## 1 Introduction

This document is translated and modified based on a document written for the course TDIU16.

This guide describes step-by-step how you can install a virtual machine running Linux Ubuntu (the same distribution that run in the computer labs). We will install everything that is needed to write and compile C++ programs with the C++17 standard. You will probably want to install a text editors, for example emacs. Instructions for this can be found later in this document.

## 2 Instructions

Begin by downloading and installing VirtualBox. It is available at this url: https://www. virtualbox.org/. Click on *Downloads* in the left menu and choose the operating system of your computer. In this guide all screenshots are taken from a Windows Machine. Save the downloaded file and run it. You will see this window:



Click Next:

🕞 Oracle VM VirtualBox 6.0.18 Setup	×
Custom Setup Select the way you want features to be installed.	
Click on the icons in the tree below to change the way features will be installed.	
VirtualBox Python 2.x Su	
Version 6.0.18 Disk Usage < Back Next > Cancel	

For basic usage we will not need "VirtualBox USB Support" nor "VirtualBox Networking" (we can still access internet from the machine). Click on the icon to the left of them and choose: "Entire feature will be unavailable" (at the bottom, with a red cross). When it looks like the picture above, click *Next* (if you want to install everything some extra steps might appear).

🕞 Oracle VM VirtualBox 6.0.18 Setup	$\times$
Custom Setup	
Select the way you want features to be installed.	
Please choose from the options below:	
Create start menu entries	
Create a shortcut on the desktop	
Create a shortcut in the Quick Launch Bar	
Register file associations	
Version 6.0.18 < Back Next > Cance	4

## Click Next:

🙀 Oracle VM VirtualBox 6.0.18 Setup	×
Ready to Install	
The Setup Wizard is ready to begin the Custom installation.	
Click Install to begin the installation. If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.	
Version 6.0.18 < Back Install Cance	:

oClick Next:

😽 Oracle VM VirtualBox 6.0.18 Setup		—		×
Oracle VM VirtualBox 6.0.18				
Please wait while the Setup Wizard insta take several minutes. Status:	alls Oracle VM VirtualB	ox 6.0.18. Th	iis may	
Version 6.0.18	< Back N	lext >	Cano	el

You will se a security warning from Windows. Click Allow or corresponding. When everything is done you will see the following window:



Make sure that *Start Oracle VM VirtualBox...* is checked and then click *Finish*. Then VirtualBox will open:



I already have a few virtual machines in the list to the left, you will not. Click New (either the button or via Machine  $\rightarrow New$ ):

		?	×
<ul> <li>Create Virtual</li> </ul>	Machine		
Name and c	operating system		
Please choose a machine and sel The name you d machine.	descriptive name and destination folder for the ect the type of operating system you intend to hoose will be used throughout VirtualBox to ide	e new v install o ntify thi	irtual on it. is
Name:	Ubuntu Mate		
Machine Folder:	C:\Users\Filip\\VirtualBox VMs		~
Type:	Linux	•	<sup>™</sup>
Version:	Ubuntu (64-bit)	•	
	Expert Mode Next	Cano	:el

Give the machine the name *Ubuntu Mate*, then *Type* will be set to *Linux* and *Version* will be set to *Ubuntu (64-bit)* automatically. Then click on *Next*.

	?	×
<ul> <li>Create Virtual Machine</li> </ul>		
Memory size		
Select the amount of memory (RAM) in megabytes to be allow virtual machine.	ated to	the
The recommended memory size is <b>1024</b> MB.		
	2048	MB
4 MB 8192 MB		
Next	Ca	ncel

Choose how much memory the machine should have. Choose at least 1024-MB, but you should probably increase it to 2048-MB or more if possible. Make sure that the slider is out of orange or red areas. Click *Next*.

	?	×
<ul> <li>Create Virtual Machine</li> </ul>		
Hard disk		
If you wish you can add a virtual hard disk to the new machine either create a new hard disk file or select one from the list or location using the folder icon.	e. You c from ar	an Nother
If you need a more complex storage set-up you can skip this s the changes to the machine settings once the machine is creat	tep and ted.	l make
The recommended size of the hard disk is <b>10,00 GB</b> .		
🔿 Do not add a virtual hard disk		
Oreate a virtual hard disk now		
O Use an existing virtual hard disk file		
Windows XP.vdi (Normal, 10,00 GB)	T	· 🖾
Create	Can	cel

It will now ask you where the data of the virtual machine should be stored. This is done with a virtual disc-file. We want to create on, så choose *Create a virtual hard disk now* och click *Create*. Then the following window will open:

	?	×
<ul> <li>Create Virtual Hard Disk</li> </ul>		
Hard disk file type		
Please choose the type of file that you would like to use for the n hard disk. If you do not need to use it with other virtualization sof can leave this setting unchanged.	ew virtu ftware y	ial /ou
VDI (VirtualBox Disk Image)		
○ VHD (Virtual Hard Disk)		
O VMDK (Virtual Machine Disk)		
Expert Mode Next	Can	cel

