Linux in a Box

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1 Problem

You want to intall Ubuntu 12.04 in a virtual machine. You may want to do this so that you can continue to run the operating system that came with your computer or so that you can install use software that supports Ubuntu (such as Torch).

2 Solution

2.1 Introduction

The solution is to install VirtualBox and run Ubuntu 12.04 LTS as a guest inside of VirtualBox. Getting everything to work is tricky. These directions are meant to work, but have not been tested on all hardware and software combinations.

2.2 Download iso's

Download the correct VirtualBox installer for your operating system. Go to `www.virtualbox.org`, select Downloads (in the left panel), pick the right platform package for your operating system. If your operating system is recent, it is a 64-bit operating system. So pick a 64-bit version of VirtualBox. I used VirtualBox 4.2.18 for Linux in preparing this note.

You should navigate to the online VirtualBox documentation on the VirtualBox web site and bookmark it. You will need to refer to it in case these direction do not work on your system. There is a lot you can do with VirtualBox that is not covered in this note, and the documentation is pretty clear once you understand the concepts.

Download the iso for ubunutu 12.04.03. Go to `www.ubuntu.com`, select download <desktop, pick 64-bit if your operating system is not 32 bit (your operating system is most likely 64-bit if your system is only a few years old), and select Ubuntu 12.04 LTS. Canonical, the developer of Ubuntu, promises support for this release of Ubuntu until April 2017. Very seldom will upgrades to operating systems make your life as a data scientist any better, so its better to put off OS updates until you are forced.

2.3 Install Virtual Box

Follow your operating system's procedure to install Virtual Box.

If your OS in Ubuntu, you will need to open a terminal and execute these command to add your user name to the virtual box users group.

```
$ sudo groupadd vboxusers
$ sudo usermod -aG vboxusers <your user name extgreater
```

2.4 Create a virtual machine

A virtual machine is a simulated computer. It is called a "guest." The guest runs on the "host," the physical computer.

- Start Virtual Box
- Click on "New" in the GUI to create a new virtual machine.
- Click "Next."
- Name: Set the virtual machine name to "ubuntu-12.04.03-64-bit";
- Memory: accept the default 512 MB
- Hard drive: create a virtual hard drive of type VDI, dynamically allocated, 16 GB in size.

2.5 Install Ubuntu on the virtual machine

Put the virtual CD ROM (the iso file) with the operating system into the virtual CD drive of the virtual machine you just created.

- In the VirtualBox GUI, make sure the virtual machine is selected.
- Select the Settings icon on the top panel.
- Select Storage from the left panel.
- Under IDE Controller, click on Empty (the icon for the CD drive).
- In the right panel, click attribute Live CD/DVD.
- In the right panel, click the CD icon, select choose a virtual CD/DVD disk file, navigate to your Ubuntu iso file, select it, and click OK.

Boot and configure Ubuntu in the guest virtual machine.

- In the VirtualBox GUI, select the virtual machine and click Start. VirtualBox will start the virtual machine. You will see the Ubuntu boot message. Ignore any error messages.

- You may be prompted to pick a language. Choose English for now so that other people can help you. Later you can switch to your favorite language.
- Select Install Ubuntu.
- Preparing to install Ubuntu. Don't select Download updates while installing (unless you have a lot Internet bandwidth). Select Install third-party software. Select Continue.
- Installation Type. Select Erase disk and install Ubuntu. You are erasing the virtual disk you created when you made the guest machine, not your host system disk. Continue.
- Erase disk and install Ubuntu. Install Now.
- Where are you? Select New York; Continue. This sets the time zone for the virtual computer.
- Keyboard layout. Find your keyboard and select it. You want the keyboard that is on your physical system. Continue.
- Who are you? Enter your name, pick a user name, password. Select require password to log in. Do not encrypt your home folder. Continue.
- Watch the advertising. Don't move your mouse outside of the virtual screen, in an attempt to avoid a bug in VirtualBox.

When the installation is finished, click "restart now." If the guest freezes, shut it down by clicking on the close button in your GUI and selecting "power off machine." In the VirtualBox window, select the virtual machine and settings. Remove the virtual CD from the guest: Settings >Storage >select the virtual CD >select the icon for the virtual CD >click "remove from virtual drive." Now restart the virtual machine.

If the guest did not freeze, you will be told to remove the installation media (which is the virtual CD, the iso file) and press Enter. You can remove the virtual CD by right-clicking on the CD icon on the bottom panel of the VirtualBox GUI panel. After the guest system reboots, shut it down. The Ubuntu shutdown command is under the system menu in the upper right hand corner.

