.vn.hold | NET:MANAGE |
| release | one.vn.release | NET:MANAGE |
| update | one.vn.update | NET:MANAGE |
| create | one.vn.allocate | NET:CREATE [CLUSTER:ADMIN] |
| delete | one.vn.delete | NET:MANAGE |
| show | one.vn.info | NET:USE |
| chown chgrp | one.vn.chown | NET:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.vn.chmod | NET:<MANAGE/ADMIN> |
| rename | one.vn.rename | NET:MANAGE |
| list | one.vnpool.info | NET:USE |

oneuser

| oneuser command | XML-RPC Method | Auth. Request |
|-----------------|----------------------|---|
| create | one.user.allocate | USER:CREATE |
| delete | one.user.delete | USER:ADMIN |
| show | one.user.info | USER:USE |
| passwd | one.user.passwd | USER:MANAGE |
| login | one.user.login | USER:MANAGE |
| update | one.user.update | USER:MANAGE |
| chauth | one.user.chauth | USER:ADMIN |
| quota | one.user.quota | USER:ADMIN |
| chgrp | one.user.chgrp | USER:MANAGE GROUP:MANAGE |
| addgroup | one.user.addgroup | USER:MANAGE GROUP:MANAGE |
| delgroup | one.user.delgroup | USER:MANAGE GROUP:MANAGE |
| encode | – | – |
| list | one.userpool.info | USER:USE |
| – | one.userquota.info | – |
| defaultquota | one.userquota.update | Only for users in the <code>oneadmin</code> group |

onedatastore

| onedatastore com- mand | XML-RPC Method | Auth. Request |
|---------------------------|------------------------|--|
| create | one.datastore.allocate | DATASTORE:CREATE [CLUSTER:ADMIN] |
| delete | one.datastore.delete | DATASTORE:ADMIN |
| show | one.datastore.info | DATASTORE:USE |
| update | one.datastore.update | DATASTORE:MANAGE |
| rename | one.datastore.rename | DATASTORE:MANAGE |
| chown chgrp | one.datastore.chown | DATASTORE:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.datastore.chmod | DATASTORE:<MANAGE / ADMIN> |
| enable disable | one.datastore.enable | DATASTORE:MANAGE |
| list | one.datastorepool.info | DATASTORE:USE |

oneimage

| oneimage command | XML-RPC Method | Auth. Request |
|-----------------------------|---------------------------|--|
| persistent nonpersistent | one.image.persistent | IMAGE:MANAGE |
| enable disable | one.image.enable | IMAGE:MANAGE |
| chtype | one.image.chtype | IMAGE:MANAGE |
| snapshot-delete | one.image.snapshotdelete | IMAGE:MANAGE |
| snapshot-revert | one.image.snapshotrevert | IMAGE:MANAGE |
| snapshot-flatten | one.image.snapshotflatten | IMAGE:MANAGE |
| update | one.image.update | IMAGE:MANAGE |
| create | one.image.allocate | IMAGE:CREATE DATASTORE:USE |
| clone | one.image.clone | IMAGE:CREATE IMAGE:USE DATASTORE:USE |
| delete | one.image.delete | IMAGE:MANAGE |
| show | one.image.info | IMAGE:USE |
| chown chgrp | one.image.chown | IMAGE:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.image.chmod | IMAGE:<MANAGE / ADMIN> |
| rename | one.image.rename | IMAGE:MANAGE |
| list top | one.imagepool.info | IMAGE:USE |

onemarket

| onemarket mand | com- | XML-RPC Method | Auth. Request |
|-------------------|------|---------------------|--|
| update | | one.market.update | MARKETPLACE:MANAGE |
| create | | one.market.allocate | MARKETPLACE:CREATE |
| delete | | one.market.delete | MARKETPLACE:MANAGE |
| show | | one.market.info | MARKETPLACE:USE |
| chown chgrp | | one.market.chown | MARKETPLACE:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | | one.market.chmod | MARKETPLACE:<MANAGE / ADMIN> |
| rename | | one.market.rename | MARKETPLACE:MANAGE |
| list | | one.marketpool.info | MARKETPLACE:USE |

onemarketapp

| onemarketapp command | | XML-RPC Method | Auth. Request |
|-------------------------|--|------------------------|--|
| create | | one.marketapp.allocate | MARKETPLACEAPP:CREATE MARKETPLACE:USE |
| export | | – (ruby method) | MARKETPLACEAPP:USE IMAGE:CREATE DATASTORE:USE [TEMPLATE:CREATE] |
| download | | – (ruby method) | MARKETPLACEAPP:USE |
| enable disable | | one.marketapp.enable | MARKETPLACEAPP:MANAGE |
| update | | one.marketapp.update | MARKETPLACEAPP:MANAGE |
| delete | | one.marketapp.delete | MARKETPLACEAPP:MANAGE |
| show | | one.marketapp.info | MARKETPLACEAPP:USE |
| chown chgrp | | one.marketapp.chown | MARKETPLACEAPP:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | | one.marketapp.chmod | MARKETPLACEAPP:<MANAGE / ADMIN> |
| rename | | one.marketapp.rename | MARKETPLACEAPP:MANAGE |
| list | | one.marketapppool.info | MARKETPLACEAPP:USE |

onevrouter

| onevrouter command | XML-RPC Method | Auth. Request |
|--------------------|-------------------------|--|
| create | one.vrouter.allocate | VROUTER:CREATE |
| update | one.vrouter.update | VROUTER:MANAGE |
| instantiate | one.vrouter.instantiate | TEMPLATE:USE [IMAGE:USE] [NET:USE] |
| nic-attach | one.vrouter.attachnic | VROUTER:MANAGE NET:USE |
| nic-detach | one.vrouter.detachnic | VROUTER:MANAGE |
| delete | one.vrouter.delete | VROUTER:MANAGE |
| show | one.vrouter.info | VROUTER:USE |
| chown chgrp | one.vrouter.chown | VROUTER:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.vrouter.chmod | VROUTER:<MANAGE/ADMIN> |
| rename | one.vrouter.rename | VROUTER:MANAGE |
| list top | one.vrouterpool.info | VROUTER:USE |

onezone

| onezone command | XML-RPC Method | Auth. Request |
|-----------------|-------------------|---------------|
| create | one.zone.allocate | ZONE:CREATE |
| rename | one.zone.rename | ZONE:MANAGE |
| update | one.zone.update | ZONE:MANAGE |
| delete | one.zone.delete | ZONE:ADMIN |
| show | one.zone.info | ZONE:USE |
| list | one.zonepool.info | ZONE:USE |
| set | - | ZONE:USE |

onesecgroup

| onesecgroup mand | com- | XML-RPC Method | Auth. Request |
|---------------------|------|-----------------------|---|
| create | | one.secgroup.allocate | SECGROUP:CREATE |
| clone | | one.secgroup.clone | SECGROUP:CREATE SECGROUP:USE |
| delete | | one.secgroup.delete | SECGROUP:MANAGE |
| chown chgrp | | one.secgroup.chown | SECGROUP:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | | one.secgroup.chmod | SECGROUP:<MANAGE / ADMIN> |
| update | | one.secgroup.update | SECGROUP:MANAGE |
| commit | | one.secgroup.commit | SECGROUP:MANAGE |
| rename | | one.secgroup.rename | SECGROUP:MANAGE |
| show | | one.secgroup.info | SECGROUP:USE |
| list | | one.secgrouppool.info | SECGROUP:USE |

onevmgroup

| onevmgroup command | XML-RPC Method | Auth. Request |
|--------------------|--------------------------|--|
| create | one.vmgrouppool.allocate | VMGROUP:CREATE |
| delete | one.vmgrouppool.delete | VMGROUP:MANAGE |
| chown chgrp | one.vmgrouppool.chown | VMGROUP:MANAGE [USER:MANAGE] [GROUP:USE] |
| chmod | one.vmgrouppool.chmod | VMGROUP:<MANAGE / ADMIN> |
| update | one.vmgrouppool.update | VMGROUP:MANAGE |
| rename | one.vmgrouppool.rename | VMGROUP:MANAGE |
| show | one.vmgrouppool.info | VMGROUP:USE |
| list | one.vmgrouppool.info | VMGROUP:USE |

oneacl

| oneacl command | XML-RPC Method | Auth. Request |
|----------------|-----------------|---------------|
| create | one.acl.addrule | ACL:MANAGE |
| delete | one.acl.delrule | ACL:MANAGE |
| list | one.acl.info | ACL:MANAGE |

oneacct

| command | XML-RPC Method | Auth. Request |
|---------|-----------------------|---------------|
| oneacct | one.vmpool.accounting | VM:USE |

oneshowback

| command | XML-RPC Method | Auth. Request |
|-----------|------------------------------|-------------------------|
| list | one.vmpool.showback | VM:USE |
| calculate | one.vmpool.calculateshowback | Only for oneadmin group |

documents

| | |
|-----------------------|---|
| XML-RPC Method | Auth. Request |
| one.document.update | DOCUMENT:MANAGE |
| one.document.allocate | DOCUMENT:CREATE |
| one.document.clone | DOCUMENT:CREATE DOCUMENT:USE |
| one.document.delete | DOCUMENT:MANAGE |
| one.document.info | DOCUMENT:USE |
| one.document.chown | DOCUMENT:MANAGE [USER:MANAGE] [GROUP:USE] |
| one.document.chmod | DOCUMENT:<MANAGE / ADMIN> |
| one.document.rename | DOCUMENT:MANAGE |
| one.document.lock | DOCUMENT:MANAGE |
| one.document.unlock | DOCUMENT:MANAGE |
| one.documentpool.info | DOCUMENT:USE |

system

| | | |
|---------|--------------------|---|
| command | XML-RPC Method | Auth. Request |
| - | one.system.version | - |
| - | one.system.config | Only for users in the <code>oneadmin</code> group |

1.2.2 Actions for Templates Management**one.template.allocate**

- **Description:** Allocates a new template in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.template.clone

- **Description:** Clones an existing virtual machine template.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The ID of the template to be cloned. |
| IN | String | Name for the new template. |
| IN | Boolean | true to clone the template plus any image defined in DISK. The new IMAGE_ID is set into each DISK. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new template ID / The error string. |
| OUT | Int | Error code. |

one.template.delete

- **Description:** Deletes the given template from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Boolean | true to delete the template plus any image defined in DISK. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.template.instantiate

- **Description:** Instantiates a new virtual machine from a template.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | Name for the new VM instance. If it is an empty string, OpenNebula will assign one automatically. |
| IN | Boolean | False to create the VM on pending (default), True to create it on hold. |
| IN | String | A string containing an extra template to be merged with the one being instantiated. It can be empty. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Boolean | true to create a private persistent copy of the template plus any image defined in DISK, and instantiate that copy. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new virtual machine ID / The error string. |
| OUT | Int | Error code. |

Sample template string:

```
MEMORY=4096\nCPU=4\nVCPU=4
```

Note: Declaring a field overwrites the template. Thus, declaring `DISK=[...]` overwrites the template `DISK` attribute and as such, must contain the entire `DISK` definition.

one.template.update

- **Description:** Replaces the template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.template.chmod

- **Description:** Changes the permission bits of a template.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| IN | Boolean | true to chmod the template plus any image defined in DISK. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.template.chown

- **Description:** Changes the ownership of a template.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.template.rename

- **Description:** Renames a template.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.template.info

- **Description:** Retrieves information for the template.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Boolean | optional flag to process the template and include extended information, such as the SIZE for each DISK |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.templatepool.info

- **Description:** Retrieves information for all or part of the Resources in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use $(-1, -1)$; to retrieve all the pool from a specific ID to the last one, use $(<id>, -1)$, and to retrieve the first elements up to an ID, use $(0, <id>)$.

1.2.3 Actions for Virtual Machine Management

one.vm.allocate

- **Description:** Allocates a new virtual machine in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template for the vm. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Boolean | False to create the VM on pending (default), True to create it on hold. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vm.deploy

- **Description:** initiates the instance of the given vmid on the target host.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The Host ID of the target host where the VM will be deployed. |
| IN | Boolean | true to enforce the Host capacity is not overcommitted. |
| IN | Int | The Datastore ID of the target system datastore where the VM will be deployed. It is optional, and can be set to -1 to let OpenNebula choose the datastore. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.action

- **Description:** submits an action to be performed on a virtual machine.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | the action name to be performed, see below. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

The action String must be one of the following:

- **terminate-hard**
- **terminate**
- **undeploy-hard**
- **undeploy**
- **poweroff-hard**
- **poweroff**
- **reboot-hard**
- **reboot**
- **hold**
- **release**
- **stop**
- **suspend**
- **resume**
- **resched**
- **unresched**

one.vm.migrate

- **Description:** migrates one virtual machine (vid) to the target host (hid).
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | the target host id (hid) where we want to migrate the vm. |
| IN | Boolean | if true we are indicating that we want livemigration, otherwise false. |
| IN | Boolean | true to enforce the Host capacity is not overcommitted. |
| IN | Int | the target system DS id where we want to migrate the vm. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.disksaveas

- **Description:** Sets the disk to be saved in the given image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Disk ID of the disk we want to save. |
| IN | String | Name for the new Image where the disk will be saved. |
| IN | String | Type for the new Image. If it is an empty string, then the default one will be used. See the existing types in the Image template reference. |
| IN | Int | Id of the snapshot to export, if -1 the current image state will be used. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new allocated Image ID / The error string. If the Template was cloned, the new Template ID is not returned. The Template can be found by name: "<image_name>-<image_id>" |
| OUT | Int | Error code. |

one.vm.disksnapshotcreate

- **Description:** Takes a new snapshot of the disk image
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Disk ID of the disk we want to save. |
| IN | String | Description for the snapshot. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new snapshot ID / The error string. |
| OUT | Int | Error code. |

one.vm.disksnapshotdelete

- **Description:** Deletes a disk snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Disk ID of the disk we want to save. |
| IN | Int | ID of the snapshot to be deleted. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The ID of the snapshot deleted/ The error string. |
| OUT | Int | Error code. |

one.vm.disksnapshotrevert

- **Description:** Reverts disk state to a previously taken snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Disk ID of the disk to revert its state. |
| IN | Int | Snapshot ID to revert the disk state to. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The snapshot ID used / The error string. |
| OUT | Int | Error code. |

one.vm.attach

- **Description:** Attaches a new disk to the virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | A string containing a single DISK vector attribute. Syntax can be the usual attribute=value or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

Sample DISK vector attribute:

```
DISK=[IMAGE_ID=42, TYPE=RBD, DEV_PREFIX=vd, SIZE=123456, TARGET=vdc]
```

one.vm.detach

- **Description:** Detaches a disk from a virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The disk ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.diskresize

- **Description:** Resizes a disk of a virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The disk ID. |
| IN | String | The new size string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.attachnic

- **Description:** Attaches a new network interface to the virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | A string containing a single NIC vector attribute. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.detachnic

- **Description:** Detaches a network interface from a virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The nic ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.chmod

- **Description:** Changes the permission bits of a virtual machine.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vm.chown

- **Description:** Changes the ownership of a virtual machine.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vm.rename

- **Description:** Renames a virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.snapshotcreate

- **Description:** Creates a new virtual machine snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new snapshot name. It can be empty. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new snapshot ID / The error string. |
| OUT | Int | Error code. |

one.vm.snapshotrevert

- **Description:** Reverts a virtual machine to a snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The snapshot ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.snapshotdelete

- **Description:** Deletes a virtual machine snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The snapshot ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.resize

- **Description:** Changes the capacity of the virtual machine
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | Template containing the new capacity elements CPU, VCPU, MEMORY. If one of them is not present, or its value is 0, it will not be resized. |
| IN | Boolean | true to enforce the Host capacity is not overcommitted. This parameter is only acknowledged for users in the onadmin group, Host capacity will be always enforced for regular users. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vm.update

- **Description:** Replaces the **user template** contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new user template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vm.updateconf

- **Description:** Updates (appends) a set of supported configuration attributes in the VM template
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

The supported attributes are:

| Attribute | Sub-attributes |
|-----------|--|
| OS | ARCH, MACHINE, KERNEL, INITRD, BOOTLOADER, BOOT |
| FEATURES | ACPI, PAE, APIC, LOCALTIME, HYPERV, GUEST_AGENT |
| INPUT | TYPE, BUS |
| GRAPHICS | TYPE, LISTEN, PASSWD, KEYMAP |
| RAW | DATA, DATA_VMX, TYPE |
| CONTEXT | Any value. Variable substitution will be made |

Note: Visit the Virtual Machine Template reference for a complete description of each attribute

one.vm.recover

- **Description:** Recovers a stuck VM that is waiting for a driver operation. The recovery may be done by failing or succeeding the pending operation. You need to manually check the vm status on the host, to decide if the operation was successful or not.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Recover operation: success (1), failure (0), retry (2), delete (3), delete-recreate (4) |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vm.info

- **Description:** Retrieves information for the virtual machine.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vm.monitoring

- **Description:** Returns the virtual machine monitoring records.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The monitoring information string / The error string. |
| OUT | Int | Error code. |

The monitoring information returned is a list of VM elements. Each VM element contains the complete xml of the VM with the updated information returned by the poll action.

For example:

```
<MONITORING_DATA>
  <VM>
    ...
    <LAST_POLL>123</LAST_POLL>
    ...
  </VM>
  <VM>
    ...
    <LAST_POLL>456</LAST_POLL>
    ...
  </VM>
</MONITORING_DATA>
```

one.vmpool.info

- **Description:** Retrieves information for all or part of the VMs in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| IN | Int | VM state to filter by. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use (-1, -1); to retrieve all the pool from a specific ID to the last one, use (<id>, -1), and to retrieve the first elements up to an ID, use (0, <id>).

The state filter can be one of the following:

| Value | State |
|-------|---------------------------|
| -2 | Any state, including DONE |
| -1 | Any state, except DONE |
| 0 | INIT |
| 1 | PENDING |
| 2 | HOLD |
| 3 | ACTIVE |
| 4 | STOPPED |
| 5 | SUSPENDED |
| 6 | DONE |
| 8 | POWEROFF |
| 9 | UNDEPLOYED |
| 10 | CLONING |
| 11 | CLONING_FAILURE |

Warning: Value 7 is reserved for FAILED VMs for compatibility reasons.

one.vmpool.monitoring

- **Description:** Returns all the virtual machine monitoring records.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

See *one.vm.monitoring*.

Sample output:

```
<MONITORING_DATA>
  <VM>
    <ID>0</ID>
    <LAST_POLL>123</LAST_POLL>
    ...
  </VM>
  <VM>
    <ID>0</ID>
    <LAST_POLL>456</LAST_POLL>
    ...
  </VM>
  <VM>
    <ID>3</ID>
    <LAST_POLL>123</LAST_POLL>
    ...
  </VM>
  <VM>
    <ID>3</ID>
    <LAST_POLL>456</LAST_POLL>
    ...
  </VM>
</MONITORING_DATA>
```

one.vmpool.accounting

- **Description:** Returns the virtual machine history records.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | Start time for the time interval. Can be -1, in which case the time interval won't have a left boundary. |
| IN | Int | End time for the time interval. Can be -1, in which case the time interval won't have a right boundary. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The XML output is explained in detail in the "oneacct" guide.

one.vmpool.showback

- **Description**: Returns the virtual machine showback records
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | Filter flag - <= -3 : Connected user's resources - -2 : All resources - -1 : Connected user's and his group's resources - >= 0 : UID User's Resources |
| IN | Int | First month for the time interval. January is 1. Can be -1, in which case the time interval won't have a left boundary. |
| IN | Int | First year for the time interval. Can be -1, in which case the time interval won't have a left boundary. |
| IN | Int | Last month for the time interval. January is 1. Can be -1, in which case the time interval won't have a right boundary. |
| IN | Int | Last year for the time interval. Can be -1, in which case the time interval won't have a right boundary. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The XML output will be similar to this one:


```

<SHOWBACK_RECORDS>

  <SHOWBACK>
    <VMID>4315</VMID>
    <VMNAME>vm_4315</VMNAME>
    <UID>2467</UID>
    <GID>102</GID>
    <UNAME>cloud_user</UNAME>
    <GNAME>vdc-test</GNAME>
    <YEAR>2014</YEAR>
    <MONTH>11</MONTH>
    <CPU_COST>13</CPU_COST>
    <MEMORY_COST>21</MEMORY_COST>
    <DISK_COST>7</DISK_COST>
    <TOTAL_COST>41</TOTAL_COST>
    <HOURS>10</HOURS>
  </SHOWBACK>

  <SHOWBACK>
    ...
  </SHOWBACK>

  ...
</SHOWBACK_RECORDS>

```

one.vmpool.calculateshowback

- **Description:** Processes all the history records, and stores the monthly cost for each VM
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | First month for the time interval. January is 1. Can be -1, in which case the time interval won't have a left boundary. |
| IN | Int | First year for the time interval. Can be -1, in which case the time interval won't have a left boundary. |
| IN | Int | Last month for the time interval. January is 1. Can be -1, in which case the time interval won't have a right boundary. |
| IN | Int | Last year for the time interval. Can be -1, in which case the time interval won't have a right boundary. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | Empty / The error string. |
| OUT | Int | Error code. |

1.2.4 Actions for Hosts Management

one.host.allocate

- **Description:** Allocates a new host in OpenNebula
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | Hostname of the machine we want to add |
| IN | String | The name of the information manager (im_mad_name), this values are taken from the oned.conf with the tag name IM_MAD (name) |
| IN | String | The name of the virtual machine manager mad name (vmm_mad_name), this values are taken from the oned.conf with the tag name VM_MAD (name) |
| IN | Int | The cluster ID. If it is -1, the default one will be used. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated Host ID / The error string. |
| OUT | Int | Error code. |

one.host.delete

- **Description:** Deletes the given host from the pool
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.host.status

- **Description:** Sets the status of the host
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The Host ID. |
| IN | Int | 0: ENABLED 1: DISABLED 2: OFFLINE |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.host.update

- **Description:** Replaces the host's template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.host.rename

- **Description:** Renames a host.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.host.info

- **Description:** Retrieves information for the host.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.host.monitoring

- **Description:** Returns the host monitoring records.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The monitoring information string / The error string. |
| OUT | Int | Error code. |

The monitoring information returned is a list of HOST elements. Each HOST element contains the complete xml of the host with the updated information returned by the poll action.

For example:

```
<MONITORING_DATA>
  <HOST>
    ...
    <LAST_MON_TIME>123</LAST_MON_TIME>
    ...
  </HOST>
  <HOST>
    ...
    <LAST_MON_TIME>456</LAST_MON_TIME>
    ...
  </HOST>
</MONITORING_DATA>
```

one.hostpool.info

- **Description:** Retrieves information for all the hosts in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.hostpool.monitoring

- **Description:** Returns all the host monitoring records.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

Sample output:

```
<MONITORING_DATA>
  <HOST>
    <ID>0</ID>
    <LAST_MON_TIME>123</LAST_MON_TIME>
    ...
  </HOST>
  <HOST>
    <ID>0</ID>
    <LAST_MON_TIME>456</LAST_MON_TIME>
    ...
```

```

</HOST>
<HOST>
  <ID>3</ID>
  <LAST_MON_TIME>123</LAST_MON_TIME>
  ...
</HOST>
<HOST>
  <ID>3</ID>
  <LAST_MON_TIME>456</LAST_MON_TIME>
  ...
</HOST>
</MONITORING_DATA>

```

1.2.5 Actions for Cluster Management

one.cluster.allocate

- **Description:** Allocates a new cluster in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | Name for the new cluster. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated cluster ID / The error string. |
| OUT | Int | Error code. |

one.cluster.delete

- **Description:** Deletes the given cluster from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.update

- **Description:** Replaces the cluster template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.addhost

- **Description:** Adds a host to the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.delhost

- **Description:** Removes a host from the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.adddatastore

- **Description:** Adds a datastore to the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.deldatastore

- **Description:** Removes a datastore from the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.addvnet

- **Description:** Adds a vnet to the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.delvnet

- **Description:** Removes a vnet from the given cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The cluster ID. |
| IN | Int | The vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.cluster.rename

- **Description:** Renames a cluster.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.cluster.info

- **Description:** Retrieves information for the cluster.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.clusterpool.info

- **Description:** Retrieves information for all the clusters in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

1.2.6 Actions for Virtual Network Management

one.vn.allocate

- **Description:** Allocates a new virtual network in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the virtual network. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The cluster ID. If it is -1, the default one will be used. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.delete

- **Description:** Deletes the given virtual network from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.add_ar

- **Description:** Adds address ranges to a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | template of the address ranges to add. Syntax can be the usual <code>attribute=value</code> or XML, see below. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

Examples of valid templates:

```
AR = [
  TYPE = IP4,
  IP = 192.168.0.5,
  SIZE = 10 ]
```

```
<TEMPLATE>
  <AR>
    <TYPE>IP4</TYPE>
    <IP>192.168.0.5</IP>
    <SIZE>10</SIZE>
  </AR>
</TEMPLATE>
```

one.vn.rm_ar

- **Description:** Removes an address range from a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | ID of the address range to remove. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.update_ar

- **Description:** Updates the attributes of an address range.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | template of the address ranges to update. Syntax can be the usual attribute=value or XML, see below. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

Examples of valid templates:

```
AR = [
  AR_ID = 7,
  GATEWAY = "192.168.30.2",
  EXTRA_ATT = "VALUE",
  SIZE = 10 ]
```

```
<TEMPLATE>
<AR>
  <AR_ID>7</AR_ID>
  <GATEWAY>192.168.30.2</GATEWAY>
  <EXTRA_ATT>VALUE</EXTRA_ATT>
  <SIZE>10</SIZE>
</AR>
</TEMPLATE>
```

one.vn.reserve

- **Description:** Reserve network addresses.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The virtual network to reserve from. |
| IN | String | Template, see below. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

The third parameter must be an OpenNebula ATTRIBUTE=VALUE template, with these values:

| Attribute | Description | Mandatory |
|-------------|--|-----------|
| SIZE | Size of the reservation | YES |
| NAME | If set, the reservation will be created in a new Virtual Network with this name | NO |
| AR_ID | ID of the AR from where to take the addresses | NO |
| NET-WORK_ID | Instead of creating a new Virtual Network, the reservation will be added to the existing virtual network with this ID. | NO |
| MAC | First MAC address to start the reservation range [MAC, MAC+SIZE) | NO |
| IP | First IPv4 address to start the reservation range [IP, IP+SIZE) | NO |

one.vn.free_ar

- **Description:** Frees a reserved address range from a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | ID of the address range to free. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.hold

- **Description:** Holds a virtual network Lease as used.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | template of the lease to hold, e.g. LEASES=[IP=192.168.0.5]. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.release

- **Description:** Releases a virtual network Lease on hold.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | template of the lease to release, e.g. LEASES=[IP=192.168.0.5]. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.update

- **Description:** Replaces the virtual network template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.chmod

- **Description:** Changes the permission bits of a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.chown

- **Description:** Changes the ownership of a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vn.rename

- **Description:** Renames a virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vn.info

- **Description:** Retrieves information for the virtual network.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

Note: The ACL rules do not apply to VNET reservations in the same way as they do to normal VNETs and other objects. Read more in the ACL documentation guide.

one.vnpool.info

- **Description:** Retrieves information for all or part of the virtual networks in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use $(-1, -1)$; to retrieve all the pool from a specific ID to the last one, use $(\langle id \rangle, -1)$, and to retrieve the first elements up to an ID, use $(0, \langle id \rangle)$.

Note: The ACL rules do not apply to VNET reservations in the same way as they do to normal VNETs and other objects. Read more in the ACL documentation guide.

1.2.7 Actions for Security Group Management

one.secgroup.allocate

- **Description:** Allocates a new security group in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | A string containing the template of the security group. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.clone

- **Description:** Clones an existing security group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The ID of the security group to be cloned. |
| IN | String | Name for the new security group. |
| IN | Int | The ID of the target datastore. Optional, can be set to -1 to use the current one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new security group ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.delete

- **Description:** Deletes the given security group from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.update

- **Description:** Replaces the security group template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.commit

- **Description:** Commit security group changes to associated VMs. This is intended for retrying updates of VMs or reinitialize the updating process if oned stopped or failed after a `one.secgroup.update` call.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Boolean | I true the action will only operate on outdated and error VMs. False to update all VMs. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.chmod

- **Description:** Changes the permission bits of a security group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.chown

- **Description:** Changes the ownership of a security group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.rename

- **Description:** Renames a security group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.secgroup.info

- **Description:** Retrieves information for the security group.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.secgrouppool.info

- **Description:** Retrieves information for all or part of the security groups in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is >= -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values >= -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use (-1, -1); to retrieve all the pool from a specific ID to the last one, use (<id>, -1), and to retrieve the first elements up to an ID, use (0, <id>).

