

Installing JBoss EAP 6.2 in domain mode over an OpenNebula 4.4.0 Cluster

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1 Introduction

The aim of this tutorial is to teach you how to properly install a JBoss EAP cluster over several VMs handled by OpenNebula.

Every part of this software needs to be very well configured in order to work properly. Thus we wanted to write down every single step we faced.

1.1 Status of this document

This document has been written by many authors while working on the configuration. Therefore it can result messy and grammatically incorrect. We will try to review this document as best we can. By the way the future readers/authors of this document that want to help us are more than welcome. The \LaTeX source code of this document is stored at <https://www.writelatex.com/702523kffcns>.

1.2 OpenNebula

OpenNebula orchestrates storage, network, virtualization, monitoring, and security technologies to deploy multi-tier services (e.g. compute clusters) as virtual machines on distributed infrastructures, combining both data center resources and remote cloud resources, according to allocation policies. The toolkit includes features for integration, management, scalability, security and accounting. It also claims standardization, interoperability and portability, providing cloud users and administrators with a choice of several cloud interfaces (Amazon EC2 Query, OGF Open Cloud Computing Interface and vCloud) and hypervisors (Xen, KVM and VMware), and can accommodate multiple hardware and software combinations in a data center.[1]

1.3 JBoss

WildFly, formerly known as JBoss AS, or simply JBoss, is an application server authored by JBoss, now developed by Red Hat. WildFly is written in Java and is executable on top of the Java Platform, Enterprise Edition (Java EE), which is available cross-platform. WildFly is free and open-source software, subject to the requirements of the GNU Lesser General Public License (LGPL), version 2.1. The renaming to WildFly was done to reduce confusion. The renaming only affects the JBoss Application Server project. The JBoss Community or the Red Hat JBoss product line (with JBoss Enterprise Application Platform) all retain their names.[2]

