Installing VirtualBox, Lubuntu, and CodeLite

In this course, we are going to be working within a virtual machine installed on your laptop and running the Lubuntu (https://lubuntu.me/) Linux distribution (a lightweight version of the Ubuntu Linux system). Linux is one of a number of descendants of the original Unix (https://en.wikipedia.org/wiki/Unix) operating system. Programming for this course will be done in C++ using this virtual Linux installation.

Please install VirtualBox, Lubuntu Linux, and CodeLite as described below. You will probably need about 10 to 15 GB of free disk space before starting to install and use the required software. You may need to read the installation instructions for VirtualBox, Lubuntu, and CodeLite to get everything working. Some Lubuntu installation assistance is provided below.

Step 1: Install VirtualBox on Your Computer and Create Your Linux Virtual Machine

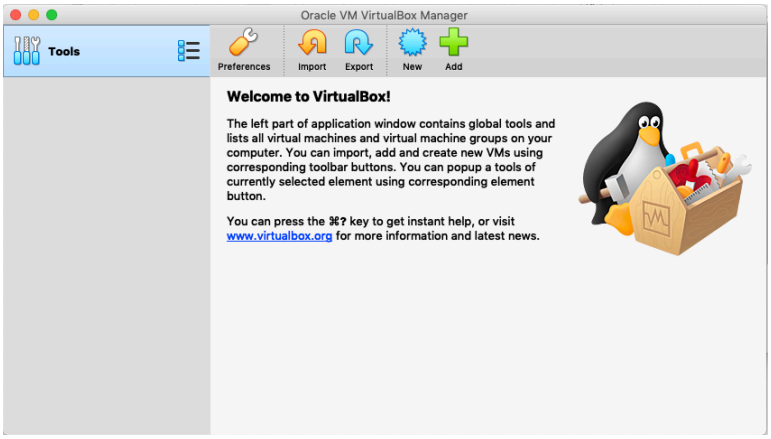
Install Virtual Box

Important: We will be installing VirtualBox 6.0.14 rather than the latest version of VirtualBox. The latest version (6.1) still has bugs.

Install VirtualBox 6.0.14 from https://www.virtualbox.org/wiki/Download_Old_Builds_6_0. The Extension Pack, SDK, and source code are not required. The screen shots below are from VirtualBox 6.0.14. If you have downloaded a later version, you may see some minor differences in the screen shots compared to what you see on your computer.

Create your Linux Virtual Machine

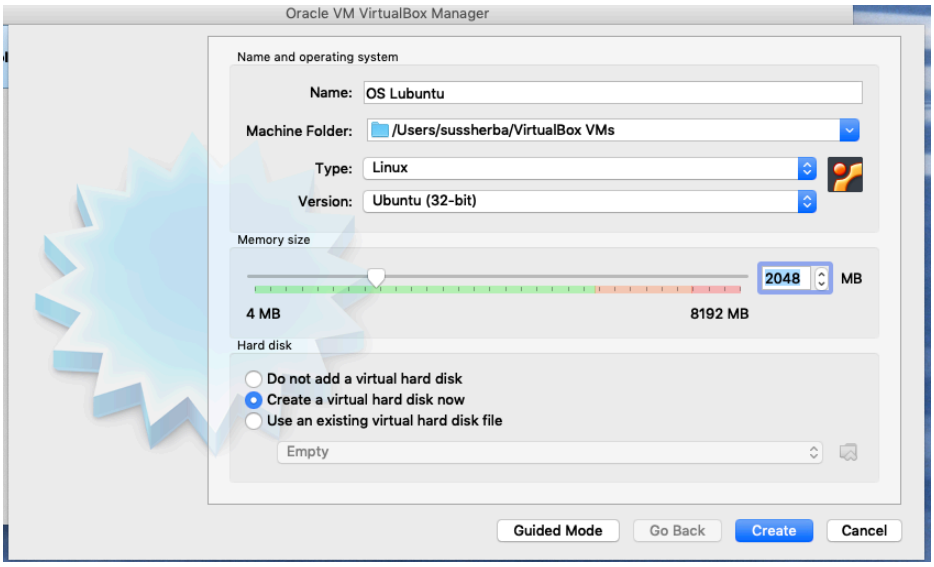
Once you have completed installation of VirtualBox, go ahead and start VirtualBox. You will see a screen similar to the following. Screen shots are from a Mac, but the Windows screens will look very similar.



If this is the first time you have used VirtualBox, you will not see any virtual machines in the left columns. If you have used VirtualBox previously, you may see one or more virtual machines.

Create a Virtual Machine to Run Ubuntu

Click on “New" and then if necessary, click the "Expert Mode" button at the bottom of the window to get to the following screen:



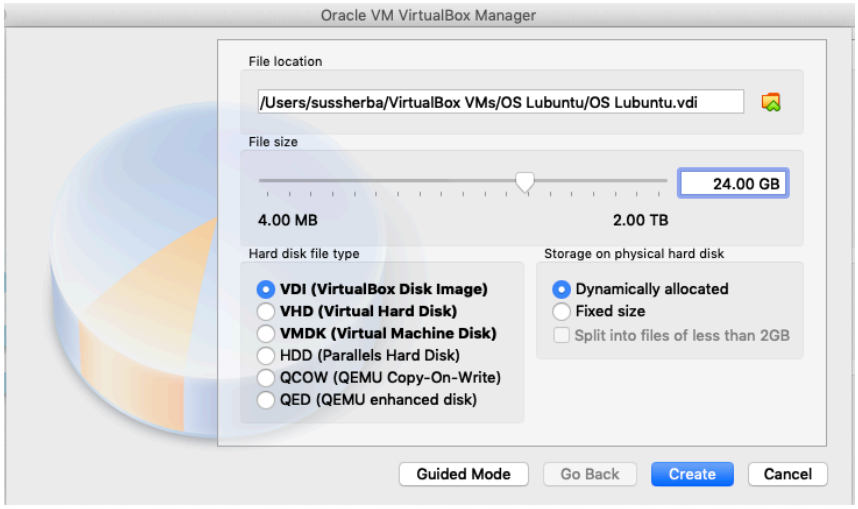
Give the Virtual Machine (VM) a name that you will use to identify it. Choose "Linux" as the Type, and "Ubuntu (32-bit)” as the Version. Choose 32-bit even if you have a 64-bit machine. We will use the 32-bit version since it takes up less resources than the 64-bit version and since some Windows machines have BIOS issues running 64-bit VMs. So, just to keep everyone on the same type of system, we will use the 32-bit system for this course.