2.6 Hint on keyboard and mouse capture

VirtualBox tried to figure out whether mouse movement and clicks and keyboard keystrokes should be sent to the host or to the guest. Sometimes it gets confused and the input focus gets stuck in the guest. When that happens, you need to tell the guest to release input focus. Look at the VirtualBox GUI. The lower right hand corner is the key combination that releases focus from the virtual machine.

2.7 Configure the virtual machine

Shut down the virtual machine if you have not already done so.

You are in the VirtualBox GUI. Select the Ubuntu virtual machine and click settings. On the System tab, set the Base Memory to something higher than the default. I set it to the max that is in the green area. That's because I tend to do most of my work in the guest OS, not the host OS, so I want the guest to have as much memory as possible. If you use your host system a lot, you will want to make your guest smaller than your host. Note that you can change this setting easily as your usage of your system changes.

In the Shared Folders tab, add a shared folder that is your home directory in the host system. Choose full access and auto-mount.

Restart the guest system. Log in.

Install the dkms file system in Ubuntu. Open a terminal and type `sudo apt-get install dkms`.

In the VirtualBox menu, select Devices >Install Guest Additions. Click Run when asked if you trust the software. When the installation finished, press Return as instructed.

Resize the window holding the display for the guest. The Ubuntu display should resize to fit the window. If it does not, shut down the virtual machine and restart it.

In the VirtualBox menus, pick View >Full Screen. Read the message and memorize the Host key. Then click Switch. Mouse down to the bottom of the screen. You should see a tiny strip. That's a menu bar that will pop up. Exit full-screen mode by picking the multiple-window icon.

Remove the guest additions virtual CD by using the VirtualBox Device menu.

2.8 Configure and install Ubuntu software

Your vitual machine should be running Ubuntu.

Install synaptic, a software package manager. Click on the icon for the Ubuntu software center in the left strip. Search for "synaptic" and select "Synaptic Package Manager." Install it. Once it installs, exit the Ubuntu Sofware Center.

Start synaptic by searching for it using the dash home. Ubuntu comes with `gedit`, an easy-to-use GUI-requiring text editor. You will want to use a text editor that does not require a GUI. Their are two equally good choices: emacs and vim. Emacs is easier to use for beginners and some say that vim is faster to use for experts. You should pick one and use it, as going back and forth is just too confusing. I recommend using tmux (to multiplex terminal sessions) and tmux is a bit more friendly to vim than emacs. So I use vim. But before switching to vim, I had happily used emacs for many years.

Use the Quick Filter to find emacs or vim and mark it for installation. Choose Apply (under the check mark) to install all the software you picked.

Synaptic will download the software and install it. Later, if the software gets updated, Synaptic will prompt you to install the updates.

In the guest, select the folder icon in the strip on the left. You should see your home folder. Check the devices section of the panel. If it has a CD-ROM containing the Virtual Box Additions, click on the eject icon to its right.

Now let's gain access to your home folder in the host. Previously you configured your guest machine to have full access to your home folder. Now you need to give your Ubuntu user id permissio to access this folder. You do that by adding yourself to the vboxsf user group. (A user may be a member of many groups. Being a member of a group gives a user permission to read, write, and execute certain files.) To add yourself to the vboxsf group, open a terminal and execute:

```
$ sudo groupadd vboxsf
$ sudo usermod -aG vboxsf <your user name>
```

Don't worry if the first command fails.

Log out and log back in in order to active your membership in the new group. The icon in the upper right corner of the Ubuntu screen is a drop-down menu. One menu pick will log you out.

Now let's access the home folder in the host system. Reopen the file browser. Click on file system. Select the media folder. In it, you should see a folder whose name begins with "fs_". This is your home folder in the host. It is visible in the guest. Double click on this folder to open it.

You should update the operating system software. Go to the system menu, select Updates available and follow the prompts. At the end of the update, you will need to reboot. Do so, then shut down the guest.

3 Discussion

3.1 Sofware selections

VirtualBox is specified as the virtual machine manager because it is free and runs on Linux, OS X, and Windows. Other virtual managers can be used. Search for virtualbox alternatives.

I have found VirtualBox to be difficult to work with. It does not always behave consistently. Sometimes to get it to work, I have to restart the guest, VirtualBox, and/or my host system. Once I misconfigured VirtualBox and its locked up my Windows 7 system. If the GUI freezes, try not moving input focus away from the virtual machine's window after you restart.