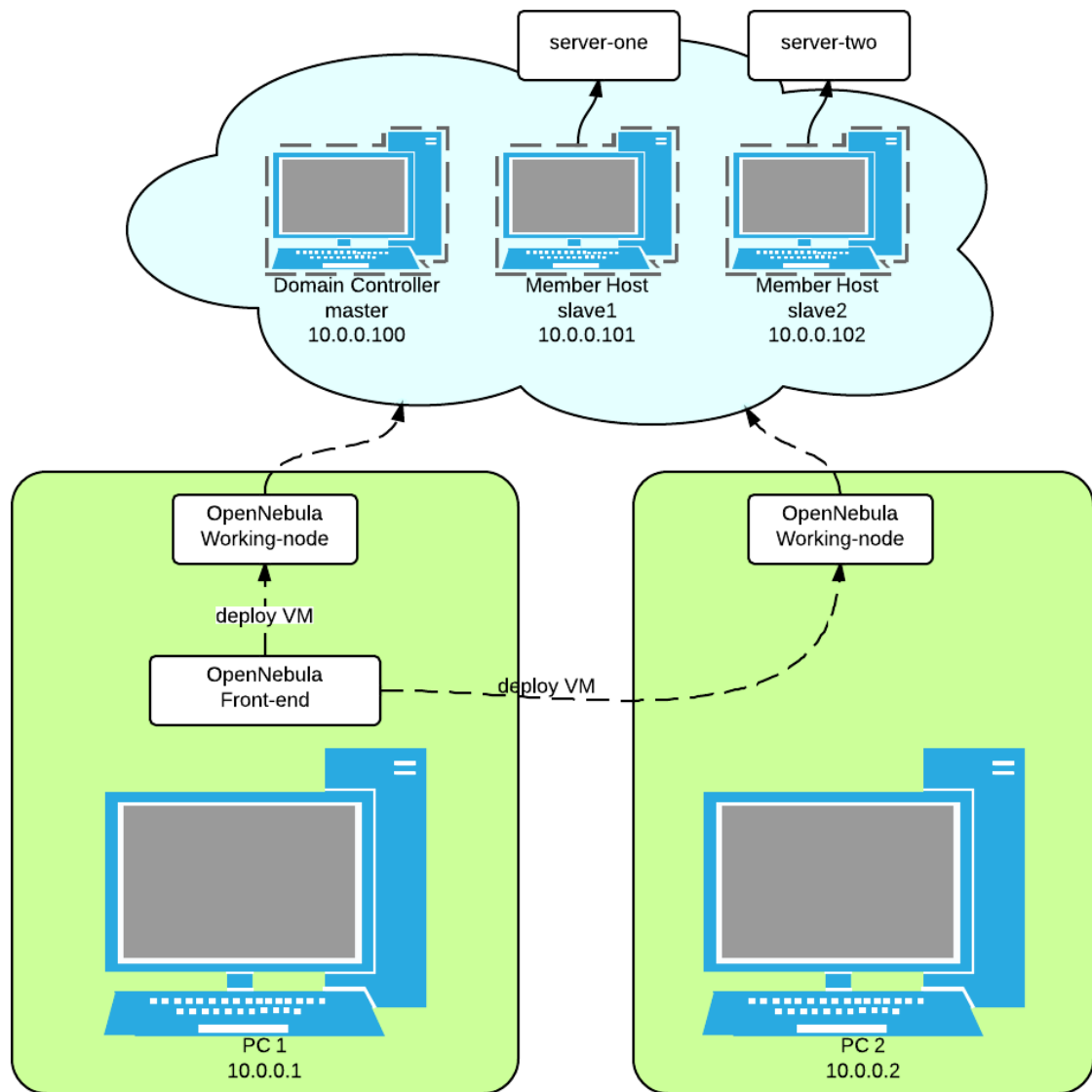


Figure 1: The final cluster configuration.