Set the VM memory size to 2048 MB (2GB) or more if your laptop has at least 8GB of memory. If you have less than 8GB of physical memory on your computer, set the VM memory size to 1024 MB (1GB). You can change this later if necessary, using the settings for the VM. Note that both DU and CS laptop specification require at least 8GB of memory. You can view the minimum DU and CS laptop specifications at https://www.du.edu/it/laptops/specs.html and https://support.cs.du.edu/computer-science-laptop-requirements. You may experience performance problems if you have less than 8GB of memory.

You can find your computer's memory size by:

- **Windows 10:** bring up the "Start" menu, and type "about". Click on "About your PC". "Installed RAM" is the size of main memory.
- **Mac:** click the Apple icon on the left edge of the top menu bar, and then select "About this Mac". The "Memory" value is the size of main memory.

Select "Create a virtual hard disk now". Then click on "Create". That will result in a new dialog to create the virtual hard disk:



The default file location is the folder where VirtualBox will create your VM. You should not need to change this. The file size is the *maximum* size of the disk; set this to at least 24 GB. For hard disk file type, use "VDI (VirtualBox Disk Image)", and also select "Dynamically allocated". Then click on "Create". Your VM is now ready to install Ubuntu.

Setting for High-Resolution Displays

If you have a high-resolution display (such as an Apple Retina display or a 4K display on a Windows system), you may find the text and icons in the virtual machine to be extremely small. If this is the case, before proceeding to the next step, I suggest you open the Settings for your new virtual machine, go to the "Display" tab, select "Screen", and adjust the "Scale Factor" to 150% or 200%. You can adjust this as necessary later (you'll need to restart your VM to apply changes if it is already running).

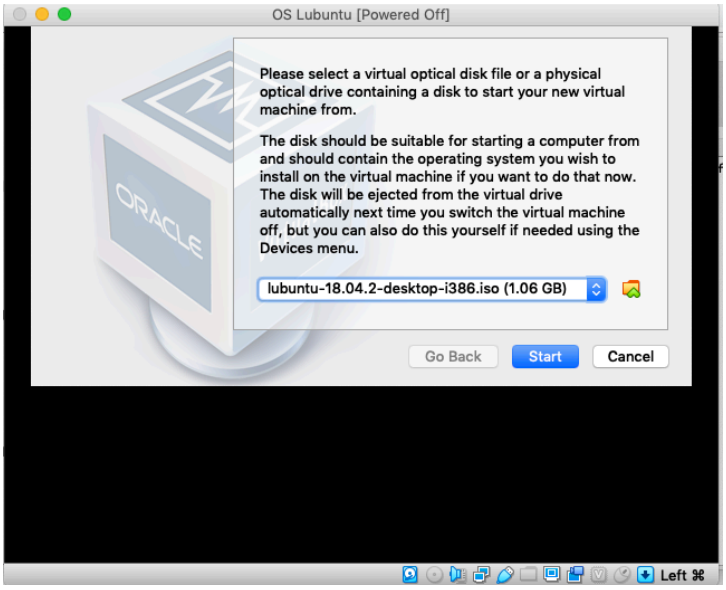
Step 2: Install Lubuntu in your Virtual Machine

At this point, download the latest Lubuntu 18.04 (Bionic Beaver) LTS installer (18.04.3 at the time of this writing). Lubuntu is a lightweight version of the Ubuntu Linux distribution. LTS indicates a stable Long Term Support release; any non-LTS version on the page is a developer's release and may be unstable. The download is a .iso file, which is a DVD ROM image file. From the download page https://lubuntu.me/downloads/, select "Desktop 32-bit" and save the .iso file on your local disk.

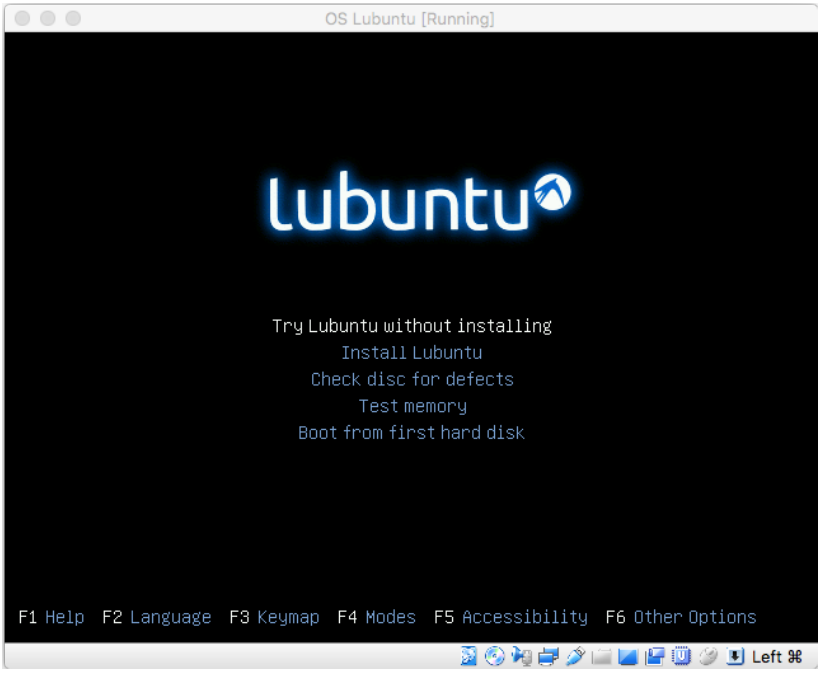
Important Note about Lubuntu Versions

If your installation screens don't look like the following examples, you've probably downloaded a newer version of Lubuntu. I highly recommend using long-term-support release 18.04.3 LTS, not newer versions 19.10 or 20.04.