1.2.8 Actions for VM Group Management

one.vmgroupp.allocate

- **Description:** Allocates a new VM group in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the VM. Syntax can be the usual attribute=value or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vmgroupp.delete

- **Description:** Deletes the given VM group from the pool.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vmgrou.update

- **Description:** Replaces the VM group template contents.

- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vmgrou.chmod

- **Description:** Changes the permission bits of a VM group.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vmgrou.chown

- **Description:** Changes the ownership of a VM group.

- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vmgroup.rename

- **Description:** Renames a VM group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vmgroup.info

- **Description:** Retrieves information for the VM group.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vmgrouppool.info

- **Description:** Retrieves information for all or part of the VM groups in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use $(-1, -1)$; to retrieve all the pool from a specific ID to the last one, use $(\langle id \rangle, -1)$, and to retrieve the first elements up to an ID, use $(0, \langle id \rangle)$.

1.2.9 Actions for Datastore Management

one.datastore.allocate

- **Description:** Allocates a new datastore in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the datastore. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The cluster ID. If it is -1, the default one will be used. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.delete

- **Description:** Deletes the given datastore from the pool.

- Parameters

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.update

- **Description:** Replaces the datastore template contents.

- Parameters

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.chmod

- **Description:** Changes the permission bits of a datastore.

- Parameters

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.chown

- **Description:** Changes the ownership of a datastore.

- Parameters

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.rename

- **Description:** Renames a datastore.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.enable

- **Description:** Enables or disables a datastore.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Boolean | True for enabling, false for disabling. |
| OUT | Boolean | true or false whenever is successful or not. |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.datastore.info

- **Description:** Retrieves information for the datastore.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.datastorepool.info

- **Description:** Retrieves information for all or part of the datastores in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

1.2.10 Actions for Image Management**one.image.allocate**

- **Description:** Allocates a new image in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the image. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.image.clone

- **Description:** Clones an existing image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The ID of the image to be cloned. |
| IN | String | Name for the new image. |
| IN | Int | The ID of the target datastore. Optional, can be set to -1 to use the current one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new image ID / The error string. |
| OUT | Int | Error code. |

one.image.delete

- **Description:** Deletes the given image from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.image.enable

- **Description:** Enables or disables an image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The Image ID. |
| IN | Boolean | True for enabling, false for disabling. |
| OUT | Boolean | true or false whenever is successful or not. |
| OUT | Int/String | The Image ID / The error string. |
| OUT | Int | Error code. |

one.image.persistent

- **Description:** Sets the Image as persistent or not persistent.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The Image ID. |
| IN | Boolean | True for persistent, false for non-persistent. |
| OUT | Boolean | true or false whenever is successful or not. |
| OUT | Int/String | The Image ID / The error string. |
| OUT | Int | Error code. |

one.image.chtype

- **Description:** Changes the type of an Image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The Image ID. |
| IN | String | New type for the Image. See the existing types in the Image template reference. |
| OUT | Boolean | true or false whenever is successful or not. |
| OUT | Int/String | The Image ID / The error string. |
| OUT | Int | Error code. |

one.image.update

- **Description:** Replaces the image template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.image.chmod

- **Description:** Changes the permission bits of an image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.image.chown

- **Description:** Changes the ownership of an image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.image.rename

- **Description:** Renames an image.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.image.snapshotdelete

- **Description:** Deletes a snapshot from the image
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | ID of the snapshot to delete |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | ID of the deleted snapshot/The error string. |
| OUT | Int | Error code. |

one.image.snapshotrevert

- **Description:** Reverts image state to a previous snapshot
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | ID of the snapshot to revert to |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | ID of the snapshot/The error string. |
| OUT | Int | Error code. |

one.image.snapshotflatten

- **Description:** Flatten the snapshot of image and discards others
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | ID of the snapshot to flatten |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | ID of the snapshot/The error string. |
| OUT | Int | Error code. |

one.image.info

- **Description:** Retrieves information for the image.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.imagepool.info

- **Description:** Retrieves information for all or part of the images in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is >= -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values >= -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use (-1, -1); to retrieve all the pool from a specific ID to the last one, use (<id>, -1), and to retrieve the first elements up to an ID, use (0, <id>).

1.2.11 Actions for Marketplace Management

one.market.allocate

- **Description:** Allocates a new marketplace in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | A string containing the template of the marketplace. Syntax can be the usual attribute=value or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.market.delete

- **Description:** Deletes the given marketplace from the pool.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.market.update

- **Description:** Replaces the marketplace template contents.

- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.market.chmod

- **Description:** Changes the permission bits of a marketplace.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.market.chown

- **Description:** Changes the ownership of a marketplace.

- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.market.rename

- **Description:** Renames a marketplace.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.market.info

- **Description:** Retrieves information for the marketplace.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.marketpool.info

- **Description:** Retrieves information for all or part of the marketplaces in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

1.2.12 Actions for MarketplaceApp Management

one.marketapp.allocate

- **Description:** Allocates a new marketplace app in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the marketplace app. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.delete

- **Description:** Deletes the given marketplace app from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.enable

- **Description:** Enables or disables a marketplace app.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The marketplace app ID. |
| IN | Boolean | True for enabling, false for disabling. |
| OUT | Boolean | true or false whenever is successful or not. |
| OUT | Int/String | The marketplace app ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.update

- **Description:** Replaces the marketplace app template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.chmod

- **Description:** Changes the permission bits of a marketplace app.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.chown

- **Description:** Changes the ownership of a marketplace app.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.rename

- **Description:** Renames a marketplace app.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.marketapp.info

- **Description:** Retrieves information for the marketplace app.

- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.marketapppool.info

- **Description:** Retrieves information for all or part of the marketplace apps in the pool.

- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use $(-1, -1)$; to retrieve all the pool from a specific ID to the last one, use $(\langle id \rangle, -1)$, and to retrieve the first elements up to an ID, use $(0, \langle id \rangle)$.

1.2.13 Actions for Virtual Routers Management

one.vrouter.allocate

- **Description:** Allocates a new virtual router in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the virtual router contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.delete

- **Description:** Deletes the given virtual router from the pool.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Boolean | true to delete the virtual router plus any image defined in DISK. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.instantiate

- **Description:** Instantiates a new virtual machine from a virtual router.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | Number of VMs to instantiate. |
| IN | Int | VM Template id to instantiate. |
| IN | String | Name for the VM instances. If it is an empty string OpenNebula will set a default name. Wildcard %i can be used. |
| IN | Boolean | False to create the VM on pending (default), True to create it on hold. |
| IN | String | A string containing an extra template to be merged with the one being instantiated. It can be empty. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new virtual machine ID / The error string. |
| OUT | Int | Error code. |

Sample template string:

```
MEMORY=4096\nCPU=4\nVCPU=4
```

Note: Declaring a field overwrites the template. Thus, declaring `DISK=[...]` overwrites the template `DISK` attribute and as such, must contain the entire `DISK` definition.

one.vrouter.attachnic

- **Description:** Attaches a new network interface to the virtual router and the virtual machines
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | A string containing a single NIC vector attribute. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.detachnic

- **Description:** Detaches a network interface from the virtual router and the virtual machines
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The nic ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.update

- **Description:** Replaces the template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.chmod

- **Description:** Changes the permission bits of a virtual router.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.chown

- **Description:** Changes the ownership of a virtual router.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.rename

- **Description:** Renames a virtual router.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vrouter.info

- **Description:** Retrieves information for the virtual router.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vrouterpool.info

- **Description:** Retrieves information for all or part of the Resources in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is ≥ -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values ≥ -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use $(-1, -1)$; to retrieve all the pool from a specific ID to the last one, use $(\langle id \rangle, -1)$, and to retrieve the first elements up to an ID, use $(0, \langle id \rangle)$.

1.2.14 Actions for User Management

one.user.allocate

- **Description:** Allocates a new user in OpenNebula
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | username for the new user |
| IN | String | password for the new user |
| IN | String | authentication driver for the new user. If it is an empty string, then the default ('core') is used |
| IN | Array | array of Group IDs. The first ID will be used as the main group. This array can be empty, in which case the default group will be used |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated User ID / The error string. |
| OUT | Int | Error code. |

one.user.delete

- **Description:** Deletes the given user from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.user.passwd

- **Description:** Changes the password for the given user.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new password |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The User ID / The error string. |
| OUT | Int | Error code. |

one.user.login

- **Description:** Generates or sets a login token.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | String | The user name to generate the token for |
| IN | String | The token, if empty oned will generate one |
| IN | Int | Valid period in seconds; 0 reset the token and -1 for a non-expiring token. |
| IN | Int | Effective GID to use with this token. To use the current GID and user groups set it to -1 |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The new token / The error string. |
| OUT | Int | Error code. |

one.user.update

- **Description:** Replaces the user template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.user.chauth

- **Description:** Changes the authentication driver and the password for the given user.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new authentication driver. |
| IN | String | The new password. If it is an empty string, the password is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The User ID / The error string. |
| OUT | Int | Error code. |

one.user.quota

- **Description:** Sets the user quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new quota template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.user.chgrp

- **Description:** Changes the group of the given user.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The User ID. |
| IN | Int | The Group ID of the new group. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The User ID / The error string. |
| OUT | Int | Error code. |

one.user.addgroup

- **Description:** Adds the User to a secondary group.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The User ID. |
| IN | Int | The Group ID of the new group. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The User ID / The error string. |
| OUT | Int | Error code. |

one.user.delgroup

- **Description:** Removes the User from a secondary group
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The User ID. |
| IN | Int | The Group ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The User ID / The error string. |
| OUT | Int | Error code. |

one.user.info

- **Description:** Retrieves information for the user.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. If it is -1, then the connected user's own info info is returned |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.userpool.info

- **Description:** Retrieves information for all the users in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.userquota.info

- **Description:** Returns the default user quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The quota template contents / The error string. |
| OUT | Int | Error code. |

one.userquota.update

- **Description:** Updates the default user quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | String | The new quota template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The quota template contents / The error string. |
| OUT | Int | Error code. |

1.2.15 Actions for Group Management

one.group.allocate

- **Description:** Allocates a new group in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | Name for the new group. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated Group ID / The error string. |
| OUT | Int | Error code. |

one.group.delete

- **Description:** Deletes the given group from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.group.info

- **Description:** Retrieves information for the group.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. If it is -1, then the connected user's group info info is returned |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.group.update

- **Description:** Replaces the group template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.group.addadmin

- **Description:** Adds a User to the Group administrators set
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The group ID. |
| IN | Int | The user ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.group.deladmin

- **Description:** Removes a User from the Group administrators set
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The group ID. |
| IN | Int | The user ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.group.quota

- **Description:** Sets the group quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new quota template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.grouppool.info

- **Description:** Retrieves information for all the groups in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.groupquota.info

- **Description:** Returns the default group quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The quota template contents / The error string. |
| OUT | Int | Error code. |

one.groupquota.update

- **Description:** Updates the default group quota limits.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | String | The new quota template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The quota template contents / The error string. |
| OUT | Int | Error code. |

1.2.16 Actions for VDC Management**one.vdc.allocate**

- **Description:** Allocates a new VDC in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the VDC. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The cluster ID. If it is -1, this virtual network won't be added to any cluster. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delete

- **Description:** Deletes the given VDC from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.update

- **Description:** Replaces the VDC template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.rename

- **Description:** Renames a VDC.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vdc.info

- **Description:** Retrieves information for the VDC.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. If it is -1, then the connected user's VDC info info is returned |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vdcpool.info

- **Description:** Retrieves information for all the VDCs in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vdc.addgroup

- **Description:** Adds a group to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The group ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delgroup

- **Description:** Deletes a group from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The group ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addcluster

- **Description:** Adds a cluster to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Cluster ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delcluster

- **Description:** Deletes a cluster from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Cluster ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addhost

- **Description:** Adds a host to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delhost

- **Description:** Deletes a host from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.adddatastore

- **Description:** Adds a datastore to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.deldatastore

- **Description:** Deletes a datastore from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addvnet

- **Description:** Adds a vnet to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delvnet

- **Description:** Deletes a vnet from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

1.2.17 Actions for VDC Management

one.vdc.allocate

- **Description:** Allocates a new VDC in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | A string containing the template of the VDC. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delete

- **Description:** Deletes the given VDC from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.update

- **Description:** Replaces the VDC template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.rename

- **Description:** Renames a VDC.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.vdc.info

- **Description:** Retrieves information for the VDC.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. If it is -1, then the connected user's VDC info info is returned |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vdcpool.info

- **Description:** Retrieves information for all the VDCs in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.vdc.addgroup

- **Description:** Adds a group to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The group ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delgroup

- **Description:** Deletes a group from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The group ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addcluster

- **Description:** Adds a cluster to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Cluster ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delcluster

- **Description:** Deletes a cluster from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Cluster ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addhost

- **Description:** Adds a host to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delhost

- **Description:** Deletes a host from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Host ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.adddatastore

- **Description:** Adds a datastore to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.deldatastore

- **Description:** Deletes a datastore from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Datastore ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.addvnet

- **Description:** Adds a vnet to the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.vdc.delvnet

- **Description:** Deletes a vnet from the VDC
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The VDC ID. |
| IN | Int | The Zone ID. |
| IN | Int | The Vnet ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

1.2.18 Actions for Zone Management

one.zone.allocate

- **Description:** Allocates a new zone in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | A string containing the template of the zone. Syntax can be the usual <code>attribute=value</code> or XML. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

one.zone.delete

- **Description:** Deletes the given zone from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.zone.update

- **Description:** Replaces the zone template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.zone.rename

- **Description:** Renames a zone.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.zone.info

- **Description:** Retrieves information for the zone.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.zonepool.info

- **Description:** Retrieves information for all the zones in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

1.2.19 Actions for ACL Rules Management**one.acl.addrule**

- **Description:** Adds a new ACL rule.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | String | User component of the new rule. A string containing a hex number. |
| IN | String | Resource component of the new rule. A string containing a hex number. |
| IN | String | Rights component of the new rule. A string containing a hex number. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated ACL rule ID / The error string. |
| OUT | Int | Error code. |

To build the hex. numbers required to create a new rule we recommend you to read the [ruby](#) or [java](#) code.

one.acl.delrule

- **Description:** Deletes an ACL rule.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | ACL rule ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The ACL rule ID / The error string. |
| OUT | Int | Error code. |

one.acl.info

- **Description:** Returns the complete ACL rule set.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | ACL rule ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

1.2.20 Actions for Document Management

one.document.allocate

- **Description:** Allocates a new document in OpenNebula.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | String | A string containing the document template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | The document type (*). |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The allocated resource ID / The error string. |
| OUT | Int | Error code. |

(*) Type is an integer value used to allow dynamic pools compartmentalization.

Let's say you want to store documents representing Chef recipes, and EC2 security groups; you would allocate documents of each kind with a different type. This type is then used in the `one.documentpool.info` method to filter the results.

one.document.clone

- **Description:** Clones an existing document.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The ID of the document to be cloned. |
| IN | String | Name for the new document. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The new document ID / The error string. |
| OUT | Int | Error code. |

one.document.delete

- **Description:** Deletes the given document from the pool.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.document.update

- **Description:** Replaces the document template contents.
- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new document template contents. Syntax can be the usual <code>attribute=value</code> or XML. |
| IN | Int | Update type: 0 : Replace the whole template. 1 : Merge new template with the existing one. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.document.chmod

- **Description:** Changes the permission bits of a document.
- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | USER USE bit. If set to -1, it will not change. |
| IN | Int | USER MANAGE bit. If set to -1, it will not change. |
| IN | Int | USER ADMIN bit. If set to -1, it will not change. |
| IN | Int | GROUP USE bit. If set to -1, it will not change. |
| IN | Int | GROUP MANAGE bit. If set to -1, it will not change. |
| IN | Int | GROUP ADMIN bit. If set to -1, it will not change. |
| IN | Int | OTHER USE bit. If set to -1, it will not change. |
| IN | Int | OTHER MANAGE bit. If set to -1, it will not change. |
| IN | Int | OTHER ADMIN bit. If set to -1, it will not change. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.document.chown

- **Description:** Changes the ownership of a document.

- **Parameters**

| Type | Data Type | Description |
|------|------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | Int | The User ID of the new owner. If set to -1, the owner is not changed. |
| IN | Int | The Group ID of the new group. If set to -1, the group is not changed. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The resource ID / The error string. |
| OUT | Int | Error code. |

one.document.rename

- **Description:** Renames a document.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | The new name. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The VM ID / The error string. |
| OUT | Int | Error code. |

one.document.lock

- **Description:** Locks the document at the api level. The lock automatically expires after 2 minutes.

- **Parameters**

| Type | Data Type | Description |
|------|----------------|--|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | String to identify the application requesting the lock. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Boolean/String | True if the lock was granted, and false if the object is already locked. / The error string. |
| OUT | Int | Error code. |

one.document.unlock

- **Description:** Unlocks the document at the api level.

- **Parameters**

| Type | Data Type | Description |
|------|------------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| IN | String | String to identify the application requesting the lock. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | Int/String | The object ID / The error string. |
| OUT | Int | Error code. |

one.document.info

- **Description:** Retrieves information for the document.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| IN | Int | The object ID. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

one.documentpool.info

- **Description:** Retrieves information for all or part of the Resources in the pool.
- **Parameters**

| Type | Data Type | Description |
|------|-----------|--|
| IN | String | The session string. |
| IN | Int | Filter flag <ul style="list-style-type: none"> • -4: Resources belonging to the user's primary group • -3: Resources belonging to the user • -2: All resources • -1: Resources belonging to the user and any of his groups • >= 0: UID User's Resources |
| IN | Int | When the next parameter is >= -1 this is the Range start ID. Can be -1. For smaller values this is the offset used for pagination. |
| IN | Int | For values >= -1 this is the Range end ID. Can be -1 to get until the last ID. For values < -1 this is the page size used for pagination. |
| IN | Int | The document type. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The information string / The error string. |
| OUT | Int | Error code. |

The range can be used to retrieve a subset of the pool, from the 'start' to the 'end' ID. To retrieve the complete pool, use (-1, -1); to retrieve all the pool from a specific ID to the last one, use (<id>, -1), and to retrieve the first elements up to an ID, use (0, <id>).

1.2.21 System Methods

one.system.version

- **Description:** Returns the OpenNebula core version
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The OpenNebula version, e.g. 4 . 4 . 0 |
| OUT | Int | Error code. |

one.system.config

- **Description:** Returns the OpenNebula configuration
- **Parameters**

| Type | Data Type | Description |
|------|-----------|---|
| IN | String | The session string. |
| OUT | Boolean | true or false whenever is successful or not |
| OUT | String | The loaded oned.conf file, in XML form |
| OUT | Int | Error code. |

1.2.22 XSD Reference

The XML schemas describe the XML returned by the one.*.info methods

Schemas for Cluster

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:element name="CLUSTER">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="HOSTS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
  ↪"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="DATASTORES">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
  ↪"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="VNETS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
  ↪"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="TEMPLATE" type="xs:anyType"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
```



```

<xs:include schemaLocation="cluster.xsd"/>
<xs:element name="CLUSTER_POOL">
  <xs:complexType>
    <xs:sequence maxOccurs="1" minOccurs="1">
      <xs:element ref="CLUSTER" maxOccurs="unbounded" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for Datastore

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://opennebula.org/
↳XMLSchema" elementFormDefault="qualified" targetNamespace="http://opennebula.org/
↳XMLSchema">
  <xs:element name="DATASTORE">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="DS_MAD" type="xs:string"/>
        <xs:element name="TM_MAD" type="xs:string"/>
        <xs:element name="BASE_PATH" type="xs:string"/>
        <xs:element name="TYPE" type="xs:integer"/>
        <xs:element name="DISK_TYPE" type="xs:integer"/>
        <xs:element name="STATE" type="xs:integer"/>
        <xs:element name="CLUSTERS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↳"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="TOTAL_MB" type="xs:integer"/>
        <xs:element name="FREE_MB" type="xs:integer"/>

```

```

<xs:element name="USED_MB" type="xs:integer"/>
<xs:element name="IMAGES">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
  <xs:include schemaLocation="datastore.xsd"/>
  <xs:element name="DATASTORE_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="DATASTORE" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Group

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
  <xs:element name="GROUP">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="TEMPLATE" type="xs:anyType"/>
        <xs:element name="USERS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="ADMINS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

</xs:element>
<xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ID" type="xs:string"/>
            <xs:element name="IMAGES" type="xs:string"/>
            <xs:element name="IMAGES_USED" type="xs:string"/>
            <xs:element name="SIZE" type="xs:string"/>
            <xs:element name="SIZE_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ID" type="xs:string"/>
            <xs:element name="LEASES" type="xs:string"/>
            <xs:element name="LEASES_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="VM" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="CPU" type="xs:string"/>
            <xs:element name="CPU_USED" type="xs:string"/>
            <xs:element name="MEMORY" type="xs:string"/>
            <xs:element name="MEMORY_USED" type="xs:string"/>
            <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
            <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/>
            <xs:element name="VMS" type="xs:string"/>
            <xs:element name="VMS_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>

```

```

        <xs:sequence>
          <xs:element name="ID" type="xs:string"/>
          <xs:element name="RVMS" type="xs:string"/>
          <xs:element name="RVMS_USED" type="xs:string"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="DEFAULT_GROUP_QUOTAS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded"
↔">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="ID" type="xs:string"/>
                  <xs:element name="IMAGES" type="xs:string"/>
                  <xs:element name="IMAGES_USED" type="xs:string"/>
                  <xs:element name="SIZE" type="xs:string"/>
                  <xs:element name="SIZE_USED" type="xs:string"/>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="ID" type="xs:string"/>
                  <xs:element name="LEASES" type="xs:string"/>
                  <xs:element name="LEASES_USED" type="xs:string"/>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="VM" minOccurs="0" maxOccurs="1">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="CPU" type="xs:string"/>
                  <xs:element name="CPU_USED" type="xs:string"/>
                  <xs:element name="MEMORY" type="xs:string"/>
                  <xs:element name="MEMORY_USED" type="xs:string"/>
                  <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                  <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/
↔>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

        <xs:element name="VMS" type="xs:string"/>
        <xs:element name="VMS_USED" type="xs:string"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="RVMS" type="xs:string"/>
                        <xs:element name="RVMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:element name="GROUP_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:choice maxOccurs="unbounded" minOccurs="0">
          <xs:element name="GROUP" maxOccurs="unbounded" minOccurs="0">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="ID" type="xs:integer"/>
                <xs:element name="NAME" type="xs:string"/>
                <xs:element name="TEMPLATE" type="xs:anyType"/>
                <xs:element name="USERS">
                  <xs:complexType>
                    <xs:sequence>
                      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
                      ↪"unbounded"/>
                    </xs:sequence>
                  </xs:complexType>
                </xs:element>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
          <xs:element name="ADMINS">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
                ↪"unbounded"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:choice>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

```

        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="QUOTAS" maxOccurs="unbounded" minOccurs="0">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="ID" type="xs:integer"/>
            <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded
↪ ">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="IMAGES" type="xs:string"/>
                                    <xs:element name="IMAGES_USED" type="xs:string"/>
                                    <xs:element name="SIZE" type="xs:string"/>
                                    <xs:element name="SIZE_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="LEASES" type="xs:string"/>
                                    <xs:element name="LEASES_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="VM" minOccurs="0" maxOccurs="1">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="CPU" type="xs:string"/>
                                    <xs:element name="CPU_USED" type="xs:string"/>
                                    <xs:element name="MEMORY" type="xs:string"/>
                                    <xs:element name="MEMORY_USED" type="xs:string"/>
                                    <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                                    <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/
↪ >
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="VMS" type="xs:string"/>
            <xs:element name="VMS_USED" type="xs:string"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>

```

```

        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="RVMS" type="xs:string"/>
                        <xs:element name="RVMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:choice>
<xs:element name="DEFAULT_GROUP_QUOTAS" minOccurs="1" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded
↪ ">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="IMAGES" type="xs:string"/>
                                    <xs:element name="IMAGES_USED" type="xs:string"/>
                                    <xs:element name="SIZE" type="xs:string"/>
                                    <xs:element name="SIZE_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="LEASES" type="xs:string"/>
                                    <xs:element name="LEASES_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>

```

```

        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="VM" minOccurs="0" maxOccurs="1">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="CPU" type="xs:string"/>
                <xs:element name="CPU_USED" type="xs:string"/>
                <xs:element name="MEMORY" type="xs:string"/>
                <xs:element name="MEMORY_USED" type="xs:string"/>
                <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/
→
                <xs:element name="VMS" type="xs:string"/>
                <xs:element name="VMS_USED" type="xs:string"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="ID" type="xs:string"/>
                <xs:element name="RVMS" type="xs:string"/>
                <xs:element name="RVMS_USED" type="xs:string"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for VDC

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
→XMLSchema">
  <xs:element name="VDC">
    <xs:complexType>
      <xs:sequence>

```



```

<xs:element name="ID" type="xs:integer"/>
<xs:element name="NAME" type="xs:string"/>
<xs:element name="GROUPS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="CLUSTERS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="CLUSTER" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ZONE_ID" type="xs:integer"/>
            <xs:element name="CLUSTER_ID" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="HOSTS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="HOST" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ZONE_ID" type="xs:integer"/>
            <xs:element name="HOST_ID" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="DATASTORES">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ZONE_ID" type="xs:integer"/>
            <xs:element name="DATASTORE_ID" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="VNETS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="VNET" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>

```

```

        <xs:element name="ZONE_ID" type="xs:integer"/>
        <xs:element name="VNET_ID" type="xs:integer"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪/XMLSchema">
  <xs:include schemaLocation="vdc.xsd"/>
  <xs:element name="VDC_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="VDC" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Host

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://opennebula.org/
  ↪/XMLSchema" elementFormDefault="qualified" targetNamespace="http://opennebula.org/
  ↪/XMLSchema">
  <xs:element name="HOST">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="NAME" type="xs:string"/>
        <!-- STATE values

        INIT                = 0  Initial state for enabled hosts
        MONITORING_MONITORED = 1  Monitoring the host (from monitored)
        MONITORED           = 2  The host has been successfully monitored
        ERROR                = 3  An error occurred while monitoring the host
        DISABLED             = 4  The host is disabled
        MONITORING_ERROR     = 5  Monitoring the host (from error)
        MONITORING_INIT      = 6  Monitoring the host (from init)
        MONITORING_DISABLED  = 7  Monitoring the host (from disabled)
        OFFLINE              = 8  The host is totally offline

        -->
        <xs:element name="STATE" type="xs:integer"/>
        <xs:element name="IM_MAD" type="xs:string"/>
        <xs:element name="VM_MAD" type="xs:string"/>
        <xs:element name="LAST_MON_TIME" type="xs:integer"/>
        <xs:element name="CLUSTER_ID" type="xs:integer"/>

```

```

<xs:element name="CLUSTER" type="xs:string"/>
<xs:element name="HOST_SHARE">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DISK_USAGE" type="xs:integer"/>
      <xs:element name="MEM_USAGE" type="xs:integer"/>
      <!-- ^^ KB, Usage of MEMORY calculated by ONE as the summatory MEMORY_
↳requested by all VMs running in the host -->
      <xs:element name="CPU_USAGE" type="xs:integer"/>
      <!-- ^^ Percentage, Usage of CPU calculated by ONE as the summatory CPU_
↳requested by all VMs running in the host -->
      <xs:element name="MAX_DISK" type="xs:integer"/>
      <xs:element name="MAX_MEM" type="xs:integer"/>
      <!-- ^^ KB, Total memory in the host -->
      <xs:element name="MAX_CPU" type="xs:integer"/>
      <!-- ^^ Percentage, Total CPU in the host (# cores * 100) -->
      <xs:element name="FREE_DISK" type="xs:integer"/>
      <xs:element name="FREE_MEM" type="xs:integer"/>
      <!-- ^^ KB, Free MEMORY returned by the probes -->
      <xs:element name="FREE_CPU" type="xs:integer"/>
      <!-- ^^ Percentage, Free CPU as returned by the probes -->
      <xs:element name="USED_DISK" type="xs:integer"/>
      <xs:element name="USED_MEM" type="xs:integer"/>
      <!-- ^^ KB, Memory used by all host processes (including VMs) over a_
↳total of MAX_MEM -->
      <xs:element name="USED_CPU" type="xs:integer"/>
      <!-- ^^ Percentage of CPU used by all host processes (including VMs)_
↳over a total of # cores * 100 -->
      <xs:element name="RUNNING_VMS" type="xs:integer"/>
      <xs:element name="DATASTORES">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="DS" minOccurs="0" maxOccurs="unbounded">
              <xs:complexType>
                <xs:all>
                  <xs:element name="ID" type="xs:integer"/>
                  <xs:element name="FREE_MB" type="xs:integer"/>
                  <xs:element name="TOTAL_MB" type="xs:integer"/>
                  <xs:element name="USED_MB" type="xs:integer"/>
                </xs:all>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="PCI_DEVICES">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="PCI" type="xs:anyType" minOccurs="0" maxOccurs=
↳"unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="VMS">
  <xs:complexType>