1.4 Fault Tolerance - Load Balancing

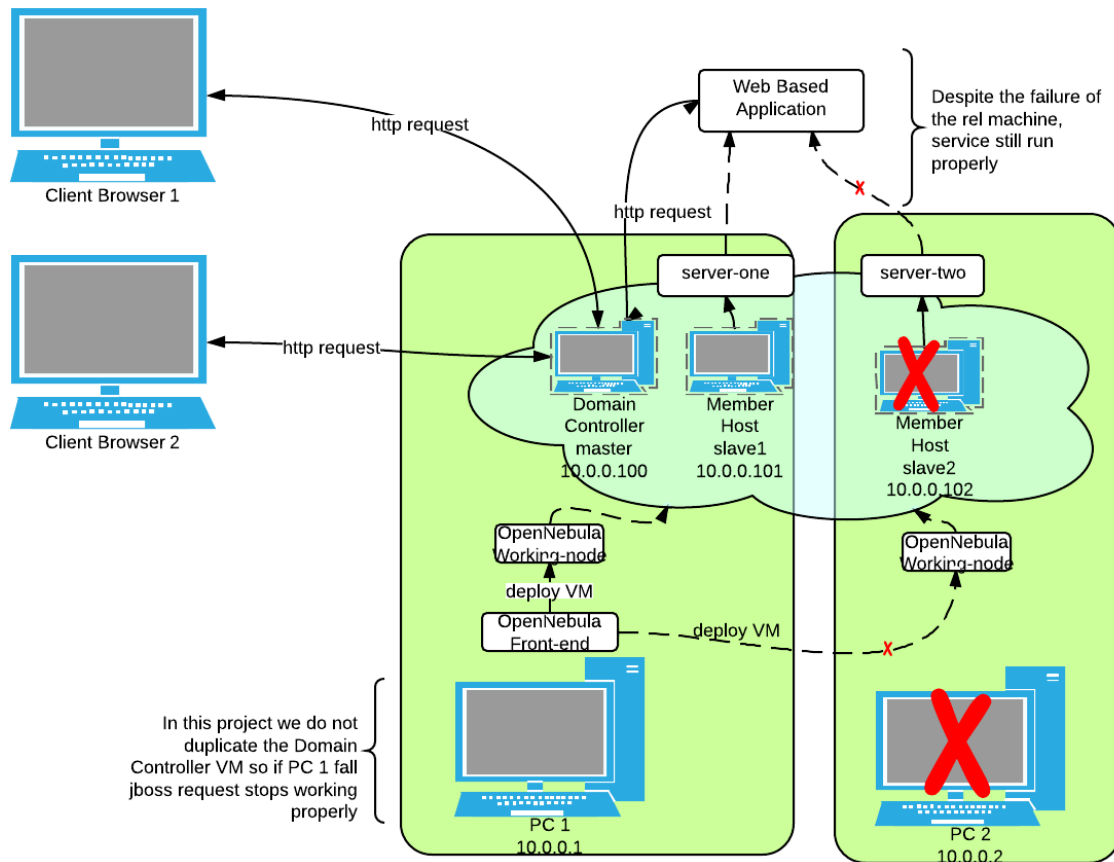


Figure 2: The amazing part about fault tolerance in cloud.

This middleware keeps working even if one of the real machine falls. This happens because there are several JBoss server instances on the top of different physical machines. Therefore if one machine crashes the other one keep responding to the clients HTTP requests. The Figure 2 explains this behaviour.

In our configuration, the JBoss Domain Controller machine should be protected in some other way because the JBoss domain pattern does not provide any fault tolerance policy in the case that the Domain Controller falls.

The OpenNebula Front-End machine is needed just to deploy and monitor the VMs but there is no fault risk if it crashes after the VM deployment phase (if there isn't any VM deployed on the Front-End host).

In this tutorial we did not replicate the nfs file system, thus if the machine that hosts the file system falls, the middleware won't work anymore.

We also wanted to figure a scenario where a lot of VMs are deployed on just one host. In this case you can migrate one of them to another host.

JBoss itself provides some load balancing feature on an upper level.

2 Set up the Software

2.1 Installing Debian

First of all you have to install Debian on all of your hosts.

You can find the iso here: <http://cdimage.debian.org/debian-cd/7.3.0/amd64/iso-dvd/debian-7.3.0-amd64-DVD-1.iso>

We skip the debian installation part as it's already a well documented procedure.

2.2 Installing OpenNebula

We followed the procedure explained in the url below but we changed some step in order to get a working OpenNebula installation.[3] http://docs.opennebula.org/stable/design_and_installation/building_your_cloud/ignc.html

2.2.1 Installing the Core

The following steps must be done in both the Fron-End host and the Worker Node hosts. Install the dipendencies first:

```
$ sudo apt-get install ruby1.9.1-full
$ sudo apt-get install gem
$ sudo gem install json
$ sudo mv /usr/lib/ruby/1.9.1/json.rb /usr/lib/ruby/1.9.1/json.rb.no
```

Add the OpenNebula repository:

```
# wget http://downloads.opennebula.org/repo/Debian/repo.key
# apt-key add repo.key
# echo "deb http://downloads.opennebula.org/repo/Debian/7 stable opennebula" >
  /etc/apt/sources.list.d/opennebula.list
```

2.2.2 Front-End Side

The following steps must be done on the Front-End host. Update the packages list and install OpenNebula.

```
# apt-get update
# apt-get install opennebula opennebula-sunstone
```

Install nfs service

```
$ sudo apt-get install nfs-kernel-server portmap nfs-common
```

Configure the oneadmin account. The password choosen in the first command must be the same of password choosed in the fourth one (unstead of "password").

```
$ sudo passwd oneadmin
$ su oneadmin
$ mkdir ~/.one
$ echo "oneadmin:password" > ~/.one/one_auth
$ chmod 600 ~/.one/one_auth
```

After than you have to make the md5 of your password and insert it in the sunstone_auth file.