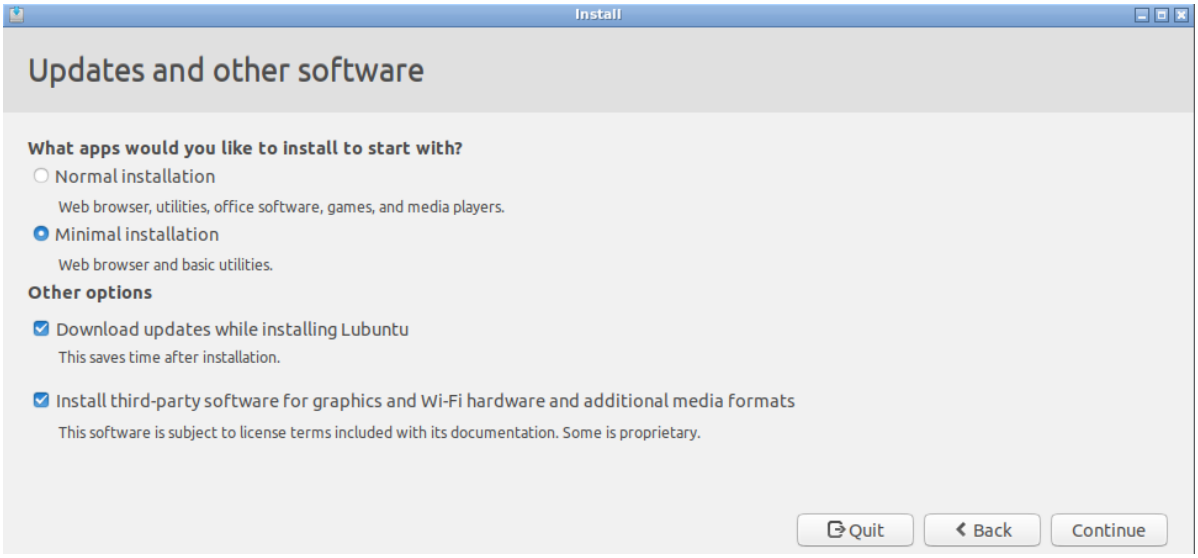
Once you've completed the Ubuntu download above, start your virtual machine by selecting it and then clicking on "Start" in Virtual Box. Since there is no operating system, VirtualBox will ask you for a boot disk. Click on the yellow folder icon and use the file chooser to select the Lubuntu.iso file your downloaded earlier. It may be a later version than shown below.



Then click on "Start" to boot Lubuntu from the .iso file. The installer will boot the system and ask you to choose your language. After you choose the language, you'll see this screen (in the language you've chosen):

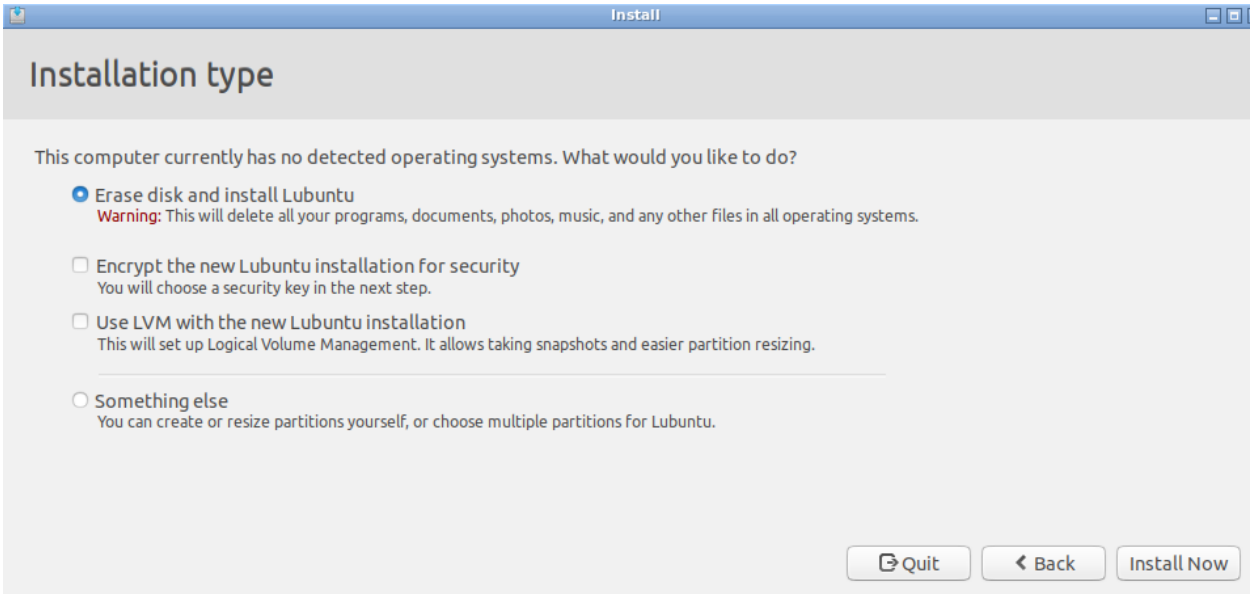


Use the arrow keys to select "Install Lubuntu", then press the Enter key. Proceed through the remainder of the installer to this screen:



Select "Minimal installation" if you're tight on disk space or memory. You should also select "Download updates while installing Lubuntu" and "Install third-party software...".

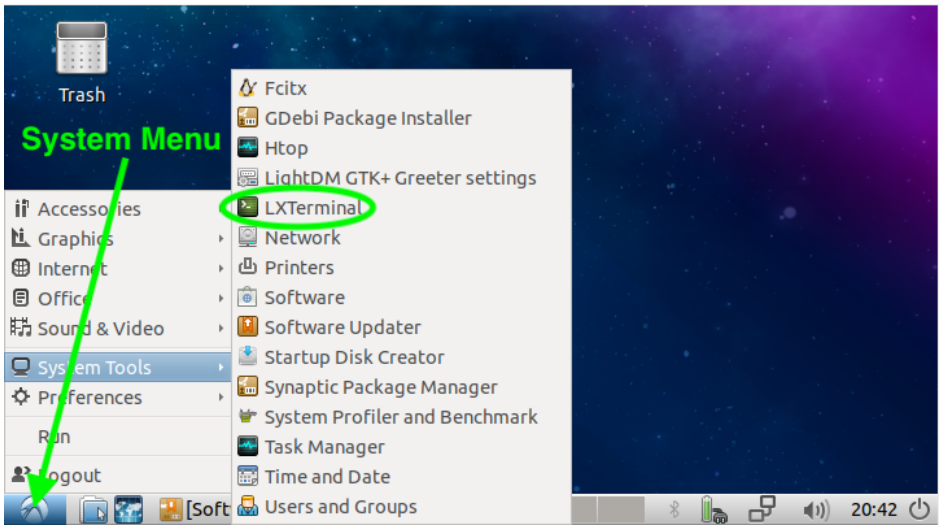
After clicking "Continue", you'll see this screen:



Select "Erase disk and install Lubuntu" (Don't worry, this just erases your VM disk, not your host computer disk.), then click "Install Now". Proceed through the following screens until installation is complete. On the "Who are you?" screen, you may select "Log in automatically", since this is a virtual machine hosted on your laptop. Remember your password. You'll need it later when installing software.

