

# HOW-TO: Install OpenHPC

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A step-by-step guide to installing OpenHPC.

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# 1. INTRODUCTION

*This guide was initially produced for the HPC Ecosystems Project. Find out more: [hpcecosystems.blogspot.com](http://hpcecosystems.blogspot.com).*

## Keywords

OpenHPC	HPC Ecosystems	Introduction	HPC
Virtual Lab	Hands-on	Virtual Cluster	SysAdmin

This is designed as a supplementary guide to the **OpenHPC Cluster Building Recipes** (see here: <https://openhpc.community/downloads/>).

Whereas the **OpenHPC Cluster Building Recipe** is an adequate guide for installing OpenHPC, this document intends to steer participants towards a specific implementation model of the OpenHPC software stack on a Virtual Cluster.

# 2. QUICKSTART

\*\*\*Jump to the hands-on practical steps if you are ready to begin deployment.

## 3. PREPARATION

### 3.1. Pre-Requisites & Readiness

The OpenHPC install recipe is targeted at **experienced Linux system administrators for HPC environments**.

This guide seeks to complement the OpenHPC install recipe while bridging the gap for those that are new to HPC environments, or have basic (*but still some*) Linux system administrator experience.

If you can answer “yes” to the following questions, you should have no difficulty in completing this guide:

1. Do you know how to navigate the file system using the Linux shell ?
2. Have you installed packages via the Linux shell using **yum**, **apt** or **compilers** ?
3. Do you know how to **stop** and **start services** in Linux shell ?
4. Do you understand basic principles of **computer networking** such as **IPv4**, **PXE**, **DNS** ?
5. Do you know what **High Performance Computing** is, and why you are learning to install it?

If you answered “no” to any of the previous questions, it may be worth revisiting the source of the question and ensuring you are comfortable with the details before proceeding further.

This guide is not going away, so take your time and be sure you are comfortable to continue!

### 3.2. Workload Time

- Download speeds aside (Vagrant is 200MB, the CentOS 7 image [http://isoredirect.centos.org/centos/7/isos/x86\\_64/](http://isoredirect.centos.org/centos/7/isos/x86_64/) is approx. 1GB and the DVD image is over 5GB), it should take approximately **10 to 15 minutes** to complete the Vagrant installation and Virtualbox VM deployment.
- The actual time to configure the OpenHPC **input.local** and run through the guide will vary, depending on
  - Your willingness to read the guide thoroughly before executing each step (**THIS IS HIGHLY RECOMMENDED**)
  - Your familiarity with the instruction syntax and commands used in the guide
  - Your familiarity with the HPC design being implemented in this guide
  - Your willingness to plan before executing (look before you leap, crawl before you walk, read before you write, live before you die, etc.)

**TIP: READ the instructions carefully!**

Make sure that you understand them before executing them.

You need to know what you have done so you can fix anything that doesn't work as expected!

### 3.3. Virtual Lab Overview

This section provides a step-by-step guide for setting up the Virtual Lab environment. The Virtual Lab will configure **three lightweight virtual machines**\* that will be used to create a **Virtual Cluster** using the **Virtualbox** hypervisor. See **Figure 1**. ***Make sure you understand the overview because you will be adding your specifications to the figure!***

Whereas the OpenHPC recipe expects **four** compute nodes, we will work with **two**.

*\*If resources do not allow for **three** VMs, the process can be concluded with two VMs as a proof-of-concept*

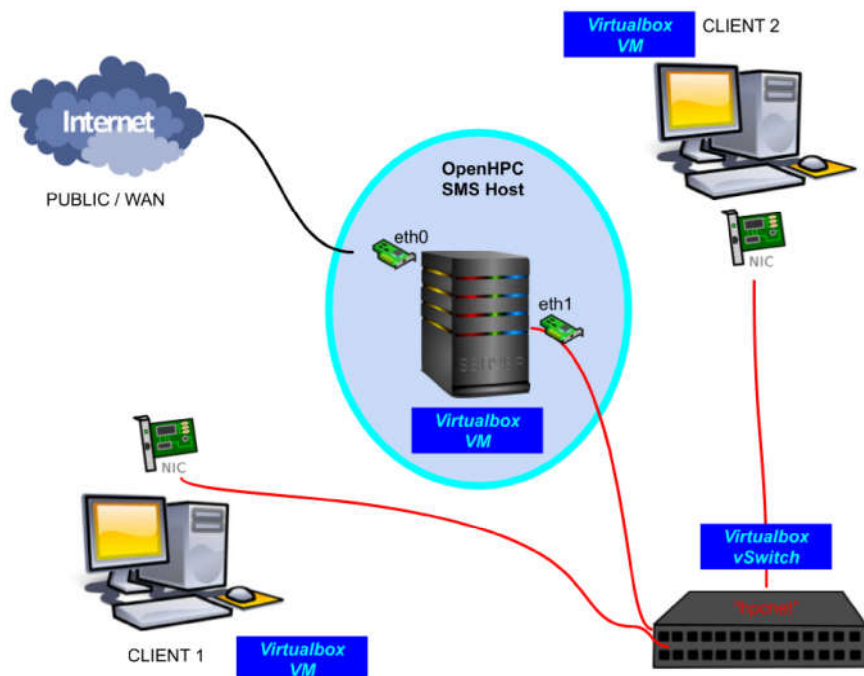


Figure 1: overview of the Virtual Cluster layout

### IMPORTANT

This guide uses **VIRTUALBOX** for the virtual lab environment.