```

```

        <xs:sequence>
          <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded" />
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="TEMPLATE" type="xs:anyType" />
  </xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
  <xs:include schemaLocation="host.xsd" />
  <xs:element name="HOST_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="HOST" maxOccurs="unbounded" minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Image

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema" elementFormDefault="qualified" targetNamespace="http://opennebula.org/
↪ XMLSchema">
  <xs:element name="IMAGE">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer" />
        <xs:element name="UID" type="xs:integer" />
        <xs:element name="GID" type="xs:integer" />
        <xs:element name="UNAME" type="xs:string" />
        <xs:element name="GNAME" type="xs:string" />
        <xs:element name="NAME" type="xs:string" />
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer" />
              <xs:element name="OWNER_M" type="xs:integer" />
              <xs:element name="OWNER_A" type="xs:integer" />
              <xs:element name="GROUP_U" type="xs:integer" />
              <xs:element name="GROUP_M" type="xs:integer" />
              <xs:element name="GROUP_A" type="xs:integer" />
              <xs:element name="OTHER_U" type="xs:integer" />
              <xs:element name="OTHER_M" type="xs:integer" />
              <xs:element name="OTHER_A" type="xs:integer" />
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

<xs:element name="TYPE" type="xs:integer"/>
<xs:element name="DISK_TYPE" type="xs:integer"/>
<xs:element name="PERSISTENT" type="xs:integer"/>
<xs:element name="REGTIME" type="xs:integer"/>
<xs:element name="SOURCE" type="xs:string"/>
<xs:element name="PATH" type="xs:string"/>
<xs:element name="FSTYPE" type="xs:string"/>
<xs:element name="SIZE" type="xs:integer"/>

<!-- STATE values,
    INIT      = 0, Initialization state
    READY     = 1, Image ready to use
    USED      = 2, Image in use
    DISABLED  = 3, Image can not be instantiated by a VM
    LOCKED    = 4, FS operation for the Image in process
    ERROR     = 5, Error state the operation FAILED
    CLONE     = 6, Image is being cloned
    DELETE    = 7, DS is deleting the image
    USED_PERS = 8, Image is in use and persistent
    LOCKED_USED = 9,      FS operation in progress, VMs waiting
    LOCKED_USED_PERS = 10 FS operation in progress, VMs waiting. Persistent
-->
<xs:element name="STATE" type="xs:integer"/>
<xs:element name="RUNNING_VMS" type="xs:integer"/>
<xs:element name="CLONING_OPS" type="xs:integer"/>
<xs:element name="CLONING_ID" type="xs:integer"/>
<xs:element name="TARGET_SNAPSHOT" type="xs:integer"/>
<xs:element name="DATASTORE_ID" type="xs:integer"/>
<xs:element name="DATASTORE" type="xs:string"/>
<xs:element name="VMS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="CLONES">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="APP_CLONES">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="SNAPSHOTS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="SNAPSHOT" minOccurs="0" maxOccurs="unbounded">

```

```

        <xs:complexType>
          <xs:sequence>
            <xs:element name="CHILDREN" type="xs:string" minOccurs="0"
↪maxOccurs="1"/>
            <xs:element name="ACTIVE" type="xs:string" minOccurs="0"
↪maxOccurs="1"/>
            <xs:element name="DATE" type="xs:integer"/>
            <xs:element name="ID" type="xs:integer"/>
            <xs:element name="NAME" type="xs:string" minOccurs="0" maxOccurs=
↪"1"/>
            <xs:element name="PARENT" type="xs:integer"/>
            <xs:element name="SIZE" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪/XMLSchema">
  <xs:include schemaLocation="image.xsd"/>
  <xs:element name="IMAGE_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="IMAGE" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for User

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪/XMLSchema">
  <xs:element name="USER">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="GROUPS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="1" maxOccurs=
↪"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

<xs:element name="GNAME" type="xs:string"/>
<xs:element name="NAME" type="xs:string"/>
<xs:element name="PASSWORD" type="xs:string"/>
<xs:element name="AUTH_DRIVER" type="xs:string"/>
<xs:element name="ENABLED" type="xs:integer"/>
<xs:element name="LOGIN_TOKEN" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="TOKEN" type="xs:string"/>
      <xs:element name="EXPIRATION_TIME" type="xs:integer"/>
      <xs:element name="EGID" type="xs:integer"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ID" type="xs:string"/>
            <xs:element name="IMAGES" type="xs:string"/>
            <xs:element name="IMAGES_USED" type="xs:string"/>
            <xs:element name="SIZE" type="xs:string"/>
            <xs:element name="SIZE_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ID" type="xs:string"/>
            <xs:element name="LEASES" type="xs:string"/>
            <xs:element name="LEASES_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="VM" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="CPU" type="xs:string"/>
            <xs:element name="CPU_USED" type="xs:string"/>
            <xs:element name="MEMORY" type="xs:string"/>
            <xs:element name="MEMORY_USED" type="xs:string"/>
            <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

        <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/>
        <xs:element name="VMS" type="xs:string"/>
        <xs:element name="VMS_USED" type="xs:string"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="RVMS" type="xs:string"/>
                        <xs:element name="RVMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="DEFAULT_USER_QUOTAS">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded
→ ">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="IMAGES" type="xs:string"/>
                                    <xs:element name="IMAGES_USED" type="xs:string"/>
                                    <xs:element name="SIZE" type="xs:string"/>
                                    <xs:element name="SIZE_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="ID" type="xs:string"/>
                                    <xs:element name="LEASES" type="xs:string"/>
                                    <xs:element name="LEASES_USED" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>

```



```

        </xs:complexType>
    </xs:element>
    <xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="VM" minOccurs="0" maxOccurs="1">
                    <xs:complexType>
                        <xs:sequence>
                            <xs:element name="CPU" type="xs:string"/>
                            <xs:element name="CPU_USED" type="xs:string"/>
                            <xs:element name="MEMORY" type="xs:string"/>
                            <xs:element name="MEMORY_USED" type="xs:string"/>
                            <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                            <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/>
                            <xs:element name="VMS" type="xs:string"/>
                            <xs:element name="VMS_USED" type="xs:string"/>
                        </xs:sequence>
                    </xs:complexType>
                </xs:element>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
    <xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                        <xs:sequence>
                            <xs:element name="ID" type="xs:string"/>
                            <xs:element name="RVMS" type="xs:string"/>
                            <xs:element name="RVMS_USED" type="xs:string"/>
                        </xs:sequence>
                    </xs:complexType>
                </xs:element>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
    <xs:element name="USER_POOL">
        <xs:complexType>
            <xs:sequence maxOccurs="1" minOccurs="1">
                <xs:choice maxOccurs="unbounded" minOccurs="0">
                    <xs:element name="USER" maxOccurs="unbounded" minOccurs="0">
                        <xs:complexType>
                            <xs:sequence>
                                <xs:element name="ID" type="xs:integer"/>

```

```

<xs:element name="GID" type="xs:integer"/>
<xs:element name="GROUPS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="1" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="GNAME" type="xs:string"/>
<xs:element name="NAME" type="xs:string"/>
<xs:element name="PASSWORD" type="xs:string"/>
<xs:element name="AUTH_DRIVER" type="xs:string"/>
<xs:element name="ENABLED" type="xs:integer"/>
<xs:element name="LOGIN_TOKEN" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="TOKEN" type="xs:string"/>
      <xs:element name="EXPIRATION_TIME" type="xs:integer"/>
      <xs:element name="EGID" type="xs:integer"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="QUOTAS" maxOccurs="unbounded" minOccurs="0">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer"/>
      <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded
↪ ">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="ID" type="xs:string"/>
                  <xs:element name="IMAGES" type="xs:string"/>
                  <xs:element name="IMAGES_USED" type="xs:string"/>
                  <xs:element name="SIZE" type="xs:string"/>
                  <xs:element name="SIZE_USED" type="xs:string"/>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ID" type="xs:string"/>
            <xs:element name="LEASES" type="xs:string"/>
            <xs:element name="LEASES_USED" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="VM" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="CPU" type="xs:string"/>
                        <xs:element name="CPU_USED" type="xs:string"/>
                        <xs:element name="MEMORY" type="xs:string"/>
                        <xs:element name="MEMORY_USED" type="xs:string"/>
                        <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                        <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/

                        <xs:element name="VMS" type="xs:string"/>
                        <xs:element name="VMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="RVMS" type="xs:string"/>
                        <xs:element name="RVMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:choice>
<xs:element name="DEFAULT_USER_QUOTAS">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="DATASTORE_QUOTA" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="DATASTORE" minOccurs="0" maxOccurs="unbounded

                        <xs:complexType>
                            <xs:sequence>
                                <xs:element name="ID" type="xs:string"/>
                                <xs:element name="IMAGES" type="xs:string"/>

```

```

        <xs:element name="IMAGES_USED" type="xs:string"/>
        <xs:element name="SIZE" type="xs:string"/>
        <xs:element name="SIZE_USED" type="xs:string"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="NETWORK_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="NETWORK" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="LEASES" type="xs:string"/>
                        <xs:element name="LEASES_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="VM_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="VM" minOccurs="0" maxOccurs="1">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="CPU" type="xs:string"/>
                        <xs:element name="CPU_USED" type="xs:string"/>
                        <xs:element name="MEMORY" type="xs:string"/>
                        <xs:element name="MEMORY_USED" type="xs:string"/>
                        <xs:element name="SYSTEM_DISK_SIZE" type="xs:string"/>
                        <xs:element name="SYSTEM_DISK_SIZE_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="VMS" type="xs:string"/>
            <xs:element name="VMS_USED" type="xs:string"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="IMAGE_QUOTA" minOccurs="0" maxOccurs="1">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="IMAGE" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="ID" type="xs:string"/>
                        <xs:element name="RVMS" type="xs:string"/>
                        <xs:element name="RVMS_USED" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>

```

```

        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for Virtual Machine

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:element name="VM">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="LAST_POLL" type="xs:integer"/>

        <!-- STATE values,
        see http://docs.opennebula.org/stable/user/references/vm_states.html
        -->
        <xs:element name="STATE" type="xs:integer"/>

        <!-- LCM_STATE values, this sub-state is relevant only when STATE is
        ACTIVE (4)
        see http://docs.opennebula.org/stable/user/references/vm_states.html
        -->
        <xs:element name="LCM_STATE" type="xs:integer"/>
        <xs:element name="PREV_STATE" type="xs:integer"/>
        <xs:element name="PREV_LCM_STATE" type="xs:integer"/>
        <xs:element name="RESCHED" type="xs:integer"/>
        <xs:element name="STIME" type="xs:integer"/>

```

```

<xs:element name="ETIME" type="xs:integer"/>
<xs:element name="DEPLOY_ID" type="xs:string"/>
<xs:element name="MONITORING">
  <!--
    <xs:complexType>
      <xs:all>
        <- Percentage of 1 CPU consumed (two fully consumed cpu is 200) ->
        <xs:element name="CPU" type="xs:decimal" minOccurs="0" maxOccurs="1"/>

        <- MEMORY consumption in kilobytes ->
        <xs:element name="MEMORY" type="xs:integer" minOccurs="0" maxOccurs="1"/>

        <- NETTX: Sent bytes to the network ->
        <xs:element name="NETTX" type="xs:integer" minOccurs="0" maxOccurs="1"/>

        <- NETRX: Received bytes from the network ->
        <xs:element name="NETRX" type="xs:integer" minOccurs="0" maxOccurs="1"/>
      </xs:all>
    </xs:complexType>
  -->
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="USER_TEMPLATE" type="xs:anyType"/>
<xs:element name="HISTORY_RECORDS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="HISTORY" maxOccurs="unbounded" minOccurs="0">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="OID" type="xs:integer"/>
            <xs:element name="SEQ" type="xs:integer"/>
            <xs:element name="UID" type="xs:integer"/>
            <xs:element name="GID" type="xs:integer"/>
            <xs:element name="REQUEST_ID" type="xs:string"/>
            <xs:element name="HOSTNAME" type="xs:string"/>
            <xs:element name="HID" type="xs:integer"/>
            <xs:element name="CID" type="xs:integer"/>
            <xs:element name="STIME" type="xs:integer"/>
            <xs:element name="ETIME" type="xs:integer"/>
            <xs:element name="VM_MAD" type="xs:string"/>
            <xs:element name="TM_MAD" type="xs:string"/>
            <xs:element name="DS_ID" type="xs:integer"/>
            <xs:element name="PSTIME" type="xs:integer"/>
            <xs:element name="PETIME" type="xs:integer"/>
            <xs:element name="RSTIME" type="xs:integer"/>
            <xs:element name="RETIME" type="xs:integer"/>
            <xs:element name="ESTIME" type="xs:integer"/>
            <xs:element name="EETIME" type="xs:integer"/>

            <!-- ACTION values:
              NONE_ACTION           = 0
              MIGRATE_ACTION        = 1
              LIVE_MIGRATE_ACTION   = 2
              SHUTDOWN_ACTION       = 3
              SHUTDOWN_HARD_ACTION  = 4
              UNDEPLOY_ACTION       = 5
              UNDEPLOY_HARD_ACTION  = 6
            -->
          
```

```

        HOLD_ACTION           = 7
        RELEASE_ACTION        = 8
        STOP_ACTION           = 9
        SUSPEND_ACTION         = 10
        RESUME_ACTION          = 11
        BOOT_ACTION            = 12
        DELETE_ACTION          = 13
        DELETE_RECREATE_ACTION = 14
        REBOOT_ACTION          = 15
        REBOOT_HARD_ACTION     = 16
        RESCHED_ACTION         = 17
        UNRESCHED_ACTION       = 18
        POWEROFF_ACTION        = 19
        POWEROFF_HARD_ACTION   = 20
        DISK_ATTACH_ACTION     = 21
        DISK_DETACH_ACTION     = 22
        NIC_ATTACH_ACTION      = 23
        NIC_DETACH_ACTION      = 24
        DISK_SNAPSHOT_CREATE_ACTION = 25
        DISK_SNAPSHOT_DELETE_ACTION = 26
        TERMINATE_ACTION       = 27
        TERMINATE_HARD_ACTION  = 28
        DISK_RESIZE_ACTION     = 29
        DEPLOY_ACTION          = 30
        CHOWN_ACTION           = 31
        CHMOD_ACTION           = 32
        UPDATECONF_ACTION      = 33
        RENAME_ACTION          = 34
        RESIZE_ACTION          = 35
        UPDATE_ACTION          = 36
        SNAPSHOT_CREATE_ACTION = 37
        SNAPSHOT_DELETE_ACTION = 38
        SNAPSHOT_REVERT_ACTION = 39
        DISK_SAVEAS_ACTION     = 40
        DISK_SNAPSHOT_REVERT_ACTION = 41
        RECOVER_ACTION         = 42
        RETRY_ACTION           = 43
        MONITOR_ACTION         = 44
    -->
    <xs:element name="ACTION" type="xs:integer"/>
  </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="SNAPSHOTS" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DISK_ID" type="xs:integer"/>
      <xs:element name="SNAPSHOT" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ACTIVE" type="xs:string" minOccurs="0"
↳maxOccurs="1"/>
            <xs:element name="CHILDREN" type="xs:string" minOccurs="0"
↳maxOccurs="1"/>
            <xs:element name="DATE" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="NAME" type="xs:string" minOccurs="0" maxOccurs=
↪ "1"/>
        <xs:element name="PARENT" type="xs:integer"/>
        <xs:element name="SIZE" type="xs:integer"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="unqualified
↪ "
    targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
    <xs:include schemaLocation="vm.xsd"/>
    <xs:element name="VM_POOL">
        <xs:complexType>
            <xs:sequence maxOccurs="1" minOccurs="1">
                <xs:element ref="VM" maxOccurs="unbounded" minOccurs="0"/>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
</xs:schema>

```

Schemas for Virtual Machine Template

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema" elementFormDefault="qualified" targetNamespace="http://opennebula.org/
↪ XMLSchema">
    <xs:element name="VMTEMPLATE">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="ID" type="xs:integer"/>
                <xs:element name="UID" type="xs:integer"/>
                <xs:element name="GID" type="xs:integer"/>
                <xs:element name="UNAME" type="xs:string"/>
                <xs:element name="GNAME" type="xs:string"/>
                <xs:element name="NAME" type="xs:string"/>
                <xs:element name="PERMISSIONS" minOccurs="1" maxOccurs="1">
                    <xs:complexType>
                        <xs:sequence>
                            <xs:element name="OWNER_U" type="xs:integer"/>
                            <xs:element name="OWNER_M" type="xs:integer"/>
                            <xs:element name="OWNER_A" type="xs:integer"/>
                            <xs:element name="GROUP_U" type="xs:integer"/>
                            <xs:element name="GROUP_M" type="xs:integer"/>
                            <xs:element name="GROUP_A" type="xs:integer"/>
                            <xs:element name="OTHER_U" type="xs:integer"/>

```



```

        <xs:element name="OTHER_M" type="xs:integer"/>
        <xs:element name="OTHER_A" type="xs:integer"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="REGTIME" type="xs:integer"/>
<xs:element name="TEMPLATE" type="xs:anyType"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪/XMLSchema">
  <xs:include schemaLocation="vmtemplate.xsd"/>
  <xs:element name="VMTEMPLATE_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="VMTEMPLATE" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Virtual Network

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪/XMLSchema">
  <xs:element name="VNET">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

<xs:element name="CLUSTERS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↳ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="BRIDGE" type="xs:string"/>
<xs:element name="PARENT_NETWORK_ID" type="xs:string"/>
<xs:element name="VN_MAD" type="xs:string"/>
<xs:element name="PHYDEV" type="xs:string"/>
<xs:element name="VLAN_ID" type="xs:string"/>
<xs:element name="VLAN_ID_AUTOMATIC" type="xs:string"/>
<xs:element name="USED_LEASES" type="xs:integer"/>
<xs:element name="VROUTERS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↳ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="AR_POOL">
  <xs:complexType>
    <xs:sequence minOccurs="0">
      <xs:element name="AR" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="AR_ID" type="xs:string"/>
            <xs:element name="GLOBAL_PREFIX" type="xs:string" minOccurs="0"/>
            <xs:element name="IP" type="xs:string" minOccurs="0"/>
            <xs:element name="MAC" type="xs:string"/>
            <xs:element name="PARENT_NETWORK_AR_ID" type="xs:string"
↳ minOccurs="0"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="SIZE" type="xs:integer"/>
      <xs:element name="TYPE" type="xs:string"/>
      <xs:element name="ULA_PREFIX" type="xs:string" minOccurs="0"/>
      <xs:element name="VN_MAD" type="xs:string" minOccurs="0"/>
      <xs:element name="MAC_END" type="xs:string" minOccurs="0"/>
      <xs:element name="IP_END" type="xs:string" minOccurs="0"/>
      <xs:element name="IP6_ULA" type="xs:string" minOccurs="0"/>
      <xs:element name="IP6_ULA_END" type="xs:string" minOccurs="0"/>
      <xs:element name="IP6_GLOBAL" type="xs:string" minOccurs="0"/>
      <xs:element name="IP6_GLOBAL_END" type="xs:string" minOccurs="0"/>
      <xs:element name="USED_LEASES" type="xs:string"/>
      <xs:element name="LEASES" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="LEASE" minOccurs="0" maxOccurs="unbounded
↳ ">
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
  <xs:all>
    <xs:element name="IP" type="xs:string" minOccurs="0"/>
    <xs:element name="IP6_GLOBAL" type="xs:string"
↳ minOccurs="0"/>
    <xs:element name="IP6_LINK" type="xs:string"
↳ minOccurs="0"/>
  </xs:all>
</xs:complexType>
</xs:element>

```

```

↪ "0" />
<xs:element name="IP6_ULA" type="xs:string" minOccurs=
<xs:element name="MAC" type="xs:string"/>
<xs:element name="VM" type="xs:integer" minOccurs="0"/
↪ >
<xs:element name="VNET" type="xs:integer" minOccurs="0
↪ "/>
<xs:element name="VROUTER" type="xs:integer"
↪ minOccurs="0" />
</xs:all>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
<xs:include schemaLocation="vnet.xsd"/>
<xs:element name="VNET_POOL">
<xs:complexType>
<xs:sequence maxOccurs="1" minOccurs="1">
<xs:element name="VNET" maxOccurs="unbounded" minOccurs="0">
<xs:complexType>
<xs:sequence>
<xs:element name="ID" type="xs:integer"/>
<xs:element name="UID" type="xs:integer"/>
<xs:element name="GID" type="xs:integer"/>
<xs:element name="UNAME" type="xs:string"/>
<xs:element name="GNAME" type="xs:string"/>
<xs:element name="NAME" type="xs:string"/>
<xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
<xs:complexType>
<xs:sequence>
<xs:element name="OWNER_U" type="xs:integer"/>
<xs:element name="OWNER_M" type="xs:integer"/>
<xs:element name="OWNER_A" type="xs:integer"/>
<xs:element name="GROUP_U" type="xs:integer"/>
<xs:element name="GROUP_M" type="xs:integer"/>
<xs:element name="GROUP_A" type="xs:integer"/>
<xs:element name="OTHER_U" type="xs:integer"/>
<xs:element name="OTHER_M" type="xs:integer"/>
<xs:element name="OTHER_A" type="xs:integer"/>
</xs:sequence>
</xs:complexType>
</xs:element>

```

```

<xs:element name="CLUSTERS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="BRIDGE" type="xs:string"/>
<xs:element name="PARENT_NETWORK_ID" type="xs:string"/>
<xs:element name="VN_MAD" type="xs:string"/>
<xs:element name="PHYDEV" type="xs:string"/>
<xs:element name="VLAN_ID" type="xs:string"/>
<xs:element name="VLAN_ID_AUTOMATIC" type="xs:string"/>
<xs:element name="USED_LEASES" type="xs:integer"/>
<xs:element name="VROUTERS">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="AR_POOL">
  <xs:complexType>
    <xs:sequence minOccurs="0">
      <xs:element name="AR" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ALLOCATED" type="xs:string" minOccurs="0"/
↪ >
            <xs:element name="AR_ID" type="xs:string"/>
            <xs:element name="GLOBAL_PREFIX" type="xs:string" minOccurs=
↪ "0"/>
            <xs:element name="IP" type="xs:string" minOccurs="0"/>
            <xs:element name="MAC" type="xs:string"/>
            <xs:element name="PARENT_NETWORK_AR_ID" type="xs:string"
↪ minOccurs="0"/>
            <xs:element name="SIZE" type="xs:integer"/>
            <xs:element name="TYPE" type="xs:string"/>
            <xs:element name="ULA_PREFIX" type="xs:string" minOccurs="0
↪ "/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for Accounting

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↳XMLSchema">

  <xs:element name="HISTORY_RECORDS">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="HISTORY" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="HISTORY">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="OID" type="xs:integer"/>
        <xs:element name="SEQ" type="xs:integer"/>
        <xs:element name="HOSTNAME" type="xs:string"/>
        <xs:element name="HID" type="xs:integer"/>
        <xs:element name="CID" type="xs:integer"/>
        <xs:element name="STIME" type="xs:integer"/>
        <xs:element name="ETIME" type="xs:integer"/>
        <xs:element name="VM_MAD" type="xs:string"/>
        <xs:element name="TM_MAD" type="xs:string"/>
        <xs:element name="DS_ID" type="xs:integer"/>
        <xs:element name="PSTIME" type="xs:integer"/>
        <xs:element name="PETIME" type="xs:integer"/>
        <xs:element name="RSTIME" type="xs:integer"/>
        <xs:element name="RETIME" type="xs:integer"/>
        <xs:element name="ESTIME" type="xs:integer"/>
        <xs:element name="EETIME" type="xs:integer"/>

        <!-- REASON values:
          NONE = 0 History record is not closed yet
          ERROR = 1 History record was closed because of an error
          USER = 2 History record was closed because of a user action
        -->
        <xs:element name="REASON" type="xs:integer"/>

        <!-- ACTION values:
          NONE_ACTION = 0
          MIGRATE_ACTION = 1
          LIVE_MIGRATE_ACTION = 2
          SHUTDOWN_ACTION = 3
          SHUTDOWN_HARD_ACTION = 4
          UNDEPLOY_ACTION = 5
          UNDEPLOY_HARD_ACTION = 6
          HOLD_ACTION = 7
          RELEASE_ACTION = 8
          STOP_ACTION = 9
          SUSPEND_ACTION = 10
          RESUME_ACTION = 11
          BOOT_ACTION = 12
          DELETE_ACTION = 13
          DELETE_RECREATE_ACTION = 14

```

```

REBOOT_ACTION          = 15
REBOOT_HARD_ACTION    = 16
RESCHED_ACTION        = 17
UNRESCHED_ACTION      = 18
POWEROFF_ACTION       = 19
POWEROFF_HARD_ACTION  = 20
DISK_ATTACH_ACTION    = 21
DISK_DETACH_ACTION    = 22
NIC_ATTACH_ACTION     = 23
NIC_DETACH_ACTION     = 24
DISK_SNAPSHOT_CREATE_ACTION = 25
DISK_SNAPSHOT_DELETE_ACTION = 26
TERMINATE_ACTION      = 27
TERMINATE_HARD_ACTION = 28
-->
<xs:element name="ACTION" type="xs:integer"/>

<xs:element name="VM">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ID" type="xs:integer"/>
      <xs:element name="UID" type="xs:integer"/>
      <xs:element name="GID" type="xs:integer"/>
      <xs:element name="UNAME" type="xs:string"/>
      <xs:element name="GNAME" type="xs:string"/>
      <xs:element name="NAME" type="xs:string"/>
      <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="OWNER_U" type="xs:integer"/>
            <xs:element name="OWNER_M" type="xs:integer"/>
            <xs:element name="OWNER_A" type="xs:integer"/>
            <xs:element name="GROUP_U" type="xs:integer"/>
            <xs:element name="GROUP_M" type="xs:integer"/>
            <xs:element name="GROUP_A" type="xs:integer"/>
            <xs:element name="OTHER_U" type="xs:integer"/>
            <xs:element name="OTHER_M" type="xs:integer"/>
            <xs:element name="OTHER_A" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="LAST_POLL" type="xs:integer"/>

      <!-- STATE values,
      see http://docs.opennebula.org/stable/user/references/vm_states.html
      -->
      <xs:element name="STATE" type="xs:integer"/>

      <!-- LCM_STATE values, this sub-state is relevant only when STATE is
      ACTIVE (4)
      see http://docs.opennebula.org/stable/user/references/vm_states.html
      -->
      <xs:element name="LCM_STATE" type="xs:integer"/>
      <xs:element name="PREV_STATE" type="xs:integer"/>
      <xs:element name="PREV_LCM_STATE" type="xs:integer"/>
      <xs:element name="RESCHED" type="xs:integer"/>
      <xs:element name="STIME" type="xs:integer"/>
      <xs:element name="ETIME" type="xs:integer"/>

```

```

<xs:element name="DEPLOY_ID" type="xs:string"/>
<xs:element name="MONITORING">
  <!--
    <xs:complexType>
      <xs:all>
        <- Percentage of 1 CPU consumed (two fully consumed cpu is 200) ->
        <xs:element name="CPU" type="xs:decimal" minOccurs="0" maxOccurs=
↳ "1"/>

        <- MEMORY consumption in kilobytes ->
        <xs:element name="MEMORY" type="xs:integer" minOccurs="0"
↳ maxOccurs="1"/>

        <- NETTX: Sent bytes to the network ->
        <xs:element name="NETTX" type="xs:integer" minOccurs="0"
↳ maxOccurs="1"/>

        <- NETRX: Received bytes from the network ->
        <xs:element name="NETRX" type="xs:integer" minOccurs="0"
↳ maxOccurs="1"/>
      </xs:all>
    </xs:complexType>
  -->
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<xs:element name="USER_TEMPLATE" type="xs:anyType"/>
<xs:element name="HISTORY_RECORDS">
</xs:element>
<xs:element name="SNAPSHOTS" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="DISK_ID" type="xs:integer"/>
      <xs:element name="SNAPSHOT" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="ACTIVE" type="xs:string" minOccurs="0"
↳ maxOccurs="1"/>

            <xs:element name="CHILDREN" type="xs:string" minOccurs="0"
↳ maxOccurs="1"/>

            <xs:element name="DATE" type="xs:integer"/>
            <xs:element name="ID" type="xs:integer"/>
            <xs:element name="NAME" type="xs:string" minOccurs="0"
↳ maxOccurs="1"/>

            <xs:element name="PARENT" type="xs:integer"/>
            <xs:element name="SIZE" type="xs:integer"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for Marketplace