Additional System Software

After installation of Ubuntu is complete, restart Lubuntu. If prompted to remove the installation media, simply press return. The VirtualBox Guest Additions require some additional system software to be installed. You'll need to do this from the Linux command line. To open a command line window, click on the "System Menu" button highlighted below, then select "System Tools" and "LXTerminal":



In the terminal window, enter the following commands (enter your Linux password when asked, and answer "Y" when asked whether you want to proceed with installations):

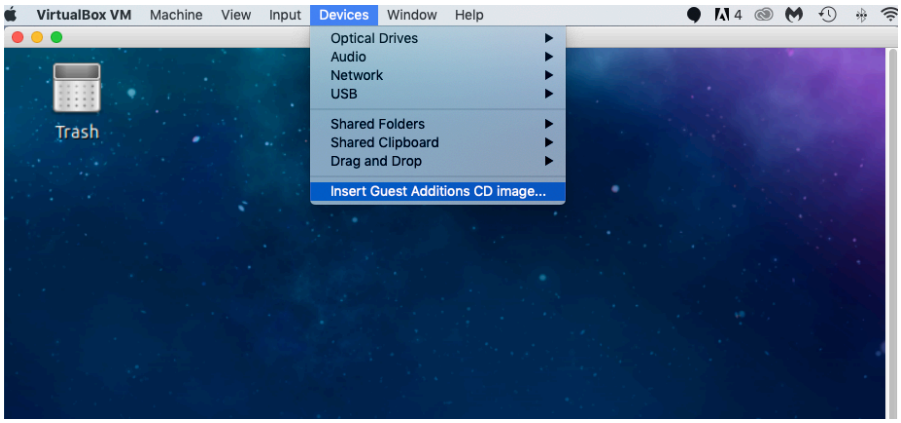
```
sudo apt-get update
sudo apt-get install gcc gdb g++ make perl
```

Advanced Package Tool (APT) is a collection of tools that works with core libraries to handle the installation and removal of software on Debian, Ubuntu, and related Linux distributions.

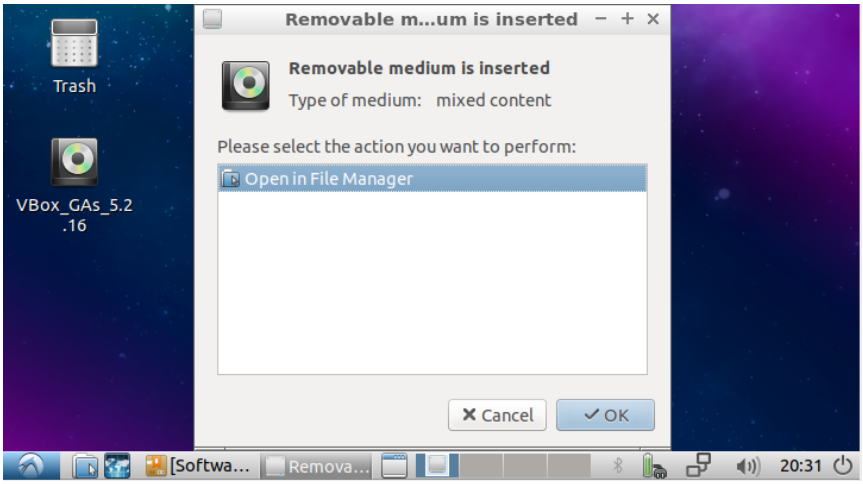
Installing Guest Additions in Lubuntu

The VirtualBox Guest Additions integrate your VM with the host (Windows or Mac) operating system for smoother operation. The installation procedure is outlined below (full details at https://www.virtualbox.org/manual/ch04.html#idm2099).

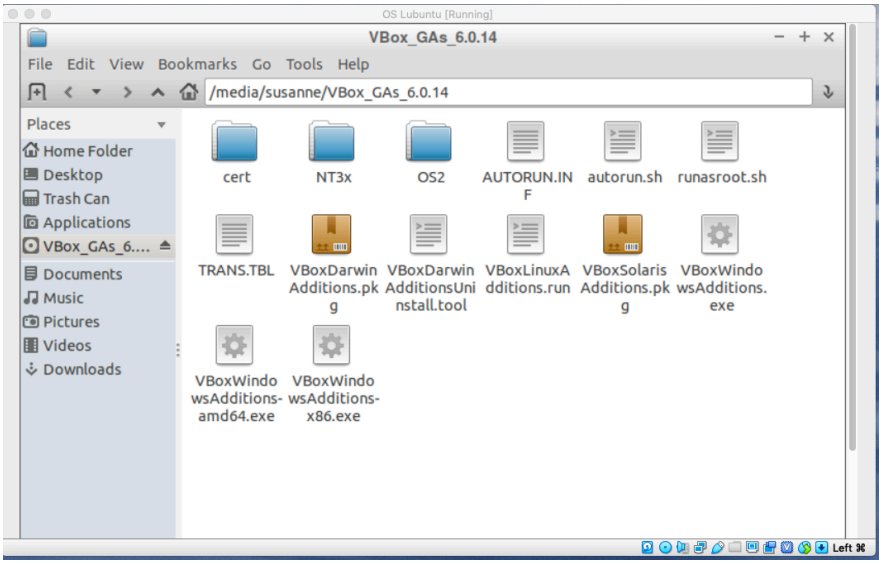
With Lubuntu installed and running in your VirtualBox VM, go to the VirtualBox menu (not the Ubuntu menu) and click on "Devices", then "Insert Guest Additions CD image ...".



