# OpenNebula.org

# OpenNebula 4.6 Quickstart CentOS 6 and ESX 5.x

Release 4.6

**OpenNebula Project** 

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This guide aids in the process of quickly get a VMware-based OpenNebula cloud up and running on CentOS 6. After following this guide, users will have a working OpenNebula with graphical interface (Sunstone), at least one hypervisor (host) and a running virtual machines. This is useful at the time of setting up pilot clouds, to quickly test new features and as base deployment to build a large infrastructure.

Throughout the installation there are two separate roles: Frontend and Virtualization Nodes. The Frontend server will execute the OpenNebula services, and the Nodes will be used to execute virtual machines.

# ONE

# PACKAGE LAYOUT

- opennebula-server: OpenNebula Daemons
- opennebula: OpenNebula CLI commands
- opennebula-sunstone: OpenNebula's web GUI
- opennebula-java: OpenNebula Java API
- opennebula-node-kvm: Installs dependencies required by OpenNebula in the nodes
- opennebula-gate: Send information from Virtual Machines to OpenNebula
- opennebula-flow: Manage OpenNebula Services
- opennebula-context: Package for OpenNebula Guests

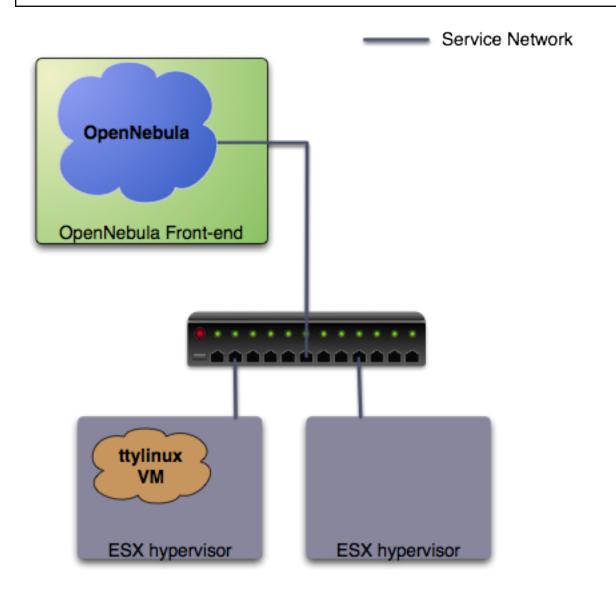
Additionally opennebula-common and opennebula-ruby exist but they're intended to be used as dependencies. opennebula-occi, which is RESTful service to manage the cloud, is included in the opennebula-sunstone package.

TWO

# **STEP 1. INFRASTRUCTURE SET-UP**

The infrastructure needs to be set up in a similar fashion as the one depicted in the figure.

**Warning:** A ESX version 5.0 was used to create this guide. This guide may be useful for other versions of ESX, although the configuration (and therefore your mileage) may vary.



In this guide it is assumed that at least two physical servers are available, one to host the OpenNebula front-end and one to be used as a ESX virtualization node (this is the one you need to configure in the following section). The figure depicts one more ESX host, to show that the pilot cloud is ready to grow just by adding more virtualization nodes.

#### **Front-End**

- Operating System: Centos 6.4
- Required extra repository: EPEL
- Required packages: NFS, libvirt

Let's install the repository (as root) and required packages

# yum install http://dl.fedoraproject.org/pub/epel/6/i386/epel-release-6-8.noarch.rpm # cat << EOT > /etc/yum.repos.d/opennebula.repo [opennebula] name=opennebula baseurl=http://downloads.opennebula.org/repo/CentOS/6/stable/x86\_64 enabled=1 gpgcheck=0 EOT

# yum install nfs-utils nfs-utils-lib libvirt

#### Virtualization node

• Operating System: ESX 5.0

**Warning:** The ESX hosts needs to be configured. To achieve this, you will need access to a Windows machine with the Virtual Infrastructure Client (vSphere client) install. The VI client can be downloaded from the ESX node, by pointing a browser to its IP.

**Warning:** The ESX hosts need to be properly licensed, with write access to the exported API (as the Evaluation license does). More information on valid licenses here.