The standard choice, VDI works. Click Next:

	?	×
<ul> <li>Create Virtual Hard Disk</li> </ul>		
Storage on physical hard disk		
Please choose whether the new virtual hard disk file should gro (dynamically allocated) or if it should be created at its maximum size).	w as it is u size (fixe	used d
A <b>dynamically allocated</b> hard disk file will only use space on your physical hard disk as it fills up (up to a maximum <b>fixed size</b> ), although it will not shrink again automatically when space on it is freed.		
A <b>fixed size</b> hard disk file may take longer to create on some s often faster to use.	ystems bu	ut is
Oynamically allocated		
○ Fixed size		
Next	Can	ncel

The standard choice, Dynamically allocated works. Click Next:

	?	×
<ul> <li>Create Virtual Hard Disk</li> </ul>		
File location and size		
Please type the name of the new virtual hard disk file into the on the folder icon to select a different folder to create the file	box below in.	or click
C:\Users\Filip\VirtualBox VMs\Ubuntu Mate\Ubuntu Mate.vdi		
Select the size of the virtual hard disk in megabytes. This size amount of file data that a virtual machine will be able to store	is the limit o on the hard	on the d disk.
· · · · · · · · · · · · · · · · · · ·	10	,00 GB
4,00 MB 2,00 TB		
Create	Car	ncel

Choose the harddrive size of the virtual machine. The default value, 10 GB works, but if you have more space on your computer than you can increase a bit. If you have little space on your computer, 5 GB should work.

💱 Oracle VM VirtualBox Manager		– 🗆 X
File Machine Help		
Tools	New Settings Discard Start	
64 Ubuntu Mate	📃 General	Preview
Powered Off	Name: Ubuntu Mate Operating System: Ubuntu (64-bit)	
	System	
	Base Memory: 2048 MB Boot Order: Floppy, Optical, Hard Disk Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization	Ubuntu Mate
	📃 Display	
	Video Memory: 16 MB Graphics Controller: VMSVGA Remote Desktop Server: Disabled Recording: Disabled	
	Storage	
	Controller: IDE IDE Secondary Master: [Optical Drive] Empty Controller: SATA SATA Port 0: Ubuntu Mate.vdi (Normal, :	10,00 GB)
	🕩 Audio	
	Host Driver: Windows DirectSound Controller: ICH AC97	
	P Network	
	Adapter 1: Intel PRO/1000 MT Desktop (NAT)	
	🖉 USB	
	USB Controller: OHCI Device Filters: 0 (0 active)	

The new machine will now be in the list to the left in the main window of VirtualBox. Make sure that is selected as in the picture. Now we can download Ubuntu. Gå to https://ubuntu-mate.org/download/ and click on 64-bit followed by 18.04.4 LTS (Bionic) and finally ubuntu-mate-18.04.4-desktop-amd64.iso and save that file somewhere.

Click on *Start* in the VirtualBox window:

🚏 Ubuntu Mate [Powered Of	f] - Oracle VM VirtualBox			$\times$
File Machine View Inpu	t Devices Help			
	? ×			
	Select start-up disk			
	Please select a virtual optical disk file or a physical optical drive containing a disk to start your new virtual machine from. The disk should be suitable for starting a computer from and should contain the operating system you wish to install on the virtual machine if you want to do that now. The disk will be ejected from the virtual drive automatically next time you switch the virtual machine off, but you can also do this yourself if needed using the Devices menu.			
	Empty 🔻 🧔			
	Start Cancel			
	🖸 🕢 🛄 🗗 🆉 🗖 🗏	00	HÖGER	CRTL .:

The machine will now begin rebooting. It will ask you to choose an installation medium. Click on the yellow symbol to the right of *Empty*. You will now see the following window:

Optical Disk Selector		?	×
Medium			
Add Create Refresh			
Name Virtual Size	Actual Size		
Search By Name 🔻		•	Q 1
	Choose Leave Emp	Cano	el

Click on Add in the upper left corner and then select the *ubuntu-mate-18.04.4-desktop-amd64.iso* file you just downloaded. Then click *Choose* followed by *Start* in the previous window:



The machine will now boot. It might take a while. I saw a blinking cursor for 20-30 seconds before I saw the screen above, and I started to worry whether or not everything was working. So let it take its sweet time.



After a while it has started Ubuntu properly and you will see the following screen. Click *Install Ubuntu MATE*.

