Operating Systems
Linux Installation

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The course ”Virtual Machine”

- A *virtual machine* is a *software emulation* of an *hardware machine*.
- Download it at http://www.hep.lu.se/courses/MNXB01/
- **OBS!**: right click, save link as... and save it in **`C:\VirtualBox\`**
  OR IT WILL NOT WORK!
  - Reason: there is not enough free space in your personal folder. A virtual machine has big files. Why?

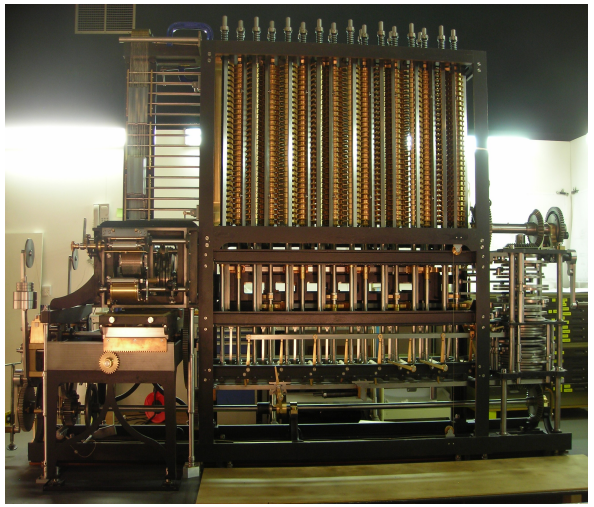
NO NEED TO DO THIS TODAY.
THE SYSADMIN DID IT FOR US!

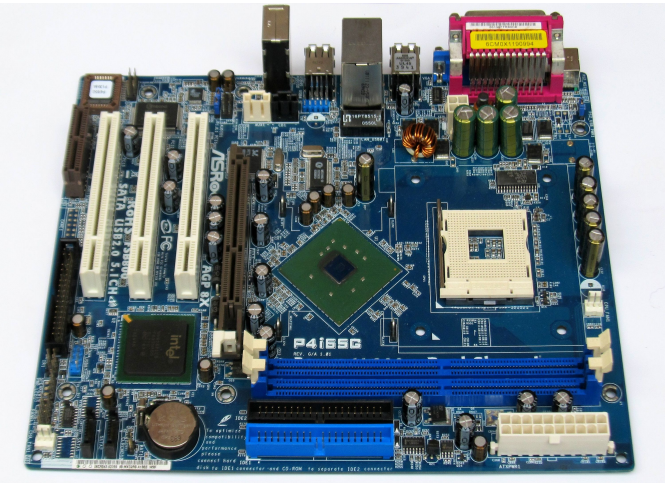
Outline

- What is a computer?
  - A computer as a finite state machine
  - Brief history and architecture overview
- Introduction to virtualization
  - Installing the course virtual machine
  - Basic Lubuntu use
  - Creating a virtual machine with VirtualBox
- Operating Systems
  - Why do we need it?
  - Examples of operating systems
  - Linux and distributions
  - Linux Installation

What is a computer?

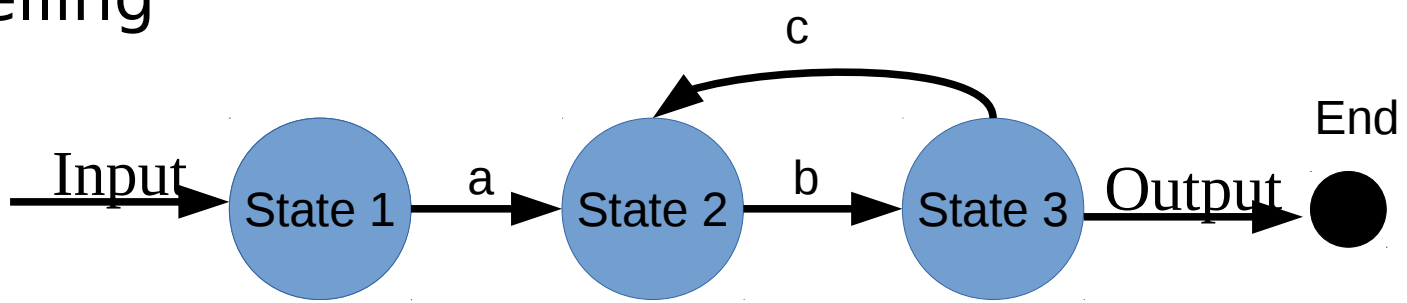
- A **programmable machine** that can store, retrieve and process **information**.
- **Information** can be, for example
  - Data
  - Simple and complex operations
- Most of modern computers are based on electronic circuits. Whatever we **program** these circuits to do for our needs is usually called **information processing.**