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:element name="MARKETPLACE">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="MARKET_MAD" type="xs:string"/>
        <xs:element name="ZONE_ID" type="xs:string"/>
        <xs:element name="TOTAL_MB" type="xs:integer"/>
        <xs:element name="FREE_MB" type="xs:integer"/>
        <xs:element name="USED_MB" type="xs:integer"/>
        <xs:element name="MARKETPLACEAPPS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
              ↪"unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="TEMPLATE" type="xs:anyType"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="unqualified"
  ↪"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:include schemaLocation="marketplace.xsd"/>
  <xs:element name="MARKETPLACE_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">

```



```

        <xs:element ref="MARKETPLACE" maxOccurs="unbounded" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

Schemas for Marketplace App

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  ↪XMLSchema">
  <xs:element name="MARKETPLACEAPP">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="REGTIME" type="xs:integer"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="ZONE_ID" type="xs:string"/>
        <xs:element name="ORIGIN_ID" type="xs:string"/>
        <xs:element name="SOURCE" type="xs:string"/>
        <xs:element name="MD5" type="xs:string"/>
        <xs:element name="SIZE" type="xs:integer"/>
        <xs:element name="DESCRIPTION" type="xs:string"/>
        <xs:element name="VERSION" type="xs:string"/>
        <xs:element name="FORMAT" type="xs:string"/>
        <xs:element name="APPTEMPLATE64" type="xs:string"/>
        <xs:element name="MARKETPLACE_ID" type="xs:integer"/>
        <xs:element name="MARKETPLACE" type="xs:string"/>
        <xs:element name="STATE" type="xs:integer"/>
        <xs:element name="TYPE" type="xs:integer"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="TEMPLATE" type="xs:anyType"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="unqualified"
↪ "
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
  <xs:include schemaLocation="marketplaceapp.xsd"/>
  <xs:element name="MARKETPLACEAPP_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="MARKETPLACEAPP" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Virtual Router

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
  <xs:element name="VROUTER">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="VMS">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ID" type="xs:integer" minOccurs="0" maxOccurs=
↪ "unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="TEMPLATE" type="xs:anyType"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="unqualified"
↳ "
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↳ XMLSchema">
  <xs:include schemaLocation="vrouter.xsd"/>
  <xs:element name="VROUTER_POOL">
    <xs:complexType>
      <xs:sequence maxOccurs="1" minOccurs="1">
        <xs:element ref="VROUTER" maxOccurs="unbounded" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Schemas for Virtual Machine Group

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
↳ XMLSchema">
  targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
  <xs:element name="VM_GROUP">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ID" type="xs:integer"/>
        <xs:element name="UID" type="xs:integer"/>
        <xs:element name="GID" type="xs:integer"/>
        <xs:element name="UNAME" type="xs:string"/>
        <xs:element name="GNAME" type="xs:string"/>
        <xs:element name="NAME" type="xs:string"/>
        <xs:element name="PERMISSIONS" minOccurs="0" maxOccurs="1">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="OWNER_U" type="xs:integer"/>
              <xs:element name="OWNER_M" type="xs:integer"/>
              <xs:element name="OWNER_A" type="xs:integer"/>
              <xs:element name="GROUP_U" type="xs:integer"/>
              <xs:element name="GROUP_M" type="xs:integer"/>
              <xs:element name="GROUP_A" type="xs:integer"/>
              <xs:element name="OTHER_U" type="xs:integer"/>
              <xs:element name="OTHER_M" type="xs:integer"/>
              <xs:element name="OTHER_A" type="xs:integer"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="ROLES">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ROLE" maxOccurs="unbounded" minOccurs="0">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="ID" type="xs:integer"/>
                    <xs:element name="NAME" type="xs:string" maxOccurs="1" minOccurs="0"/>

```

```

<xs:element name="POLICY" type="xs:string" maxOccurs="1"
↪ minOccurs="0"/>
    <!-- POLICY values:
        AFFINED
        ANTI_AFFINED
    -->
    <xs:element name="HOST_AFFINED" type="xs:string" maxOccurs="1"
↪ minOccurs="0"/>
    <xs:element name="HOST_ANTI_AFFINED" type="xs:string" maxOccurs="1
↪ " minOccurs="0"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="TEMPLATE" type="xs:anyType"/>
<!-- POLICY values:
    AFFINED = "<list of roles>"
    ANTI_AFFINED = "<list of roles>"
-->
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="unqualified
↪ "
    targetNamespace="http://opennebula.org/XMLSchema" xmlns="http://opennebula.org/
↪ XMLSchema">
    <xs:include schemaLocation="vrouter.xsd"/>
    <xs:element name="VM_GROUP_POOL">
        <xs:complexType>
            <xs:sequence maxOccurs="1" minOccurs="1">
                <xs:element ref="VM_GROUP" maxOccurs="unbounded" minOccurs="0"/>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
</xs:schema>

```

1.3 Ruby OpenNebula Cloud API

This page contains the OpenNebula Cloud API Specification for Ruby. It has been designed as a wrapper for the *XML-RPC methods*, with some basic helpers. This means that you should be familiar with the XML-RPC API and the XML formats returned by the OpenNebula core. As stated in the *XML-RPC documentation*, you can download the *XML Schemas (XSD) here*.

1.3.1 API Documentation

You can consult the doc online.

1.3.2 Usage

You can use the Ruby OCA included in the OpenNebula distribution by adding the OpenNebula Ruby library path to the search path:

```
#####
# Environment Configuration
#####
ONE_LOCATION=ENV["ONE_LOCATION"]

if !ONE_LOCATION
  RUBY_LIB_LOCATION="/usr/lib/one/ruby"
else
  RUBY_LIB_LOCATION=ONE_LOCATION+"/lib/ruby"
end

$: << RUBY_LIB_LOCATION

#####
# Required libraries
#####
require 'openebula'
```

1.3.3 Code Sample: Shutdown all the VMs of the Pool

This is a small code snippet. As you can see, the code flow would be as follows:

- Create a new Client, setting up the authorization string. You only need to create it once.
- Get the VirtualMachine pool that contains the VirtualMachines owned by this User.
- You can perform “actions” over these objects right away, like `myVNet.delete()`; . In this example all the VirtualMachines will be shut down.

```
#!/usr/bin/env ruby

#####
# Environment Configuration
#####
ONE_LOCATION=ENV["ONE_LOCATION"]

if !ONE_LOCATION
  RUBY_LIB_LOCATION="/usr/lib/one/ruby"
else
  RUBY_LIB_LOCATION=ONE_LOCATION+"/lib/ruby"
end

$: << RUBY_LIB_LOCATION

#####
# Required libraries
#####
require 'openebula'

include OpenNebula

# OpenNebula credentials
CREDENTIALS = "oneuser:onepass"
```

```

# XML_RPC endpoint where OpenNebula is listening
ENDPOINT = "http://localhost:2633/RPC2"

client = Client.new(CREDENTIALS, ENDPOINT)

vm_pool = VirtualMachinePool.new(client, -1)

rc = vm_pool.info
if OpenNebula.is_error?(rc)
  puts rc.message
  exit -1
end

vm_pool.each do |vm|
  rc = vm.shutdown
  if OpenNebula.is_error?(rc)
    puts "Virtual Machine #{vm.id}: #{rc.message}"
  else
    puts "Virtual Machine #{vm.id}: Shutting down"
  end
end

exit 0

```

1.3.4 Code Sample: Create a new Virtual Network

```

#!/usr/bin/env ruby

#####
# Environment Configuration
#####
ONE_LOCATION=ENV["ONE_LOCATION"]

if !ONE_LOCATION
  RUBY_LIB_LOCATION="/usr/lib/one/ruby"
else
  RUBY_LIB_LOCATION=ONE_LOCATION+"/lib/ruby"
end

$: << RUBY_LIB_LOCATION

#####
# Required libraries
#####
require 'openebula'

include OpenNebula

# OpenNebula credentials
CREDENTIALS = "oneuser:onepass"
# XML_RPC endpoint where OpenNebula is listening
ENDPOINT = "http://localhost:2633/RPC2"

client = Client.new(CREDENTIALS, ENDPOINT)

template = <<-EOT

```

```

NAME      = "Red LAN"

# Now we'll use the host private network (physical)
BRIDGE    = vbr0

# Custom Attributes to be used in Context
GATEWAY   = 192.168.0.1
DNS       = 192.168.0.1

LOAD_BALANCER = 192.168.0.3

AR = [
  TYPE = IP4,
  IP   = 192.168.0.1,
  SIZE = 255
]
EOT

xml = OpenNebula::VirtualNetwork.build_xml
vn  = OpenNebula::VirtualNetwork.new(xml, client)

rc = vn.allocate(template)
if OpenNebula.is_error?(rc)
  STDERR.puts rc.message
  exit(-1)
else
  puts "ID: #{vn.id.to_s}"
end

puts "Before info:"
puts vn.to_xml

puts

vn.info

puts "After info:"
puts vn.to_xml

```

1.4 Java OpenNebula Cloud API

This page contains the OpenNebula Cloud API Specification for Java. It has been designed as a wrapper for the *XML-RPC methods*, with some basic helpers. This means that you should be familiar with the XML-RPC API and the XML formats returned by the OpenNebula core. As stated in the *XML-RPC documentation*, you can download the *XML Schemas (XSD) here*.

1.4.1 Download

You can download the `.jar` file compiled using Java 1.8, the required libraries, and the javadoc packaged in a `tar.gz` file following [this link](#) in the OpenNebula version you have installed.

You can also consult the [javadoc online](#).

1.4.2 Usage

To use the OpenNebula Cloud API for Java in your Java project, you have to add to the classpath the `org.opennebula.client.jar` file and the xml-rpc libraries located in the `lib` directory.

1.4.3 Code Sample

This is a small code snippet. As you can see, the code flow would be as follows:

- Create a `org.opennebula.client.Client` object, setting up the authorization string and the endpoint. You only need to create it once.
- Create a pool (e.g. `HostPool`) or element (e.g. `VirtualNetwork`) object.
- You can perform “actions” over these objects right away, like `myVNet.delete()`;
- If you want to query any information (like what objects the pool contains, or one of the element attributes), you have to issue an `info()` call before, so the object retrieves the data from OpenNebula.

For more complete examples, please check the `src/oca/java/share/examples` directory included. You may be also interested in the java files included in `src/oca/java/test`.

```
// First of all, a Client object has to be created.
// Here the client will try to connect to OpenNebula using the default
// options: the auth. file will be assumed to be at $ONE_AUTH, and the
// endpoint will be set to the environment variable $ONE_XMLRPC.
Client oneClient;

try
{
    oneClient = new Client();

    // We will try to create a new virtual machine. The first thing we
    // need is an OpenNebula virtual machine template.

    // This VM template is a valid one, but it will probably fail to run
    // if we try to deploy it; the path for the image is unlikely to
    // exist.
    String vmTemplate =
        "NAME      = vm_from_java    CPU = 0.1    MEMORY = 64\n"
        + "#DISK      = [\n"
        + "#\tsource    = \"/home/user/vmachines/ttylinux/ttylinux.img\", \n"
        + "#\ttarget    = \"hda\", \n"
        + "#\treadonly  = \"no\" ]\n"
        + "# NIC       = [ NETWORK = \"Non existing network\" ]\n"
        + "FEATURES = [ acpi=\"no\" ]";

    // You can try to uncomment the NIC line, in that case OpenNebula
    // won't be able to insert this machine in the database.

    System.out.println("Virtual Machine Template:\n" + vmTemplate);
    System.out.println();

    System.out.print("Trying to allocate the virtual machine... ");
    OneResponse rc = VirtualMachine.allocate(oneClient, vmTemplate);

    if( rc.isError() )
    {
        System.out.println( "failed!");
    }
}
```



```

        throw new Exception( rc.getErrorMessage() );
    }

    // The response message is the new VM's ID
    int newVMID = Integer.parseInt(rc.getMessage());
    System.out.println("ok, ID " + newVMID + ".");

    // We can create a representation for the new VM, using the returned
    // VM-ID
    VirtualMachine vm = new VirtualMachine(newVMID, oneClient);

    // Let's hold the VM, so the scheduler won't try to deploy it
    System.out.print("Trying to hold the new VM.. ");
    rc = vm.hold();

    if(rc.isError())
    {
        System.out.println("failed!");
        throw new Exception( rc.getErrorMessage() );
    }
    else
        System.out.println("ok.");

    // And now we can request its information.
    rc = vm.info();

    if(rc.isError())
        throw new Exception( rc.getErrorMessage() );

    System.out.println();
    System.out.println(
        "This is the information OpenNebula stores for the new VM:");
    System.out.println(rc.getMessage() + "\n");

    // This VirtualMachine object has some helpers, so we can access its
    // attributes easily (remember to load the data first using the info
    // method).
    System.out.println("The new VM " +
        vm.getName() + " has status: " + vm.status());

    // And we can also use xpath expressions
    System.out.println("The path of the disk is");
    System.out.println( "\t" + vm.xpath("template/disk/source") );

    // Let's delete the VirtualMachine object.
    vm = null;

    // The reference is lost, but we can ask OpenNebula about the VM
    // again. This time however, we are going to use the VM pool
    VirtualMachinePool vmPool = new VirtualMachinePool(oneClient);
    // Remember that we have to ask the pool to retrieve the information
    // from OpenNebula
    rc = vmPool.info();

    if(rc.isError())
        throw new Exception( rc.getErrorMessage() );

    System.out.println(

```

```

        "\nThese are all the Virtual Machines in the pool:");
    for ( VirtualMachine vmachine : vmPool )
    {
        System.out.println("\tID : " + vmachine.getId() +
            ", Name : " + vmachine.getName() );

        // Check if we have found the VM we are looking for
        if ( vmachine.getId().equals( ""+newVMID ) )
        {
            vm = vmachine;
        }
    }

    // We have also some useful helpers for the actions you can perform
    // on a virtual machine, like suspend:
    rc = vm.suspend();
    System.out.println("\nTrying to suspend the VM " + vm.getId() +
        " (should fail)...");

    // This is all the information you can get from the OneResponse:
    System.out.println("\tOpenNebula response");
    System.out.println("\t  Error: " + rc.isError());
    System.out.println("\t  Msg:    " + rc.getMessage());
    System.out.println("\t  ErrMsg: " + rc.getErrorMessage());

    rc = vm.terminate();
    System.out.println("\nTrying to terminate the VM " +
        vm.getId() + "...");

    System.out.println("\tOpenNebula response");
    System.out.println("\t  Error: " + rc.isError());
    System.out.println("\t  Msg:    " + rc.getMessage());
    System.out.println("\t  ErrMsg: " + rc.getErrorMessage());
}
catch (Exception e)
{
    System.out.println(e.getMessage());
}

```

1.4.4 Compilation

To compile the Java OCA, untar the [OpenNebula source](#), cd to the java directory and use the build script:

```

$ cd src/oca/java
$ ./build.sh -d
Compiling java files into class files...
Packaging class files in a jar...
Generating javadocs...

```

This command will compile and package the code in `jar/org.opennebula.client.jar`, and the javadoc will be created in `share/doc/`.

You might want to copy the `.jar` files to a more convenient directory. You could use `/usr/lib/one/java/`

```
$ sudo mkdir /usr/lib/one/java/
$ sudo cp jar/* lib/* /usr/lib/one/java/
```

1.5 OneFlow Specification

The OpenNebula OneFlow API is a RESTful service to create, control and monitor services composed of interconnected Virtual Machines with deployment dependencies between them. Each group of Virtual Machines is deployed and managed as a single entity, and is completely integrated with the advanced OpenNebula user and group management. There are two kind of resources; services templates and services. All data is sent and received as JSON.

This guide is intended for developers. The OpenNebula distribution includes a cli to interact with OneFlow and it is also fully integrated in the Sunstone GUI

1.5.1 Authentication & Authorization

User authentication will be [HTTP Basic access authentication](#). The credentials passed should be the User name and password.

```
$ curl -u "username:password" https://onflow.server
```

1.5.2 Return Codes

The OneFlow API uses the following subset of HTTP Status codes:

- **200 OK** : The request has succeeded.
- **201 Created** : Request was successful and a new resource has being created
- **202 Accepted** : The request has been accepted for processing, but the processing has not been completed
- **204 No Content** : The request has been accepted for processing, but no info in the response
- **400 Bad Request** : Malformed syntax
- **401 Unauthorized** : Bad authentication
- **403 Forbidden** : Bad authorization
- **404 Not Found** : Resource not found
- **500 Internal Server Error** : The server encountered an unexpected condition which prevented it from fulfilling the request.
- **501 Not Implemented** : The functionality requested is not supported

```
> POST /service_template HTTP/1.1
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: onflow.server:2474
>
< HTTP/1.1 400 Bad Request
< Content-Type: text/html;charset=utf-8
< Content-Type: application/json;charset=utf-8
< Content-Length: 40
<
{
```

```

"error": {
  "message": "Role 'worker' 'cardinality' must be greater than or equal to 'min_vms'
↪"
}
}

```

The methods specified below are described without taking into account **4xx** (can be inferred from authorization information in section above) and **5xx** errors (which are method independent). HTTP verbs not defined for a particular entity will return a **501 Not Implemented**.

1.5.3 Methods

Service

| Method | URL | Meaning / Entity Body | Response |
|---------------|----------------------------------|---|---|
| GET | /service | List the contents of the SERVICE collection. | 200 OK: A JSON representation of the collection in the http body |
| GET | /service/<id> | Show the SERVICE resource identified by <id> | 200 OK: A JSON representation of the collection in the http body |
| DELETE | service/<id> | Delete the SERVICE resource identified by <id> | 204: |
| POST | /service/<id>/action | Perform an action on the SERVICE resource identified by <id>. Available actions: shutdown, recover, chown, chgrp, chmod | 201: |
| PUT | /service/<id>/role/<name> | Update the ROLE identified by <name> of the SERVICE resource identified by <id>. Currently the only attribute that can be updated is the cardinality. | 200 OK: |
| POST | /service/<id>/role/<name>/action | Perform an action on all the Virtual Machines belonging to the ROLE identified by <name> of the SERVICE resource identified by <id>. Available actions: shutdown, shutdown-hard, undeploy, undeploy-hard, hold, release, stop, suspend, resume, boot, delete, delete-recreate, reboot, reboot-hard, poweroff, poweroff-hard, snapshot-create | 201: |

Service Template

| Method | URL | Meaning / Entity Body | Response |
|--------|--------------------------------|--|---|
| GET | /service_templates | List the contents of the SERVICE_TEMPLATE collection. | 200 OK: A JSON representation of the collection in the http body |
| GET | /service_templates/<id> | Show the SERVICE_TEMPLATE resource identified by <id> | 200 OK: A JSON representation of the collection in the http body |
| DELETE | /service_templates/<id> | Delete the SERVICE_TEMPLATE resource identified by <id> | 204: |
| POST | /service_template | Create a new SERVICE_TEMPLATE resource. | 201 Created: A JSON representation of the new SERVICE_TEMPLATE resource in the http body |
| PUT | /service_templates/<id> | Update the SERVICE_TEMPLATE resource identified by <id>. | 200 OK: |
| POST | /service_templates/<id>/action | Perform an action on the SERVICE_TEMPLATE resource identified by <id>. Available actions: instantiate, chown, chgrp, chmod | 201: |

1.5.4 Resource Representation

Service Schema

A Service is defined with JSON syntax templates.

| Attribute | Type | Mandatory | Description |
|-------------------|----------------|-----------|--|
| name | string | No | Name of the Service |
| deployment | string | No | Deployment strategy: none: All roles are deployed at the same time straight: Each Role is deployed when all its parent Roles are running Defaults to none |
| shutdown_action | string | No | VM shutdown action: 'shutdown' or 'shutdown-hard'. If it is not set, the default set in oneflow-server.conf will be used |
| ready_status_gate | boolean | No | If ready_status_gate is set to true, a VM will only be considered to be in running state the following points are true: VM is in running state for OpenNebula. Which specifically means that LCM_STATE==3 and STATE>=3; The VM has READY=YES in the user template, this can be reported by the VM using OneGate. |
| roles | array of Roles | Yes | Array of Roles, see below |

Each Role is defined as:

| Attribute | Type | Mandatory | Description |
|---------------------|-------------------|-------------------------|---|
| name | string | Yes | Role name, only word characters (letter, number, underscore) are allowed |
| cardinality | integer | No | Number of VMs to deploy. Defaults to 1 |
| vm_template | integer | Yes | OpenNebula VM Template ID. See the OpenNebula documentation for VM Templates |
| parents | array of string | No | Names of the roles that must be deployed before this one |
| shut-down_action | string | No | VM shutdown action: 'shutdown' or 'shutdown-hard'. If it is not set, the one set for the Service will be used |
| min_vms | integer | No (Yes for elasticity) | Minimum number of VMs for elasticity adjustments |
| max_vms | integer | No (Yes for elasticity) | Maximum number of VMs for elasticity adjustments |
| cooldown | integer | No | Cooldown period duration after a scale operation, in seconds. If it is not set, the default set in oneflow-server.conf will be used |
| elasticity_policies | array of Policies | No | Array of Elasticity Policies, see below |
| scheduled_policies | array of Policies | No | Array of Scheduled Policies, see below |

To define a elasticity policy:

| Attribute | Type | Mandatory | Description |
|-----------------|---------|-----------|---|
| type | string | Yes | Type of adjustment. Values: CHANGE, CARDINALITY, PERCENTAGE_CHANGE |
| adjust | integer | Yes | Positive or negative adjustment. Its meaning depends on 'type' |
| min_adjust_step | integer | No | Optional parameter for PERCENTAGE_CHANGE adjustment type. If present, the policy will change the cardinality by at least the number of VMs set in this attribute. |
| expression | string | Yes | Expression to trigger the elasticity |
| period_number | integer | No | Number of periods that the expression must be true before the elasticity is triggered |
| period | integer | No | Duration, in seconds, of each period in period_duration |
| cooldown | integer | No | Cooldown period duration after a scale operation, in seconds. If it is not set, the one set for the Role will be used |

And each scheduled policy is defined as:

| Attribute | Type | Mandatory | Description |
|-----------------|---------|-----------|---|
| type | string | Yes | Type of adjustment. Values: CHANGE, CARDINALITY, PERCENTAGE_CHANGE |
| adjust | integer | Yes | Positive or negative adjustment. Its meaning depends on 'type' |
| min_adjust_step | integer | No | Optional parameter for PERCENTAGE_CHANGE adjustment type. If present, the policy will change the cardinality by at least the number of VMs set in this attribute. |
| recurrence | string | No | Time for recurring adjustments. Time is specified with the Unix cron syntax |
| start_time | string | No | Exact time for the adjustment |

```
{
  :type => :object,
  :properties => {
    'name' => {
      :type => :string,
      :required => true
    },
    'deployment' => {
      :type => :string,
      :enum => %w{none straight},
      :default => 'none'
    },
    'shutdown_action' => {
      :type => :string,
      :enum => %w{shutdown shutdown-hard},
      :required => false
    },
    'roles' => {
      :type => :array,
      :items => ROLE_SCHEMA,
      :required => true
    },
    'custom_attrs' => {
      :type => :object,
      :properties => {
      },
      :required => false
    },
    'ready_status_gate' => {
      :type => :boolean,
      :required => false
    }
  }
}
```

Role Schema

```
{
  :type => :object,
  :properties => {
    'name' => {
```

```

    :type => :string,
    :required => true
  },
  'cardinality' => {
    :type => :integer,
    :default => 1,
    :minimum => 0
  },
  'vm_template' => {
    :type => :integer,
    :required => true
  },
  'vm_template_contents' => {
    :type => :string,
    :required => false
  },
  'parents' => {
    :type => :array,
    :items => {
      :type => :string
    }
  },
  'shutdown_action' => {
    :type => :string,
    :enum => ['shutdown', 'shutdown-hard'],
    :required => false
  },
  'min_vms' => {
    :type => :integer,
    :required => false,
    :minimum => 0
  },
  'max_vms' => {
    :type => :integer,
    :required => false,
    :minimum => 0
  },
  'cooldown' => {
    :type => :integer,
    :required => false,
    :minimum => 0
  },
  'elasticity_policies' => {
    :type => :array,
    :items => {
      :type => :object,
      :properties => {
        'type' => {
          :type => :string,
          :enum => ['CHANGE', 'CARDINALITY', 'PERCENTAGE_CHANGE'],
          :required => true
        },
        'adjust' => {
          :type => :integer,
          :required => true
        },
        'min_adjust_step' => {
          :type => :integer,

```


Action Schema

```
{
  :type => :object,
  :properties => {
    'action' => {
      :type => :object,
      :properties => {
        'perform' => {
          :type => :string,
          :required => true
        },
        'params' => {
          :type => :object,
          :required => false
        }
      }
    }
  }
}
```

1.5.5 Examples

Create a New Service Template

| Method | JURL | Meaning / Entity Body | Response |
|--------|-------------------|---|---|
| POST | /service_template | Create a new SERVICE_TEMPLATE resource. | 201 Created: A JSON representation of the new SERVICE_TEMPLATE resource in the http body |

```
curl http://127.0.0.1:2474/service_template -u 'oneadmin:password' -v --data '{
  "name": "web-application",
  "deployment": "straight",
  "roles": [
    {
      "name": "frontend",
      "cardinality": "1",
      "vm_template": "0",
      "shutdown_action": "shutdown",
      "min_vms": "1",
      "max_vms": "4",
      "cooldown": "30",
      "elasticity_policies": [
        {
          "type": "PERCENTAGE_CHANGE",
          "adjust": "20",
          "min_adjust_step": "1",
          "expression": "CUSTOM_ATT>40",
          "period": "3",
          "period_number": "30",
          "cooldown": "30"
        }
      ]
    }
  ],
```

```

    "scheduled_policies":[
      {
        "type":"CHANGE",
        "adjust":"4",
        "recurrence":"0 2 1-10 * *"
      }
    ]
  },
  {
    "name":"worker",
    "cardinality":"2",
    "vm_template":"0",
    "shutdown_action":"shutdown",
    "parents":[
      "frontend"
    ],
    "min_vms":"2",
    "max_vms":"10",
    "cooldown":"240",
    "elasticity_policies":[
      {
        "type":"CHANGE",
        "adjust":"5",
        "expression":"ATT=3",
        "period":"5",
        "period_number":"60",
        "cooldown":"240"
      }
    ],
    "scheduled_policies":[
    ]
  }
],
"shutdown_action":"shutdown"
}'

```

```

> POST /service_template HTTP/1.1
> Authorization: Basic b25lYWRTaW46b23lbn51YnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: oneflow.server:2474
> Accept: */*
> Content-Length: 771
> Content-Type: application/x-www-form-urlencoded
>
< HTTP/1.1 201 Created
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 1990
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT": {
    "TEMPLATE": {
      "BODY": {
        "deployment": "straight",

```

```

"name": "web-application",
"roles": [
  {
    "scheduled_policies": [
      {
        "adjust": 4,
        "type": "CHANGE",
        "recurrence": "0 2 1-10 * *"
      }
    ],
    "vm_template": 0,
    "name": "frontend",
    "min_vms": 1,
    "max_vms": 4,
    "cardinality": 1,
    "cooldown": 30,
    "shutdown_action": "shutdown",
    "elasticity_policies": [
      {
        "expression": "CUSTOM_ATT>40",
        "adjust": 20,
        "min_adjust_step": 1,
        "cooldown": 30,
        "period": 3,
        "period_number": 30,
        "type": "PERCENTAGE_CHANGE"
      }
    ]
  },
  {
    "scheduled_policies": [
    ],
    "vm_template": 0,
    "name": "worker",
    "min_vms": 2,
    "max_vms": 10,
    "cardinality": 2,
    "parents": [
      "frontend"
    ],
    "cooldown": 240,
    "shutdown_action": "shutdown",
    "elasticity_policies": [
      {
        "expression": "ATT=3",
        "adjust": 5,
        "cooldown": 240,
        "period": 5,
        "period_number": 60,
        "type": "CHANGE"
      }
    ]
  }
],
"shutdown_action": "shutdown"
}
},

```

```

"TYPE": "101",
"GNAM": "oneadmin",
"NAME": "web-application",
"GID": "0",
"ID": "4",
"UNAME": "oneadmin",
"PERMISSIONS": {
  "OWNER_A": "0",
  "OWNER_M": "1",
  "OWNER_U": "1",
  "OTHER_A": "0",
  "OTHER_M": "0",
  "OTHER_U": "0",
  "GROUP_A": "0",
  "GROUP_M": "0",
  "GROUP_U": "0"
},
"UID": "0"
}

```

Get Detailed Information of a Given Service Template

| Method | URL | Meaning / Entity Body | Response |
|--------|------------------------|---|---|
| GET | /service_template/<id> | Show the SERVICE_TEMPLATE resource identified by <id> | 200 OK: A JSON representation of the collection in the http body |

```
curl -u 'oneadmin:opennebula' http://127.0.0.1:2474/service_template/4 -v
```

