COMP 3500 Introduction to Operating Systems
Project 1 (Option 2): How to Install VirtualBox and CentOS

Important! If you intend to access your local Linux machine rather than a remote Linux server, you may follow the instructions in option 2 to install CentOS on VirtualBox in your Windows PCs or Apple Macs. To improve your Linux programming skills, you are strongly encouraged to go through option 1 after the completion of option 2.

1. Goals

- To setup VirtualBox (i.e., virtual machine) on your local Windows PCs or Apple Macs.
- To learn how to install CentOS (i.e., a Linux distribution) in the VirtualBox.
- To learn how to compile and run your first c program.
- To learn a few basic and important Linux commands.
- Reference: https://linuxhint.com/install_centos8_virtualbox

2. Getting Started with VirtualBox and CentOS

2.1 Download CentOS ISO image file from the official website of CentOS and click on CentOS Linux DVD ISO: https://centos.org/download/

2.2 Download VirtualBox
https://www.virtualbox.org/wiki/Downloads

2.3 Installation of CentOS in VirtualBox
http://teaching.idallen.com/cst8207/14f/notes/000_centos_virtualbox_install.html

2.4 Install CentOS

4.1 Important! When power on (boot) your virtual machine, you should see the CentOS installation screen. You must click in the window and use the arrow keys to stop the Automatic boot.

4.2 Important! After the installation is done, please reconfigure the Boot Order. Hard disk first followed by CD/DVD.

2.5 Create a user account in CentOS and Login CentOS using your newly created account

2.6 Become a root using `$su` and Install:

```
# yum -y install gcc
# yum -y install gcc-c++
# yum -y install vim-enhanced
# yum -y install emacs
# yum -y install gdb
# yum -y install ethtool
```

```
# yum -y install hdparm
# yum -y install pciutils
# yum -y install file
# yum install ncurses-devel
```

Important! If you don't install the `ncurses-devel` package, you will receive an error message when you install `cs161-gdb-1.5` in your project 2.

2.7 A Desktop Environment in CentOS:
A default CentOS 7 instance comes with an installed graphical user interface (i.e., GUI). In case you have decided to skip the GUI installation or are using a minimal distribution, you can always set up your visual environment later.

Please refer to the following webpage on how to install a desktop environment in CentOS: https://blog.vpscheap.net/how-to-setup-a-desktop-environment-in-centos-7/

3. Using the Linux Terminal in CentOS

Now you are ready to start using the terminal in your newly installed CentOS in the VirtualBox. You can launch a terminal from your desktop's application menu. The detailed instructions on how to use the Linux Terminal can be found here:

https://www.howtogeek.com/140679/beginner-geek-how-to-start-using-the-linux-terminal/

4. Some Linux Commands:

`exit`

This is how you leave the system.

`ls`

This lists all the files in the current directory. It is like the DOS dir command.

`mkdir`

This creates a new directory. Say mkdir dirname to create a new directory named dirname. Directories are the same thing as folders in Windows terminology. They allow you to collect related files in one place.

`cd`

Commands apply to files in the "current directory". The command cd dir changes the current directory to be dir.

`rm`

This deletes files; say rm fn to delete the file named fn. This is like DOS delete. The name stands for "remove".

5. Compile and Run your First C Program:

Please take the following steps to compile and run your first program:

- Step 1: In the Linux session in the PuTTY window, create a folder (e.g., comp3500) in your home holder. Please use "`mkdir comp3500`" to create the folder.
- Step 2 Change your directory using the following command:

```
$cd comp3500
```

- Step 3: create your first C program (e.g., helloworld.c). You can find sample source code here: https://www.programiz.com/c-programming/examples/print-sentence
- and save this source code file in "H:\comp3500" of the your Windows machine. Note that "H:" drive in your windows machine is the same as the home folder in the remote Linux machine.
- Step 4: Compile the source code using the command below:

```
$gcc helloworld.c –o helloworld
```

  Alternatively, you can compile the source code using the following command. By default, an executable file call "helloworld" will be generated.

```
$make helloworld.c
```

- Step 5: run the program:

```
$./helloworld
```

6. Using the VI editor:

Note: A detailed tutorial can be found at
http://www.eng.hawaii.edu/Tutor/vi.html

6.1 Getting Out of VI

VI has two modes and in order to get out of VI, you have to be in command mode. Hit the key labeled "Escape" or "Esc" (If your terminal does not have such a key, then try ^[, or control-[.) to get into command mode. If you were already in the command mode when you hit "Escape", don't worry. It might beep, but you will still be in the command mode.

The command to quit out of VI is :q. Once in command mode, type colon, and 'q', followed by return. If your file has been modified in any way, the editor will warn you of this, and not let you quit. To ignore this message, the command to quit out of VI without saving is :q!. This lets you exit VI without saving any of the changes.

Of course, normally in an editor, you would want to save the changes you have made. The command to save the contents of the editor is :w. You can combine the above

command with the quit command, or :wq. You can specify a different file name to save to by specifying the name after the :w. For example, if you wanted to save the file you were working as another filename called filename2, you would type: w filename2 and return.

Another way to save your changes and exit out of VI is the ZZ command. When in command mode, type ZZ and it will do the equivalent of :wq. If any changes were made to the file, it will be saved. This is the easiest way to leave the editor, with only two keystrokes.

6.2 The Two Modes of VI

The first thing most users learn about the VI editor is that it has two modes: command and insert. The command mode allows the entry of commands to manipulate text. These commands are usually one or two characters long, and can be entered with few keystrokes. The insert mode puts anything typed on the keyboard into the current file.

VI starts out in command mode. There are several commands that put the VI editor into insert mode. The most commonly used commands to get into insert mode are a and i. These two commands are described below. Once you are in insert mode, you get out of it by hitting the escape key. If your terminal does not have an escape key, ^[should work (control-[). You can hit escape two times in a row and VI would definitely be in command mode. Hitting escape while you are already in command mode doesn't take the editor out of command mode. It may beep to tell you that you are already in that mode.

6.3 Simple VI Commands

Here is a simple set of commands to get a beginning VI user started. There are many other convenient commands, which will be discussed in later sections.

`a`

enter insert mode, the characters typed in will be inserted after the current cursor position. If you specify a count, all the text that had been inserted will be repeated that many times.

`h`

move the cursor to the left one character position.

`i`

enter insert mode, the characters typed in will be inserted before the current cursor position. If you specify a count, all the text that had been inserted will be repeated that many times.

`j`

move the cursor down one line.

`k`

move the cursor up one line.

`l`

move the cursor to the right one character position.

`r`

replace one character under the cursor. Specify count to replace a number of characters

`u`

undo the last change to the file. Typing u again will re-do the change.

`x`

delete character under the cursor. Count specifies how many characters to delete. The characters will be deleted after the cursor.

6.4 Modify your first C program using VI

Can you start editing your `helloworld.c` source code by the following command in Linux. We assume that you working directory is `$~/comp3500`

```
$vi helloworld.c
```