

Assignment 1 - Create A Virtual Machine

Overview

This section teaches you how to set up the most popular Linux tools and server applications on a basic version of Ubuntu VMware virtual machine (VM), Ubuntu, which you learned to set up in a previous section.

Even though our instructions are on the installation of applications on a VMware virtual machine, they apply to the case when you install the applications on an Ubuntu/Linux installation on a physical PC. Therefore, when we refer to a VM, we also implicitly refer to a physical PC if you are actually doing application installation on a physical Linux PC.

Since Linux, utility and application versions change all the time, you need to adjust the URLs, installer file names, installation folder names/paths accordingly when necessary.

In Ubuntu there are three popular utilities for installing applications: apt-get, aptitude, and Synaptic. Utilities apt-get and aptitude are both terminal commands and very concise and flexible, while Synaptic has a graphic user interface (GUI) but is less flexible. In this guide we mainly use apt-get to install applications. In Linux, if you need to know how to use a command cmd, you can try to run `"man cmd"` to read cmd's manual pages, or `"cmd --help"` for a short usage explanation.

While this guide uses Ubuntu as the base Linux system, most of the instructions apply to other flavors of Linux too, including Red Hat, Fedora (a community version of Red Hat) and Debian. On Red Hat Linux systems, the application installers are normally in the form of RPM format, and utility yum is used instead of apt-get or aptitude.

[IMPORTANT]

- If you have a M1 Mac you should be able to use [VMWare Fusion](#) or VirtualBox as your hypervisor. Note, there is a 30 days trial available for VMWare Fusion, VirtualBox is free.
 - [You Can Now Run VirtualBox on Apple Silicon \(M1 / M2\)](#)
- You can use the above instructions as a guide for creating your Ubuntu virtual machine using a hypervisor other than VirtualBox. The basic steps are the same but the screenshots in the tutorial will not match your setup if you use a different hypervisor.
- **Installing Latest Versions of Software:**
 - You can create a virtual machine with the latest version of the Ubuntu linux distribution.
 - You can install the latest version of all the applications, packages etc.

Step 1: Install Hypervisor + Ubuntu

Create an **Ubuntu 18.04** virtual machine by following these [instructions](#). Please feel free to install the latest version of Ubuntu. Note, VirtualBox can be installed on Windows, Mac and Linux machines. You may need to install additional tools depending on your operating system. **DO NOT install BRB-DGE**, the last section in this tutorial you should complete is setting up shared folders.

Suggested Resources For VM

- 2 GB or more memory (Recommended)

Step 2: Running Command `sudo` without Needing Password

Read and follow the instructions in the passage below. Note, that allowing `sudo` access without entering a password is arguably a less secure way of using `sudo` as it would allow any user in the `sudoers` list to assume root privileges without challenging them for a password. However, it is fine for the purpose of this exercise.

Many programs need to be installed or run as super user root, but we don't want to share root's password with other people, even if we believe them. Command "`sudo`" allows a user to run programs as the super user root. For example, "`sudo ls -alg`" may ask you for your Linux password (sudo remembers your password for 15 minutes in a terminal window), and then run "`ls -alg`" as root.

File "`/etc/sudoers`" defines who can assume root's privilege and whether these people need to enter their Linux passwords when they use "`sudo`". You edit the file "`/etc/sudoers`" by running the command "`visudo`". To allow Linux user "john" to use "`sudo`" to run commands as root, add the line "`john ALL=(ALL) ALL`" in file "`sudoers`". When user "john" uses "`sudo`", he may be prompted to enter his Linux password. If we have instead used the line "`john ALL=(ALL) NOPASSWD: ALL`", then user "john" can use "`sudo`" without being prompted for his Linux password. You can find more information on "`sudo`" at <https://www.unixtutorial.org/how-to-use-sudo/#editing-sudoers>.

Since we will use `sudo` often to run commands as root, we don't want to type our password each time we use `sudo`. We can avoid entering passwords for using `sudo` by running command "`sudo visudo`" to use editor nano to edit file "`/etc/sudoers`". Use "Page Down" key to reach the end of the file, and insert the following line:

```
user ALL=(ALL) NOPASSWD: ALL
```

Type key combination `Ctrl+O` and then key Enter to write the modified file (`/etc/sudoers.tmp`) out, and type key combination `Ctrl+X` to exit the editor (the basic nano editing commands are listed at the bottom of the editor window, where `^` means the `Ctrl` key). This new line in file

`/etc/sudoers` specifies that user “user” can run sudo without providing his/her password. Now you can test by typing `sudo ls -alg` to run as root to list attributes of the files and folders in the current folder, and you will not be prompted to enter your password.

Step 3: Installing 7z

7z is a popular file zipping/unzipping utility. To install 7z, run `sudo apt-get install p7zip-full`. Run command `7z` to see how to use 7z.

Step 4: Installing MySQL Database Server

MySQL community version is a popular open-source database server from Oracle. The instructions below show how to install it on our VM.