THREE

# **STEP 2. OPENNEBULA FRONT-END SET-UP**

#### 2.1 OpenNebula installation

With the repository added, installing OpenNebula is straightforward (as root):

# yum install opennebula-server opennebula-sunstone

**Warning:** Do not start OpenNebula at this point, some pre configuration needs to be done. Starting OpenNebula is not due until *here*.

Find out the uid and gid of oneadmin, we will need it for the next section:

```
$ id oneadmin
uid=499(oneadmin) gid=498(oneadmin)
```

In order to avoid problems, we recommend to disable SELinux for the pilot cloud front-end (sometimes it is the root of all evil):

```
# vi /etc/sysconfig/selinux
...
SELINUX=disabled
...
# setenforce 0
# getenforce
Permissive
```

#### 2.2 NFS configuration

The front-end needs to export via NFS two datastores (the system and the images datastore). This is required just so the ESX has access to two different datastores, and this guides uses NFS exported from the front-end to achieve this. This can be seamlessly replaced with two iSCSI backed datastores or even two local hard disks. In any case, we will use the 'vmfs' drivers to manage both datastores, independently of the storage backend. See the *VMFS Datastore Guide* for more details.

Let's configure the NFS server. You will need to allow incoming connections, here we will simply stop iptables (as root):

```
$ sudo su - oneadmin
$ sudo vi /etc/exports
/var/lib/one/datastores/0 *(rw,sync,no_subtree_check,root_squash,anonuid=499,anongid=498)
/var/lib/one/datastores/1 *(rw,sync,no_subtree_check,root_squash,anonuid=499,anongid=498)
$ sudo service iptables stop
$ sudo service nfs start
```

\$ sudo exportfs -a

Warning: Make sure anonuid and anongid are set to the oneadmin uid and gid.

#### 2.3 Networking

There must be connection between the front-end and the ESX node. This can be tested with the ping command:

\$ ping <esx-ip>

FOUR

# **STEP 3. VMWARE VIRTUALIZATION NODE SET-UP**

This is probably the step that involves more work to get the pilot cloud up and running, but it is crucial to ensure its correct functioning. The ESX that is going to be used as worker node needs the following steps:

#### 3.1 Creation of a oneadmin user

With the VI client connected to the ESX host, go to the "local Users & Groups" and add a new user like shown in the figure (**the UID is important, it needs to match the one of the front-end.**). Make sure that you are selecting the "Grant shell to this user" checkbox, and write down the password you enter.

🖉 Edit User -	oneadmin	×
User Information	on	1
Login:	oneadmin UID; 501	
User Name:	oneadmin	
	User name and UID are optional	
🔽 🗖 Change p	assword	
Password:		
Confirm:		
Shell Access	ell access to this user	
Group member	ship	
Group:	Select Group 🔹 Add	
daemon nfsnobody root users		
	Remove	;
	ОК С	ancel

Afterwards, go to the "Permissions" tab and assign the "Administrator" Role to one admin (right click  $\rightarrow$  Add Permission...).

🛃 Assign Permissi	ions		
To assign a permiss one or more of the Users and Groups These users and gr object according to	names and assign a	arole.	Assigned Role Selected users and groups can interact with the current object according to the chosen role and privileges.
Name	Role	Propagate	Read-only
2 oneadmin	Read-only	Yes	No access Read-only Administrator  Administrator  Datacenter  Datastore  Datastore  Datastore cluster  dvPort group  ESX Agent Manager  EXtension  Folder  Description: Select a privilege to view its description
	Add	Remove	✓ Propagate to Child Objects
Help			OK Cancel

#### 3.2 Grant ssh access

Again in the VI client go to Configuration  $\rightarrow$  Security Profile  $\rightarrow$  Services Properties (Upper right). Click on the SSH label, select the "Options" button, and then "Start". You can set it to start and stop with the host, as seen on the picture.