You'll see this dialog:



Click "OK" to open the CD image in the File Manager:



Open or switch to a terminal window, and enter the commands (case sensitive)

```
cd /media/$USER/VBox*
sudo bash VBoxLinuxAdditions.run
```

Enter your password if requested. Installation may take a while. Once installation is done, use the power icon in the lower right of the VM screen to select “Shutdown."

Virtual Machine Settings

After successfully completing the above steps, shut down your virtual machine (if you haven’t already) and then click on "Settings". The following settings will improve performance and usability for your VM:

- General/Advanced: change "Shared Clipboard" to "Bidirectional" to allow copy/paste between the VM and your host system.
- System/Processor: the green bar on the "Processor(s)" line shows how many actual CPUs are present on your host system. You may want to increase the number of processors available to your VM to improve performance. I recommend either making this at least 1 less than the number of actual CPU's, or changing the "Execution Cap" below to a smaller number (80% or so), to avoid having your VM consume all available CPU time.
- Display/Screen:
  - Set "Video Memory" to the maximum value (128 MB) if your VM has 4GB of memory. Use a lower setting (32MB) if your VM has less memory.
  - Select "Enable 3D Acceleration" to speed up screen updates.
  - "Scale Factor" may be used to magnify the virtual machine screen for high-resolution displays.
- Shared Folders: You should add a folder on your host system that is accessible to your VM. Make sure that the path to the folder and the folder name do not contain spaces. Select the "Auto-mount" option when adding a shared folder. In order to access a shared folder, restart your Lubuntu system and then enter the following command in a terminal window:

  ```
  sudo usermod –a –G vboxsf $USER
  ```

You'll then need to logout and login (or reboot) to put this into effect. Your shared folders will be under the path "/media". For example, if your shared folder is name "myfiles", then you can access it by the path "/media/sf_myfiles".

Lubuntu Settings

Text Size

Depending on your preferences and screen resolution, you may want to change the size of the text displayed by Lubuntu. There are multiple places you can change text size:

- Main screen icon names: right click on an empty area of the desktop background, select Desktop Preferences, and change the font and font size on the Appearance tab.
- Text on system menus and window menus: click the System Menu button in the lower left corner of the screen, select Preferences and then Customize Look and Feel. On the Widget tab, change the font and font size as desired.
- Text in LXTerminal: on the Edit -> Preferences menu, use the Style tab to change the font and font size as desired.

Step 3: Install and Configure CodeLite

In this course, we will be using the CodeLite Integrated Development Environment (https://codelite.org). Additional CodeLite documentation is available at https://wiki.codelite.org/pmwiki.php.

Install CodeLite

To install CodeLite on Lubuntu open the LXTerminal and enter the following commands in a terminal window. I recommend that you copy and paste the commands. In the Lubuntu Terminal you will find the paste command in the Edit menu. The keyboard shortcut for paste is Shift+Ctl+V.

1. Add the CodeLite public key to avoid warnings from apt with this command:

```
sudo apt-key adv --fetch-keys http://repos.codelite.org/CodeLite.asc
```

2. Now let apt know that the repositories exist (The command should be entered on one line.):

```
sudo apt-add-repository 'deb https://repos.codelite.org/ubuntu/ bionic universe'
```

3. Next, update the repositories:

```
sudo apt-get update
```

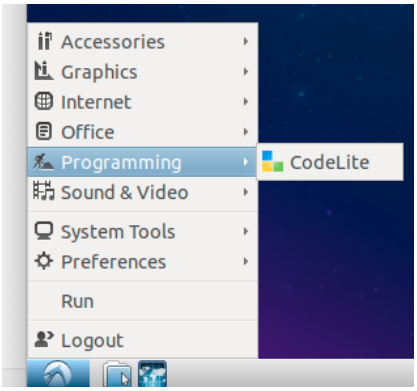
4. You use this command to install CodeLite:

```
sudo apt-get install codelite
```

Additional information about installing CodeLite on Ubuntu/Debian systems is available at: https://wiki.codelite.org/pmwiki.php/Main/Repositories#toc1

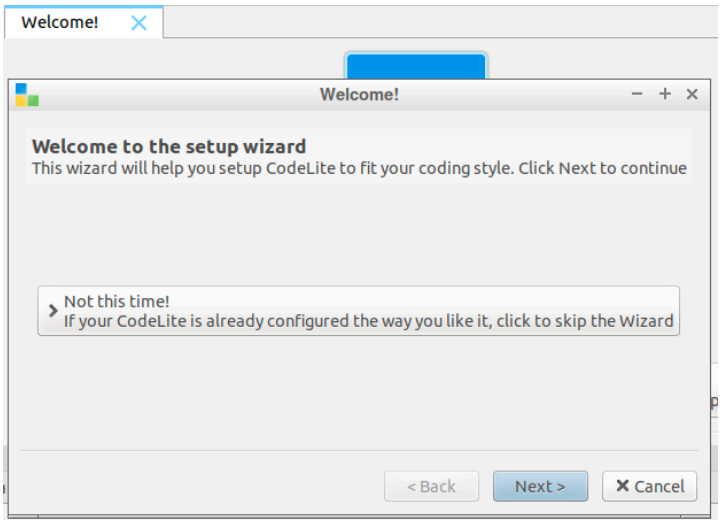
Configure CodeLite

Open CodeLite. Click on the "System Menu" button then select "Programming" and "CodeLite."

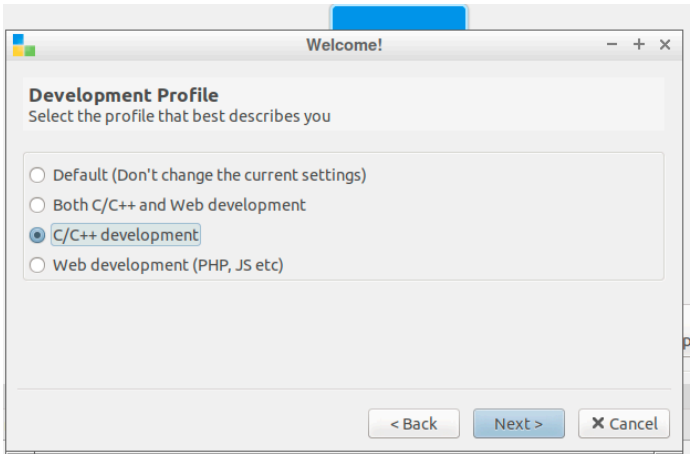


Once you have opened CodeLite, you will probably need to make the window a little larger.