Finite State Machine

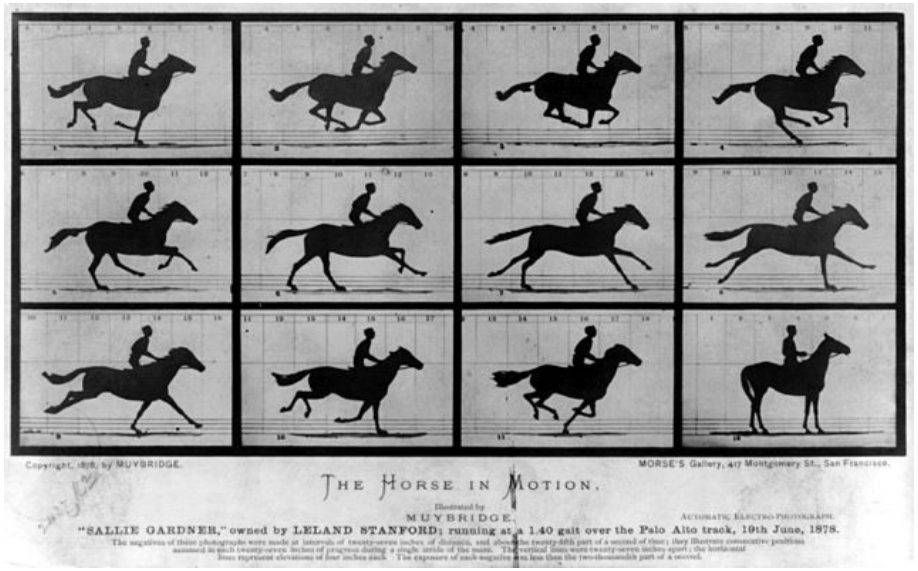
- A mathematical object that represents a sequence of events and their possible outcomes
- You can use this model for:
  - Evolution of a closed system
  - Card games
  - Movies cutting
  - Storytelling
  - Music



Finite state automaton

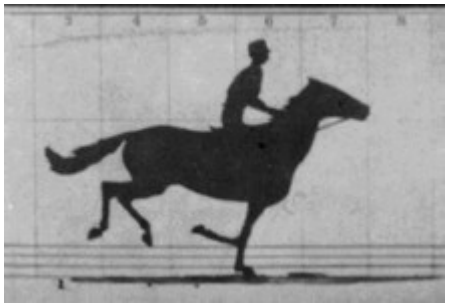
Finite state machines

- A modern computer is modeled by a finite state machine.
  - A “state” is the contents of “memories” of the machine
  - If we could stop time, the computer would stay in a defined state



States

- A state can be restored by restoring the machine's ”memories”
  - Examples: hibernation, **virtualization (some about it later)**