```

> GET /service_template/4 HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
>
< HTTP/1.1 200 OK
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 1990
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT": {
    "TEMPLATE": {
      "BODY": {
        "deployment": "straight",
        "name": "web-application",
        "roles": [
          {
            "scheduled_policies": [

```

```

        "adjust": 4,
        "type": "CHANGE",
        "recurrence": "0 2 1-10 * *"
    }
],
"vm_template": 0,
...

```

List the Available Service Templates

| Method | URL | Meaning / Entity Body | Response |
|--------|--------------------|---|--|
| GET | /service_templates | List the contents of the SERVICE_TEMPLATE collection. | 200 OK: A JSON representation of the collection in the http body |

```
curl -u 'oneadmin:opennebula' http://127.0.0.1:2474/service_template -v
```

```

> GET /service_template HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
>
< HTTP/1.1 200 OK
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 6929
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT_POOL": {
    "DOCUMENT": [
      {
        "TEMPLATE": {
          "BODY": {
            "deployment": "straight",
            "name": "web-server",
            "roles": [
              {
                "scheduled_policies": [
                  {
                    "adjust": 4,
                    "type": "CHANGE",
                    "recurrence": "0 2 1-10 * *"
                  }
                ]
              },
            ],
            "vm_template": 0,
            "name": "frontend",
            "min_vms": 1,
            "max_vms": 4,
            "cardinality": 1,
            "cooldown": 30,

```

```

    "shutdown_action": "shutdown",
    "elasticity_policies": [
        {
            ...

```

Update a Given Template

| Method | URL | Meaning / Entity Body | Re- sponse |
|------------|----------------------------|---|----------------|
| PUT | /service_template/ <id> | Update the SERVICE_TEMPLATE resource identified by <id>. | 200 OK: |

```

curl http://127.0.0.1:2474/service_template/4 -u 'oneadmin:opennebula' -v -X PUT --
->data '{
  "name":"web-application",
  "deployment":"straight",
  "roles":[
    {
      "name":"frontend",
      "cardinality":"1",
      "vm_template":"0",
      "shutdown_action":"shutdown-hard",
      "min_vms":"1",
      "max_vms":"4",
      "cooldown":"30",
      "elasticity_policies":[
        {
          "type":"PERCENTAGE_CHANGE",
          "adjust":"20",
          "min_adjust_step":"1",
          "expression":"CUSTOM_ATT>40",
          "period":"3",
          "period_number":"30",
          "cooldown":"30"
        }
      ],
      "scheduled_policies":[
        {
          "type":"CHANGE",
          "adjust":"4",
          "recurrence":"0 2 1-10 * *"
        }
      ]
    },
    {
      "name":"worker",
      "cardinality":"2",
      "vm_template":"0",
      "shutdown_action":"shutdown",
      "parents":[
        "frontend"
      ],
      "min_vms":"2",
      "max_vms":"10",
      "cooldown":"240",

```

```

    "elasticity_policies":[
      {
        "type":"CHANGE",
        "adjust":"5",
        "expression":"ATT=3",
        "period":"5",
        "period_number":"60",
        "cooldown":"240"
      }
    ],
    "scheduled_policies":[
    ]
  }
],
"shutdown_action":"shutdown"
}'

```

```

> PUT /service_template/4 HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm51YnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
> Content-Length: 1219
> Content-Type: application/x-www-form-urlencoded
> Expect: 100-continue
>
* Done waiting for 100-continue
< HTTP/1.1 200 OK
< Content-Type: text/html;charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 1995
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT": {
    "TEMPLATE": {
      "BODY": {
        "deployment": "straight",
        "name": "web-application",
        "roles": [
          {
            "scheduled_policies": [
              {
                "adjust": 4,
                "type": "CHANGE",
                "recurrence": "0 2 1-10 * *"
              }
            ],
            "vm_template": 0,
            "name": "frontend",
            "min_vms": 1,
            "max_vms": 4,
            "cardinality": 1,
            "cooldown": 30,
            "shutdown_action": "shutdown-hard",

```


...

Instantiate a Given Template

| Method | URL | Meaning / Entity Body | Response |
|--------|-------------------------------|---|-------------|
| POST | /service_template/<id>/action | Perform an action on the SERVICE_TEMPLATE resource identified by <id>. Available actions: instantiate, chown, chgrp, chmod | 201: |

Available actions:

- instantiate
- chown
- chmod
- chgrp

```
curl http://127.0.0.1:2474/service_template/4/action -u 'oneadmin:opennebula' -v -X_
↪POST --data '{
  "action": {
    "perform": "instantiate"
  }
}'
```

```
> POST /service_template/4/action HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
> Content-Length: 49
> Content-Type: application/x-www-form-urlencoded
>
< HTTP/1.1 201 Created
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 2015
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT": {
    "TEMPLATE": {
      "BODY": {
        "deployment": "straight",
        "name": "web-application",
        "roles": [
          {
            "scheduled_policies": [
              {
                "adjust": 4,
                "type": "CHANGE",
```

```

    "recurrence": "0 2 1-10 * *"
  }
],
"vm_template": 0,

```

Delete a Given Template

| Method | URL | Meaning / Entity Body | Response |
|---------------|----------------------------|--|-------------|
| DELETE | /service_template/ <id> | Delete the SERVICE_TEMPLATE resource identified by <id> | 204: |

```
curl http://127.0.0.1:2474/service_template/4 -u 'oneadmin:opennebula' -v -X DELETE
```

```

> DELETE /service_template/3 HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
>
< HTTP/1.1 204 No Content
< Content-Type: text/html;charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 0
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys

```

Get Detailed Information of a Given Service

| Method | URL | Meaning / Entity Body | Response |
|------------|-------------------|---|---|
| GET | /service/ <id> | Show the SERVICE resource identified by <id> | 200 OK: A JSON representation of the collection in the http body |

```
curl http://127.0.0.1:2474/service/5 -u 'oneadmin:opennebula' -v
```

```

> GET /service/5 HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↪1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
>
< HTTP/1.1 200 OK
< Content-Type: text/html;charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 11092
< X-Frame-Options: sameorigin
< Connection: keep-alive

```

```

< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT": {
    "TEMPLATE": {
      "BODY": {
        "deployment": "straight",
        "name": "web-application",
        "roles": [
          {
            "scheduled_policies": [
              {
                "adjust": 4,
                "last_eval": 1374676803,
                "type": "CHANGE",
                "recurrence": "0 2 1-10 * *"
              }
            ],
            "vm_template": 0,
            "disposed_nodes": [

          ],
          "name": "frontend",
          "min_vms": 1,
          "nodes": [
            {
              "deploy_id": 12,
              "vm_info": {
                "VM": {
                  "CPU": "33",
                  "TEMPLATE": {
                    "CPU": "1",
                    "CONTEXT": {
                      "TARGET": "hda",
                      "NETWORK": "YES",
                      "DISK_ID": "0"
                    },
                    "MEMORY": "1024",
                    "TEMPLATE_ID": "0",
                    "VMID": "12"
                  },
                },
                "GNAME": "oneadmin",
                "RESCHED": "0",
                "NET_RX": "1300",
                "NAME": "frontend_0_(service_5)",
                "ETIME": "0",
                "USER_TEMPLATE": {
                  "SERVICE_ID": "5",
                  "ROLE_NAME": "frontend"
                },
                },
                "GID": "0",
                "LAST_POLL": "1374676793",
                "MEMORY": "786432",
                "HISTORY_RECORDS": {
                  "HISTORY": {
                    "RETIME": "0",
                    "TMMAD": "dummy",
                    "DS_LOCATION": "/var/tmp/one_install/var//datastores",

```

```

        "SEQ": "0",
        "VNMMAD": "dummy",
        "ETIME": "0",
        "PETIME": "1374676347",
        "HOSTNAME": "vmx_dummy",
        "VMMMAD": "dummy",
        "ESTIME": "0",
        "HID": "2",
        "EETIME": "0",
        "OID": "12",
        "STIME": "1374676347",
        "DS_ID": "0",
        "ACTION": "0",
        "RSTIME": "1374676347",
        "REASON": "0",
        "PSTIME": "1374676347"
    }
},
"ID": "12",
"DEPLOY_ID": "vmx_dummy:frontend_0_(service_5):dummy",
"NET_TX": "800",
"UNAME": "oneadmin",
"LCM_STATE": "3",
"STIME": "1374676345",
"UID": "0",
"PERMISSIONS": {
    "OWNER_U": "1",
    "OWNER_M": "1",
    "OWNER_A": "0",
    "GROUP_U": "0",
    "GROUP_M": "0",
    "GROUP_A": "0",
    "OTHER_U": "0",
    "OTHER_M": "0",
    "OTHER_A": "0"
},
"STATE": "3"
}
}
}
],
"last_vmname": 1,
"max_vms": 4,
"cardinality": 1,
"cooldown": 30,
"shutdown_action": "shutdown-hard",
"state": "2",
"elasticity_policies": [
    {
        "expression": "CUSTOM_ATT>40",
        "true_evals": 0,
        "adjust": 20,
        "min_adjust_step": 1,
        "last_eval": 1374676803,
        "cooldown": 30,
        "expression_evaluated": "CUSTOM_ATT[--] > 40",
        "period": 3,
        "period_number": 30,
    }
]

```

```

        "type": "PERCENTAGE_CHANGE"
    }
]
},
{
    "scheduled_policies": [

    ],
    "vm_template": 0,
    "disposed_nodes": [

    ],
    "name": "worker",
    "min_vms": 2,
    "nodes": [
        {
            "deploy_id": 13,
            "vm_info": {
                "VM": {
                    "CPU": "9",
                    "TEMPLATE": {
                        "CPU": "1",
                        "CONTEXT": {
                            "TARGET": "hda",
                            "NETWORK": "YES",
                            "DISK_ID": "0"
                        },
                        "MEMORY": "1024",
                        "TEMPLATE_ID": "0",
                        "VMID": "13"
                    },
                },
                "GNAME": "oneadmin",
                "RESCHED": "0",
                "NET_RX": "1600",
                "NAME": "worker_0_(service_5)",
                "ETIME": "0",
                "USER_TEMPLATE": {
                    "SERVICE_ID": "5",
                    "ROLE_NAME": "worker"
                },
                "GID": "0",
                "LAST_POLL": "1374676783",
                "MEMORY": "545259",
                "HISTORY_RECORDS": {
                    "HISTORY": {
                        "RETIME": "0",
                        "TMMAD": "dummy",
                        "DS_LOCATION": "/var/tmp/one_install/var//datastores",
                        "SEQ": "0",
                        "VNMMAD": "dummy",
                        "ETIME": "0",
                        "PETIME": "1374676377",
                        "HOSTNAME": "xen_dummy",
                        "VMMMAD": "dummy",
                        "ESTIME": "0",
                        "HID": "1",
                        "EETIME": "0",
                        "OID": "13",
                    }
                }
            }
        }
    ]
}

```

```

        "STIME": "1374676377",
        "DS_ID": "0",
        "ACTION": "0",
        "RSTIME": "1374676377",
        "REASON": "0",
        "PSTIME": "1374676377"
    }
},
"ID": "13",
"DEPLOY_ID": "xen_dummy:worker_0_(service_5):dummy",
"NET_TX": "600",
"UNAME": "oneadmin",
"LCM_STATE": "3",
"STIME": "1374676375",
"UID": "0",
"PERMISSIONS": {
    "OWNER_U": "1",
    "OWNER_M": "1",
    "OWNER_A": "0",
    "GROUP_U": "0",
    "GROUP_M": "0",
    "GROUP_A": "0",
    "OTHER_U": "0",
    "OTHER_M": "0",
    "OTHER_A": "0"
},
"STATE": "3"
}
}
},
{
    "deploy_id": 14,
    "vm_info": {
        "VM": {
            "CPU": "75",
            "TEMPLATE": {
                "CPU": "1",
                "CONTEXT": {
                    "TARGET": "hda",
                    "NETWORK": "YES",
                    "DISK_ID": "0"
                },
            },
            "MEMORY": "1024",
            "TEMPLATE_ID": "0",
            "VMID": "14"
        },
        "GNAME": "oneadmin",
        "RESCHED": "0",
        "NET_RX": "1100",
        "NAME": "worker_1_(service_5)",
        "ETIME": "0",
        "USER_TEMPLATE": {
            "SERVICE_ID": "5",
            "ROLE_NAME": "worker"
        },
        "GID": "0",
        "LAST_POLL": "1374676783",
        "MEMORY": "471859",

```

```

    "HISTORY_RECORDS": {
      "HISTORY": {
        "RETIME": "0",
        "TMMAD": "dummy",
        "DS_LOCATION": "/var/tmp/one_install/var//datastores",
        "SEQ": "0",
        "VNMMAD": "dummy",
        "ETIME": "0",
        "PETIME": "1374676378",
        "HOSTNAME": "kvm_dummy",
        "VMMMAD": "dummy",
        "ESTIME": "0",
        "HID": "0",
        "EETIME": "0",
        "OID": "14",
        "STIME": "1374676378",
        "DS_ID": "0",
        "ACTION": "0",
        "RSTIME": "1374676378",
        "REASON": "0",
        "PSTIME": "1374676378"
      }
    },
    "ID": "14",
    "DEPLOY_ID": "kvm_dummy:worker_1_(service_5):dummy",
    "NET_TX": "550",
    "UNAME": "oneadmin",
    "LCM_STATE": "3",
    "STIME": "1374676375",
    "UID": "0",
    "PERMISSIONS": {
      "OWNER_U": "1",
      "OWNER_M": "1",
      "OWNER_A": "0",
      "GROUP_U": "0",
      "GROUP_M": "0",
      "GROUP_A": "0",
      "OTHER_U": "0",
      "OTHER_M": "0",
      "OTHER_A": "0"
    },
    "STATE": "3"
  }
}
}
],
"last_vmname": 2,
"max_vms": 10,
"cardinality": 2,
"parents": [
  "frontend"
],
"cooldown": 240,
"shutdown_action": "shutdown",
"state": "2",
"elasticity_policies": [
  {
    "expression": "ATT=3",

```

```

        "true_evals": 0,
        "adjust": 5,
        "last_eval": 1374676803,
        "cooldown": 240,
        "expression_evaluated": "ATT[--] = 3",
        "period": 5,
        "period_number": 60,
        "type": "CHANGE"
    }
  ]
}
],
"log": [
  {
    "message": "New state: DEPLOYING",
    "severity": "I",
    "timestamp": 1374676345
  },
  {
    "message": "New state: RUNNING",
    "severity": "I",
    "timestamp": 1374676406
  }
],
"shutdown_action": "shutdown",
"state": 2
}
},
"TYPE": "100",
"GNAM": "oneadmin",
"NAME": "web-application",
"GID": "0",
"ID": "5",
"UNAME": "oneadmin",
"PERMISSIONS": {
  "OWNER_A": "0",
  "OWNER_M": "1",
  "OWNER_U": "1",
  "OTHER_A": "0",
  "OTHER_M": "0",
  "OTHER_U": "0",
  "GROUP_A": "0",
  "GROUP_M": "0",
  "GROUP_U": "0"
},
"UID": "0"
}

```

List the Available Services

| Method | URL | Meaning / Entity Body | Response |
|--------|----------|--|---|
| GET | /service | List the contents of the SERVICE collection. | 200 OK: A JSON representation of the collection in the http body |


```
curl http://127.0.0.1:2474/service -u 'oneadmin:opennebula' -v
```

```
> GET /service HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm5lYnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
→1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
>
< HTTP/1.1 200 OK
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 12456
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
<
{
  "DOCUMENT_POOL": {
    "DOCUMENT": [
      {
        "TEMPLATE": {
          "BODY": {
            "deployment": "straight",
            "name": "web-application",
            "roles": [
              {
                "scheduled_policies": [
                  {
                    "adjust": 4,
                    "last_eval": 1374676986,
                    "type": "CHANGE",
                    "recurrence": "0 2 1-10 * *"
                  }
                ]
              }
            ],
            ...
          }
        }
      }
    ]
  }
}
```

Perform an Action on a Given Service

| Method | URL | Meaning / Entity Body | Re- sponse |
|--------|--------------------------|---|---------------|
| POST | /service/<id>/ action | Perform an action on the SERVICE resource identified by <id>. | 201: |

Available actions:

- **shutdown: Shutdown a service.**
 - From RUNNING or WARNING shuts down the Service
- **recover: Recover a failed service, cleaning the failed VMs.**
 - From FAILED_DEPLOYING continues deploying the Service
 - From FAILED_SCALING continues scaling the Service
 - From FAILED_UNDEPLOYING continues shutting down the Service

- From COOLDOWN the Service is set to running ignoring the cooldown duration
- From WARNING failed VMs are deleted, and new VMs are instantiated

- chown
- chmod
- chgrp

```
curl http://127.0.0.1:2474/service/5/action -u 'oneadmin:opennebula' -v -X POST --
↳data '{
  "action": {
    "perform": "shutdown"
  }
}'
```

```
curl http://127.0.0.1:2474/service/5/action -u 'oneadmin:opennebula' -v -X POST --
↳data '{
  "action": {
    "perform": "chgrp",
    "params": {
      "group_id": 2
    }
  }
}'
```

Update the Cardinality of a Given Role

| Method | URL | Meaning / Entity Body | Response |
|--------|---------------------------|---|----------|
| PUT | /service/<id>/role/<name> | Update the ROLE identified by <name> of the SERVICE resource identified by <id>. Currently the only attribute that can be updated is the cardinality. | 200 OK: |

You can force a cardinality outside the defined range with the force param.

```
curl http://127.0.0.1:2474/service/5/role/frontend -u 'oneadmin:opennebula' -X PUT -v --
↳--data '{
  "cardinality": 2,
  "force": true
}'
```

```
> PUT /service/5/role/frontend HTTP/1.1
> Authorization: Basic b25lYWRTaW46b3Blbm51YnVsYQ==
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/
↳1.2.3 libidn/1.18 libssh2/1.4.2
> Host: 127.0.0.1:2474
> Accept: */*
> Content-Length: 41
> Content-Type: application/x-www-form-urlencoded
>
< HTTP/1.1 200 OK
< Content-Type: text/html; charset=utf-8
< X-XSS-Protection: 1; mode=block
< Content-Length: 0
```

```
< X-Frame-Options: sameorigin
< Connection: keep-alive
< Server: thin 1.2.8 codename Black Keys
```

Perform an Action on All the VMs of a Given Role

| Method | URL | Meaning / Entity Body | Response |
|--------|----------------------------------|--|----------|
| POST | /service/<id>/role/<name>/action | Perform an action on all the Virtual Machines belonging to the ROLE identified by <name> of the SERVICE resource identified by <id>. | 201: |

You can use this call to perform a VM action on all the Virtual Machines belonging to a role. For example, if you want to suspend the Virtual Machines of the worker Role:

These are the commands that can be performed:

- shutdown
- shutdown-hard
- undeploy
- undeploy-hard
- hold
- release
- stop
- suspend
- resume
- boot
- delete
- delete-recreate
- reboot
- reboot-hard
- poweroff
- poweroff-hard
- snapshot-create

Instead of performing the action immediately on all the VMs, you can perform it on small groups of VMs with these options:

- period: Seconds between each group of actions
- number: Number of VMs to apply the action to each period

```
curl http://127.0.0.1:2474/service/5/role/frontend/action -u 'oneadmin:opennebula' -v
↪-X POST --data '{
  "action": {
    "perform": "stop",
```

```
"params" : {  
  "period" : 60,  
  "number" : 2  
}  
}  
'
```

```
> POST /service/5/role/frontend/action HTTP/1.1  
> Authorization: Basic b25lYWRtaW46b3Blbm51YnVsYQ==  
> User-Agent: curl/7.19.7 (x86_64-redhat-linux-gnu) libcurl/7.19.7 NSS/3.14.0.0 zlib/  
↪1.2.3 libidn/1.18 libssh2/1.4.2  
> Host: 127.0.0.1:2474  
> Accept: */*  
> Content-Length: 106  
> Content-Type: application/x-www-form-urlencoded  
>  
< HTTP/1.1 201 Created  
< Content-Type: text/html;charset=utf-8  
< X-XSS-Protection: 1; mode=block  
< Content-Length: 57  
< X-Frame-Options: sameorigin  
< Connection: keep-alive  
< Server: thin 1.2.8 codename Black Keys
```

INFRASTRUCTURE INTEGRATION

2.1 Overview

The interactions between OpenNebula and the Cloud infrastructure are performed by specific drivers. Each one addresses a particular area:

- **Storage.** The OpenNebula core issue abstracts storage operations (e.g. clone or delete) that are implemented by specific programs that can be replaced or modified to interface special storage backends and file-systems.
- **Virtualization.** The interaction with the hypervisors are also implemented with custom programs to boot, stop or migrate a virtual machine. This allows you to specialize each VM operation so to perform custom operations.
- **Monitoring.** Monitoring information is also gathered by external probes. You can add additional probes to include custom monitoring metrics that can later be used to allocate virtual machines or for accounting purposes.
- **Authorization.** OpenNebula can be also configured to use an external program to authorize and authenticate user requests. In this way, you can implement any access policy to Cloud resources.
- **Networking.** The hypervisor is also prepared with the network configuration for each Virtual Machine.

Use the driver interfaces if you need OpenNebula to interface any specific storage, virtualization, monitoring or authorization system already deployed in your datacenter or to tune the behavior of the standard OpenNebula drivers.

2.1.1 How Should I Read This Chapter

You should be reading this Chapter if you are trying to extend OpenNebula functionality.

You can proceed to any of the following sections depending on which component you want to understand and extend the *virtualization system* (with a separate Section for *cloud bursting*), the *storage system*, the *information system*, the authentication system, the *network system* or the *marketplace drivers*. Also you might be interested in the *Hook mechanism*, a powerful way of integrating OpenNebula within your datacenter processes.

After this Chapter, congratulations! You finished OpenNebula.

2.1.2 Hypervisor Compatibility

All the Sections of this Chapter applies to both KVM and vCenter hypervisors.

2.2 Using Hooks

The Hook Manager present in OpenNebula enables the triggering of custom scripts tied to a change in state in a particular resource, being that a Host or a Virtual Machine. This opens a wide area of automation for system administrators

to tailor their cloud infrastructures.

2.2.1 Configuration

Hook Manager configuration is set in `/etc/one/oned.conf`. Hooks can be tied to changes in host or virtual machine states, and they can be executed locally to the OpenNebula front-end and remotely in the relevant worker node.

In general, hook definition in `/etc/one/oned.conf` has two parameters:

- **executable**: path of the hook driver executable, can be an absolute path or relative to `/usr/lib/one/mads`
- **arguments**: for the driver executable, can be an absolute path or relative to `/etc/one/`

2.2.2 Hooks for VirtualMachines

In the case of VirtualMachine hooks, the following can be defined:

- **name** : for the hook, useful to track the hook (OPTIONAL)
- **on** : when the hook should be executed,
 - **CREATE**, when the VM is created (`onevm create`)
 - **RUNNING**, after the VM is successfully booted
 - **SHUTDOWN**, after the VM is shutdown
 - **STOP**, after the VM is stopped (including VM image transfers)
 - **DONE**, after the VM is destroyed or shutdown
 - **UNKNOWN**, when the VM enters the unknown state
 - **CUSTOM**, user defined specific STATE and LCM_STATE combination of states to trigger the hook.
- **command** : path can be absolute or relative to `/var/lib/one/remotes/hooks`
- **arguments** : for the hook. You can access the following VM attributes with \$
 - **\$ID**, the ID of the VM that triggered the hook execution
 - **\$TEMPLATE**, the template of the VM that triggered the hook, in xml and base64 encoded
 - **\$PREV_STATE**, the previous STATE of the Virtual Machine
 - **\$PREV_LCM_STATE**, the previous LCM STATE of the Virtual Machine
- **remote** : values,
 - **YES**, The hook is executed in the host where the VM was allocated
 - **NO**, The hook is executed in the OpenNebula server (default)

The following is an example of a hook tied to the DONE state of a VM:

```
VM_HOOK = [
  name      = "notify_done",
  on        = "DONE",
  command   = "notify.rb",
  arguments = "$ID $TEMPLATE" ]
```

Or an more advanced example:

```

VM_HOOK = [
  name      = "advanced_hook",
  on        = "CUSTOM",
  state     = "ACTIVE",
  lcm_state = "BOOT_UNKNOWN",
  command   = "log.rb",
  arguments = "$ID $PREV_STATE $PREV_LCM_STATE" ]

```

2.2.3 Hooks for Hosts

In the case of Host hooks, the following can be defined:

- **name** : for the hook, useful to track the hook (OPTIONAL)
- **on** : when the hook should be executed,
 - **CREATE**, when the Host is created (onehost create)
 - **ERROR**, when the Host enters the error state
 - **DISABLE**, when the Host is disabled
- **command** : path can be absolute or relative to `/var/lib/one/remotes/hooks`
- **arguments** : for the hook. You can use the following Host attributes with \$
 - **\$ID**, the ID of the Host that triggered the hook execution
 - **\$TEMPLATE**, the full Host information, in xml and base64 encoded
- **remote** : values,
 - **YES**, The hook is executed in the host
 - **NO**, The hook is executed in the OpenNebula server (default)

The following is an example of a hook tied to the ERROR state of a Host:

```

*****
# Fault Tolerance Hooks
*****
# This hook is used to perform recovery actions when a host fails.
# Script to implement host failure tolerance
#   One of the following modes must be chosen
#       -m resched VMs to another host. (Only for images in shared storage!)
#       -r recreate VMs running in the host. State will be lost.
#       -d delete VMs running in the host
#
# Additional flags
#       -f resubmit suspended and powered off VMs (only for recreate)
#       -p <n> avoid resubmission if host comes back after n monitoring
#           cycles. 0 to disable it. Default is 2.
#       -u disables fencing. Fencing is enabled by default. Don't disable it
#           unless you are very sure about what you're doing
*****

HOST_HOOK = [
  name      = "error",
  on        = "ERROR",
  command   = "ft/host_error.rb",
  arguments = "$ID -m -p 5",

```

```
remote    = "no" ]
#-----
```

Note: In the case when the resched VMs mode is selected (-m) but the host is wrongly recognized as failed (for example due to failure of the management network) it is essential to have properly configured and working `ft/fence_host.sh`. Otherwise it is possible to have data corruption because the old still running VM and the new VM both will write to the shared disk.

2.2.4 Other Hooks

Other OpenNebula entities like Virtual Networks, Users, Groups and Images can be hooked on creation and removal. These hooks are specified with the following variables in `oned.conf`:

- **VNET_HOOK**, for virtual networks
- **USER_HOOK**, for users
- **GROUP_HOOK**, for groups
- **IMAGE_HOOK**, for disk images.

These hooks are always executed on the front-end and are defined by the following attributes

- **name** : for the hook, useful to track the hook (OPTIONAL)
- **on** : when the hook should be executed,
 - **CREATE**, when the object (virtual network, user, group or image) is created
 - **REMOVE**, when the object is removed from the DB
- **command** : path can be absolute or relative to `/var/lib/one/remotes/hooks`
- **arguments** : for the hook. You can use the following Host attributes with \$
 - **\$ID**, the ID of the Host that triggered the hook execution
 - **\$TEMPLATE**, the full Host information, in xml and base64 encoded

The following is an example of a hook that sends an email to a new register user:

```
USER_HOOK = [
  name      = "mail",
  on        = "CREATE",
  command   = "email2user.rb",
  arguments = "$ID $TEMPLATE"]
```

Note: In a Federation, **USER** and **GROUP** hooks can only be defined in the **master** OpenNebula. Because the slaves will rely the user and group actions to the master, they will only be triggered once, in the master. The hooks for any other resource are defined locally for each OpenNebula instance.

2.2.5 Developing your Hooks

The execution of each hook is tied to the object that trigger the event. The data of the object can be passed to the hook through the `$ID` and the `$TEMPLATE` variables:

- \$TEMPLATE will give you the full output of the corresponding show command in XML and base64 encoding. This can be easily deal with in any language. If you are using bash for your scripts you may be interested in the xpath.rb util, check the following example:

```
#!/bin/bash
# Argument hook for virtual network add to oned.conf
# VNET_HOOK = [
#   name="bash_arguments",
#   on="CREATE",
#   command=<path_to_this_file>,
#   arguments="$TEMPLATE" ]