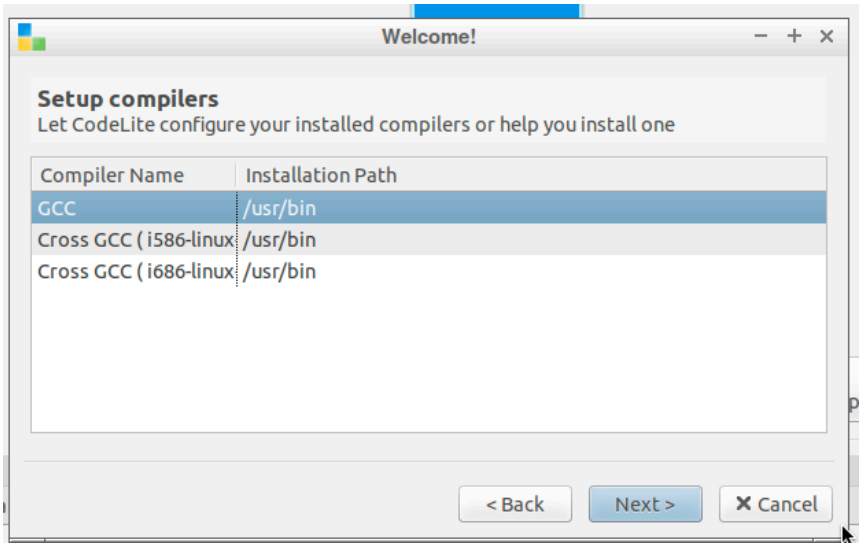
We want to run the Setup Wizard. If it does not open automatically, you can open it by going to the “Help” menu and selecting “Run the Setup Wizard.” The Setup Wizard welcome window should appear. Click “Next”.



We will only be using CodeLite for C++. In the next window select the C/C++ development profile and click “Next”.



In the next window, click the top button to scan your computer for installed compilers. Once the list appears select GCC and click “Next.”



The next dialog allows you to customize the color scheme of the editor. Select a theme that you like from the dropdown list and click “Next”.

The defaults in the Whitespace and Indentation dialog are fine. Click “Finish” to exit the Setup Wizard.

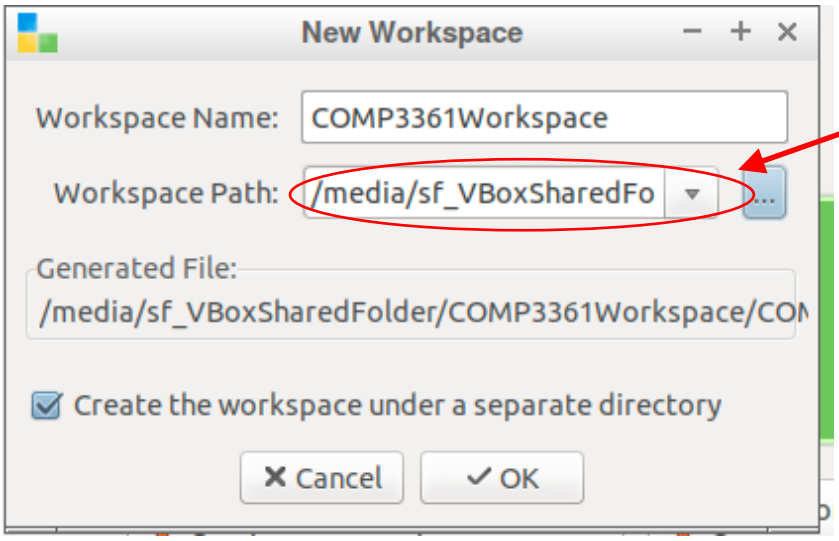
If you’d like to make the button tool bar visible, select the “View” menu and then uncheck the “Toggle minimal view” menu item by selecting it.

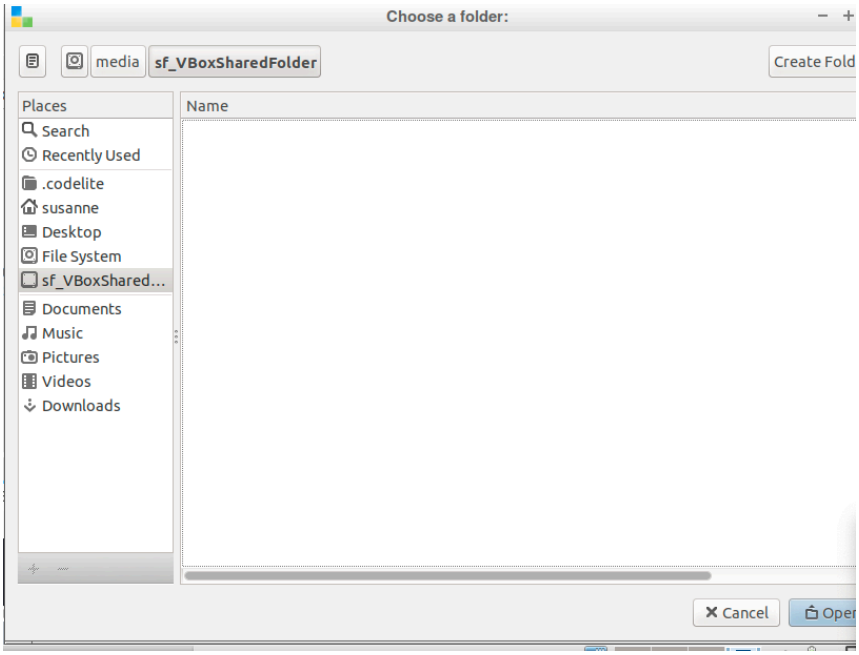
Working in CodeLite

Create a workspace

To work in CodeLite, you will need to create a Workspace. From the “File” menu, choose “New” and then “New workspace.”