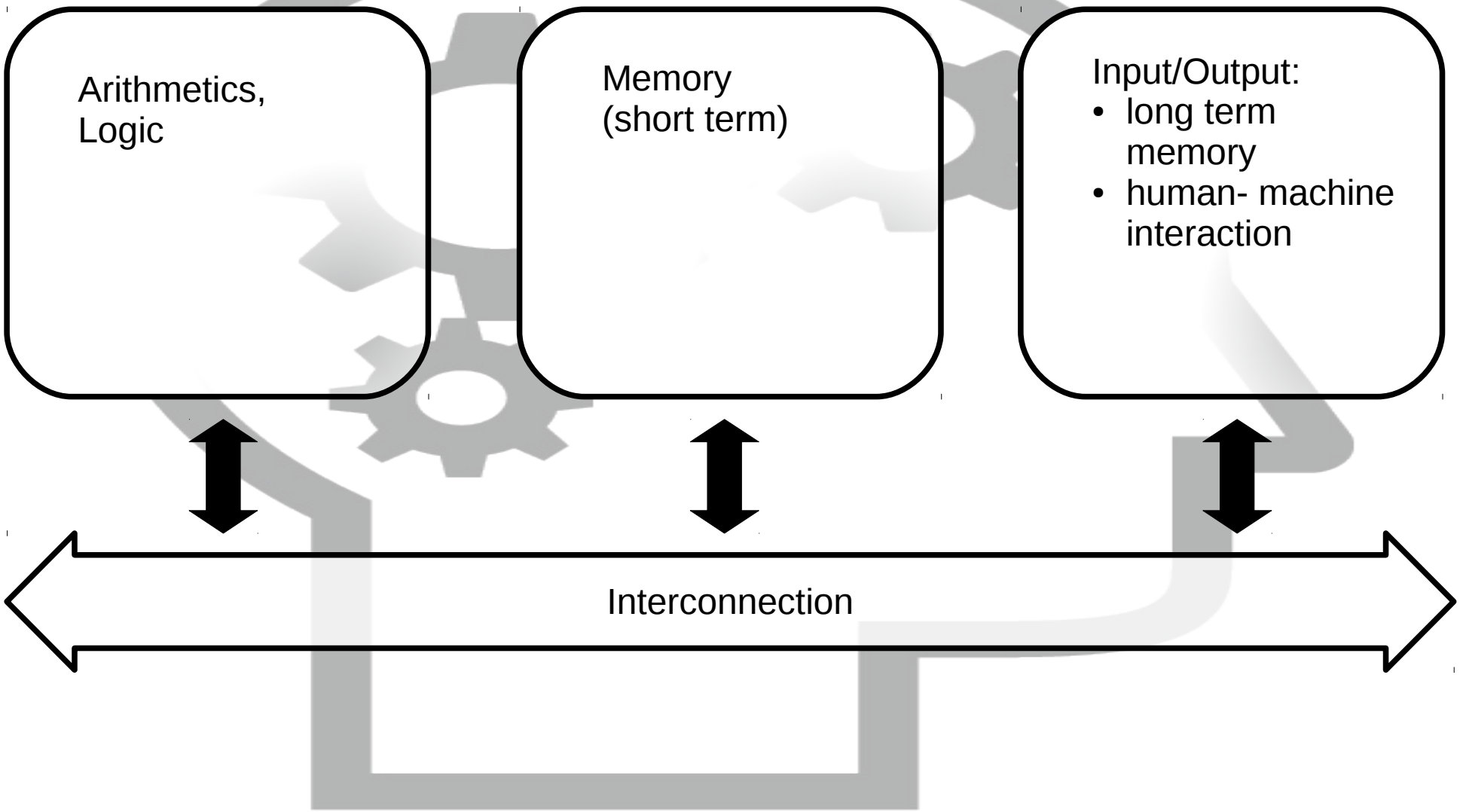
States during execution
(only visible in libreoffice)

VERY Brief history of computing

- 1945 Von Neumann's paper[1] defines the modern computer architecture
- 1960-70 Various researchers start improving the communication between components
- 2016: We still use the same basic approach, with lots of improvements, and increased complexity.

[1] First Draft of a Report on the EDVAC, John von Neumann, Contract No. W-670-ORD-4926, June 30, 1945

Von Neumann-based modern architecture



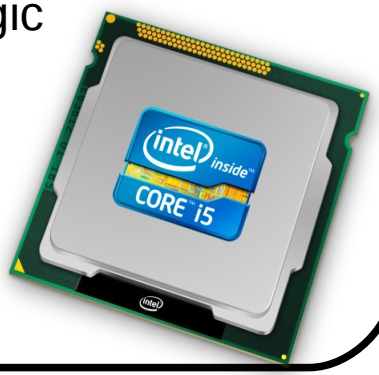
Von Neumann-based modern architecture

- Arithmetics and Logic: Brain ability to process numbers and operations
- Memory:
  - Short term: used in quick operations
  - Long term: memories
- Interconnection: neurons, the spine or the nervous system
- Interaction with external world: the senses, like sight, smell, taste, touch, ...