Services Proper	(165					
Remote Access By default, remote c accessing services of Jnless configured ot	n remote hosts.			, and local clients	are prevented	from
Label		Daemon				
I/O Redirector (Acti	ve Directory Se	Stopped				
Network Login Serv		Stopped				
lbtd		Running				
vpxa		Stopped				
ESXi Shell		Running				
Local Security Auth	entication Serv	Stopped				
NTP Daemon		Stopped				
SSH		Running				
	tatus		k			
Service Pro						
General -5	tartup Policy ——					
Comiese	Start automatica	Illy if any ports are	open, and stop wh	en all ports are c	losed	
Service:	Start and stop w	ith host				
Package :	Start and stop m	anually				
s	start	Stop	Restart			
			ок	Cancel	Help	
				Cancer	ricip	

Then the following needs to be done:

• Connect via ssh to the OpenNebula front-end as the oneadmin user. Copy the output of the following command to the clipboard:

\$ ssh-keygen Enter an empty passphrase

\$ cat .ssh/id\_rsa.pub

• Connect via ssh to the ESX worker node (as oneadmin). Run the following from the front-end:

```
$ ssh <esx-ip>
Enter the password you set in the step 3.1
$ su
# mkdir /etc/ssh/keys-oneadmin
# chmod 755 /etc/ssh/keys-oneadmin
# vi /etc/ssh/keys-oneadmin/authorized_keys
paste here the contents of oneadmin's id_rsa.pub and exit vi
# chown oneadmin /etc/ssh/keys-oneadmin/authorized_keys
# chmod 600 /etc/ssh/keys-oneadmin/authorized_keys
# chmod +s /sbin/vmkfstools /bin/vim-cmd # This is needed to create volatile disks
```

#### • Now oneadmin should be able to ssh without been prompted for a password

```
$ ssh <esx-ip>
```

#### 3.3 Mount datastores

We need now to mount the two datastores exported by default by the OpenNebula front-end. First, you need to make sure that the firewall will allow the NFS Client to connect to the front-end. Go to Configuration  $\rightarrow$  Software  $\rightarrow$  Security Profile, and enable the row NFS Client:

#### 🖉 Firewall Properties

#### **Remote Access**

	Label		Incoming Ports	Outgoing Ports	Protocols	Daemon	^
	DVSSync	ļ	8301,8302	8302,8301	UDP	N/A	
	CIM Server	!	5988		TCP	Stopped	
	Software iSCSI Client			3260	TCP	N/A	
	NFS Client			0-65535	TCP	N/A	
]	DHCPv6	!	546	547	TCP,UDP	N/A	
]	vSphere Client		902,443		TCP	N/A	
	vCenter Update Manager			80,9000-9100	TCP	N/A	_
	netDump			6500	UDP	N/A	
	SNMP Server		161		UDP	N/A	
	Active Directory All			88,123,137,139,389,	UDP,TCP	N/A	~
	neral						
Se	rvice: ickage Information:	NFS Client					
Se Pa ire		NFS Client 192.168.1.46	5				

Again in the VI client, go to Configuration  $\rightarrow$  Storage  $\rightarrow$  Add Storage (Upper right). We need to add two datastores (0 and 1). The picture shows the details for the datastore 100, to add datastore 0 and 1 simply change the reference from 100 to 0 and then 1 in the Folder and Datastore Name textboxes.

Please note that the IP of the server displayed may not correspond with your value, which has to be the IP your front-end uses to connect to the ESX.

🛃 Add Storage		×
Locate Network File System Which shared folder will be u	d as a vSphere datastore?	
NAS Network File System Ready to Complete	Properties         Server:       192.168.2.122         Examples: nas, nas.it.com, 192.168.0.1 or         FE80:0:0:0:2AA:FF:FE9A:4CA2         Folder:       //var/lib/one/datastores/100         Example: /vols/vol0/datastore-001         Mount NFS read only         If a datastore already exists in the datacenter for this NFS share and you intend to configure the same datastore on new hosts, make sure that you enter the same input data (Server and Folder) that you used for the original datastore. Different input data would mean different datastores even if the underlying NFS storage is the same.         Datastore Name       100	
Help	< Back Next > Cancel	

#### The paths to be used as input:

```
/var/lib/one/datastores/0
```

```
/var/lib/one/datastores/1
```

More info on *datastores* and different possible configurations.