In the next window, give your workspace a name with no spaces. I strongly recommend that you create your workspace in your shared folder so you can access your files from both your host computer and the guest computer (Lubuntu). You’ll need to browse to this folder to set the Workspace path (see second image below). If you have not already created a shared folder, see Step 1, Virtual Machine Settings for information on how to create a shared folder. Leave the “Create the workspace under a separate directory” box checked. When you have filled in the name and path, click “OK” to create the workspace.

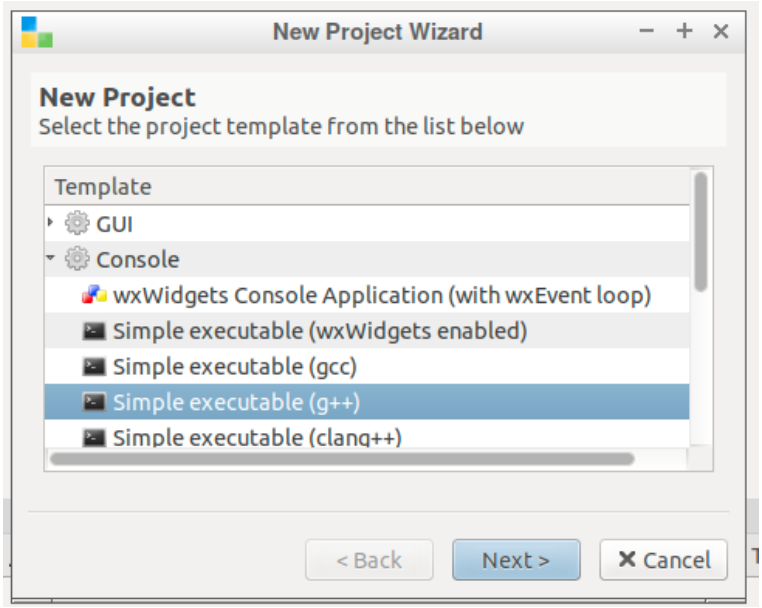




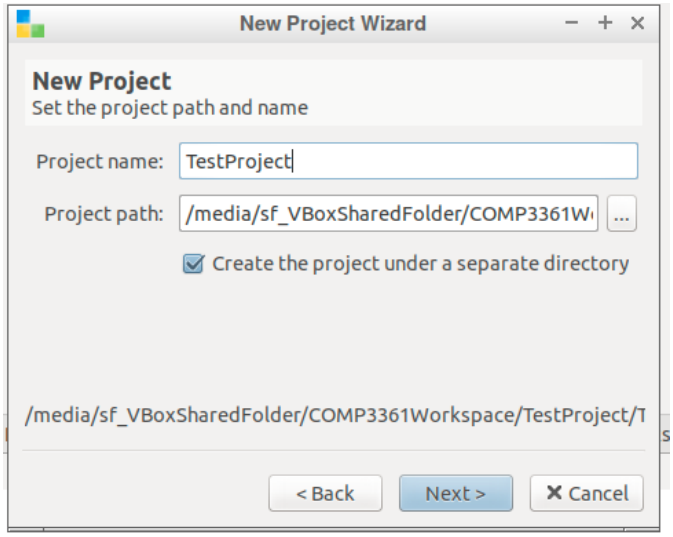
Add a project

Open the New Project wizard by right clicking on your workspace and selecting “New” and then “New project.” You can also do this from the file menu with the same selections.

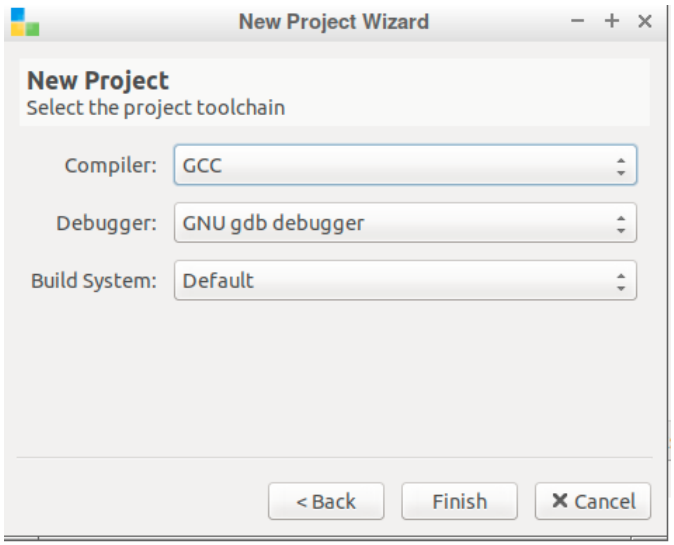
In the first window, open the list of Console templates and select “Simple executable (g++).” g++ in the GNU C++ compiler. Click “Next.”



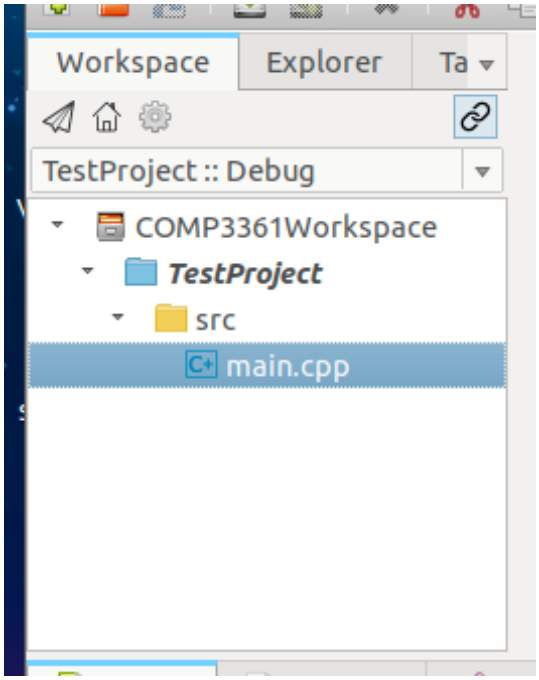
In the next window, give your project a name (no spaces). Leave the “create project in a separate directory” box checked. Click “Next.”



