

# CSC326 – Programming in Unix-like environments

# Software installation and usage guide

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## **Table of contents**

Table of contents	1
Introduction	3
Obtaining the software	4
What software will be used	4
Downloading the software	4
Removable storage	4
Installing the software	
Installing Virtualbox	5
Creating the virtual machine	
Installing Ubuntu (on the virtual machine)	
Installing <g++></g++>	
Using <gedit> and <g++></g++></gedit>	21
Creating the first program	21
Compiling and running	21
Programming tips	

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## Introduction

The aim of this document is to (briefly) present some simple instructions on obtaining, installing and using the software tools that are required for this course. I believe that in order to do well in the course you should have the software up-and-running in the shortest amount of time possible.

It is also my opinion that the following should hold true.

#### Constant availability (R1)

The university provides the software already installed and configured in the relevant laboratory. However students (and instructors) tend to require the software to be installed on their own home/office machine for constant availability.

#### Minimum impact to existing configuration (R2)

Nowadays most home machines are already installed and configured with some version of Microsoft Windows. Actually installing the Ubuntu operating system is not difficult but it certainly requires changing your system configuration to support the new operating system. I would like this to be avoided if possible

#### Minimum configuration of new OS (R3)

When Ubuntu is installed in a 'clean' partition it usually does not require any other configurations. However, sometimes, certain configurations are required and some users might find them confusing and/or difficult to implement. I would like this to be avoided also.

Lab 106 already has everything installed and configured. If you plan to work in the lab, that is fine. However, for the reasons mentioned above I am going to be using the following configuration on my office machine:

- Keep whatever version of windows exist on the machine
- Install Oracle Virtual Box to support virtual machines running under Windows
- Install <u>Ubuntu</u> as a virtual machine running under Virtual Box.

## **Obtaining the software**

## What software will be used

The software to be used in the course includes:

- Whatever version of windows you (already) have running on your machine
- Oracle Virtual Box v 3.2.8
- Ubuntu v10.04 LTS <u>Be advised</u>: you must get an ISO image (see below)
- <g++> compiler (available in Ubuntu)
- <gedit> editor (available in Ubuntu)

## Downloading the software

Virtualbox can be downloaded from <u>http://www.virtualbox.org</u>. Go to the download section and make sure you select the correct version for your platform.

Ubuntu can be downloaded from <u>http://www.ubuntu.com</u>. Go to the **Desktop edition** find the link for **Get Ubuntu Desktop Edition** and then select **Alternative downloads**. Once on that page you can click on any of the mirrors to get to links for ISO images.

#### Why get the Ubuntu as an ISO?

Because virtual box will be able to use it to install ubuntu (see the installation of ubuntu later on)

### Removable storage

If your machine is using an Intel (i386-base) processor, then you are in luck. I already have the above software downloaded. Bring me some removable storage and you can have it. Note:

- the Ubuntu ISO is 685 MB and is for i386-platforms
- the VirtualBox is around 80 MB and is for i386 and amd64 platforms

## Installing the software

In this section you are presented with instructions on how to install:

- Virtualbox
- Ubuntu
- <g++> (the c++ compiler)

## Installing Virtualbox

Virtualbox is a standard windows application so all you have to do is click on setup.exe and follow the wizard-based prompts. Nothing out of the ordinary there; after a few clicks you should have a shortcut on your desktop that looks like the one below



We will install Ubuntu under Virtualbox. The description that follows assumes that:

- you have already installed Virtualbox
- you have at least 5 gigabytes of disk space available
- you have obtained the relevant Ubuntu ISO image and know where it is in your file system structure.
  - Mine was in z:\Data images\ubuntu-10.04.1-desktop-i386.iso
- You are operating with Administrator (or at least power user) privileges

## Creating the virtual machine

1 Start up Virtualbox.

> As you can see I already have my original Ubuntu installation but I will do another one for this demonstration



Click the <New> button on the top left of the Virtualbox window.

2

The wizard starts up and you going to set up the new virtual machine.