#### 3.4 Configure VNC

Open an ssh connection to the ESX as root, and:

```
# cd /etc/vmware
# chown -R root firewall/
# chmod 7777 firewall/
# cd firewall/
# chmod 7777 service.xml
```

Add the following to /etc/vmware/firewall/service.xml

```
# vi /etc/vmware/firewall/service.xml
```

Warning: The service id must be the last service id+1. It will depend on your firewall configuration

```
<!--- VNC -->
 <service id="0033">
  <id>VNC</id>
   <rule id='0000'>
       <direction>outbound</direction>
       <protocol>tcp</protocol>
       <porttype>dst</porttype>
       <port>
          <begin>5800</begin>
          <end>5999</end>
       </port>
    </rule>
    <rule id='0001'>
       <direction>inbound</direction>
       <protocol>tcp</protocol>
       <porttype>dst</porttype>
       <port>
          <begin>5800</begin>
          <end>5999</end>
       </port>
    </rule>
    <enabled>true</enabled>
    <required>false</required>
 </service>
```

#### Refresh the firewall

```
# /sbin/esxcli network firewall refresh
# /sbin/esxcli network firewall ruleset list
```

# **STEP 4. OPENNEBULA CONFIGURATION**

Let's configure OpenNebula in the front-end to allow it to use the ESX hypervisor. The following must be run under the "oneadmin" account.

#### 4.1 Configure oned and Sunstone

Edit /etc/one/oned.conf with "sudo" and uncomment the following:

```
# DataStore Configuration
# DATASTORE_LOCATION: *Default* Path for Datastores in the hosts. It IS the
 same for all the hosts in the cluster. DATASTORE_LOCATION IS ONLY FOR THE
#
#
 HOSTS AND *NOT* THE FRONT-END. It defaults to /var/lib/one/datastores (or
#
 $ONE LOCATION/var/datastores in self-contained mode)
#
# DATASTORE_BASE_PATH: This is the base path for the SOURCE attribute of
#
 the images registered in a Datastore. This is a default value, that can be
 changed when the datastore is created.
DATASTORE_LOCATION = /vmfs/volumes
DATASTORE_BASE_PATH = /vmfs/volumes
   _____
# VMware Information Driver Manager Configuration
#_____
                                _____
IM_MAD = [
   name = "vmware",
   executable = "one_im_sh",
   arguments = "-c -t 15 -r 0 \text{ vmware"}
#_____
# VMware Virtualization Driver Manager Configuration
#_____
                                  _____
VM_MAD = [
  name
       = "vmware",
  executable = "one_vmm_sh",
  arguments = "-t 15 -r 0 vmware -s sh",
         = "vmm_exec/vmm_exec_vmware.conf",
  default
         = "vmware" ]
  type
```

Edit /etc/one/sunstone-server.conf with "sudo" and allow incoming connections from any IP:

sudo vi /etc/one/sunstone-server.conf

```
# Server Configuration
#
:host: 0.0.0.0
:port: 9869
```

#### 4.2 Add the ESX credentials

```
$ sudo vi /etc/one/vmwarerc
<Add the ESX oneadmin password, set in section 3.1>
# Username and password of the VMware hypervisor
:username: "oneadmin"
:password: "password"
```

Warning: Do not edit : libvirt\_uri:, the HOST placeholder is needed by the drivers

#### 4.3 Start OpenNebula

Start OpenNebula and Sunstone as oneadmin

```
$ one start
$ sunstone-server start
```

If no error message is shown, then everything went smooth!

#### 4.4 Configure physical resources

Let's configure both system and image datastores:

```
$ onedatastore update 0
SHARED="YES"
TM_MAD="vmfs"
TYPE="SYSTEM_DS"
BASE_PATH="/vmfs/volumes"
```

```
$ onedatastore update 1
TM_MAD="vmfs"
DS_MAD="vmfs"
BASE_PATH="/vmfs/volumes"
CLONE_TARGET="SYSTEM"
DISK_TYPE="FILE"
LN_TARGET="NONE"
TYPE="IMAGE_DS"
BRIDGE_LIST="esx-ip"
```