**VAGRANT** is used to manage the Virtualbox VM's.

Although it is technically feasible to run a VM as part of an HPC system,  
**YOU DO NOT NEED VIRTUALBOX OR VAGRANT FOR THE FINAL HPC DEPLOYMENT.**

Vagrant and Virtualbox are used for the VIRTUAL LAB.

## 4. Virtual Lab Deployment

This guide involves deploying an **OpenHPC-ready Virtualbox VM** using **Vagrant**.

Although this guide is not explicitly addressing other hypervisors, the **Vagrant** deployment should allow for the same results on any other hypervisor of your preference (for example, **VMware**).

*Note that similar results can only be guaranteed with Virtualbox and Vagrant deployment as per the steps outlined in this guide.*

The VM will be pre-configured with the standard software environment used in the hands-on workshop but can also be replicated at home, in the office, in a lab, or in the bath\*.

The custom additions to the base VM image include:

- pre-installed packages
  - **tmux & screen**
  - **vim**
  - **git**
- input.local (from OpenHPC) with custom edits which do not need to be replicated
- **setenv.c**

*\* results may vary if you choose to run your Virtual Cluster in the bath*

### 4.1. Install & Prepare testbed VM with Vagrant

#### 4.1.1. Install Virtualbox

**Virtualbox** is used to run the Virtual Cluster.

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We will concentrate on deploying the **Management server (SMS host)** as a VM (although this VM can also be used as the final Management Server solution for the physical HPC system, we do not recommend this as a long-term solution).

**This Virtual Management Server is not required for the final HPC system.**

- [Download Virtualbox](#)
- Install Virtualbox

### 4.1.2. Install Vagrant Environment

Vagrant will be used to manage the Virtualbox VM - it will configure the VM to precise specifications for the guide and makes sure every user will have the same setup, every time.

**Vagrant is not required for the final HPC system.**

- Download and install Vagrant from <https://www.vagrantup.com/downloads.html>
  - *TIP: be sure to select the package that matches your host machine's operating system, not the CentOS VM! **The system may need to be rebooted.***

**TIP: There are two options for obtaining the testbed VM settings...**

1. Use **git** to clone the HPC Ecosystems OpenHPC repository (recommended for a group workshop)
2. Directly copy the Vagrant configuration files (suitable for solo learning)

### 4.1.2.1. OPTION 1: Clone git repository *you must have **git** installed*

This option will keep all updates or changes synchronised with your system. This is the best solution for a hands-on workshop.

1. Install git
  - 1.1. Git BASH for Windows <https://gitforwindows.org/>
  - 1.2. git for Linux
  - 1.3. git for MacOS
2. Navigate to the preferred **git root** for this guide
  - 2.1. For example <your user home>/desktop/openhpc-handson
3. initialise the git repository

```
git init
```

4. add the main git template from the HPC Ecosystems repository and pull it down

```
git remote add origin  
https://github.com/brattex/hpc-ecosystems-openhpc101.git
```

```
git pull origin master
```

5. all the files stored in the remote git repository should now be copied to the directory that you specified as the **git root**.

The most important files right now are:

- 5.1. **input.local** → the OpenHPC configuration parameter file in **shell** format for the OpenHPC auto-deployment script
- 5.2. **setenv.c** → the hands-on configuration parameter file in **script** format for the Virtual Cluster Lab.
- 5.3. **Vagrantfile** → the Vagrant configuration file for the VMs

### 4.1.1.2. OPTION 2: Download the HPC Ecosystems OpenHPC SMS-host Vagrantfile

This option will not use **git** for the guide. This will not synchronise with the files on the OpenHPC Ecosystems repository. You will need to manually copy the files you need for the workshop to your PC. This is suitable for individuals running through this guide outside of a group or class.

1. Navigate to the directory where you want to install the Vagrant VM. This will be referred to as the head / root of the directory. **For example:** `/openhpc/sms-host/`
2. Download the HPC Ecosystems SMS-host **Vagrantfile** into this location.
  - 2.1. <https://raw.githubusercontent.com/brattex/hpc-ecosystems-openhpc101/master/Vagrantfile> (save as **Vagrantfile** with no file extensions)

## 4.2. Deploy HPC Ecosystems OpenHPC SMS Host VM

- **vagrant up** will initialise the vagrant environment (and download the vagrant VM) - the entire process may take significant time, depending on your Internet connection.
- \*\*\* pre-download the file

**TIP: be careful where you run 'vagrant up'**

- be sure to run **vagrant up** from the root of your VM directory - vagrant will install the VM at the current location as the root directory

```
vagrant up
```

- This will read the **Vagrantfile** parameters and ...
- Create the **Virtualbox** (or other Hypervisor) framework (such as vCPUs, RAM, NIC's, etc.) then ...
- Download the **CentOS** image and install it onto the VM.
  - Note: this is currently CentOS 7.7 64bit
  - *At ~400MB this could take a significant amount of time to download*