The md5 of pippo is 0c88028bf3aa6a6a143ed846f2be1ea4.

```
# echo oneadmin:0c88028bf3aa6a6a143ed846f2be1ea4 > ~/.one/sunstone_auth
```

Restart OpenNebula.

```
rm ~/one.db
$ one start
$ sunstone-server start
$ onevm list
```

The last command just shows the OpenNebula VMs status. Now open a browser and navigate to localhost:9869. The sunstone web interface should be accessible.

2.2.3 Worker-Node Side

Install OpenNebula node software.

```
$ sudo apt-get install opennebula-node
# sudo su
# passwd oneadmin
```

2.2.4 Both Side - oneadmin user configuration

You have to find the oneadmin uid in all of your hosts. Then change them in order to have the same uid in all of your hosts.

```
# id oneadmin
```

For example if the user oneadmin has uid 9869 and the group oneadmin (or cloud) has the gid 9869 in the Front-End host, you can use the following command in all of the worker node to have the same uid,gid assignment.

```
# usermod -u UID username //change uid for an user
# usermod -u 9869 oneadmin
# groupmod -u 9869 oneadmin //change group for an user
# usermod -g oneadmin oneadmin
```

Check that the uid choosen is free on the host you are going to modify:

```
# cat /etc/passwd | grep UID
```

Now for each node you have to create the ssh keys to avoid the password authentication. In this way OpenNebula can connect to a machine automatically. In all of your hosts run:

```
$ su oneadmin
$ ssh-keygen
```

Then in the Front-End *.ssh/authorized_keys* file, past all the public keys of all the hosts, of the Front-End itself too (*.ssh/id_rsa.pub*).

2.2.5 Front-End Side - datastore

Now install the datastore from the sunston web interface.

In the browser go to <http://localhost:9869>. Login with the oneadmin user and password. Then go to the Infrastructure/Datastore section and select Create

Use this configuration

type: System

nome: WhatYouWant

Trasfer: shared

leave the other options unchanged.

You need to create the hosts and the virutal network. Create the hosts under the Infras-
tructure/Hosts section. Then under the Infrastructure/Virtual Networks section create a new
network. Insert the bridge name in the corrisponding field, then select "fixed network" and add
three ip address (leave the MAC address fields empty):

```
10.0.0.100
10.0.0.101
10.0.0.102
```

You can leave the other fields empty. After that open Sunstone and inside Cluster Create
host select the default datastore plus the one just created.

To share the datastore directory with all Worker Nodes you need to edit the `/etc/exports`
file adding that line:

```
/var/lib/one/datastores          *(rw, sync, no_subtree_check)
```

And now you can start the nfs service with:

```
$ sudo /etc/init.d/nfs-common start
$ sudo /etc/init.d/nfs-kernel-server start
```

2.2.6 Both Side - network configuration

Now both the Front-End hosts and the Worker Node hosts must perform the following steps:
Configuring the Bridge

```
$ sudo su
# brctl addbr smbr0
# brctl show
# brctl addif smbr0 eth0
# ifconfig smbr0 10.0.0.N netmask 255.0.0.0 //Instead of N use a progressive number,
    for the Front-End, 2 for the Worker Node
# ip addr
ping 10.0.0.1 // to check if it works
```

NB this command must be done every time you want to configure the network, so it can be
useful making a bash script bash.

On the Front-End host open the "Marketplace" from the sunstone web interface

Select ttlinux-kvm.

Now select import.

You had to chose the default datastore.