💱 Create New Virtual Mac	hine ? 🛛
Create New Virtual Mac	Mine Welcome to the New Virtual Machine Wizard! This wizard will guide you through the steps that are necessary to create a new virtual machine for VirtualBox. Use the Next button to go to the next page of the wizard and the Back button to return to the previous page. You can also press Cancel if you want to cancel the execution of this wizard.
	< Back Next > Cancel
	K Dark Tieve >

#### Your action: Click next

3 Virtualbox is now asking you to name the virtual machine and supply information on to what OS it will use.

💱 Create New Virtual Mac	ine ?	×
	VM Name and OS Type Enter a name for the new virtual machine and select the type of the guest operating system you plan to install onto the virtual machine. The name of the virtual machine usually indicates its software and hardware configuration. will be used by all VirtualBox components to identify your virtual machine. Name Operating System: Microsoft Windows Yersion: Windows XP	
	< <u>B</u> ack <u>N</u> ext > Cancel	

Your action: Enter <Ubuntu> as the name and select <Linux> at the operating system dropdown and <Ubuntu> as the version. Click next when finished

4 Virtualbox is now asking how much RAM should this new system use from your machine's available RAM.

💱 Create New Virtual Maa	chine	? 🔀
	Memory	
	Select the amount of base memory (RAM) in megabytes to be allocated to the virtual machine.	
	The recommended base memory size is <b>512</b> MB.	
	Base Memory Size	
	51	2 MB
	4 MB 1500 MB	
	< <u>B</u> ack <u>N</u> ext > Ca	ncel

Your action: Depending on the RAM you have installed select something appropriate. I have 2GB RAM on my machine and I left the setting as it is (512MB). Click next

Virtualbox is now asking the location of the hard disk to use for the virtual machine.

💱 Create New Virtual Mac	hine 🔹 🔀
	Virtual Hard Disk Select a hard disk image to be used as the boot hard disk of the virtual machine. You can either create a new hard disk using the <b>New</b> button or select an existing hard disk image from the drop-down list or by pressing the <b>Existing</b> button (to invoke the Virtual Media Manager dialog). If you need a more complicated hard disk setup, you can also skip this step and attach hard disks later using the VM Settings dialog. The recommended size of the boot hard disk is <b>8192</b> MB. ♥ <u>Boot Hard Disk</u> ● <u>Gr</u> eate new hard disk ■ <u>Use existing hard disk</u> ● <u>Ubunut.vdi (Normal, 5.05 GB)</u> ♥ <del>©</del>
	< <u>B</u> ack <u>N</u> ext > Cancel

Your action: Leave the selections as they stand. The <Boot hard disk> should be ticked and the <create new hard disk> must be selected. Click next

5

The virtual hard disk wizard starts up and you will select which space to use

6



#### Your action: Click next

7 The wizard asks about the type of storage (dynamic or fixed)

💱 Create New Virtual Disl	<		
	Hard Disk Storage Type		
	Select the type of virtual hard disk you want to create.		
	A <b>dynamically expanding storage</b> initially occupies a very small amount of space on your physical hard disk. It will grow dynamically (up to the size specified) as the Guest OS claims disk space.		
	A <b>fixed-size storage</b> does not grow. It is stored in a file of approximately the same size as the size of the virtual hard disk. The creation of a fixed-size storage may take a long time depending on the storage size and the write performance of your harddisk.   Storage Type  Dynamically expanding storage  Fixed-size storage		
	< Back Next > Cancel		

Your action: Select <fixed-size storage> and click next

The wizard now asks where and how much space to take up.

> Usually the virtual disks are created under the Virtualbox directory by just having one file. The location is the file and your can select the size at the bottom

💱 Create New Virtual Disk	2 🛛
	Virtual Disk Location and Size         Press the Select button to select the location of a file to store the hard disk data or type a file name in the entry field.         Location         Ubuntu demo         Select the size of the virtual hard disk in megabytes. This size will be reported to the Guest OS as the maximum size of this hard disk.         Size         4.00 MB       2.00 TB
	< Back Next > Cancel

Your action: leave the settings as are. The name of the virtual disk will be the name of the system you entered (Ubuntu) and the recommended size is 8 gigabyte. Click next

8

9 The wizard confirms the action and you are finished with the creation of the virtual hard disk



Your action: read the details and ensure that you know what is happening. Click finish to create the disk.