XPATH=/var/lib/one/remotes/datastore/xpath.rb
T64=$1

USER_NAME=`$XPATH -b $T64 UNAME`
OWNER_USE_PERMISSION=`$XPATH -b $T64 PERMISSIONS/OWNER_U`

#UNAME and PERMISSIONS/OWNER_U are the XPATH for the attributes without the root_
↪element
```

- \$ID you can use the ID of the object to retrieve more information or to perform an action over the object. (e.g. onevm hold \$ID)

A good starting point is the hook that implements the Virtual Machine High Availability, that uses the OpenNebula Cloud API to implement the HA functionality of VMs when the host that are running on crashes.

Note that within the hook you can further interact with OpenNebula to retrieve more information, or perform any other action.

2.3 Virtualization Driver

The component that deals with the hypervisor to create, manage and get information about virtual machine objects is called Virtual Machine Manager (VMM for short). This component has two parts. The first one resides in the core and holds most of the general functionality common to all the drivers (and some specific), the second is the driver that is the one able to translate basic VMM actions to the hypervisor.

2.3.1 Driver Configuration

There are two main drivers `one_vmm_exec` and `one_vmm_sh`. Both take commands from OpenNebula and execute a set of scripts for those actions, the main difference is that `one_vmm_exec` executes the commands remotely (logging into the host where VM is being or is going to be executed) and `one_vmm_sh` does the execution of the scripts in the frontend.

The driver takes some parameters, described here:

| parameter | description |
|--------------------|---|
| -r <num> | number of retries when executing an action |
| -t <num> | number of threads, i.e. number of actions done at the same time |
| -l <actions> | (<code>one_vmm_exec</code> only) actions executed locally, command can be overridden for each action |
| <driver_directory> | where in the remotes directory the driver can find the action scripts |

These are the actions valid in the -l parameter:

- attach_disk
- attach_nic
- cancel
- deploy
- detach_disk
- detach_nic
- kvmrc
- migrate
- migrate_local
- poll
- reboot
- reset
- restore
- save
- shutdown
- snapshot_create
- snapshot_delete
- snapshot_revert

You can also provide an alternative script name for local execution, by default the script is called the same as the action, in this fashion `action=script_name`. As an example:

```
-l migrate,poll=poll_ganglia,save
```

These arguments are specified in the `oned.conf` file, `arguments` variable:

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

Each driver can define a list of supported actions for imported VMs. Please note that in order to import VMs, your monitoring drivers should report the *IMPORT_TEMPLATE* variable. The complete list of actions is:

- migrate
- live-migrate
- shutdown
- shutdown-hard
- undeploy
- undeploy-hard
- hold
- release

- stop
- suspend
- resume
- delete
- delete-recreate
- reboot
- reboot-hard
- resched
- unresched
- poweroff
- poweroff-hard
- disk-attach
- disk-detach
- nic-attach
- nic-detach
- snap-create
- snap-delete

These supported action are specified in the oned.conf file, `imported_vms_actions` variable:

```

VM_MAD = [
  sunstone_name = "KVM",
  name          = "kvm",
  executable    = "one_vmm_exec",
  arguments     = "-t 15 -r 0 -i kvm",
  default       = "vmm_exec/vmm_exec_kvm.conf",
  type          = "kvm",
  keep_snapshots = "no",
  imported_vms_actions = "shutdown, shutdown-hard, hold, release, suspend, resume, delete,
↪reboot, reboot-hard, resched, unresched, disk-attach, disk-detach, nic-attach, nic-detach,
↪snap-create, snap-delete"
]

```

The hypervisor may preserve system snapshots across power on/off cycles and live migrations, in that case you can set `keep_snapshots` variable to `yes`.

The sunstone name will be used in the host creation dialog in the Sunstone WebUI.

2.3.2 Actions

Every action should have an executable program (mainly scripts) located in the remote dir (`remotes/vmm/<driver_directory>`) that performs the desired action. These scripts receive some parameters (and in the case of `DEPLOY` also `STDIN`) and give back the error message or information in some cases writing to `STDOUT`.

VMM actions, they are the same as the names of the scripts:

- **attach_disk**: Attaches a new DISK in the VM
 - Arguments

- * **DOMAIN:** Domain name: one-101
- * **SOURCE:** Image path
- * **TARGET:** Device in the guest: hda, sdc, vda, xvdc
- * **TARGET_INDEX:** Position in the list of disks
- * **DRV_ACTION:** action xml. Base: /VMM_DRIVER_ACTION_DATA/VM/TEMPLATE/DISK[ATTACH=' YES ']
 - **DRIVER:** Disk format: raw, qcow2
 - **TYPE:** Disk type: block, cdrom, rbd, fs or swap
 - **READONLY:** The value is YES when it's read only
 - **CACHE:** Cache mode: none, writethrough, writeback
 - **SOURCE:** Image source, used for ceph
- Response
 - * **Success:** -
 - * **Failure:** Error message
- **attach_nic:** Attaches a new NIC in the VM
 - Arguments
 - * **DOMAIN:** Domain name: one-808
 - * **MAC:** MAC address of the new NIC
 - * **BRIDGE:** Bridge where to attach the new NIC
 - * **MODEL:** NIC model to emulate, ex: e1000
 - * **NET_DRV:** Network driver used, ex: ovswitch
 - * **TARGET:** Names the VM interface in the host bridge
 - Response
 - * **Success:** -
 - * **Failure:** Error message
- **cancel:** Destroy a VM
 - Arguments:
 - * **DOMAIN:** Domain name: one-909
 - Response
 - * **Success:** -
 - * **Failure:** Error message
- **deploy:** Deploy a new VM
 - Arguments:
 - * **DEPLOYMENT_FILE:** where to write the deployment file. You have to write whatever comes from STDIN to a file named like this parameter. In shell script you can do: `cat > $domain`
 - Response
 - * **Success:** Deploy id, ex: one-303

- * Failure: Error message
- **detach_disk**: Detaches a DISK from a VM
 - Arguments
 - * **DOMAIN**: Domain name: one-286
 - * **SOURCE**: Image path
 - * **TARGET**: Device in the guest: hda, sdc, vda, xvdc
 - * **TARGET_INDEX**: Position in the list of disks
 - Response
 - * Success: -
 - * Failure: Error message
- **detach_nic**: Detaches a NIC from a VM
 - Arguments
 - * **DOMAIN**: Domain name: one-286
 - * **MAC**: MAC address of the NIC to detach
 - Response
 - * Success: -
 - * Failure: Error message
- **migrate**: Live migrate a VM to another host
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **DESTINATION_HOST**: Host where to migrate the VM
 - * **HOST**: Host where the VM is currently running
 - Response
 - * Success: -
 - * Failure: Error message
- **migrate_local**: Live migrate a VM to another host, initiating the connection from the front-end
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **DESTINATION_HOST**: Host where to migrate the VM
 - * **HOST**: Host where the VM is currently running
 - Response
 - * Success: -
 - * Failure: Error message
- **poll**: Get information from a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286

- * **HOST**: Host where the VM is running
- Response
 - * Success: -
 - * Failure: Error message
- **reboot**: Orderly reboots a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **HOST**: Host where the VM is running
 - Response
 - * Success: -
 - * Failure: Error message
- **reset**: Hard reboots a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **HOST**: Host where the VM is running
 - Response
 - * Success: -
 - * Failure: Error message
- **restore**: Restores a previously saved VM
 - Arguments:
 - * **FILE**: VM save file
 - * **HOST**: Host where to restore the VM
 - Response
 - * Success: -
 - * Failure: Error message
- **restore.<SYSTEM_TM>**: *[Only for KVM drivers]* If this script exists, the `restore` script will execute it right at the beginning to extract the checkpoint from the system datastore. For example, for the `ceph` system datastore the `restore.ceph` script is defined.
 - Arguments:
 - * **FILE**: VM save file
 - * **HOST**: Host where to restore the VM
- **save**: Saves a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **FILE**: VM save file
 - * **HOST**: Host where the VM is running
 - Response

- * Success: -
- * Failure: Error message
- **save.<SYSTEM_TM>**: *[Only for KVM drivers]* If this script exists, the `save` script will execute it right at the end to store the checkpoint in the system datastore. For example, for the `ceph` system datastore the `save.ceph` script is defined.
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **FILE**: VM save file
 - * **HOST**: Host where the VM is running
- **shutdown**: Orderly shutdowns a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **HOST**: Host where the VM is running
 - Response
 - * Success: -
 - * Failure: Error message
- **snapshot_create**: Makes a new snapshot of a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **ONE_SNAPSHOT_ID**: OpenNebula snapshot identifier
 - Response
 - * Success: Snapshot name for the hypervisor. Used later to delete or revert
 - * Failure: Error message
- **snapshot_delete**: Deletes a snapshot of a VM
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **SNAPSHOT_NAME**: Name used to refer the snapshot in the hypervisor
 - Response
 - * Success: -
 - * Failure: Error message
- **snapshot_revert**: Returns a VM to an saved state
 - Arguments:
 - * **DOMAIN**: Domain name: one-286
 - * **SNAPSHOT_NAME**: Name used to refer the snapshot in the hypervisor
 - Response
 - * Success: -
 - * Failure: Error message

action xml parameter is a base64 encoded xml that holds information about the VM. To get one of the values explained in the documentation, for example from `attach_disk READONLY` you can add to the base XPATH the name of the parameter. XPATH:

```
/VMM_DRIVER_ACTION_DATA/VM/TEMPLATE/DISK[ATTACH='YES']/READONLY
```

When using shell script there is a handy script that gets parameters for given XPATH in that XML. Example:

```

XPATH="${DRIVER_PATH}/../../datastore/xpath.rb -b $DRV_ACTION"

unset i j XPATH_ELEMENTS

DISK_XPATH="/VMM_DRIVER_ACTION_DATA/VM/TEMPLATE/DISK[ATTACH='YES']"

while IFS= read -r -d '' element; do
    XPATH_ELEMENTS[i++]="$element"
done < <($XPATH      $DISK_XPATH/DRIVER \
                $DISK_XPATH/TYPE \
                $DISK_XPATH/READONLY \
                $DISK_XPATH/CACHE \
                $DISK_XPATH/SOURCE)

DRIVER="${XPATH_ELEMENTS[j++] :-$DEFAULT_TYPE}"
TYPE="${XPATH_ELEMENTS[j++]}"
READONLY="${XPATH_ELEMENTS[j++]}"
CACHE="${XPATH_ELEMENTS[j++]}"
IMG_SRC="${XPATH_ELEMENTS[j++]}"

```

`one_vmm_sh` has the same script actions and meanings but an argument more that is the host where the action is going to be performed. This argument is always the first one. If you use `-p` parameter in `one_vmm_ssh` the poll action script is called with one more argument that is the host where the VM resides, also it is the same parameter.

2.3.3 Poll Information

POLL is the action that gets monitoring info from the running VMs. This action is called when the VM is not found in the host monitoring process for whatever reason. The format it is supposed to give back information is a line with KEY=VALUE pairs separated by spaces. It also supports vector values KEY = [SK1=VAL1, SK2=VAL2]. An example monitoring output looks like this:

```

STATE=a USEDMEMORY=554632 DISK_SIZE=[ ID=0, SIZE=24 ] DISK_SIZE=[ ID=1, SIZE=242 ]
↔SNAPSHOT_SIZE=[ ID=0, DISK_ID=0, SIZE=24 ]

```

The poll action can give back any information and it will be added to the VM information hold but there are some variables that should be given back as they are meaningful to OpenNebula:

| Variable | Description |
|----------------|---|
| STATE | State of the VM (explained later) |
| CPU | Percentage of 1 CPU consumed (two fully consumed cpu is 200) |
| MEMORY | Memory consumption in kilobytes |
| NETRX | Received bytes from the network |
| NETTX | Sent bytes to the network |
| DISKRD-BYTES | Read bytes from all disks since last VM start |
| DISKWR-BYTES | Written bytes from all disks since last VM start |
| DISKRDIOPS | Read IO operations from all disks since last VM start |
| DISKWRIOPS | Written IO operations all disks since last VM start |
| DISK_SIZE | Vector attribute two sub-attributes: <code>ID</code> id of the disk, and <code>SIZE</code> real size of the disk in MB |
| SNAP-SHOT_SIZE | Vector attribute two sub-attributes: <code>ID</code> id of the snapshot, <code>DISK_ID</code> id of the disk, and <code>SIZE</code> real size of the snapshot in MB |

STATE is a single character that tells OpenNebula the status of the VM, the states are the ones in this table:

| state | description |
|-------|--|
| N/A | Detecting state error. The monitoring could be done, but it returned an unexpected output. |
| a | Active. The VM alive (running, blocked, booting...). The VM will be set to <code>RUNNING</code> |
| p | Paused. The VM will be set to <code>SUSPENDED</code> |
| e | Error. The VM crashed or somehow its deployment failed. The VM will be set to <code>UNKNOWN</code> |
| d | Disappeared. VM not known by the hypervisor anymore. The VM will be set to <code>POWEROFF</code> |

2.3.4 Deployment File

The deployment file is a text file written by OpenNebula core that holds the information of a VM. It is used when deploying a new VM. OpenNebula is able to generate three formats of deployment files:

- **kvm**: libvirt format used to create kvm VMs
- **xml**: xml representation of the VM

If the target hypervisor is not libvirt/kvm the best format to use is xml as it holds more information than the two others. It has all the template information encoded as xml. This is an example:

```
<TEMPLATE>
  <CPU><![CDATA[1.0]]></CPU>
  <DISK>
    <DISK_ID><![CDATA[0]]></DISK_ID>
    <SOURCE><![CDATA[/home/user/vm.img]]></SOURCE>
    <TARGET><![CDATA[sda]]></TARGET>
  </DISK>
  <MEMORY><![CDATA[512]]></MEMORY>
  <NAME><![CDATA[test]]></NAME>
  <VMID><![CDATA[0]]></VMID>
</TEMPLATE>
```

There are some information added by OpenNebula itself like the VMID and the DISK_ID for each disk. DISK_ID is very important as the disk images are previously manipulated by the TM driver and the disk should be accessible at `VM_DIR/VMID/images/disk.DISK_ID`.

2.4 Storage Driver

The Storage subsystem is highly modular. These drivers are separated into two logical sets:

- **DS:** Datastore drivers. They serve the purpose of managing images: register, delete, and create empty datablocks.
- **TM:** Transfer Manager drivers. They manage images associated to instantiated VMs.

2.4.1 Datastore Drivers Structure

Located under `/var/lib/one/remotes/datastore/<ds_mad>`

- **cp:** copies/dumps the image to the datastore
 - **ARGUMENTS:** `datastore_image_dump image_id`
 - **RETURNS:** `image_source size`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - `image_source` is the image source which will be later sent to the transfer manager
- **mkfs:** creates a new empty image in the datastore
 - **ARGUMENTS:** `datastore_image_dump image_id`
 - **RETURNS:** `image_source size`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - `image_source` is the image source which will be later sent to the transfer manager.
- **rm:** removes an image from the datastore
 - **ARGUMENTS:** `datastore_image_dump image_id`
 - **RETURNS:** -
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
- **stat:** returns the size of an image in Mb
 - **ARGUMENTS:** `datastore_image_dump image_id`
 - **RETURNS:** `size`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - `size` the size of the image in Mb.
- **clone:** clones an image.
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** `source`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - `source` the new source for the image.

- **monitor:** monitors a datastore
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** `monitor data`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - `monitor data` The monitoring information of the datastore, namely “USED_MB=...\nTOTAL_MB=...\nFREE_MB=...” which are respectively the used size of the datastore in MB, the total capacity of the datastore in MB and the available space in the datastore in MB.
- **snap_delete:** Deletes a snapshot of a persistent image.
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** –
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*. This dump, in addition to the elements in the example, contains a ROOT element: TARGET_SNAPSHOT, with the ID of the snapshot.
- **snap_flatten:** Flattens a snapshot. The operation results in an image without snapshots, with the contents of the selected snapshot.
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** –
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*. This dump, in addition to the elements in the example, contains a ROOT element: TARGET_SNAPSHOT, with the ID of the snapshot.
- **snap_revert:** Overwrites the contents of the image by the selected snapshot (discarding any non-saved changes).
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** –
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*. This dump, in addition to the elements in the example, contains a ROOT element: TARGET_SNAPSHOT, with the ID of the snapshot.
- **export:** Generates an XML file required to export an image from a datastore. This script represents only the first part of the export process, it only generates metadata (an xml). The information returned by this script is then fed to `downloader.sh` which completes the export process.
 - **ARGUMENTS:** `datastore_action_dump image_id`
 - **RETURNS:** `export_xml`
 - `datastore_image_dump` is an XML dump of the driver action encoded in Base 64. See a decoded *example*. This dump, in addition to the elements in the example, contains a ROOT element: TARGET_SNAPSHOT, with the ID of the snapshot.
 - `export_xml`: The XML response should follow *this* structure. The variables that appear within are the following:
 - * `<src>`: The SOURCE of the image (path to the image in the datastore)
 - * `<md5>`: The MD5 of the image
 - * `<format>`: The format of the image, e.g.: `qcow2, raw, vmdk, unknown...`

- * `<dispose>`: Can be either YES or NO. Dispose will remove the image from the reported path after the image has been successfully exported. This is regularly not necessary if the `downloader.sh` script can access the path to the image directly in the datastore (`src`).

Note: `image_source` has to be dynamically generated by the `cp` and `mkfs` script. It will be passed later on to the transfer manager, so it should provide all the information the transfer manager needs to locate the image.

2.4.2 TM Drivers Structure

This is a list of the TM drivers and their action. Note that they don't return anything. If the exit code is not 0, the driver failed.

Located under `/var/lib/one/remotes/tm/<tm_mad>`. There are two types of action scripts: the first group applies to general image datastores and includes (`clone`, `ln`, `mv` and `mvds`); the second one is only used in conjunction with the system datastore.

Action scripts for generic image datastores:

- **clone:** clones the image from the datastore (non-persistent images)
 - **ARGUMENTS:** `fe:SOURCE host:remote_system_ds/disk.i vm_id ds_id`
 - `fe` is the front-end hostname
 - `SOURCE` is the path of the disk image in the form `DS_BASE_PATH/disk`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)
- **ln:** Links the image from the datastore (persistent images)
 - **ARGUMENTS:** `fe:SOURCE host:remote_system_ds/disk.i vm_id ds_id`
 - `fe` is the front-end hostname
 - `SOURCE` is the path of the disk image in the form `DS_BASE_PATH/disk`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)
- **mvds:** moves an image back to its datastore (persistent images)
 - **ARGUMENTS:** `host:remote_system_ds/disk.i fe:SOURCE vm_id ds_id`
 - `fe` is the front-end hostname
 - `SOURCE` is the path of the disk image in the form `DS_BASE_PATH/disk`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the original datastore for the image)

- **cpds**: copies an image back to its datastore (executed for the saveas operation)
 - **ARGUMENTS**: `host:remote_system_ds/disk.i fe:SOURCE snap_id vm_id ds_id`
 - `fe` is the front-end hostname
 - `SOURCE` is the path of the disk image in the form `DS_BASE_PATH/disk`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `snap_id` the ID of the snapshot to save. If the ID is -1 it saves the current state and not a snapshot.
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the original datastore for the image)
- **mv**: moves images/directories across `system_ds` in different hosts. When used for the system datastore the script will received the directory ARGUMENT. This script will be also called for the image TM for each disk to perform setup tasks on the target node.
 - **ARGUMENTS**: `hostA:system_ds/disk.i|hostB:system_ds/disk.i vm_id ds_id`
OR `hostA:system_ds/|hostB:system_ds/ vm_id ds_id`
 - `hostA` is the host the VM is in.
 - `hostB` is the target host to deploy the VM
 - `system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)

Note: You only need to implement one `mv` script, but consider the arguments received when the TM is used for the system datastore, a regular image datastore or both.

- **premigrate**: It is executed before a livemigration operation is issued to the hypervisor. Note that **only the premigrate script from the system datastore will be used**. Any customization must be done for the premigrate script of the system datastore, although you will probably add operations for other backends than that used by the system datastore.
 - **ARGUMENTS**: `source_host dst_host remote_system_dir vmid dsid template`
 - `src_host` is the host the VM is in.
 - `dst_host` is the target host to migrate the VM to
 - `remote_system_ds_dir` is the path for the VM directory in the system datastore in the host
 - `vmid` is the id of the VM
 - `dsid` is the target datastore
 - `template` is the template of the VM in XML and base64 encoded
- **postmigrate**: It is executed after a livemigration operation. Note that **only the postmigrate script from the system datastore will be used**. Any customization must be done for the postmigrate script of the system datastore, although you will probably add operations for other backends than that used by the system datastore.
 - **ARGUMENTS**: `source_host dst_host remote_system_dir vmid dsid template`
 - see `premigrate` description.
- **snap_create**: Creates a disk snapshot of the selected disk

- **ARGUMENTS:** `host:remote_system_ds/disk.i snapshot_id vm_id ds_id`
- `remote_system_ds_dir` is the path for the VM directory in the system datastore in the host
- `host` is the target host where the VM is running
- `snapshot_id` the id of the snapshot to be created/reverted to/deleted
- `vm_id` is the id of the VM
- `ds_id` is the target datastore (the system datastore)
- **snap_create_live:** Creates a disk snapshot of the selected disk while the VM is running in the hypervisor. This is a hypervisor operation.
 - **ARGUMENTS:** `host:remote_system_ds/disk.i snapshot_id vm_id ds_id`
 - `remote_system_ds_dir` is the path for the VM directory in the system datastore in the host
 - `host` is the target host where the VM is running
 - `snapshot_id` the id of the snapshot to be created/reverted to/deleted
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)
- **snap_delete:** Deletes a disk snapshot
 - **ARGUMENTS:** `host:remote_system_ds/disk.i snapshot_id vm_id ds_id`
 - see `snap_create` description.
- **snap_revert:** Reverts to the selected snapshot (and discards any changes to the current disk)
 - **ARGUMENTS:** `host:remote_system_ds/disk.i snapshot_id vm_id ds_id`
 - see `snap_create` description.

Action scripts needed when the TM is used for the system datastore:

- **context:** creates an ISO that contains all the files passed as an argument.
 - **ARGUMENTS:** `file1 file2 ... fileN host:remote_system_ds/disk.i vm_id ds_id`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)
- **delete:** removes the either system datastore's directory of the VM or a disk itself.
 - **ARGUMENTS:** `host:remote_system_ds/disk.i|host:remote_system_ds/ vm_id ds_id`
 - `host` is the target host to deploy the VM
 - `remote_system_ds` is the path for the system datastore in the host
 - `vm_id` is the id of the VM
 - `ds_id` is the target datastore (the system datastore)
- **mkimage:** creates an image on-the-fly bypassing the datastore/image workflow
 - **ARGUMENTS:** `size format host:remote_system_ds/disk.i vm_id ds_id`

- size size in MB of the image
- format format for the image
- host is the target host to deploy the VM
- remote_system_ds is the path for the system datastore in the host
- vm_id is the id of the VM
- ds_id is the target datastore (the system datastore)
- **mkswap**: creates a swap image
 - **ARGUMENTS**: size host:remote_system_ds/disk.i vm_id ds_id
 - size size in MB of the image
 - host is the target host to deploy the VM
 - remote_system_ds is the path for the system datastore in the host
 - vm_id is the id of the VM
 - ds_id is the target datastore (the system datastore)
- **monitor**: monitors a **shared** system datastore. Non-shared system datastores are monitored through monitor_ds script.
 - **ARGUMENTS**: datastore_action_dump image_id
 - **RETURNS**: monitor data
 - datastore_image_dump is an XML dump of the driver action encoded in Base 64. See a decoded *example*.
 - monitor data Including:
 - * The monitoring information of the datastore, namely “USED_MB=... \nTOTAL_MB=... \nFREE_MB=...” which are respectively the used size of the datastore in MB, the total capacity of the datastore in MB and the available space in the datastore in MB.
 - * It also needs to return for each VM the size of each disk and any snapshot on those disks. In the form:

```

VM = [ ID = ${vm_id}, POLL = "\
  DISK_SIZE=[ID=${disk_id},SIZE=${disk_size}]
  ...
  SNAPSHOT_SIZE=[ID=${snap},DISK_ID=${disk_id},SIZE=${snap_size}]
  ...
  "
]
...

```

- **monitor_ds**: monitors a **ssh-like** system datastore. Distributed system datastores should `exit 0` on the previous monitor script. Arguments and return values are the same as the monitor script.

Note: If the TM is only for regular images you only need to implement the first group.

2.4.3 Tuning OpenNebula Core and Driver Integration

The behavior of OpenNebula can be adapted depending on how the storage perform the underlying operations. For example quotas are computed on the original image datastore depending on the CLONE attribute. In particular,

you may want to set two configuration attributes for your drivers: `DS_MAD_CONF` and `TM_MAD_CONF`. See the OpenNebula configuration reference for details.

2.4.4 The Monitoring Process

Image Datastores

The information is obtained periodically using the Datastore driver monitor script

Shared System Datastores

These datastores are monitored from a single point once (either the front-end or one of the storage bridges in `BRIDGE_LIST`). This will prevent overloading the storage by all the nodes querying it at the same time.

The driver plugin `<tm_mad>/monitor` will report the information for two things:

- Total storage metrics for the datastore (`USED_MB FREE_MB TOTAL_MB`)
- Disk usage metrics (all disks: volatile, persistent and non-persistent)

Non-shared System Datastores (SSH-like)

Non-shared SSH datastores are labeled by including a `.monitor` file in the datastore directory in any of the clone or In operations. Only those datastores are monitored remotely by the `monitor_ds.sh` probe. The datastore is monitored with `<tm_mad>/monitor_ds`, but `tm_mad` is obtained by the probes reading from the `.monitor` file.

The plugins `<tm_mad>/monitor_ds + kvm-probes.d/monitor_ds.sh` will report the information for two things:

- Total storage metrics for the datastore (`USED_MB FREE_MB TOTAL_MB`)
- Disk usage metrics (all disks volatile, persistent and non-persistent)

Note: `.monitor` will be only present in SSH datastores to be monitored in the nodes. System Datastores that need to be monitored in the nodes will need to provide a `monitor_ds` script and not the `monitor` one. This is to prevent errors, and not invoke the shared mechanism for local datastores.

The `monitor_ds` script.

The `monitor_ds.sh` probe from the IM, if the `.monitor` file is present (e.g. `/var/lib/one/datastores/100/.monitor`), will execute its contents in the form `/var/tmp/one/remotes/tm/$(cat .monitor)/monitor_ds /var/lib/one/datastores/100/`. Note that the argument is the datastore path and not the VM or VM disk.

The script is responsible from getting the information from all disks of all VMs in the datastore in that node.

2.4.5 An Example VM

Consider a VM with two disks:


```

NAME    = vm01
CPU     = 0.1
MEMORY  = 64

DISK    = [ IMAGE_ID = 0 ] # non-persistent disk
DISK    = [ IMAGE_ID = 1 ] # persistent disk

```

This is a list of TM actions that will be called upon the events listed:

CREATE

```

<tm_mad>/clone <frontend>:<non_pers_image_source> <host01>:<ds_path>/<vm_id>/disk.0
<tm_mad>/ln <frontend>:<pers_image_source> <host01>:<ds_path>/<vm_id>/disk.1

```

STOP

```

<tm_mad>/mv <host01>:<ds_path>/<vm_id>/disk.0 <frontend>:<ds_path>/<vm_id>/disk.0
<tm_mad>/mv <host01>:<ds_path>/<vm_id>/disk.1 <frontend>:<ds_path>/<vm_id>/disk.1
<tm_mad_sysds>/mv <host01>:<ds_path>/<vm_id> <frontend>:<ds_path>/<vm_id>

```

RESUME

```

<tm_mad>/mv <frontend>:<ds_path>/<vm_id>/disk.0 <host01>:<ds_path>/<vm_id>/disk.0
<tm_mad>/mv <frontend>:<ds_path>/<vm_id>/disk.1 <host01>:<ds_path>/<vm_id>/disk.1
<tm_mad_sysds>/mv <frontend>:<ds_path>/<vm_id> <host01>:<ds_path>/<vm_id>

```

MIGRATE host01 → host02

```

<tm_mad>/mv <host01>:<ds_path>/<vm_id>/disk.0 <host02>:<ds_path>/<vm_id>/disk.0
<tm_mad>/mv <host01>:<ds_path>/<vm_id>/disk.1 <host02>:<ds_path>/<vm_id>/disk.1
<tm_mad_sysds>/mv <host01>:<ds_path>/<vm_id> <host02>:<ds_path>/<vm_id>

```

SHUTDOWN

```

<tm_mad>/delete <host02>:<ds_path>/<vm_id>/disk.0
<tm_mad>/mvds <host02>:<ds_path>/<vm_id>/disk.1 <pers_image_source>
<tm_mad_sysds>/delete <host02>:<ds_path>/<vm_id>

```

- `non_pers_image_source`: Source of the non persistent image.
- `pers_image_source` : Source of the persistent image.
- `frontend`: hostname of the frontend
- `host01`: hostname of host01
- `host02`: hostname of host02
- `tm_mad`: TM driver of the datastore where the image is registered
- `tm_mad_sysds`: TM driver of the system datastore

2.4.6 Helper Scripts

There is a helper shell script with some functions defined to do some common tasks. It is located in `/var/lib/one/remotes/scripts_common.sh`

Here are the description of those functions.

- **log**: Takes one parameter that is a message that will be logged into the VM log file.