Initialize the Virtual Resource Template
Open the Section Virtual Resource / Template Create
Leave all the default option
Open the advanced mode
Paste this configuration

```
CONTEXT=[NETWORK="YES",SSH_PUBLIC_KEY="$USER[SSH_PUBLIC_KEY]" ]  
CPU="1"  
DISK=[IMAGE="ttylinux - kvm",IMAGE_UNAME="oneadmin"]  
GRAPHICS=[LISTEN="0.0.0.0",TYPE="VNC"]  
HOST_0="0"  
HOST_1="1"  
MEMORY="512"  
NIC=[NETWORK="SM-network",NETWORK_UNAME="oneadmin"]
```

Now select instantiate.

2.2.7 Worker-node section

```
$ sudo mount -tnfs4 10.0.0.1:/var/lib/one/datastores /var/lib/one/datastores
```

NB this command must be done every time after the physical machine reboot, so it can be useful making a bash script.

2.2.8 Front-End Migrating of virtual machine

Now open sunstone in the Template section, then select Instantiate as in Figure 3.

Choose a name for the virtual machine (optional)

Log in as oneadmin and do ssh to the virtual machine just created.

```
$ su oneadmin  
$ ssh root@10.0.0.100 //password is "password" by default
```

In the VM just run a program like ping, or yes or something that stays active in the terminal during the migration process.

```
$ watch -n 1 date
```

Now open the Sunstone interface and select Migrate Live from the drop down menu as in Figure 4.

Select now the host where you want to send the Virtual Machine. NB you have to manually update the Sunstone interface by clicking the update button.

2.3 Installing Debian 7.3.0 on Virtual Machine

Download Debian 7.3.0 netinst from the mirror like <http://cdimage.debian.org/debian-cd/7.3.0/i386/iso-cd/debian-7.3.0-i386-netinst.iso>

In Sunstone open the section Virtual Resources/Images
then Create two images.

One for the iso as type:CDROM using the netinst (upload browse and select the netinst).

The other one for the HD, using type:DATABLOCK with empty datablock for the installation.