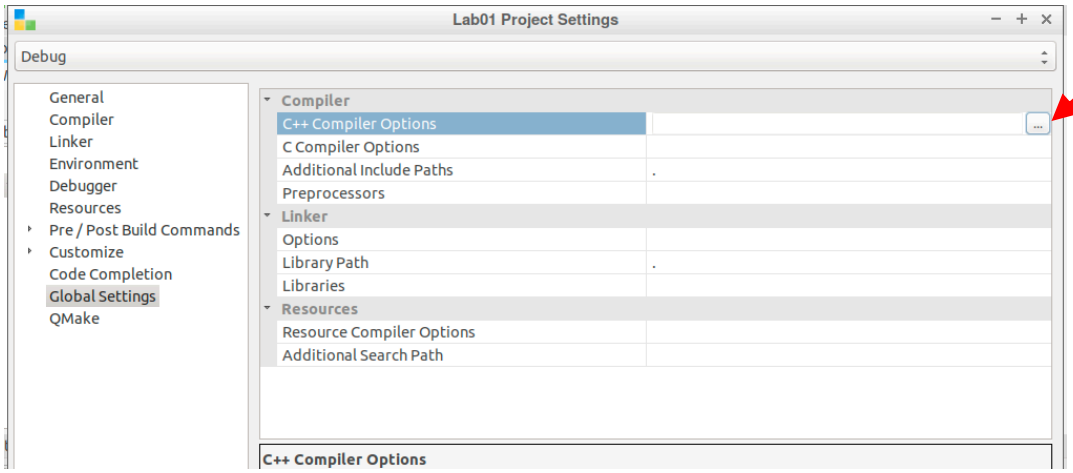
The defaults in the project toolchain dialog are fine. Click “Finish” to create your project.

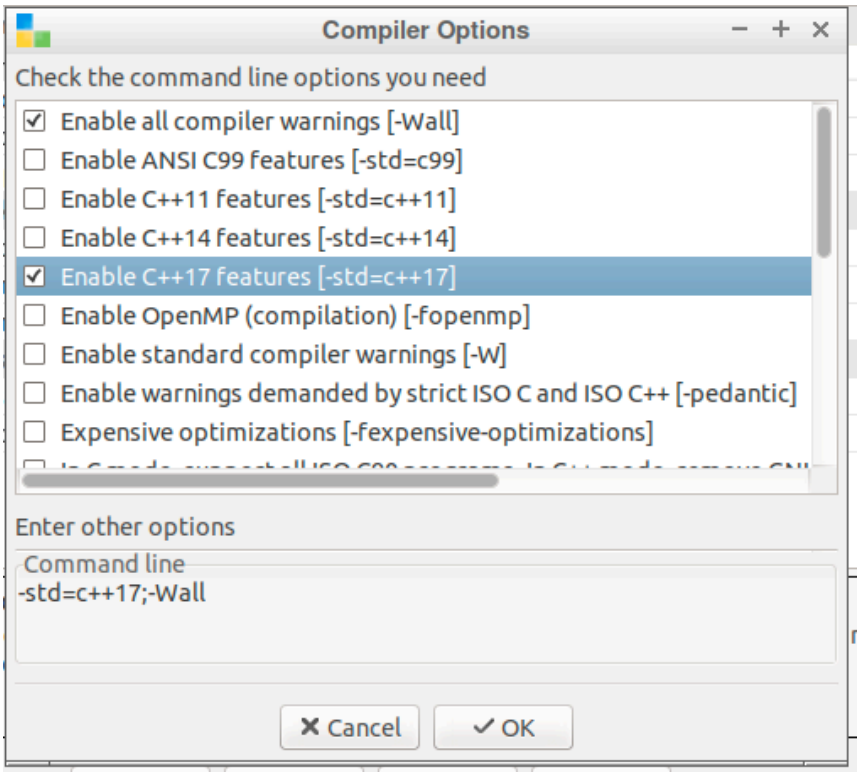


You should now see a project within your workspace as shown below.



Before we can start coding, we need to configure our project. Right click on your project and select “Settings.” It’s at the bottom of the menu. Select “Global Settings” and “C++ Compiler Options.” Click on the button with three little dots to open the C++ Compiler Options dialog. Check the two options shown below (“Enable all compiler warnings” and “Enable C++ 17 features.”) Click “OK” in this dialog and the next. (See the two screenshots below.)





If you would like to enable code completion, right click on the workspace and select "Workspace Settings." On the code completion tab, click "Enable C++ 17 Standard." Click "OK" when you are finished.

Now open your main.cpp file. If you would like to increase the size of your font select the "Settings" from the CodeLite menu and then "Colors and Fonts."

To test your setup, delete the program in main.cpp and type in the following:

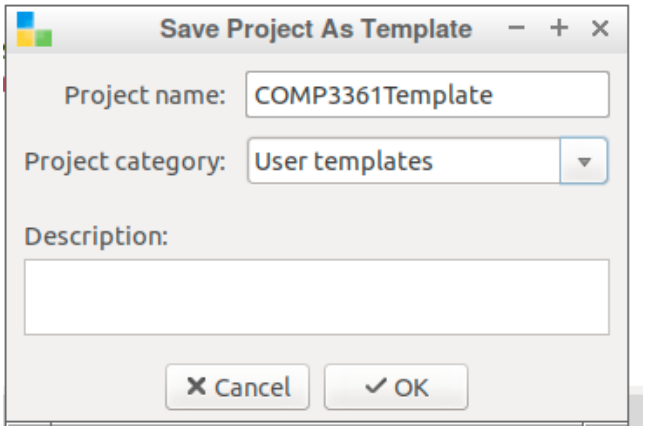
```
#include <iostream>
int main(int argc, char* argv[])
{
      std::cout << "Hello world" << std::endl;
      return 0;
}
```

Make sure you can build and run this project. You will find options to clean, build, rebuild, and run your project under the "Build" menu. Note that CodeLite always builds or runs the active project. The active project's name is italicized. To make a different project the active project, you will need to double click the project's name.

Create a Project Template

Now let's use the project you just created to create a CodeLite project template. This will save you time as you won't need to configure each project separately.

- Right click on your project and choose Save as Template.
- Give your template a name and indicate that the category is User templates. Click "OK."



- The next time you create a new project, you can use this template as a starting point.