10 The virtual hard disk is created

Creating fixed medium	storage unit 'C:\Docu	ments and Settings\	grondoudisVirtualBo	x\HardDisks\Ubunt	u demo.	vdi'
					4%	X
					)	

Your action: Nothing just wait for this to be finished

You will then be taken back to resume the virtual machine setup

11 Virtualbox is now confirming that it is ready to create the virtual machine



Your action: Click finish.

12 The new machine is created.

As you can see a new entry has been entered below my original Ubuntu.

The <u>Ubuntu</u> <u>demo</u> machine is now ready to be installed



Your action: Click the yellow <Settings> button

13 The settings dialog appears.

Here you can configure the setting of the virtual machine.

What we want to do now is load the image in the CD/DVD drive and start the Ubuntu installation

🌼 Ubuntu demo - Se	ttings	? 🛮
📃 General 🔝 System	Storage	
<ul> <li>Display</li> <li>Storage</li> <li>Audio</li> <li>Network</li> </ul>	Storage Tree          IDE Controller         IDE Controller         Empty         SATA Controller	Attributes Slot: IDE Secondary Master Slot: Empty Bassthrough
<ul> <li>Serial Ports</li> <li>USB</li> <li>Shared Folders</li> </ul>	Ubuntu demo.vdi	Information Size: Location: Attached To:
	Selects the virtual disk image or the host driv	re used by this attachment.

Your action: Select <Storage> from the listing on the left. The <Storage tree> appears and as you can see there are two items. 1) at the bottom the SATA controller (the hard disk) named Ubuntu demo and 2) the IDE controller, the CD/DVD drive which currently is indicated as empty.

Go to <Attributes> and the CD/DVD device and click the little icon to the right of the drop down

Virtual box will now ask for the CD/DVD image to load so that it will appear to be inserted in the CD/DVD of the virtual machine.

14

The virtual media manager will have (at the bottom) a listing of previously used media but you can add a new

🔋 Virtual Nedia Manager	? 🔀
Actions	
Image: New Add     Image: Second	
Hard Disks 😟 CD/DVD Images	
Name	Size
Leven ubuntu-10.04.1-desktop-i386.iso	685.56 MB
Location: Z:\DATA IMAGES\ubuntu-10.04.1-desktop-i386.iso	
Attached to: Not Attached	
Select Cancel	Help
	.:

My listing already includes the image file and I can select it; but I am going to demo how to add a new one.

Your action: Click the <Add> button at the top

15 The dialog opens up and you are asked to select an image

Select a CD/DAD-I		
Look jn:	🔁 DATA IMAGES 🔹 🔶 🖻 📸	
My Recent Documents Desktop My Documents My Computer	C off2k3 Office 2k7 DVD Ubuntu-10.04.1-desktop-i386 VB 2k3 CD0 VB 2k3 CD1 VS 2k3 Pre VS 2k5 STD CD1 VS 2k5 STD CD2 VS 2k8 DVD	
My Network Places	File name: ubuntu-10.04.1-desktop-i386	<u>O</u> pen
	Files of type: CD/DVD-ROM images (*.iso)	Cancel

Your action: find the Ubuntu (ISO) image file in your file system; select it; and click open.

The entry will now be entered in the media list; select it and click <Select>

16 You are taken back to the settings dialog and as you can see the CD/DVD device dropdown has now changed.

🔅 Ubuntu demo - Se	Storage	• ک
<ul> <li>System</li> <li>Display</li> <li>Storage</li> <li>Audio</li> <li>Network</li> <li>Serial Ports</li> <li>USB</li> <li>Shared Folders</li> </ul>	Storage Tree → IDE Controller → ubuntu-10.04.1-desktop-i386.i → SATA Controller → Ubuntu demo.vdi Compared to the state of the	Attributes Slot: IDE Secondary Master
	Select a settings category from the list on th item to get more information.	e left-hand side and move the mouse over a settings

Your action: Click OK to apply changes and load the image

17 In Virtualbox with the <Ubuntu> virtual machine selected.

The CD/DVD contents have now changed.