1. Run command `sudo apt-get install mysql-server` to download and install the current MySQL server prepared for Linux.
2. When asked for password for root (MySQL account root; it is different from Linux’s super user root), enter 123456 (make sure you use this password because some of our example web applications use it; you can change the password later after you are proficient in Linux).
3. MySQL will be installed as a Linux service, and it will start automatically at system boot up time.
4. Many of our example web applications will use a database named “test”. For security reason our installer doesn’t create this “test” database for us. We now create it with MySQL’s administrator console.
 - a. Run command `mysql -u root -p123456` to login to the MySQL admin console with root as the username and 123456 as password.
 - b. After the MySQL command prompt `mysql>`,
 - i. run command `create database test;` to create database “test”
 - ii. run command `show databases;` to view a list of available databases
 - iii. run command `use test;` to use database “test” as the default database for the following commands
 - iv. run command `show tables;` to list the tables in the current database
 - v. run command `quit;` to quit the MySQL admin console.

Step 5: Installing Java & Apache Tomcat

Using the tutorial below Install Java and Apache Tomcat.

** Follow these steps 1 - 6 in this [tutorial](#).

Step 6: Installing Apache Web Server and PHP

Installing Apache 2

Apache web server is the most popular open-source web server. This section explains how to install it.

1. Run `sudo apt-get install apache2` to download and install Apache. If you see 404 error messages, make sure you update your VM's apt-get information by running `sudo apt-get update` and then try this step again.
2. Run `sudo gedit /etc/apache2/apache2.conf` and insert the following line in it: `ServerName localhost`
3. Run command `ln -s /var/www/www` to create a symbolic link or shortcut `"/home/user/www" to "/var/www"`, the document root folder for Apache. Each web site of yours on Apache will be in a folder under `"/var/www"`. The Apache web server's installation folder is `"/etc/apache2"`.
4. Launch Firefox web browser and visit `http://localhost`. You will see a screen similar to the following one. Firefox is rendering an HTML file `"/var/www/html/index.html"`. Apache has been installed as a Linux service and it will automatically start at Linux boot-up time.



Installing PHP

[IMPORTANT]

- Note, if the version of PHP is no longer available in the package manager, install the latest version of PHP. If the version is not available you may get an error stating something to the effect of ***“Unable to locate package...”***

PHP is a CGI (Common Gateway Interface) technique for dynamically generating HTML files based on clients' HTTP requests. It is more powerful than Perl. To install PHP v7.1 on Apache, run the following commands:

1. Run `"sudo apt-get install php7.1 libapache2-mod-php7.1"` to install PHP7 on your Linux system.
2. Run command `"sudo systemctl restart apache2"` to restart Apache web server.
3. Run `"sudo chown -R user /var/www"` to give "user" the right to work in Apache folders as their owners.
4. To test your PHP7.1 installation, run command `"gedit ~/www/html/testphp.php"`, and insert the following line into the file: `<?php phpinfo(); ?>`
5. Save the file, go to <http://localhost/testphp.php> in your web browser. If you see a screen similar to the following one, you have succeeded in installing PHP7.1 in Apache.



System	Linux ubuntu 4.4.0-22-generic #40-Ubuntu SMP Thu May 12 22:03:46 UTC 2016 x86_64
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.0/apache2
Loaded Configuration File	/etc/php/7.0/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.0/apache2/conf.d
Additional .ini files parsed	/etc/php/7.0/apache2/conf.d/10-opcache.ini, /etc/php/7.0/apache2/conf.d/10-pdo.ini, /etc/php/7.0/apache2/conf.d/20-calendar.ini, /etc/php/7.0/apache2/conf.d/20-ctype.ini, /etc/php/7.0/apache2/conf.d/20-exif.ini, /etc/php/7.0/apache2/conf.d/20-fileinfo.ini, /etc/php/7.0/apache2/conf.d/20-ftp.ini, /etc/php/7.0/apache2/conf.d/20-gettext.ini, /etc/php/7.0/apache2/conf.d/20-iconv.ini, /etc/php/7.0/apache2/conf.d/20-jon.ini, /etc/php/7.0/apache2/conf.d/20-phonetic.ini, /etc/php/7.0/apache2/conf.d/20-phar.ini, /etc/php/7.0/apache2/conf.d/20-posix.ini, /etc/php/7.0/apache2/conf.d/20-readline.ini, /etc/php/7.0/apache2/conf.d/20-shmop.ini, /etc/php/7.0/apache2/conf.d/20-sockets.ini, /etc/php/7.0/apache2/conf.d/20-system.ini, /etc/php/7.0/apache2/conf.d/20-sysvsem.ini, /etc/php/7.0/apache2/conf.d/20-sysvshm.ini, /etc/php/7.0/apache2/conf.d/20-tokenizer.ini
PHP API	20151012
PHP Extension	20151012
Zend Extension	320151012
Zend Extension Build	320151012

Questions

Answer these questions in a file and save them as a PDF. This file must be included in the zip folder along with a link to your screencast videos for each section in the above assignment tutorial.

- Have you succeeded in installing the given course VM?
- What are the environment variables "PATH" and "CLASSPATH"?
- What are the differences between JRE and JDK?
- What are the differences between Apache web server and Tomcat web server?
- How to start/stop a Tomcat web server?

References

Some materials have been taken from Professor Tao's Internet Computing Hands-on Tutorials which are included in CS 612 "Course Materials" folder.