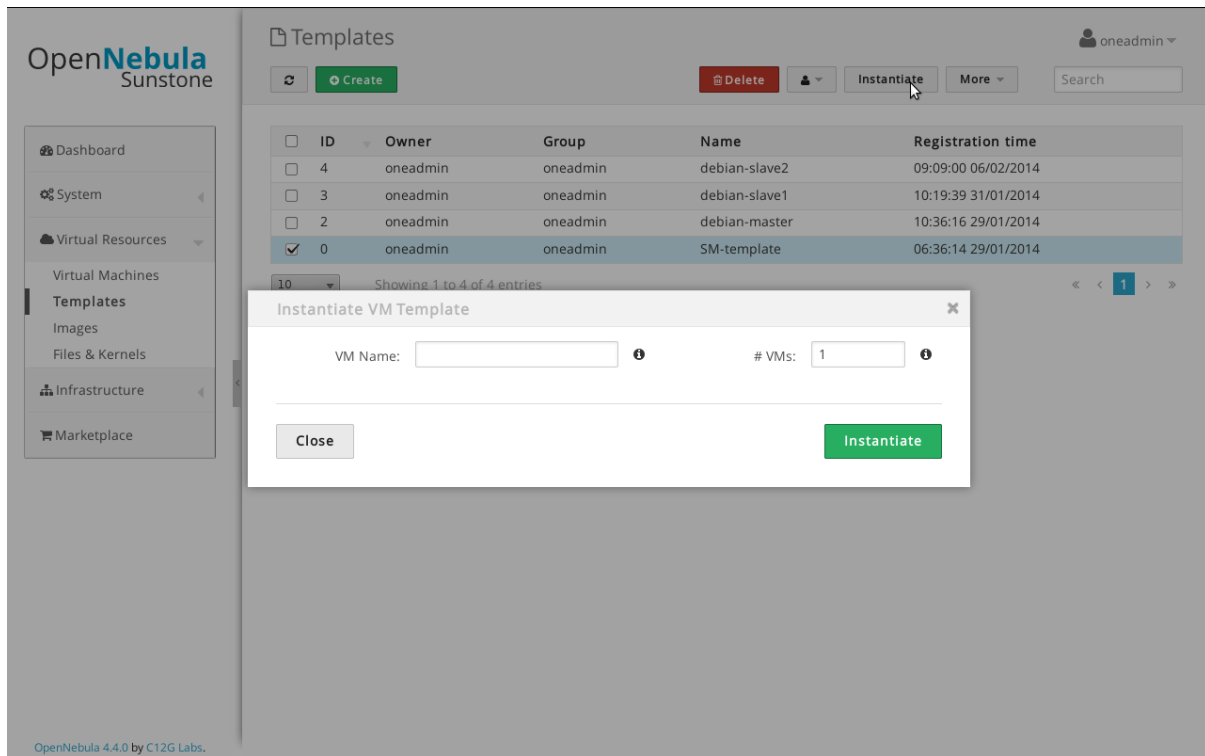


Figure 3: The Template section of OpenNebula Sunstone.

In the Template Section, create a new template for the debian VMs. Assign then two disk to the template under the Storage tab. One of them with the iso netinst disk and the other one with the empty datablock image just created. Assign the 10.0.0.100 to the template too. Instantiate a machine with this Template and finally install Debian as usual. N.B. the keyboard configuration must be chosen during the OS installation.

2.3.1 iptables rules

The following iptables rules are necessary in order to let the VM connect with the internet. The commands below must be run in your physical machine.

```
# echo 1 > /proc/sys/net/ipv4/ip_forward
# iptables -t nat -A POSTROUTING -o <OUTPUT INTERFACE(ex: wlan0)> -j MASQUERADE
# iptables -A FORWARD -i smbr0 -j ACCEPT
```

Now inside the VM, you have to run these commands. In this way we can assign an ip address of your subnet to the VM.

```
# ip addr add 10.0.0.100/8 dev eth0
# ip link set eth0 up
# route add default gw 10.0.0.1
# hostname master
# echo "nameserver 8.8.8.8" > /etc/resolv.conf
```

Add the first three commands in the `/etc/rc.local` file in order to have always the same ip and hostname after the VM boot.