Ubuntu demo © Powered Off	Base Memory: Processor(s): Boot Order:	512 MB 1 Floppy, CD/DVD-ROM, Hard Disk
	Display Video Memory: 3D Acceleration: 2D Video Acceleration: Remote Display Server:	12 MB Enabled Disabled Disabled
	Storage IDE Controller IDE Secondary Master (CD/DVD): SATA Controller	ubuntu-10.04.1-desktop-i386.iso (685.56 MB)
	SATA Port 0:	Ubuntu demo.vdi (Normal, 8.00 GB)

This is it with the virtual machine. Next, we start the machine and install and configure Ubuntu

Your action: Click the <Start> green arrow button to start (bootup) the virtual machine.

## Installing Ubuntu (on the virtual machine)

🎬 Ubuntu demo [Running] - Oracle VM VirtualE 1 A new window - 🗆 🔀 <u>Machine D</u>evices <u>H</u>elp will open up and a couple of minutes later 😣 🔗 Install you will see something like Welcome English the capture Español You can try Ubuntu 10.04.1 LTS from this CD without making any changes to your system. Esperanto below. The Euskara virtual machine Try Ubuntu 10.04.1 LTS Francais Gaeilge has started. the Galego Ready to install? Once you answer a few questions, the ISO image has contents of the live CD can be installed on this computer so you can run Ubuntu 10.04.1 LTS at full speed without the CD. Hrvatski been loaded Italiano Answering the questions should only take a few minutes. Kurdî and the Latviski Install Ubuntu 10.04.1 LTS installation of Lietuviškai Magyar Ubuntu has Nederlands started. Norsk bokmål Norsk nynorsk 😂 💽 🖉 🖶 🛄 🔟 🚺 🐼 💽 Right Ctrl 2 Select the 😣 🔗 Install language Welcome English You can try Ubuntu 10.04.1 LTS from this CD without making any changes to your system. Español Esperanto Euskara Try Ubuntu 10.04.1 LTS Français Gaeilge Ready to install? Once you answer a few questions, the contents of the live CD can be installed on this computer so you can run Ubuntu 10.04.1 LTS at full speed without the CD. Galego Hrvatski Italiano Kurdî Answering the questions should only take a few minutes. Latviski Install Ubuntu 10.04.1 LTS Lietuviškai Magyar Nederlands Norsk bokmål Norsk nynorsk

Click the Install Ubuntu button at the bottom

3 Select your location to set up the time zone for your machine

#### 😣 🔿 🛛 Install

#### Where are you?

Select your location, so that the system can use appropriate display conventions for your country, fetch updates from sites close to you, and set the clock to the correct local time.



Click <Forward>

4 Select the keyboard layout for the machine

hich layout is most similar to Suggested option: USA	o your keyboar	d?
Guess keymap: Guess	***	
Choose your own: Turkey Turkmenistan	*	USA - Alternative international (for
USA Ukraine		USA - Cherokee
Okrame.	U	USA - Classic Dvorak

Click <Forward>

Set up the disk to install (leave settings as they are (Erase and use the entire disk)

5

### 😣 🔿 🛛 Install

his computer has no operating systems on it	t.
here do you want to put Ubuntu 10.04.1 LTS Erase and use the entire disk	?
SCSI3 (0,0,0) (sda) - 8.6 GB ATA VBOX HA	RDDISK
• Specify partitions manually (advanced)	
Ubuntu 10.04.1 LTS	
Step 4 of 7	Ouit Back Forwar

Click <Forward>

6 Set up your credentials for the machine

What is your name?		ſ
What name do you wan	nt to use to log in?	
Usemame		
installation.	will use this computer, you can set up multiple accounts after	
Choose a password to k	keep your account safe.	
Choose a password to k Password	keep your account safe. Re-enter password	
	Re-enter password	
Password	Re-enter password	