<mark>7</mark> Ubuntu Mate [Running] - Oracle VM VirtualBox	- 0	×
File Machine View Input Devices Help		
	<b>↑</b> , 40)	ψ
<ul> <li>Install (as superuser)</li> <li>Keyboard layout</li> </ul>		8
Choose your keyboard layout:		
Spanish Spanish (Latin American) Swahili (Kenya) Swahili (Tanzania) Swedish Switzerland Taiwanese Tajik Thai Type here to test your keyboard	Swedish Swedish - Northern Saami (Sweden) Swedish - Russian (Sweden, phonetic) Swedish - Russian (Sweden, phonetic, no dead keys) Swedish - Swedish (Dvorak) Swedish - Swedish (Macintosh) Swedish - Swedish (Macintosh) Swedish - Swedish (Svdvorak) Swedish - Swedish (based on US Intl. Dvorak) Swedish - Swedish (no dead keys) Swedish - Swedish (no dead keys)	
Detect Keyboard Layout	Quit Gack Continue	
	🔛 🌝 🐙 📑 🌽 📖 🖳 👹 🚫 🕙 HOGER C	RIL 🔡

In the next step it will ask which keyboard-layout you want. If you don't want anything special you can select *Swedish* (or your native language) in the list to the left, then corresponding option will be selected automatically in the right list. You can add more layouts once the installation is complete. Click *Continue*:

💕 Ubuntu Mate [Running] - Oracle VM VirtualBox	—	C	]	×
File Machine View Input Devices Help				
		tĻ.	<b>4</b> ))	ψ
Install (as superuser)				8
Updates and other software				
<ul><li>What apps would you like to install to start with?</li><li>O Normal installation</li></ul>				
Web browser, utilities, office software, games, and media players. O Minimal installation				
Web browser and basic utilities. Other options				
Download updates while installing Ubuntu MATE This saves time after installation.				
Install third-party software for graphics and Wi-Fi hardware and additional media formats This software is subject to license terms included with its documentation. Some is proprietary.				
Quit Sack	)	Cont	tinue	
			_	_
2 • W # Ø = # W		🕑 HÖ	GER CF	RTL

Make sure that Normal installation and Download updates while installing Ubuntu MATE are checked. If you choose a disc smaller than 10 GB in the previous steps you can also check Minimal installation to save on disc space. Click Continue:

🐕 Ubuntu Mate [Running] - Oracle VM VirtualBox 🦳 🗆	×
File Machine View Input Devices Help	
t↓ •())	ψ
Install (as superuser)	8
Installation type	
This computer currently has no detected operating systems. What would you like to do?	
Erase disk and install Ubuntu MATE	
Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems.	
Encrypt the new Ubuntu MATE installation for security	
You will choose a security key in the next step.	
<ul> <li>Use LVM with the new Ubuntu MATE installation</li> <li>This will set up Logical Volume Management. It allows taking snapshots and easier partition resizing.</li> </ul>	
<ul> <li>Something else</li> </ul>	
You can create or resize partitions yourself, or choose multiple partitions for Ubuntu MATE.	
Out   Install Not	N
2	RTL

Make sure that *Erase disc and install Ubuntu MATE* is checked. It will *not* erase the disc on your computer, this operation occurs on the virtual disc created for the virtual machine and that disc is empty so there are no problems. Click *Install Now*.

🎽 Ubuntu Mate [Running] - Oracle VM VirtualBox —			×
File Machine View Input Devices Help			
	t,	<b>€</b> ))	ψ
<ul> <li>Install (as superuser)</li> </ul>		_	_
Installation type			
This computer currently has no detected operating systems. What would you like to do?			
• Erase disk and install Ubuntu MATE			
Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems			
<ul> <li>Write the changes to disks? (as superuser)</li> </ul>			8
If you continue, the changes listed below will be written to the disks. Otherwise, you will be able to m changes manually.	ake	furth	er
The partition tables of the following devices are changed: SCSI3 (0,0,0) (sda)			
The following partitions are going to be formatted: partition #1 of SCSI3 (0,0,0) (sda) as ext4			
Go Back	•	Contin	ue
🖉 Васк 🗌 Г	nsta	all No	W
•••••			
	۲	IÖGER (	RTL

Confirm changes with *Continue*:



Now the installation will start in the background. Choose your timezone (*Stockholm* if you are in Sweden). Click *Continue*:

🐕 Ubuntu Mate [Running] - Oracle VM VirtualBox	– 🗆 🗙
File Machine View Input Devices Help	
	<b>↑</b> ↓ •0)) -35
<ul> <li>Install (as superuser)</li> </ul>	
Who are you?	
Your name: Filip Strömbäck	<b>v</b>
Your computer's name: filip.VirtualBox	
The name it uses when it talks to other computers.	
Pick a username: filip	
Choose a password	
O Log in automatically	
• Require my password to log in	
Sack	Continue
	🖁 💟 🚫 🕙 HÖGER CRTL 🔡

Fill in your name (first name is enough). The computer name and the user name is picked automatically. It is okay to change these if you want to, but it is not necessary. Enter a password for the machine. Remember this password, you will need it to install software later!