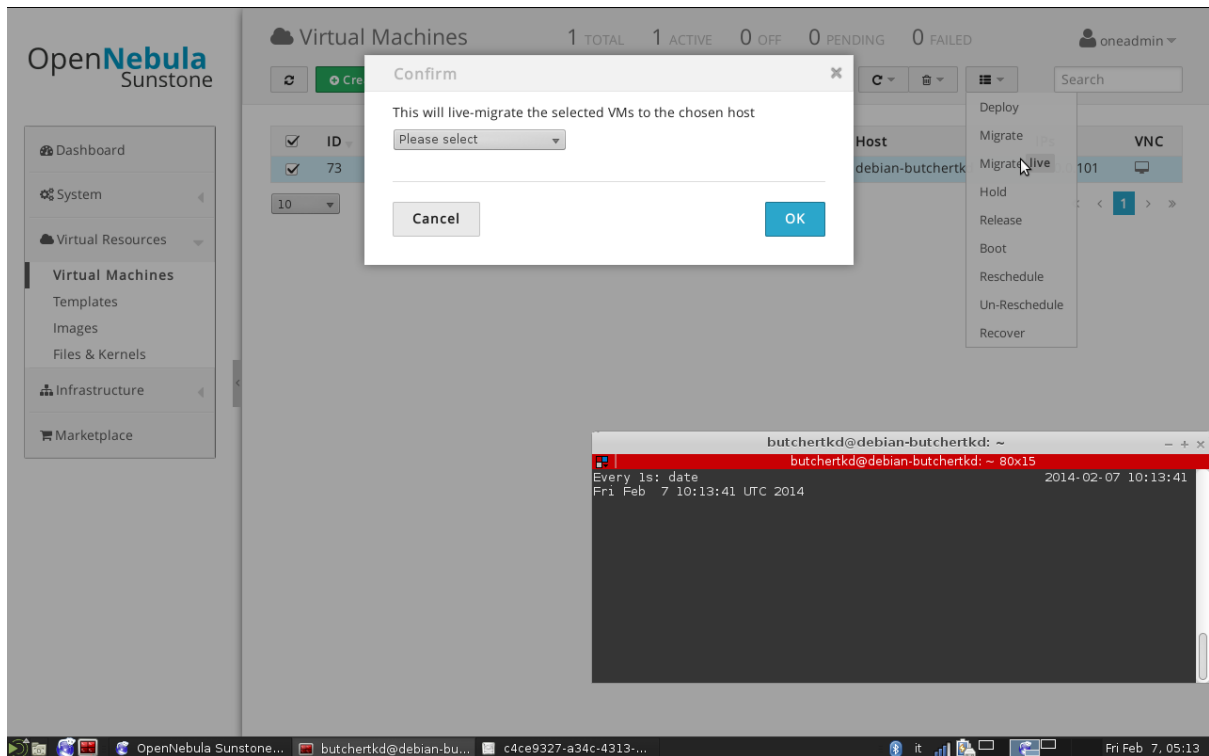


Figure 4: The Virtual Machines section of the OpenNebula Sunstone interface.

2.3.2 Set up the machine for JBOSS

Now check if internet is working in the VM, and then add some repository and install some tool.

```
nano /etc/apt/sources.list
deb http://ftp.debian.org/debian/ unstable main non-free contrib
deb-src http://ftp.debian.org/debian/ unstable main non-free contrib
# main repository
deb http://repo.mate-desktop.org/debian jessie main
# apt-get install openssh-server
# apt-get update
# apt-get install unzip
# apt-get install zip
# apt-get install openjdk-7-jre
```

2.4 Installing JBOSS

Download JBoss here <https://www.jboss.org/products/eap.html> and install it following the point 4.3 in this guide.[4] https://access.redhat.com/site/documentation/en-US/JBoss_Enterprise_Application_Platform/6/pdf/Installation_Guide/JBoss_Enterprise_Application_Platform-6-Installation_Guide-en-US.pdf

2.4.1 Installing modcluster

Now install the load balancer Mod Cluster.

Download the resource from here http://downloads.jboss.org/mod_cluster//1.2.6.Final/

linux-i686/mod_cluster-1.2.6.Final-linux2-x86.tar.gz

Now you need to choose how many slave you want in your cluster because it's time to add their ips in /etc/hosts file like this:

10.0.0.100	master
10.0.0.101	slave1
10.0.0.102	slave2

NB you can add more server when you want.

Now follow this guide to install modcluster.[5] http://docs.jboss.org/mod_cluster/1.2.0/html/Quick_Start_Guide.html

NB in section 2 form 2.3 to the end of the guide you have to use the ip of the vm in use instead 10.33.144.3

Add the following line to the /etc/rc.local in order to start httpd at boot

```
/opt/jboss/httpd/sbin/apachectl start
```

At this point you should clone the VM using the sunstone web interface. The clone option is under Virtual Resources/Images. Clone the disk image of the master and create a new template (cloning the template too). Assign to the new template the just cloned image and 10.0.0.101 as the ip address. Assign the "master" and "slave1" names to the 2 VMs and 1GB of RAM at least (also with the sunstone web interface). Inside the slave2 VM change the ip assignment (to 10.0.0.101) and the hostname (slave1) in the /etc/rc.local file and reboot. You must set now the hosts, thus in each VM modify the /etc/hosts adding the same configuration: 10.0.0.100 master 10.0.0.101 slave1 10.0.0.102 slave2

We have also added the slave2 host because we will clone the slave1 VM later.

We are going to explain how to create a Domain configuration with jboss. You will have thre VM at the end, where one of them is the the Domain Control (the master host) and the others are the Member Hosts of the domain (slave1 and slave2). In this demo we left the Domain Controller without servers and then we added one server to each host. Thus the domain controller act only as single point of access and load balancer, handling the requests workload between the two servers.