Click <Forward>

7 Ubuntu setup will confirm the details and prepare to begin installation



Click <Install>

8 Ubuntu carries on and installs

Installing system		
Welcome		
• Thank you for choosing Ubuntu 10.04 LT	rs.	
	the Ubuntu project. It is easier and more reliable than even ig a new video editor, integrated social networking and a	5
• Whether you're new to Ubuntu or a long While Ubuntu is installed, this slideshow	-time user, we're sure there is something you will enjoy. will show you around.	\$
	Ubuntu is designed to be easy. Feel free to ex	plore!
Detecting file systems		

Your action: just wait (it does not take that long)

9 In less than 15 minutes the installation is complete and you can restart your new system



Click <Restart now>

10 The disk is detected and Ubuntu notifies you



#### You must unmount the CD/DVD image

11 In the Virtual machine window that is running Ubuntu you will notice some icons at the bottom right



Your action: right click on the second icon from the left (the CD) and select <Unmount CD/DVD device> from the menu that pops up.

 6	) (	🔪 🖃 🧰 🕅 🗌 🐼 💽 Right Ctrl 🔄
		Host Drive 'E:'
	~	ubuntu-10.04.1-desktop-i386.iso
	3	More CD/DVD Images
	<b>_</b>	Unmount CD/DVD Device

12 With the CD/DVD unmounted



Your action: Press enter with the focus being on the Virtual Machine window

13 Ubuntu restarts and the select user screen appears

	adg-desktop	
2	adg	
	Other	

Your action: click on your username

14 Login	adg	
		Password:
		Cancel Log In

Your action enter the password you previously selected and click login to start using your new Ubuntu installation

## Installing <g++>

The g++ compiler is not installed with the default configuration of Ubuntu. This is why we have to configure our Ubuntu installation to include g++. The following describes how



Your action: Click on <Synaptic Package Manager>.

Note: you will be asked for your password

The window appears and you must now select the g++ compiler.

2

Notice the listing on the top right; the one starting with <2vcard>

😹 😪 📀 Synaptic Package Manager File Edit Package Settings Help						
C 🧐 Reload Mark All Upgrade	× 🐡	search 🔻				
All	S Package	Installed Version Late				
Amateur Radio (universe)	2vcard	0.5-3				
Base System (universe)	3270-common	3.3.7				
Communication	3dchess	0.8.1				
Communication (multiverse	☐ 4g8	1.0-3				
Communication (universe)	- III )	•				
Cross Platform	The GNU C++ compiler	A.				
* <u> </u>		0				
Sections	Get Screenshot	A STORE IN THE STORE				
Status	This is the GNU C++ compiler, a optimizing compiler for C++.	fairly portable				
Origin	This is a dependency package pro	oviding the default GNU				
Custom Filters	C++ compiler.					
Search Results	Canonical provides critical update	es for g++ until April				
30200 packages listed, 1304 insi	alled, 0 broken. 0 to install/upgrade	, 0 to remove				

Your action: Click on <2vcard> and on your keyboard press the letter <g>

3 The list updates to your 'selection'

3	Package	Installed Version	Late 4
	DEDIXI		0.0.2
	fyre		1.0.1
0	g++		4:4.4
	g++-4.1		4.1.2
	a++-4 1-multilib		412

Your action: Click on g++

4 The pop up appears

O gtt	A . A . A
Unmark	4:4.4
	4.1.2
Mark for Installation	412*
Mark for Reinstallation	•
Mark for Upgrade	
Mark for Removal	
Mark for Complete Removal	=
Mark for Complete Removal airly portable	

Your action: Select <Mark for Installation>

5 Ubuntu confirms



### Your action: Click Mark

6 The package manager updates. Just apply the changes now.

ade	s	А	<b>√</b> pply	۞ Properties	Qu
Â	S		Package		
J			fyre		
	Ø				
			~ 1 4 1		

Your action: click the <Apply> button to install

7 The manager will download and install the package for you.

All done

You are now ready to starting programming in your Ubuntu installation.