 $\$  onedatastore chmod 1 644

#### And the ESX Host:

\$ onehost create <esx-ip> -i vmware -v vmware -n dummy

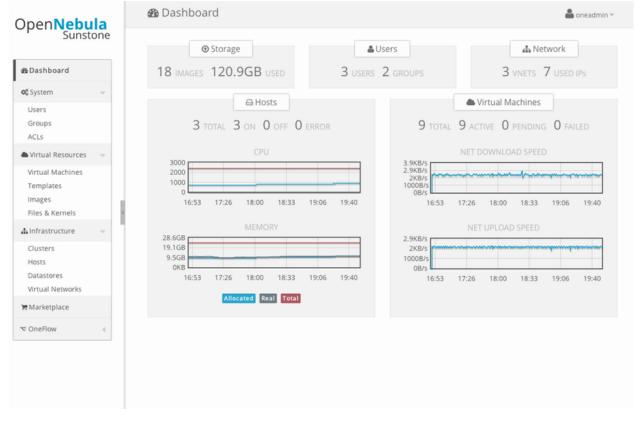
#### 4.5 Create a regular cloud user

\$ oneuser create oneuser <mypassword>

# **STEP 5. USING THE CLOUD THROUGH SUNSTONE**

Ok, so now that everything is in place, let's start using your brand new OpenNebula cloud! Use your browser to access Sunstone. The URL would be http://@IP-of-the-front-end@:9869

Once you introduce the credentials for the "oneuser" user (with the chosen password in the previous section) you will get to see the Sunstone dashboard. You can also log in as "oneadmin", you will notice the access to more functionality (basically, the administration and physical infrastructure management tasks)



It is time to launch our first VM. Let's use one of the pre created appliances found in the marketplace.

Log in as "oneuser", go to the Marketplace tab in Sunstone (in the left menu), and select the "ttylinux-VMware" row. Click on the "Import to local infrastructure" button in the upper right, and set the new image a name (use "ttylinux - VMware") and place it in the "VMwareImages" datastore. If you go to the Virtual Resources/Image tab, you will see that the new Image will eventually change its status from LOCKED to READY.

Now we need to create a template that uses this image. Go to the Virtual Resources/Templates tab, click on "+Create" and follow the wizard, or use the "Advanced mode" tab of the wizard to paste the following:

```
NAME = "ttylinux"
CPU = "1"
MEMORY = "512"
DISK = [
    IMAGE = "ttylinux - VMware",
    IMAGE_UNAME = "oneuser"
]
GRAPHICS = [
    TYPE = "vnc",
    LISTEN = "0.0.0.0"
]
```

Select the newly created template and click on the Instantiate button. You can now proceed to the "Virtual Machines" tab. Once the VM is in state RUNNING you can click on the VNC icon and you should see the ttylinux login (root/password).

penNebula Sunstone			oneadmin *
Sunstone	VNC Connected (encrypted) to: one-41 (Send CtriAktDel)	Search	
Dashboard	setting up static device nodes [ OK ] starting udevd	IPs	VNC
	/dev/hda1: clean, 2402/26208 files, 59510/104800 blocks root file system checked		
🕻 System 🤝	file systems checked[ OK ] waiting for previous ucvents[ OK ]	10.0.1.55	-
Users	setting up system clock [utc] Thu Nov 28 16:23:13 UTC 2013 [ OK ] updating module dependencies [ OK ]	10.0.1.53	
Groups	initializing random number generator [ OK ]	10.0.1.162	
ACLS	startup klogd [ OK ]	10.0.1.161	
Virtual Resources 🚽	startup syslogd[ OK ] bringing up loopback interface lo[ OK ]	10.0.1.52	
Virtual Machines	nount: nounting /dev/hda on /nnt/cdron failed: Device or resource busy startup dropbear	10.0.1.51	
Templates	startup inetd	10.0.1.160	-
Images	startup gpm	~ ~	1 > >
Files & Kernels		_	_
	ttylinux ver 14.0 [hauberk] i686 class Linux kernel 2.6.38.1 (/dev/tty1)		
infrastructure 👻	The initial "root" and "user" password is "password". ttylinux host login:		
Clusters	ssgranux_noss avgran	Manage	Admin
Hosts		ø	
Datastores		0	
Virtual Networks		•	
Marketplace			C.
		-	C C
OneFlow 4			
			Add

Please note that the minimal ttylinux VM does not come with the VMware Tools, and cannot be gracefully shutdown. Use the "Cancel" action instead.

And that's it! You have now a fully functional pilot cloud. You can now create your own virtual machines, or import other appliances from the marketplace, like Centos 6.2.

Enjoy!

# SEVEN

# **STEP 6. NEXT STEPS**

- Follow the *VMware Virtualization Driver Guide* for the complete installation and tuning reference, and how to enable the disk attach/detach functionality, and vMotion live migration.
- OpenNebula can use VMware native networks to provide network isolation through VLAN tagging.

Warning: Did we miss something? Please let us know!