With EAP-HOME we refer to the jboss installation home directory. Now let's proceed with the jboss configuration. In the master VM you must add three users, one user for accessing through the web interface, and 2 users for the hosts. Just use the jboss add-user.sh script.

```
$ EAP-HOME/bin/add-user.sh
```

Follow the indications on the interactive shell, and add an user with the name "admin" and then with the same command add two other users one named "slave1" and one named "slave2" (yes, you MUST add the same name of the hostname!!). At the end of the script execution a Base64 password inside a <secret> tag will be prompted. Save it, you will use it later. You have to modify the slaves host.xml file (the file is at EAP-HOME/domain/configuration/host.xml). Follow the steps at this url <https://access.redhat.com/site/solutions/218053> to understand how to configure it. Just skip the user creation step (you have already done it). When it refers to the Base64 secret, use the slaves secret saved before. You can now run jboss. In the master run the following command:

```
$ EAP-HOME/bin/domain.sh -b 10.0.0.100 -Djboss.bind.address.management=10.0.0.100
```

And in the slave1:

```
$ EAP-HOME/bin/domain.sh -b 10.0.0.101 -Djboss.domain.master.address=10.0.0.100
-Djboss.bind.address.management=10.0.0.101
```

If you have the "HORNETQ.CLUSTER.ADMIN.USER" authentication error you should disable the cluster authentication in the EAP-HOME/domain/configuration/domain.xml file. To do this just add the `< security - enabled > false < /security - enabled >` tag in this way:

```
<subsystem xmlns="urn:jboss:domain:messaging:1.3">
  <hornetq-server>
    ...
    <security-enabled>false</security-enabled>
    ...
  </hornetq-server>
</subsystem>
```

Now you should have a working domain configuration with two jboss instances. At this point you just need to clone the slave1 VM disk image using the opennebula sunstone interface, create a new template, with the 10.0.0.102 ip address and the just created image. Give it then the "slave2" name. Now you can deploy a slave VM too. In the slave2 VM change the ip to 10.0.0.102 and the hostname to slave2 under /etc/rc.local. Now you just have to modify the host.xml file changing the name to slave2. Now you can modify the whole servers and groups configuration through the Jboss Management browser interface accessing with the admin user at <http://10.0.0.100:9990> . In the hosts section you can configure the number of groups and the servers for each host. In our configuration we left the domain controller without server, and we assigned "server-one" to slave1 under the other-server-group and "server-two" to slave2 also under the other-server-group. Check that the server-group has the full-ha profile and the full-ha-sockets (should be as this by default).

2.4.2 Distributed filesystem on VMs in order to make statefull applications

Install nfs server in the master server:

```
$ sudo apt-get install nfs-kernel-server portmap nfs-common
```

and in /etc/rc.local add the following commands

```
/etc/init.d/nfs-common start
/etc/init.d/nfs-kernel-server start
```

To share data between slave servers you need to modify the /etc/exports file adding the shared directory. The file is located in the master server.

```
/home/USERNAME/EAP-HOME/bin/data/ *(rw, sync, no_subtree_check)
```

For instance in EAP-HOME/bin/ of slaves servers I have created a new directory called 'data'. To synchronize all data in the directory just created you need to do this command:

```
# mount -t nfs4 10.0.0.100:/home/USERNAME/EAP-HOME/bin/data
/home/USERNAME/EAP-HOME/bin/data
```

NB this command must be done every time after the slave servers reboot, so it can be useful making a bash script or adding to the jboss launcher script.

2.4.3 Migrating Trouble

Till now the migration process with JBoss active due to a lack of ram or maybe lack of knowledge won't work properly.

Sometimes the Master migrate from a machine to another but not allways.

Further research must be done in this way.

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