The installation continues. It takes a few minutes. When it is done you will see the following message:

🜠 Ubuntu Mate [Running] - Oracle VM VirtualBox	_		$\times$
File Machine View Input Devices Help			
	t,	L ⊲0))	ψ
<ul> <li>Installation Complete (as superuser)</li> <li>Installation is complete. You need to restart the computer in order to use the needed to restart to use the needed to restart the computer in order to use the needed to restart to use the needed to</li></ul>	ew installa	×	
	Restart	Now	
🖸 💿 🛄 🗗 🖉 🗔 🗎 🖆	- 🖾 🚫 💽	HÖGER C	RTL

Click Restart Now:



Press *Enter* when you see this message (the installation medium has been removed automatically already):



After a while it will be booted again and then you will see a login screen similar to the one in the computer labs. Log in with the password you set during installation:



Now you will see your Linux-desktop. Now we will install som extra software that makes it easier to work on the virtual machine. For example: we want to be able to change the size of the window normally, copy and paste between the virtual machine and other programs on your computer.

💙 Ubuntu Mate [Running] - O	racle VM VirtualBox	– 🗆 X
File Machine View Input	Devices Help	
Menu	<ul> <li>Optical Drives</li> <li>Audio</li> <li>Network</li> <li>USB</li> </ul>	tis mar 17, 11:31
filip's Home	<ul> <li>Shared Folders</li> <li>Shared Clipboard</li> <li>Drag and Drop</li> </ul>	
	Insert Guest Additions CD image	
:		
Insert the Guest Additions disk fi	le into the virtual optical drive	🙆 💿 💯 🗗 🌽 💷 🖳 💾 💟 🊫 💽 HÖGER CRTL 🔬

Choose Devices  $\rightarrow$  Insert Guest Additions CD image...



Make sure that *Open Autorun Promt* is checked, and the click *OK*:

🐕 Ubuntu Mate [Running] - Oracle VM VirtualBox				×
File Machine View Input Devices Help				
🚳 Menu 🍅 🕴 🕇	<b>⊲</b> ))	t;ti	s mar 17,	11:32
hup's Home				
• VBox_GAs_6.0.18		8		
VBox_G/ This medium contains software intended to automatically started. Would you like to run	be it?			
The software will run directly from the medium "VBox_GAs_ You should never run software that you don't trust.	_6.0.18	".		
If in doubt, press Cancel.				
Cancel Run				
	/			
				٦
🖸 💷 🔁 🕐 🛄 🗗 🏈	_ 🛛 🖉	2 🖾 🔇	U HÖGER	CRTL

Click Run:

🦻 Ubuntu Mate [Running] - Oracle VM VirtualBox	– 🗆 🗙
File Machine View Input Devices Help	
🎯 Menu 😂 🕴 🕇 📢	🔱 tis mar 17, 11:32
File Edit View Search Terminal Help	
Authenticate	
Authentication is needed to run `/bin/sh' as	
the super user	
An application is attempting to perform an action that	
requires privileges. Authentication is required to perform this action.	
Password:	
▶ Details	
Cancel Authenticate	
🔚 🗈 VirtualBox Guest Add 🔍 Authenticate 🛛 🚳 [Software Updater] 📄	3
	🖥 💟 🚫 🔁 Höger Crtl 🞡

Things will be installed and you have verify this. Enter the password you set during installation again:



The installation will take a while.



When it is done you press *Enter* to close the window.



Restart the virtual machine by clicking the icon in the upper right corner and then Shut Down... as in the image.

🐕 Ubuntu Mate [Running] - Oracle VM VirtualBox				×
File Machine View Input Devices Help				
🚳 Menu 🝅 🕴 🕴	. <b>●</b> ))	ψ	tis mar 17	, 11:33
filipic Home				
The Shore				
VBox_GAs_6.0.18				
Shut down this system now? You are currently logged in as "Filip Strömbäck".				
This system will be automatically shut down in 56 seconds				
Suspend Restart Shut Down				
🔚 🛞 [Software Updater]		1		٦
D 🖸 🗐 🖓	i 🔲 🖉		HÖGER	CRTL .:

Click *Restart*, wait until the virtual machine has restarted and log in again. Now you are ready to install programs. Open a terminal by pressing Ctrl + Alt + T. Run the command sudo apt-get install g++ gdb valgrind

This command might ask if you are sure. Press *Enter* to confirm. The installation should continue without any issues. Now you have everything you need to program C++ on your virtual machine!

You might want to install your favorite editor as well. You can install emacs with the command sudo apt-get install emacs, many other tools can be installed in a similar way, but that depends on whether or not that tool is included in Ubuntu.