Your action: just click close

## Using <gedit> and <g++>

In this brief section I'll let you know how to write your programs inside Ubuntu using <gedit> and how to then compile and run them using <g++>

Here is the typical first program for C++. Never mind what everything means (for now). What you need to know is that this program will output onto the screen the message "Hello World".

```
#include<iostream>
using namespace std;
void main()
{
    cout << "Hello World\n";
}</pre>
```

## Creating the first program

Boot up your Ubuntu and login. Once up and running, pull down the <Applications> menu and go to the <Accessories> submenu. Select the <gedit Text Editor> item. The application will start and a new document will automatically be created.

Enter the above text in there and save the file as <hello.cpp> (without the < and >). You should now have something like the capture below



This file is now ready and it should be in your home directory.

## Compiling and running

Having created the program we can now compile and run it. Pull down the <Applications> menu and go to the <Accessories> submenu. Select the <Terminal> item. An Ubuntu command prompt will open up and you are presented with something like the capture below:

		grondoudis@grondoudis-desktop: ~						
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp				
grond	loudis	s@gron	doudis-de	sktop	:~\$		I	

On the command prompt write g++ hello.cpp as shown below

			gro	ondoudis@grondoudis-des
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp
gron	doudi	s@gron	doudis-de	esktop:~\$ g++ hello.cpp

Press enter and (provided no typing mistakes were made) you should have the prompt return (just like below)

		grondoudis@grondoudis-desktop: ~							
<u>F</u> i	le	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp				
	grondoudis@grondoudis-desktop:~\$ g++ hello.cpp grondoudis@grondoudis-desktop:~\$								

This means that the compilation was successful and the executable version of your program is ready. Ubuntu (like linux, unix and zenix) create the executable in the form of a file called <u>a.out</u>. All you have to do is execute that file.

The capture below shows the execution command as well as the expected output.

	grondoudis@grondoudis-desktop: ~							
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	<u>H</u> elp				
grondo Hello	oudis Worl	@gron .d	doudis-de	sktop:~\$ g++ sktop:~\$ ./a sktop:~\$				

Note that I didn't just write a out but rather  $\underline{./a.out}$  and this has been done in order to let the system know that I would like to run the program in my home directory.

That is it. You have just edited, compiled and run your first C++ program in Ubuntu.

## Programming tips

- 1. You have to be patient and persistent. Programs can take a while to complete (compile and run). Don't give up
- 2. The compiler has nothing against you, as do the keyboard, monitor and case. They are just doing their job.
- 3. C++ is case sensitive. This means that 'String' is not the same as 'string' and 'cout' is not the same as 'Cout'
- 4. The compiler is very rarely wrong. If it is reporting a mistake then it means that you do have a mistake somewhere (see point 6 below). In time you will learn to recognize the text for reporting a mistake and you will know what needs correcting.
- 5. When you do get 10 or even 100 scrolls worth of mistakes don't despair. Usually mistakes at the beginning of the program can cause many mistakes later on. What you should do is scroll-back at the top of the mistakes window and try an correct the first few.
- 6. Quite often mistakes are reported on lines that when you see them no mistake exists. This, 99% of the times, means that there is mistake somewhere above in the program. If the code is in a loop somewhere; look at the loop first; then look and the method that the loop was in, and so on. Try and double-check related code (close and sometimes far) to the mistake reporting line.
- 7. When copying the same code in 2 or 3 places and you need to make minor adjustments; don't copy everywhere first and then go and do the adjustments. Make it so that you: make a copy-make the adjustment; make the next copy-make the adjustment and so on. This way, you will not forget to make an adjustment.
- 8. When starting a method or loop or anything that uses curly brackets ( { and } that is) don't write just the opening brace and then start writing the code inside hoping to remember the closing bracket. Instead, write both the opening and closing brackets at the same time and then take your cursor back in the middle of the two to complete the code. This way, anything you write in there (no matter how many lines it is) will be inside the braces.