The version of linux recommended is Ubuntu 12.04 because it is popular and torch is tested on it. Because it is popular, there is a lot of software that is preconfigured for it and a lot of help available on the Internet and from colleagues.

Emacs and vim are suggested as installs because both are well-established free text editors that work in both a terminal and with a GUI. You should pick one and learn it.

3.2 Mounting Dropbox in the guest's home director

The above directions cause your home folder in the host operating system to be mounted in `/media/`. You may prefer to have some of the folders in your home folder mounted elsewhere. For example, I use Dropbox to synchronize folders containing current projects. I have a bunch of scripts that depend on the Dropbox folder being in my home folder. These directions are specific to the Dropbox folder, but can be easily modified for any other folder.

There are three steps in getting your Dropbox folder from the host to be mounted in your guest home directory.

First, shut down the virtual machine and use the VirtualBox GUI to create a new shared folder. This time, share just the Dropbox folder in the host. The share name to use is `DropboxShared`. The share name cannot be the same as the folder name. Do not select read-only. Do not select auto mount. Do select make permanent.

Second, boot your virtual machine and open a terminal. When Ubuntu boots, its reads the file `/etc/fstab` to mount (make accessible) certain file systems. You are going to modify this file so that the file system "DropboxShared" is mounted in the guest's home folder. The file `/etc/fstab` is protected so you need to become the super user (root) to edit it. If you are using vim, start vim with `sudo vim /etc/fstab`. If you are using emacs, start emacs with `sudo emacs /etc/fstab`. Add the two lines below to the end of the file and save it. Change "roy" to your own user id in the guest. The user id and group id are the id's assigned by Ubuntu to the first user and group created. If you use another linux, it may have assigned different ids. The last two characters in the second line are both digit zero.

```
# make the dropbox share from VirtualBox available in home
DropboxShared /home/roy/Dropbox vboxsf uid=1000,gid=1000 0 0
```

Third, reboot your virtual machine. If all goes well, you can navigate to your home folder in the virtual machine and see your Dropbox folder. If you have messed up the edit to `/etc/fstab` you will get a error message when Ubuntu boots. Choose "S" to skip mounting, then re-edit `/etc/fstab`.

3.3 Going further

The `tmux` program lets you run multiple terminal sessions inside on terminal. It also allows you to reconnect to a server if the connection is lost. A lost connection includes shutting down your laptop.

If you have two folders of data files you need to keep in sync–say one on a server and one on your laptop–`rsync` will prove useful.

A popular tool for sharing code and providing a way to fall back to a previous version of a program is `git`. GitHub.com lets you coordinate development tasks with others and will provide a way to share your code across systems: say your laptop and servers you use.

In Ubuntu, you can hide the icons on the left to gain more screen space. You can use the alt key or Windows key to bring up a panel where you can search for programs and files. You can add indicators to the top line of the window including one that monitors CPU usage and memory usage.

In VirtualBox, you can configure a guest to use as many CPUs as are in the host system. You can also add more memory to the virtual system.

3.4 Configuring systems

I find it convenient to work in one operating system as much as possible. That operating system should be a linux variant, as linux is most popular on compuatation servers.

I configure my systems in one of two ways. When I order a system with a non-linux operating system, I typically install VirtualBox and run a Ubuntu guest. Sometimes I wipe out the vendor's operating system and install Ubuntu directly on the hardware. This is usually easier to do than configuring VirtualBox but does not make the original OS available. Usually Ubuntu supports all the hardware in the system, but sometimes not. For that reason, I consider buying systems from vendors that offer Ubuntu. These vendors typically have up-to-date desktop systems but their laptop systems tend to lag behind in hardware features.

I move between systems regularly. For example, I have a desktop and laptop at home and a desktop at NYU. I use Dropbox to synchronize files among my systems. In Dropbox, I create a folder for each project. I consider a course to be a project. The Dropbox folder is in my home folder on each system. Sometimes I access the files for a project in the host OS, sometimes in the Ubuntu guess. I do all the programming work in Ubuntu.

Dropbox doesn't work on NYU's servers. To keep source code synchronized, I use github as a central point and push and pull to my github account. I keep one github repository for each project I am working on. If data files are small and not changing frequently, I put them on github. If they are large or frequently changing, I use rsync to synchronize them among systems.

4 See also

There is a lot of documentation and tutorial on both emacs and vim on the Internet.

Oracle's VirtualBox web site contains the definite documentation on VirtualBox.

This recipe is free documentation. You can modify it by visiting the github for account "rlowrance" and forking the repo "torch-cookbook."