```
log "Creating directory $DST_DIR"
```

- **error_message**: sends an exit message to oned surrounding it by separators, use to send the error message when a command fails.

```
error_message "File '$FILE' not found"
```

- **arg_host**: gets the hostname part from a parameter

```
SRC_HOST=`arg_host $SRC`
```

- **arg_path**: gets the path part from a parameter

```
SRC_PATH=`arg_path $SRC`
```

- **exec_and_log**: executes a command and logs its execution. If the command fails the error message is sent to oned and the script ends

```
exec_and_log "chmod g+w $DST_PATH"
```

- **ssh_exec_and_log**: This function executes \$2 at \$1 host and report error \$3

```
ssh_exec_and_log "$HOST" "chmod g+w $DST_PATH" "Error message"
```

- **timeout_exec_and_log**: like `exec_and_log` but takes as first parameter the max number of seconds the command can run

```
timeout_exec_and_log 15 "cp $SRC_PATH $DST_PATH"
```

There are additional minor helper functions, please read the `scripts_common.sh` to see them.

2.4.7 Decoded Example

```
<DS_DRIVER_ACTION_DATA>
  <IMAGE>
    <ID>0</ID>
    <UID>0</UID>
    <GID>0</GID>
    <UNAME>oneadmin</UNAME>
    <GNAME>oneadmin</GNAME>
    <NAME>ttylinux</NAME>
    <PERMISSIONS>
      <OWNER_U>1</OWNER_U>
      <OWNER_M>1</OWNER_M>
      <OWNER_A>0</OWNER_A>
      <GROUP_U>0</GROUP_U>
      <GROUP_M>0</GROUP_M>
      <GROUP_A>0</GROUP_A>
      <OTHER_U>0</OTHER_U>
      <OTHER_M>0</OTHER_M>
      <OTHER_A>0</OTHER_A>
    </PERMISSIONS>
    <TYPE>0</TYPE>
    <DISK_TYPE>0</DISK_TYPE>
    <PERSISTENT>0</PERSISTENT>
    <REGTIME>1385145541</REGTIME>
```

```

<SOURCE/>
<PATH>/tmp/ttylinux.img</PATH>
<FSTYPE/>
<SIZE>40</SIZE>
<STATE>4</STATE>
<RUNNING_VMS>0</RUNNING_VMS>
<CLONING_OPS>0</CLONING_OPS>
<CLONING_ID>-1</CLONING_ID>
<DATASTORE_ID>1</DATASTORE_ID>
<DATASTORE>default</DATASTORE>
<VMS/>
<CLONES/>
<TEMPLATE>
  <DEV_PREFIX><![CDATA[hd]]></DEV_PREFIX>
  <PUBLIC><![CDATA[YES]]></PUBLIC>
</TEMPLATE>
</IMAGE>
<DATASTORE>
  <ID>1</ID>
  <UID>0</UID>
  <GID>0</GID>
  <UNAME>oneadmin</UNAME>
  <GNAME>oneadmin</GNAME>
  <NAME>default</NAME>
  <PERMISSIONS>
    <OWNER_U>1</OWNER_U>
    <OWNER_M>1</OWNER_M>
    <OWNER_A>0</OWNER_A>
    <GROUP_U>1</GROUP_U>
    <GROUP_M>0</GROUP_M>
    <GROUP_A>0</GROUP_A>
    <OTHER_U>1</OTHER_U>
    <OTHER_M>0</OTHER_M>
    <OTHER_A>0</OTHER_A>
  </PERMISSIONS>
  <DS_MAD>fs</DS_MAD>
  <TM_MAD>shared</TM_MAD>
  <TYPE>0</TYPE>
  <DISK_TYPE>0</DISK_TYPE>
  <CLUSTER_ID>-1</CLUSTER_ID>
  <CLUSTER/>
  <TOTAL_MB>86845</TOTAL_MB>
  <FREE_MB>20777</FREE_MB>
  <USED_MB>1000</USED_MB>
  <IMAGES/>
  <TEMPLATE>
    <CLONE_TARGET><![CDATA[SYSTEM]]></CLONE_TARGET>
    <DISK_TYPE><![CDATA[FILE]]></DISK_TYPE>
    <DS_MAD><![CDATA[fs]]></DS_MAD>
    <LN_TARGET><![CDATA[NONE]]></LN_TARGET>
    <TM_MAD><![CDATA[shared]]></TM_MAD>
    <TYPE><![CDATA[IMAGE_DS]]></TYPE>
  </TEMPLATE>
</DATASTORE>
</DS_DRIVER_ACTION_DATA>

```

2.4.8 Export XML

```
<IMPORT_INFO>
  <IMPORT_SOURCE><![CDATA[<src>]]></IMPORT_SOURCE>
  <MD5><![CDATA[<md5sum>]]></MD5>
  <SIZE><![CDATA[<size>]]></SIZE>
  <FORMAT><![CDATA[<format>]]></FORMAT>
  <DISPOSE><dispose></DISPOSE>
</IMPORT_INFO>
```

2.5 Monitoring Driver

The Monitoring Drivers (or IM drivers) collect host and virtual machine monitoring data by executing a set of probes in the hosts. This data is either actively queried by OpenNebula or sent periodically by an agent running in the hosts to the frontend.

This guide describes the process of customize or add probes to the hosts. It is also a starting point on how to create a new IM driver from scratch.

2.5.1 Probe Location

The default probes are installed in the frontend in the following path:

- **KVM:** `/var/lib/one/remotes/im/kvm-probes.d`
- **vCenter, EC2 and Azure:** `/var/lib/one/remotes/im/<hypervisor>.d`

In the case of KVM, the probes are distributed to the hosts, therefore if the probes are changed, they **must** be distributed to the hosts by running `onehost sync`.

2.5.2 General Probe Structure

An IM driver is composed of one or several scripts that write to `stdout` information in this form:

```
KEY1="value"
KEY2="another value with spaces"
```

The drivers receive the following parameters:

| Position | Description |
|----------|--|
| 1 | hypervisor: The name of the hypervisor: <code>kvm</code> , etc... |
| 2 | datastore location: path of the datastores directory in the host |
| 3 | collectd port: port in which the <code>collectd</code> is listening on |
| 4 | monitor push cycle: time in seconds between monitorization actions for the UDP-push model |
| 5 | host_id: id of the host |
| 6 | host_name: name of the host |

Take into account that in shell script the parameters start at 1 (`$1`) and in ruby start at 0 (`ARGV[0]`). For shell script you can use this snippet to get the parameters:

```
hypervisor=$1
datastore_location=$2
collectd_port=$3
monitor_push_cycle=$4
host_id=$5
host_name=$6
```

2.5.3 Basic Monitoring Scripts

You can add any key and value you want to use later in `RANK` and `REQUIREMENTS` for scheduling but there are some basic values you should output:

| Key | Description |
|--------------------------|---|
| <code>HYPERVISOR</code> | Name of the hypervisor of the host, useful for selecting the hosts with an specific technology. |
| <code>TOTALCPU</code> | Number of CPUs multiplied by 100. For example, a 16 cores machine will have a value of 1600. |
| <code>CPUSPEED</code> | Speed in Mhz of the CPUs. |
| <code>TOTALMEMORY</code> | Maximum memory that could be used for VMs. It is advised to take out the memory used by the hypervisor. |
| <code>USEDMEMORY</code> | Memory used, in kilobytes. |
| <code>FREEMEMORY</code> | Available memory for VMs at that moment, in kilobytes. |
| <code>FREECPU</code> | Percentage of idling CPU multiplied by the number of cores. For example, if 50% of the CPU is idling in a 4 core machine the value will be 200. |
| <code>USEDCPU</code> | Percentage of used CPU multiplied by the number of cores. |
| <code>NETRX</code> | Received bytes from the network |
| <code>NETTX</code> | Transferred bytes to the network |

For example, a probe that gets memory information about a host could be something like:

```
#!/bin/bash

total=$(free | awk ' /^Mem/ { print $2 }')
used=$(free | awk ' /buffers\/cache/ { print $3 }')
free=$(free | awk ' /buffers\/cache/ { print $4 }')

echo "TOTALMEMORY=$total"
echo "USEDMEMORY=$used"
echo "FREEMEMORY=$free"
```

Executing it should give use memory values:

```
$ ./memory_probe
TOTALMEMORY=1020696
USEDMEMORY=209932
FREEMEMORY=810724
```

For real examples check the directories at `/var/lib/one/remotes/im`.

2.5.4 VM Information

The scripts should also provide information about the VMs running in the host. This is useful as it will only need one call to gather all that information about the VMs in each host. The output should be in this form:

```
VM_POLL=YES
VM=[
  ID=115,
  DEPLOY_ID=one-115,
  VM_NAME=one-115,
  IMPORT_TEMPLATE="TkFNRT1vcGVubmVidWxhcm9ja3NiaWd0aW1lDQpDUFU9MQ0KTUVNT1JZPTIwMTQ4",
  POLL="STATE=a CPU=100.0 MEMORY=73232 NETRX=1518 NETTX=0 DISK_SIZE=[ ID=0, SIZE=24 ]
↪DISK_SIZE=[ ID=1, SIZE=0 ] SNAPSHOT_SIZE=[ ID=1, DISK_ID=0, SIZE=24 ] SNAPSHOT_
↪SIZE=[ ID=0, DISK_ID=0, SIZE=24 ] " ]
VM=[
  ID=116,
  DEPLOY_ID=one-116,
  VM_NAME=one-115,
  IMPORT_TEMPLATE=
↪"TkFNRT1vcGVubmVidWxhcm9ja3NiaWd0aW1leWVzDQpDUFU9MQ0KTUVNT1JZPTIwNDg=",
  POLL="STATE=a CPU=100.5 MEMORY=77824 NETRX=1392 NETTX=0 DISK_SIZE=[ ID=0, SIZE=24 ]
↪DISK_SIZE=[ ID=1, SIZE=0 ] " ]
VM=[
  ID=-1,
  DEPLOY_ID=f81d4fae-7dec-11d0-a765-00a0c91e6bf6,
  VM_NAME=MyVM,
  IMPORT_TEMPLATE="TkFNRT13aWxkdm0NCkNQVT0yDQpNRU1PU1k9MTAyNA==",
  POLL="STATE=a CPU=100.5 MEMORY=77824 NETRX=1392 NETTX=0 DISK_SIZE=[ ID=0, SIZE=24 ]
↪DISK_SIZE=[ ID=1, SIZE=0 ] " ]
```

The first line (VM_POLL=YES) is used to indicate OpenNebula that VM information will follow. Then the information about the VMs is output in that form.

| Key | Description |
|-----------------|---|
| ID | OpenNebula VM id. It can be -1 in case this VM was not created by OpenNebula, a wild VM, that can be imported |
| DEPLOY_ID | Hypervisor name or identifier of the VM |
| VM_NAME | Human readable VM name (to show on import dialogs) |
| IMPORT_TEMPLATE | Base64 representation of the VM template to be used on import |
| POLL | VM monitoring info, in the same format as <i>VMM driver</i> poll |

For example here is a simple script to get qemu/kvm VMs status from libvirt. As before, check the scripts from OpenNebula for a complete example:

```
#!/bin/bash

echo "VM_POLL=YES"

virsh -c qemu:///system list | grep one- | while read vm; do
  deploy_id=$(echo $vm | cut -d' ' -f 2)
  id=$(echo $deploy_id | cut -d- -f 2)
  status_str=$(echo $vm | cut -d' ' -f 3)

  if [ $status_str == "running" ]; then
    state="a"
  fi
done
```

```

else
    state="e"
fi

echo "VM=["
echo "  ID=$id,"
echo "  DEPLOY_ID=$deploy_id,"
echo "  POLL=\"STATE=$state\" ]"
done

```

```

$ ./vm_poll
VM_POLL=YES
VM=[
  ID=0,
  DEPLOY_ID=one-0,
  POLL="STATE=a" ]
VM=[
  ID=1,
  DEPLOY_ID=one-1,
  POLL="STATE=a" ]

```

2.5.5 System Datastore Information

Information Manager drivers are also responsible to collect the datastore sizes and its available space. To do so there is an already made script that collects this information for filesystem and lvm based datastores. You can copy it from the KVM driver (`/var/lib/one/remotes/im/kvm-probes.d/monitor_ds.sh`) into your driver directory.

In case you want to create your own datastore monitor you have to return something like this in STDOUT:

```

DS_LOCATION_USED_MB=1
DS_LOCATION_TOTAL_MB=12639
DS_LOCATION_FREE_MB=10459
DS = [
  ID = 0,
  USED_MB = 1,
  TOTAL_MB = 12639,
  FREE_MB = 10459
]
DS = [
  ID = 1,
  USED_MB = 1,
  TOTAL_MB = 12639,
  FREE_MB = 10459
]
DS = [
  ID = 2,
  USED_MB = 1,
  TOTAL_MB = 12639,
  FREE_MB = 10459
]

```

These are the meanings of the values:

| Variable | Description |
|----------------------|--|
| DS_LOCATION_USED_MB | Used space in megabytes in the DATASTORE LOCATION |
| DS_LOCATION_TOTAL_MB | Total space in megabytes in the DATASTORE LOCATION |
| DS_LOCATION_FREE_MB | FREE space in megabytes in the DATASTORE LOCATION |
| ID | ID of the datastore, this is the same as the name of the directory |
| USED_MB | Used space in megabytes for that datastore |
| TOTAL_MB | Total space in megabytes for that datastore |
| FREE_MB | Free space in megabytes for that datastore |

The DATASTORE LOCATION is the path where the datastores are mounted. By default is `/var/lib/one/datastores` but it is specified in the second parameter of the script call.

2.5.6 Creating a New IM Driver

Choosing the Execution Engine

OpenNebula provides two IM probe execution engines: `one_im_sh` and `one_im_ssh`. `one_im_sh` is used to execute probes in the frontend, for example `vcnenter` uses this engine as it collects data via an API call executed in the frontend. On the other hand, `one_im_ssh` is used when probes need to be run remotely in the hosts, which is the case for KVM.

Populating the Probes

Both `one_im_sh` and `one_im_ssh` require an argument which indicates the directory that contains the probes. This argument is appended with `".d"`.

Making Use of `collectd`

If the new IM driver wishes to use the `collectd` component, it needs to:

- Use `one_im_ssh`
- The `/var/lib/one/remotes/im/<im_name>.d` should **only** contain 2 files, the same that are provided by default inside `kvm.d`, which are: `collectd-client_control.sh` and `collectd-client.rb`.
- The probes should be actually placed in the `/var/lib/one/remotes/im/<im_name>-probes.d` folder.

Enabling the Driver

A new IM section should be placed added to `oned.conf`.

Example:

```
IM_MAD = [
  name      = "ganglia",
  executable = "one_im_sh",
  arguments = "ganglia" ]
```


2.6 Networking Driver

This component is in charge of configuring the network in the hypervisors. The purpose of this guide is to describe how to create a new network manager driver.

2.6.1 Driver Configuration and Description

To enable a new network manager driver, the only requirement is to make a new directory with the name of the driver in `/var/lib/one/remotes/vnm/remotes/<name>` with three files:

- **Pre:** This driver should perform all the network related actions required before the Virtual Machine starts in a host.
- **Post:** This driver should perform all the network related actions required after the Virtual Machine starts (actions which typically require the knowledge of the `tap` interface the Virtual Machine is connected to).
- **Clean:** If any clean-up should be performed after the Virtual Machine shuts down, it should be placed here.

Warning: The above three files **must exist**. If no action is required in them a simple `exit 0` will be enough.

Warning: Remember that any change in the `/var/lib/one/remotes` directory won't be effective in the Hosts until you execute, as oneadmin: `onehost sync -f`

Virtual Machine actions and their relation with Network actions:

- **Deploy:** `pre` and `post`
- **Shutdown:** `clean`
- **Cancel:** `clean`
- **Save:** `clean`
- **Restore:** `pre` and `post`
- **Migrate:** `pre` (target host), `clean` (source host), `post` (target host)
- **Attach Nic:** `pre` and `post`
- **Detach Nic:** `clean`

2.6.2 Driver Parameters

All three driver actions have a first parameter which is the XML VM template encoded in base64 format.

Additionally the `post` driver has a second parameter which is the deploy-id of the Virtual Machine e.g.: `one-17`.

2.6.3 The 802.1Q Driver

Driver Files

The code can be enhanced and modified, by changing the following files in the frontend:

- `/var/lib/one/remotes/vnm/802.1Q/post`

- /var/lib/one/remotes/vnm/802.1Q/vlan_tag_driver.rb
- /var/lib/one/remotes/vnm/802.1Q/clean
- /var/lib/one/remotes/vnm/802.1Q/pre

Driver Actions

| Action | Description |
|--------------|--|
| Pre | Creates a VLAN tagged interface in the Host and attaches it to a dynamically created bridge. |
| Post | N/A |
| Clean | It doesn't do anything. The VLAN tagged interface and bridge are kept in the Host to speed up future VMs |

2.6.4 The VXLAN Driver

Driver Files

The code can be enhanced and modified, by changing the following files in the frontend:

- /var/lib/one/remotes/vnm/vxlan/vxlan_driver.rb
- /var/lib/one/remotes/vnm/vxlan/post
- /var/lib/one/remotes/vnm/vxlan/clean
- /var/lib/one/remotes/vnm/vxlan/pre

Driver Actions

| Action | Description |
|--------------|---|
| Pre | Creates a VXLAN interface through PHYDEV, creates a bridge (if needed) and attaches the vxlan device. |
| Post | When the VM is associated to a security group, the corresponding iptables rules are applied. |
| Clean | It doesn't do anything. The VXLAN interface and bridge are kept in the Host to speed up future VMs |

2.6.5 The Open vSwitch Driver

Driver Actions

| Action | Description |
|--------------|--|
| Pre | N/A |
| Post | Performs the appropriate Open vSwitch commands to tag the virtual tap interface. |
| Clean | It doesn't do anything. The virtual tap interfaces will be automatically discarded when the VM is shut down. |

2.6.6 The ebttables Driver

Driver Actions

| Action | Description |
|--------------|--|
| Pre | N/A |
| Post | Creates EBTABLES rules in the Host where the VM has been placed. |
| Clean | Removes the EBTABLES rules created during the Post action. |

2.7 Authentication Driver

This guide will show you how to develop a new driver for OpenNebula to interact with an external authentication service.

OpenNebula comes with an internal user/password way of authentication, this is called `core`. To be able to use other auth methods there is a system that performs authentication with external systems. Authentication drivers are responsible of getting the user credentials from OpenNebula database and login and answer whether the authentication is correct or not.

In the OpenNebula database there are two values saved for every user, this is `username` and `password`. When the driver used for authentication is `core` (authenticated without an external auth driver) the `password` value holds the SHA1 hash of the user's password. In case we are using other authentication method this `password` field can contain any other information we can use to recognize a user, for example, for `x509` authentication this field contains the user's public key.

2.7.1 Authentication Driver

Authentication drivers are located at `/var/lib/one/remotes/auth`. There is a directory for each of authentication drivers with an executable inside called `authenticate`. The name of the directory has to be the same as the user's auth driver we want to authenticate. For example, if a user has as auth driver `x509` OpenNebula will execute the file `/var/lib/one/remotes/auth/x509/authenticate` when he performs an OpenNebula action.

The script receives three parameters:

- `username`: name of the user who wants to authenticate.
- `password`: value of the password field for the user that is trying to authenticate. This can be `-` when the user does not exist in the OpenNebula database.
- `secret`: value provided in the password field of the authentication string.

For example, we can create a new authentication method that just checks the length of the password. For this we can store in the password field the number of characters accepted, for example `5`, and user name `test`. Here are some example calls to the driver with several passwords:

```
authenticate test 5 testpassword
authenticate test 5 another_try
authenticate test 5 12345
```

The script should exit with a non 0 status when the authentication is not correct and write in `stderr` the error. When the authentication is correct it should return:

- Name of the driver. This is used when the user does not exist, this will be written to user's the auth driver field.
- User name

- Text to write in the user's password field in case the user does not exist.

The code for the `/var/lib/one/remotes/auth/length/authenticate` executable can be:

```
#!/bin/bash

username=$1
password=$2
secret=$3

length=$(echo -n "$secret" | wc -c | tr -d ' ')

if [ $length = $password ]; then
    echo "length $username $secret"
else
    echo "Invalid password"
    exit 255
fi
```

2.7.2 Enabling the Driver

To be able to use the new driver we need to add its name to the list of enabled drivers in `oned.conf`:

```
AUTH_MAD = [
    executable = "one_auth_mad",
    authn = "ssh,x509,ldap,server_cipher,server_x509,length"
]
```

2.8 Cloud Bursting Driver

This guide will show you how to develop a new driver for OpenNebula to interact with an external cloud provider.

Cloud bursting, or hybrid cloud, is a model in which the local resources of a Private Cloud are combined with resources from remote Cloud providers. The remote provider could be a commercial Cloud service, such as Amazon EC2 or Microsoft Azure, or a partner infrastructure running a different OpenNebula instance. Such support for cloud bursting enables highly scalable hosting environments. For more information on this model see the Cloud Bursting overview

The remote cloud provider will be included in the OpenNebula host pool like any other physical host of your infrastructure:

```
$ onehost create remote_provider im_provider vmm_provider

$ onehost list
ID NAME           CLUSTER  RVM    ALLOCATED_CPU  ALLOCATED_MEM  STAT
2  kvm-            -        0       0 / 800 (0%)   0K / 16G (0%)  on
3  kvm-1          -        0       0 / 100 (0%)   0K / 1.8G (0%) on
4  remote_provider -        0       0 / 500 (0%)   0K / 8.5G (0%) on
```

When you create a new host in OpenNebula you have to specify the following parameters:

- Name: `remote_provider`

Name of the host, in case of physical hosts it will be the ip address or hostname of the host. In case of remote providers it will be just a name to identify the provider.

- *Information Manager*: `im_provider`

IM driver gather information about the physical host and hypervisor status, so the OpenNebula scheduler knows the available resources and can deploy the virtual machines accordingly.

- *VirtualMachine Manager*: `vmm_provider`

VMM drivers translate the high-level OpenNebula virtual machine life-cycle management actions, like deploy, shutdown, etc. into specific hypervisor operations. For instance, the KVM driver will issue a `virsh create` command in the physical host. The EC2 driver translate the actions into Amazon EC2 API calls.

Note: Storage and Network drivers are derived from the VM characteristics rather than the host.

When creating a new host to interact with a remote cloud provider we will use mock versions for the TM and VNM drivers. Therefore, we will only implement the functionality required for the IM and VMM driver.

2.8.1 Adding the Information Manager

Edit `oned.conf`

Add a new IM section for the new driver in `oned.conf`:

```
#*****
# Information Driver Configuration
#*****
# You can add more information managers with different configurations but make
# sure it has different names.
#
# name      : name for this information manager
#
# executable: path of the information driver executable, can be an
#              absolute path or relative to $ONE_LOCATION/lib/mads (or
#              /usr/lib/one/mads/ if OpenNebula was installed in /)
#
# arguments : for the driver executable, usually a probe configuration file,
#              can be an absolute path or relative to $ONE_LOCATION/etc (or
#              /etc/one/ if OpenNebula was installed in /)
# -r number of retries when monitoring a host
# -t number of threads, i.e. number of hosts monitored at the same time
#*****
#-----
# EC2 Information Driver Manager Configuration
#-----
IM_MAD = [
    name      = "im_provider",
    executable = "one_im_sh",
    arguments  = "-t 1 -r 0 provider_name" ]
#-----
```

Populating the Probes

Create a new directory to store your probes, the name of this folder must match the name provided in the arguments section of the `IM_MAD` in `oned.conf`:

- `/var/lib/one/remotes/im/<provider_name>.d`

These probes must return:

- *Information of the host capacity*, to limit the number of VMs that can be deployed in this host.
- *Information of the VMs running in this host*.

You can see an example of these probes in the `ec2 driver (code)` included in OpenNebula

You must include the PUBLIC_CLOUD and HYPERVISOR attributes as one of the values returned by your probes, otherwise OpenNebula will consider this host as local. The HYPERVISOR attribute will be used by the scheduler and should match the TYPE value inside the PUBLIC_CLOUD section provided in the VM template.

```
PUBLIC_CLOUD="YES"
HYPERVISOR="provider_name"
```

2.8.2 Adding the Virtual Machine Manager

Edit oned.conf

```
#*****
# Virtualization Driver Configuration
#*****
# You can add more virtualization managers with different configurations but
# make sure it has different names.
#
#   name      : name of the virtual machine manager driver
#
#   executable: path of the virtualization driver executable, can be an
#               absolute path or relative to $ONE_LOCATION/lib/mads (or
#               /usr/lib/one/mads/ if OpenNebula was installed in /)
#
#   arguments : for the driver executable
#               -r number of retries when monitoring a host
#               -t number of threads, i.e. number of hosts monitored at the same time
#
#   default   : default values and configuration parameters for the driver, can
#               be an absolute path or relative to $ONE_LOCATION/etc (or
#               /etc/one/ if OpenNebula was installed in /)
#
#   type      : driver type, supported drivers: xen, kvm, xml
#
#-----
VM_MAD = [
  name      = "vmm_provider",
  executable = "one_vmm_sh",
  arguments = "-t 15 -r 0 provider_name",
  type      = "xml" ]
#-----
```

Create the Driver Folder and Implement the Specific Actions

Create a new folder inside the remotes dir (`/var/lib/one/remotes/vmm`). The new folder should be named “`provider_name`”, the name specified in the previous VM_MAD arguments section.

This folder must contain scripts for the supported actions. You can see the list of available actions in the *Virtual Machine Driver guide*. These scripts are language-agnostic so you can implement them using python, ruby, bash...

You can see examples on how to implement this in the `ec2 driver`:

- EC2 Shutdown action:

```
#!/usr/bin/env ruby

# ----- #
# Copyright 2002-2016, OpenNebula Project, OpenNebula Systems #
# #
# Licensed under the Apache License, Version 2.0 (the "License"); you may #
# not use this file except in compliance with the License. You may obtain #
# a copy of the License at #
# #
# http://www.apache.org/licenses/LICENSE-2.0 #
# #
# Unless required by applicable law or agreed to in writing, software #
# distributed under the License is distributed on an "AS IS" BASIS, #
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. #
# See the License for the specific language governing permissions and #
# limitations under the License. #
# ----- #

$: << File.dirname(__FILE__)

require 'ec2_driver'

deploy_id = ARGV[0]
host      = ARGV[1]

ec2_drv = EC2Driver.new(host)

ec2_drv.shutdown(deploy_id)
```

Create the New Host

After restarting oned we can create the new host that will use this new driver

```
$ onehost create remote_provider im_provider vmm_provider
```

Create a new Virtual Machine

Create a new VM using a template with an specific section for this provider. You have to include the required information to start a new VM inside the PUBLIC_CLOUD section, and the TYPE attribute must match the HYPERVISOR value of the host. For example:

```
$ cat vm_template.one
CPU=1
MEMORY=256
PUBLIC_CLOUD=[
  TYPE=provider_name
  PROVIDER_IMAGE_ID=id-141234,
  PROVIDER_INSTANCE_TYPE=small_256mb
]

$ onevm create vm_template
ID: 23

$ onevm deploy 23 remote_provider
```

After this, the deploy script will receive the following arguments:

- The path to the deployment file that contains the following XML:

```
<CPU>1</CPU>
<MEMORY>256</MEMORY>
<PUBLIC_CLOUD>
  <TYPE>provider_name</TYPE>
  <PROVIDER_IMAGE_ID>id-141234</PROVIDER_IMAGE_ID>
  <PROVIDER_INSTANCE_TYPE>small_256mb</PROVIDER_INSTANCE_TYPE>
</PUBLIC_CLOUD>
```

- The hostname: `remote_provider`
- The VM ID: `23`

The deploy script has to return the ID of the new resource and an `exit_code 0`:

```
$ cat /var/lib/one/remote/provider/deploy
#!/bin/bash
deployment_file=$1
# Parse required parameters from the template
..
# Retrieve account credentials from a local file/env
...
# Create a new resource using the API provider
...
# Return the provider ID of the new resource and exit code 0 or an error message
```

2.9 Market Driver

The Market Driver is in charge of managing both `MarketPlaces` and `MarketPlaceApps`.

2.9.1 MarketPlace Drivers Structure

The main drivers are located under `/var/lib/one/remotes/market/<market_mad>`.

import

The `import` action is a special action that involves two driver calls chained one after the other. The involved actors are: `/var/lib/one/remotes/datastore/<ds_mad>/export` and `/var/lib/one/remotes/market/<market_mad>/import`. Note they they aren't piped together: the core will run the `export` action first, collect the output and use it for the driver message of the `import` action.

`<ds_mad>/export:`

The job of the `export` is to:

- Calculate the MD5, FORMAT, SIZE
- Generate an `IMPORT_SOURCE` so the `<market_mad>/import` can do the image => market dump
- Specify `DISPOSE="YES"` if the `IMPORT_SOURCE` is a temporary file that must be removed after the dump performed by `<market_mad>/import`. `DISPOSE="NO"` if otherwise.

ARGUMENTS: `driver_dump_xml image_id`. The `driver_dump_xml` is an XML dump of the driver action encoded in Base 64, which contains all the required information: `image_data` and `ds_data`.

RETURNS

It should return an XML document:

```
<IMPORT_INFO>
  <IMPORT_SOURCE>$IMPORT_SOURCE</IMPORT_SOURCE>
  <MD5>$MD5_SUM</MD5>
  <SIZE>$SIZE</SIZE>
  <FORMAT>$FORMAT</FORMAT>
  <DISPOSE>NO</DISPOSE>
</IMPORT_INFO>"
```

```
<market_mad>/import:
```

The job of the export is to grab the `IMPORT_SOURCE` and dump it to the backend.

ARGUMENTS: `driver_dump_xml image_id`. The `driver_dump_xml` is an XML dump of the driver action encoded in Base 64, which contains all the required information: `app_data`, `market_data`, `image_data` and `ds_data`.

RETURNS

It should return this OpenNebula-syntax template:

```
SOURCE="<SOURCE>"
MD5="<MD5>"
SIZE="<SIZE_IN_MB>"
FORMAT="<FORMAT>"
```

Note that typically inside the `import` script we will find a call to the `downloader.sh` as such:

```
${UTILS_PATH}/downloader.sh $IMPORT_SOURCE -
```

Which will be in turn piped to the target destination in the MarketPlace, or in some Market Drivers the target file will appear in the `downloader.sh` command as the destination instead of `-`. Note that this might require extending `downloader.sh` to handle a custom new protocol, like: `s3://`, `rbd://`, etc...

monitor

The `monitor` action is orchestrated by the `/var/lib/one/remotes/market/<market_mad>/monitor` script.

There are two kinds of `monitor` scripts, those that do not require the discovery of the MarketPlaceApps, since OpenNebula already know about them because it has created them. And those that include this discovery, like in the case of the `one/monitor` script to monitor the official OpenNebula Systems MarketPlace.

ARGUMENTS: `driver_dump_xml market_id`. The `driver_dump_xml` is an XML dump of the driver action encoded in Base 64, which contains all the required information: `market_data`.

RETURNS

In the case of simple monitoring with no discovery, the `monitor` action must return a report of the available and used space in the MarketPlace in OpenNebula-syntax template format:

```
USED_MD=<USED_MB>
FREE_MB=<FREE_MB>
TOTAL_MB=<TOTAL_MB>
```

In the case of monitoring with discovery, it must also return the information of each Appliance, encoded in Base64 in the following way (the full APP string has been trimmed for legibility):

```
APP="TkFNRT0idHR5b..."
APP="TkFNRT0idHR5b..."
APP="TkFNRT0iQ2Fya..."
APP="TkFNRT0iVGvzd..."
APP="TkFNRT0iZlVzZ..."
APP="TkFNRT0iVnlhd..."
APP="TkFNRT0iZlVTR..."
APP="TkFNRT0iZGVia..."
...
```

If we unpack one of these APPs we will obtain the following:

```
NAME="ttylinux - kvm"
SOURCE="http://marketplace.opennebula.systems//appliance/4fc76a938fb81d3517000003/
↳download/0"
IMPORT_ID="4fc76a938fb81d3517000003"
ORIGIN_ID="-1"
TYPE="IMAGE"
PUBLISHER="OpenNebula.org"
FORMAT="raw"
DESCRIPTION="This is a very small image that works with OpenNebula. It's already
↳contextualized. The purpose of this image is to test OpenNebula deployments,
↳without wasting network bandwidth thanks to the tiny footprint of this image
(40MB) ."
VERSION="1.0"
TAGS="linux, ttylinux, 4.8, 4.10"
SIZE="40"
MD5="04c7d00e88fa66d9aaa34d9cf8ad6aaa"
VMTEMPLATE64=
↳"Q090VEVYVCA9IFsgTkVUV09SSyAgPSJZRVMiLFNTSF9QVUJMSUNfS0VZICA9IiRVU0VSW1NTSF9QVUJMSUNfS0VZXSJdCgpDU
↳"
```

Which is the MarketplaceApp template in OpenNebula-syntax format.

export

The export job is again two-fold:

- Create a new image by calling `<ds_mad>/cp`
- Create a new template, if it exists in the MarketplaceApp (VMTEPLATE64)

There is no specific `<market_mad>` driver file associated with this job, it actually calls an already existing driver, the `<ds_mad>/cp`. Please read the *Storage Driver* guide to learn more about this driver action.

It is worth noting that the MarketplaceApp's `IMPORT_SOURCE` field will be used as the `PATH` argument for the `<ds_mad>/cp` action. Therefore, this action must understand that `IMPORT_SOURCE` which in turn means that `downloader.sh` must understand it too.

delete

This job deletes a MarketplaceApp.

ARGUMENTS: `driver_dump_xml image_id`. The `driver_dump_xml` is an XML dump of the driver action encoded in Base 64, which contains all the required information: `market_data` and `marketapp_data`.

RETURNS: No return message.

2.10 IPAM driver

A IPAM driver lets you delegate IP lease management to an external component. This way you can coordinate IP use with other virtual or bare metal servers in your datacenter. To effectively use an external IPAM you need to develop four action scripts that hooks on different points of the IP network/lease life-cycle.

Note that OpenNebula includes a built-in internal IPAM. You need to develop this component if you are using a IPAM server and want to coordinate OpenNebula with it.

2.10.1 IPAM Drivers Structure

The main drivers are located under `/var/lib/one/remotes/ipam/<ipam_mad>`. For an example, you can take a look to `/var/lib/one/remotes/ipam/dummy`. This set of simple scripts can be used as an starting point to develop the integration.

register_address_range

This action is used to register a new IP network in the IPAM. The network may be selected from a pool of free networks or if an specific network is requested its availability maybe checked by the IPAM driver. The IPAM driver must return an OpenNebula AddressRange definition, potentially augmented with network specific variables to be used by VMs (e.g. GATEWAY, NETWORK_MASK...)

Arguments:

- AddressRange. The AddressRange (IP network) request in XML encoded in Base 64. The XML may contain any of the attributes used to define an AR. Note that OpenNebula uses a free format for objects so you can freely add more and process more (or less) attributes in this action. At least TYPE, IPAM_MAD and SIZE will be present:

```
<IPAM_DRIVER_ACTION_DATA>
<AR>
  <TYPE>IP4</TYPE>
  <IP> First IP in the network in '.' notation </IP>
  <MAC> First MAC in the network in ':' notation </MAC>
  <SIZE>Number of IPs in the network </SIZE>
  <NETWORK_ADDRESS> Base network address</NETWORK_ADDRESS>
  <NETWORK_MASK> Network mask</NETWORK_MASK>
  <GATEWAY> Default gateway for the network</GATEWAY>
  <DNS> DNS servers, a space separated list of servers</DNS>
  <GUEST_MTU> Sets the MTU for the NICs in this network</GUEST_MTU>
  <SEARCH_DOMAIN> for DNS client</SEARCH_DOMAIN>
</AR>
</IPAM_DRIVER_ACTION_DATA>
```

- Request ID, used internally to identify this IPAM request.

Returns: It should return through STDOUT a valid AddressRange definition in template format. The response MUST include IPAM_MAD, TYPE, IP and SIZE attribute. For example:

- A basic network definition

```
AR = [
  IPAM_MAD = "dummy",
  TYPE = "IP4",
  IP = "10.0.0.1",
  SIZE = "255"
]
```

- A complete network definition. Custom attributes (free form, key-value) can be added, names cannot be repeated.

```
AR = [
  IPAM_MAD = "dummy",
  TYPE = "IP4",
  IP = "10.0.0.2",
  SIZE = "200",
  NETWORK_ADDRESS = "10.0.0.0",
  NETWORK_MASK = "255.255.255.0",
  GATEWAY = "10.0.0.1",
  DNS = "10.0.0.1",
  IPAM_ATTR = "10.0.0.240",
  OTHER_IPAM_ATTR = ".mydoamin.com"
]
```

allocate_address

This script is used to register an specific IP address (or addresses) as used. The IP (or IPs) will be used by an OpenNebula VM and should not be allocated to any other host in the network.

Arguments:

- AddressRange and Address. The AddressRange (IP network) and address request in XML, encoded in Base 64. The XML will contain the AR as defined by the previous action; and the address request:

```
<IPAM_DRIVER_ACTION_DATA>
<AR>
  As returned by previous action, see above for examples.
</AR>
<ADDRESS>
  <IP> Requested IP address </IP>
  <SIZE> Number of IPs to allocate, in a continous range from the firs IP</SIZE>
  <MAC> Optional the MAC address </MAC>
</ADDRESS>
</IPAM_DRIVER_ACTION_DATA>
```

- Request ID, used internally to identify this IPAM request.

Returns: This scripts MUST exit 0 if the address is free.

get_address

This script is used to lease an IP address (or addresses). The IP (or IPs) will be used by an OpenNebula VM and should not be allocated to any other host in the network.

Arguments:

- AddressRange and Address. The AddressRange (IP network) and address request in XML, encoded in Base 64. The XML will contain the AR as defined by the previous action; and the address request:

```

<IPAM_DRIVER_ACTION_DATA>
<AR>
  As returned by previous action, see above for examples.
</AR>
<ADDRESS>
  <SIZE> Number of IPs to allocate, in a continous range from the firs IP</SIZE>
</ADDRESS>
</IPAM_DRIVER_ACTION_DATA>

```

- Request ID, used internally to identify this IPAM request.

Returns: This scrit MUST output the leased IP range as defined by the ADDRESS element in template format though STOUT. For example, to lease IPs from 10.0.0.2 to 10.0.0.35 return:

```
ADDRESS = [ IP = "10.0.0.2", SIZE=34 ]
```

If the “size” IPs cannot be assigned the script must return -1, otherwise it must exit 0.

free_address

This script is used to free an specific IP address (or addresses). The IP (or IPs) are no longer in use by OpenNebula VMs or reservations.

Arguments:

- AddressRange and Address. Same as in `allocate_address`.
- Request ID, used internally to identify this IPAM request.

Returns: This scripts MUST exit 0 if the address is free.

2.10.2 IPAM Usage

To use your new IPAM module you need to:

- Place the four previous scripts in `/var/lib/one/remotes/ipam/<ipam_mad>`.
- Activate the driver in `oned.conf` by adding the IPAM driver name (same as the one used to name the directory where the action scripts are stored) to the `-i` option of the `IPAM_MAD` attribute:

```

IPAM_MAD = [
  EXECUTABLE = "one_ipam",
  ARGUMENTS  = "-t 1 -i dummy, <ipam_mad>"
]

```

- You need to restart OpenNebula to load the new ipam module.
- Now, define Virtual Networks to use the IPAM. Add `IPAM_MAD` to the AR defintion, for example:

```

NAME = "IPAM Network"

BRIDGE = "br0"
VNM_MAD = "dummy"

AR = [
  SIZE      = 21,
  IPAM_MAD = <ipam_mad>
]

```

Any VM (or VNET reservation) from IPAM Network will contact the IPAM using your drivers.

REFERENCES

3.1 Overview

This Chapter contains advanced references to compile OpenNebula from the source code and how to extend the Sunstone functionality.

3.1.1 How Should I Read This Chapter

You should be reading this Chapter if you are trying to build OpenNebula from source code or trying to extend the Sunstone functionality.

This Chapter covers what are the OpenNebula *software dependencies*, how to *compile* OpenNebula and how to *extend Sunstone functionality*.

After this Chapter, if you are interested in extending the OpenNebula functionality, you need to read the *Infrastructure Integration Chapter* to understand how OpenNebula relates with the different datacenter components.

3.1.2 Hypervisor Compatibility

All the Sections of this Chapter applies to both KVM and vCenter hypervisors.

3.2 Building from Source Code

This page will show you how to compile and install OpenNebula from the sources.

If you want to install it from your package manager, visit the [software menu](#) to find out if OpenNebula is included in your official distribution package repositories.

| |
|--|
| <p>Warning: Do not forget to check the <i>Building Dependencies</i> for a list of specific software requirements to build OpenNebula.</p> |
|--|

3.2.1 Compiling the Software

Follow these simple steps to install the OpenNebula software:

- Download and untar the OpenNebula tarball.
- Change to the created folder and run `scons` to compile OpenNebula

```
$ sconsl [OPTION=VALUE]
```

the argument expression [OPTION=VALUE] is used to set non-default values for :

| OPTION | VALUE |
|------------|---|
| sqlite_db | path-to-sqlite-install |
| sqlite | no if you don't want to build sqlite support |
| mysql | yes if you want to build mysql support |
| xmlrpc | path-to-xmlrpc-install |
| parsers | yes if you want to rebuild flex/bison files |
| new_xmlrpc | yes if you have an xmlrpc-c version >= 1.31 |
| sunstone | yes if you want to build sunstone minified files |

If the following error appears, then you need to remove the option 'new_xmlrpc=yes' or install xmlrpc-c version >= 1.31:

```
error: 'class xmlrpc_c::serverAbyss::constrOpt' has no member named 'maxConn'
```

- OpenNebula can be installed in two modes: `system-wide`, or in `self-contained` directory. In either case, you do not need to run OpenNebula as root. These options can be specified when running the install script:

```
./install.sh <install_options>
```

Note: To install OpenNebula with the `system-wide` mode you should have super user privileges.

```
$ sudo ./install.sh <install_options>
```

where `<install_options>` can be one or more of:

| OP-TION | VALUE |
|-----------|--|
| -u | user that will run OpenNebula, defaults to user executing install.sh |
| -g | group of the user that will run OpenNebula, defaults to user executing install.sh |
| -k | keep configuration files of existing OpenNebula installation, useful when upgrading. This flag should not be set when installing OpenNebula for the first time |
| -d | target installation directory. If defined, it will specified the path for the self-contained install. If not defined, the installation will be performed system wide |
| -c | only install client utilities: OpenNebula cli and ec2 client files |
| -s | install OpenNebula Sunstone |
| -p | do not install OpenNebula Sunstone non-minified files |
| -G | install OpenNebula Gate |
| -f | install OpenNebula Flow |
| -r | remove Opennebula, only useful if -d was not specified, otherwise <code>rm -rf \$ONE_LOCATION</code> would do the job |
| -l | creates symlinks instead of copying files, useful for development |
| -h | prints installer help |

Note:

If you choose the `system-wide` installation, OpenNebula will be installed in the following folders:

- /etc/one
- /usr/lib/one
- /usr/share/docs/one
- /usr/share/one
- /var/lib/one
- /var/lock/one
- /var/log/one
- /var/run/one

By using `./install.sh -r`, dynamically generated files will not be removed.

The packages do a system-wide installation. To create a similar environment, create a `oneadmin` user and group, and execute:

```
oneadmin@frontend:~/ $> wget <opennebula tar gz>
oneadmin@frontend:~/ $> tar xzf <opennebula tar gz>
oneadmin@frontend:~/ $> cd opennebula-x.y.z
oneadmin@frontend:~/opennebula-x.y.z/ $> scons -j2 mysql=yes syslog=yes
[ lots of compiling information ]
scons: done building targets.
oneadmin@frontend:~/opennebula-x.y.z $> sudo ./install.sh -u oneadmin -g oneadmin
```

3.2.2 Ruby Dependencies

Ruby version needs to be:

- **ruby** `>= 1.8.7`

Some OpenNebula components need ruby libraries. Some of these libraries are interfaces to binary libraries and the development packages should be installed in your machine. This is the list of the ruby libraries that need a development package:

- **sqlite3**: sqlite3 development library
- **mysql**: mysql client development library
- **curl**: curl development library
- **nokogiri**: expat development librerie
- **xmlparse**: libxml2 and libxslt development libraries

You will also need ruby development package to be able to compile these gems.

We provide a script to ease the installation of these gems. it is located in `/usr/share/one/install_gems` (system-wide mode). It can be called with the components you want the gem dependencies to be installed. Here are the options:

- **optional**: libraries that make CLI and OCA faster
- **quota**: quota system
- **sunstone**: sunstone graphical interface
- **cloud**: ec2 and occi interfaces
- **ozones_client**: CLI of ozones

- **ozones_server**: server part of ozones, both mysql and sqlite support
- **ozones_server_sqlite**: ozones server, only sqlite support
- **ozones_server_mysql**: ozones server, only mysql support
- **acct**: accounting collector, both mysql and sqlite support
- **acct_sqlite**: accounting collector, only sqlite support
- **acct_mysql**: accounting collector, only mysql support

The tool can be also called without parameters and all the packages will be installed.

For example, to install only requirements for sunstone and ec2 interfaces you'll issue:

```
oneadmin@frontend: $> ./install_gems sunstone cloud
```

3.2.3 Building Sunstone from Source

Please check the *Sunstone Development guide* for detailed information

3.2.4 Configure sudo for oneadmin

oneadmin user, both on frontend and nodes, needs to run several commands under a privileged user via sudo. When installing the OpenNebula from official packages, the necessary configuration is part of the `opennebula-common` package. When installing from the source, you have to ensure the proper sudo configuration enables following commands to the oneadmin.

| Section | Commands |
|---------------|---|
| miscellaneous | mkfs, sync, mkswap |
| networking | brctl, ebtables, iptables, ip6tables, ip, ipset, arping |
| LVM | lvcreate, lvremove, lvs, vgdisplay, lvchange, lvscan |
| iSCSI | iscsiadm, tgt-admin, tgtadm |
| Open vSwitch | ovs-ofctl, ovs-vsctl |
| Xen | xentop, xl, xm |
| Ceph | rbd |

Each command has to be specified with the absolute path, which can be different for each platform. Commands are started on background, sudo needs to be configured **not to require real tty** and any password for them.

Example configuration

You can put following sudo configuration template into `/etc/sudoers.d/opennebula` and replace example commands `/bin/true` and `/bin/false` with comma separated list of commands listed above, with the absolute path specific for your platform.

```
Defaults:oneadmin !requiretty
Defaults:oneadmin secure_path = /sbin:/bin:/usr/sbin:/usr/bin

oneadmin ALL=(ALL) NOPASSWD: /bin/true, /bin/false
```

3.3 Build Dependencies

This page lists the **build** dependencies for OpenNebula.

If you want to install it from your package manager, visit the [software menu](#) to find out if OpenNebula is included in your official distribution package repositories.

- **g++** compiler (≥ 4.0)
- **xmlrpc-c** development libraries (≥ 1.06)
- **scons** build tool (≥ 0.98)
- **sqlite3** development libraries (if compiling with sqlite support) (≥ 3.6)
- **mysql** client development libraries (if compiling with mysql support) (≥ 5.1)
- **libxml2** development libraries (≥ 2.7)
- **openssl** development libraries ($\geq 0.9.8$)
- **ruby** interpreter ($\geq 1.8.7$)

3.3.1 Ubuntu 14.04 & 16.04

- **bash-completion**
- **bison**
- **debhelper** ($\geq 7.0.50\sim$)
- **default-jdk**
- **flex**
- **javahelper** (≥ 0.32)
- **libmysql++-dev**
- **libsqlite3-dev**
- **libssl-dev**
- **libws-commons-util-java**
- **libxml2-dev**
- **libxmlrpc3-client-java**
- **libxmlrpc3-common-java**
- **libxslt1-dev**
- **libcurl4-openssl-dev**
- **ruby**
- **scons**
- **libxmlrpc-c++8-dev**

3.3.2 Debian 8

- **bison**
- **default-jdk**
- **flex**
- **javahelper**
- **libmysql++-dev**
- **libsqlite3-dev**
- **libssl-dev**
- **libws-commons-util-java**
- **libxml2-dev**
- **libxmlrpc-c++8-dev**
- **libxmlrpc3-client-java**
- **libxmlrpc3-common-java**
- **libxslt1-dev**
- **ruby**
- **scons**

3.3.3 CentOS 7

- **gcc-c++**
- **java-1.7.0-openjdk-devel**
- **libcurl-devel**
- **libxml2-devel**
- **mysql-devel**
- **openssh**
- **openssl-devel**
- **pkgconfig**
- **ruby**
- **scons**
- **sqlite-devel**
- **sqlite-devel**
- **xmlrpc-c**
- **xmlrpc-c-devel**

3.3.4 CentOS 6

- `gcc-c++`
- `libcurl-devel`
- `libxml2-devel`
- `xmlrpc-c-devel`
- `openssl-devel`
- `mysql-devel`
- `openssh`
- `pkgconfig`
- `ruby`
- `scons`
- `sqlite-devel`
- `xmlrpc-c`
- `java-1.7.0-openjdk-devel`

3.3.5 Arch

They are listed in this [PKGBUILD](#).

3.4 Sunstone Development

In OpenNebula 5.0 the graphical interface code, Sunstone, was redesigned and modularized to improve the code readability and ease the task of adding new components. Now, each component (tab, panel, form...) is defined in a separate module using [requirejs](#) and HTML code is now defined in separate files using [Handlebars](#) templates. External libraries are handled using [Bower](#), a Javascript package manager. [Zurb Foundation](#) is used for the styles and layout of the web and additional CSS styles are added using [SASS](#). [Grunt](#) is used as a tasker to automate the different processes to generate the optimized files.

3.4.1 RequireJS

[requirejs](#) allows you to define blocks of functionality in different modules/files and then load and reuse them in other modules.

This is an example of the images-tab files layout:

```
images-tab.js
images-tab/
  actions.js
  buttons.js
  datatable.js
  dialogs/
  ...
  panels/
  ...
```

And how the different modules are used in the images-tab file:

```
/* images-tab.js content */

define(function(require) {
  var Buttons = require('./images-tab/buttons');
  var Actions = require('./images-tab/actions');
  var Table = require('./images-tab/datatable');

  var _dialogs = [
    require('./images-tab/dialogs/clone')
  ];

  var _panels = [
    require('./images-tab/panels/info'),
    require('./images-tab/panels/vms'),
    require('./images-tab/panels/snapshots')
  ];
});
```

The optimization tool provided by `requirejs` is used to group multiple files into a single minified file (`dist/main.js`). The options for the optimization are defined in the `Gruntfile.js` file using the `r.js` plugin for `Grunt`.

3.4.2 Handlebars

`Handlebars` provides the power necessary to let you build semantic templates and is largely compatible with `Mustache` templates.

```
<div id="comments">
  {{#each comments}}
  <h2><a href="/posts/{{../permalink}}#{{id}}">{{title}}</a></h2>
  <div>{{body}}</div>
  {{/each}}
</div>
```

The integration between `Handlebars` and `requirejs` is done using the `Handlebars` plugin for `requirejs`, that allows you to use the templates just adding a prefix to the `require` call

```
var TemplateHTML = require('hbs!./auth-driver/html');
return TemplateHTML({
  'dialogId': this.dialogId,
  'userCreationHTML': this.userCreation.html()
});
```

Additional helpers can be defined just creating a new file inside the `app/templates/helpers` folder. These helpers will be available for any template of the app.

```
{{#isTabActionEnabled "vms-tab" "VM.attachdisk"}}
<span class="right">
  <button id="attach_disk" class="button tiny success right radius">
    {{tr "Attach disk"}}
  </button>
</span>
{{/isTabActionEnabled}}
```

3.4.3 SASS & Foundation

The [Zurb Foundation](#) framework is used for the layout of the app. It provides a powerful grid system and different nifty widgets such as tabs, sliders, dialogs...

The Zurb Foundation configuration parameters are defined in the `app/scss/settings.scss` file and new styles for the app can be added in the `app/scss/app.scss` file. After modifying these files, the `app.css` and `app.min.css` files must be generated as explained in the following section.

3.4.4 Modifying JS & CSS files

Sunstone can be run in two different environments:

- Production, using the minified css `css/app.min.css` and javascript `dist/main.js` files.
- Development, using the non minified css `css/app.css` and javascript files `app/main.js`. Note that each file/module will be retrieved in a different HTTP request and the app will take longer to start, therefore it is not recommended for production environments

By default Sunstone is configured to use the minified files, therefore any change in the source code will not apply until the minified files are generated again. But you can set the `env` parameter in `sunstone-server.conf` to `dev` to use the non minified files and test your changes.

After testing the changes, the minified files can be generated by running the `grunt requirejs` task or the `scons sunstone=yes` command as explained in the following section. It is recommended to change again the `env` parameter in `sunstone-server.conf` to `prod` and test again the changes.

```
sunstone/
  public/
    app/                # JS sources
    bower_components/  # External libraries
    css/                # CSS optimized files
    dist/               # JS optimized files
    node_modules/      # Development dependencies
    scss/               # CSS sources
    bower.json          # List of external libraries
    Gruntfile.js        # Tasks to optimize files
    package.json        # List of dev dependencies
    routes/             # Custom routes for Sunstone Server
```

Sunstone Development Dependencies

1. Install nodejs and npm
2. Install the following npm packages:

```
sudo npm install -g bower
sudo npm install -g grunt
sudo npm install -g grunt-cli
```

3. Move to the Sunstone public folder and run:

```
npm install      # Dependencies defined in package.json
bower install    # Dependenciees define in bower.json
```

Warning: In order to run npm and bower commands git is required

Building minified JS and CSS files

Scons includes an option to build the minified JS and CSS files. Sunstone development dependencies must be installed before running this command.

```
scons sunstone=yes
```

Or you can do this process manually by running the following commands:

Run the following command to generate the app.css file in the css folder, including any modification done to the app/scss/app.scss and app/scss/settings.scss files:

```
grunt sass
```

Run the following command to generate the minified files in the dist folder, including any modification done to the js files and the app.min.css in the css folder, based on the app.css file generated in the previous step:

```
grunt requirejs
```

These are the files generated by the grunt requirejs command:

```
css
  app.min.css
dist
  login.js, login.js.map main.js main.js.map
console
  spice.js spice.js.map vnc.js vnc.js.map
```

Warning: If the following error appears when running scons sunstone=yes or any of the grunt commands, you may have skip one step, so move to the Sunstone public folder and run 'bower install'

```
Running "sass:dist" (sass) task
>> Error: File to import not found or unreadable: util/util
...
>>           on line 43 of scss/_settings.scss
>> >> @import 'util/util';
>>     ^
Warning: Use --force to continue.
```

Install.sh

By default the install.sh script will install all the files, including the non-minified ones. Providing the -p option, only the minified files will be installed.

3.4.5 Adding Custom Tabs

New tabs can be included following these steps:

- Add your code inside the app folder. The tab must be provided as a module.

- Include the new tab as a dependency in the `app/main.js` file for the app module.

```
shim: {
  'app': {
    deps: [
      'tabs/provision-tab',
      'tabs/dashboard-tab',
      'tabs/system-tab',
      ...
      'tabs/mycustom-tab'
    ]
  }
},
```

- Include the tab configuration inside the different Sunstone views `/etc/one/sunstone-views/(admin|user|...).yaml`

```
enabled_tabs:
- dashboard-tab
- system-tab
...
- mycustom-tab
tabs:
  mycustom-apps-tab:
    panel_tabs:
      mycustom_info_tab: true
    table_columns:
      - 0      # Checkbox
      - 1      # ID
      - 2      # Name
    actions:
      MyCustom.create: true
      MyCustom.refresh: true
```

- Generate the minified files including the new tab by running the `grunt requirejs` command.

You can see an example of external tabs and custom routes for AppMarket in its own [Github repository](#)

3.4.6 Custom Routes for Sunstone Server

OpenNebula Sunstone server plugins consist of a set files defining custom routes. Custom routes will have priority over default routes and allow administrators to integrate their own custom controllers in the Sunstone Server.

Configuring Sunstone Server Plugins

It is very easy to enable custom plugins:

1. Place your custom routes in the `/usr/lib/one/sunstone/routes` folder.
2. Modify `/etc/one/sunstone-server.conf` to indicate which files should be loaded, as shown in the following example:

```
# This will load 'custom.rb' and 'other.rb' plugin files.
:routes:
- custom
- other
```

Creating Sunstone Server Plugins

Sunstone server is a Sinatra application. A server plugin is simply a file containing one or several custom routes, as defined in Sinatra applications.

The following example defines 4 custom routes:

```
get '/myplugin/myresource/:id' do
  resource_id = params[:id]
  # code...
end

post '/myplugin/myresource' do
  # code
end

put '/myplugin/myresource/:id' do
  # code
end

del '/myplugin/myresource/:id' do
  # code
end
```

Custom routes take preference over Sunstone server routes. In order to ease debugging and ensure that plugins are not interfering with each other, we recommend however to place the routes in a custom namespace (`myplugin` in the example).

From the plugin code routes, there is access to all the variables, helpers, etc. which are defined in the main Sunstone application code. For example:

```
opennebula_client = $cloud_auth.client(session[:user])
sunstone_config = $conf
logger.info("New route")
vm3_log = @SunstoneServer.get_vm_log(3)
```