Hardware:
electronic components of a computer

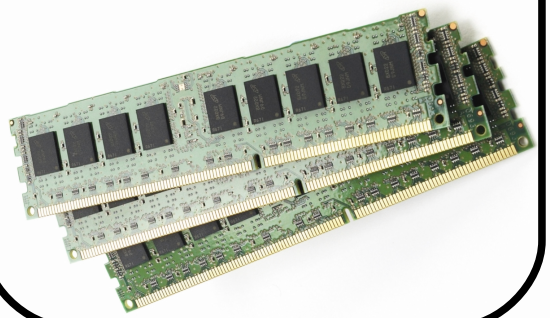
CPU, Processor

Arithmetics,
Logic



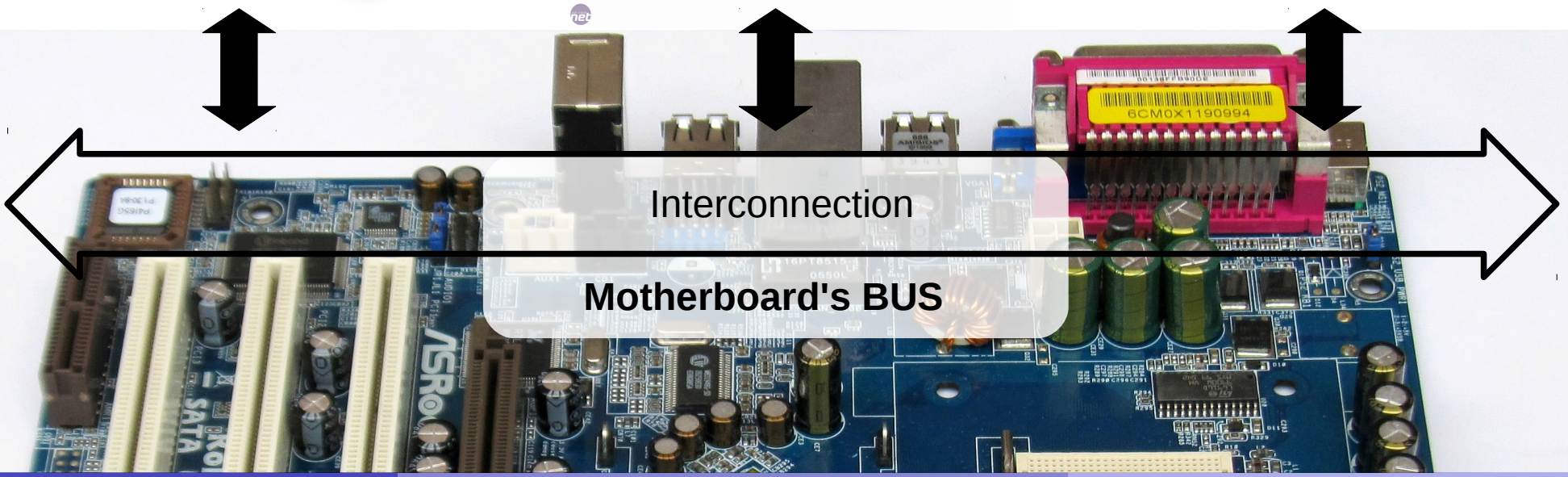
RAM

Memory used only
when machine
powered on



DEVICES

Input/Output



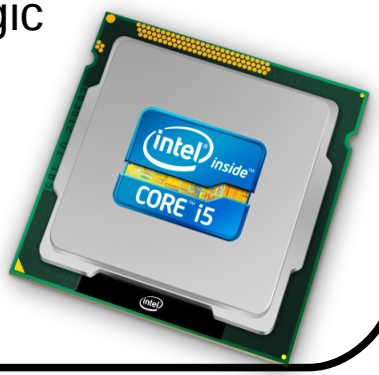
Interconnection

Motherboard's BUS

Hardware:
electronic components of a computer

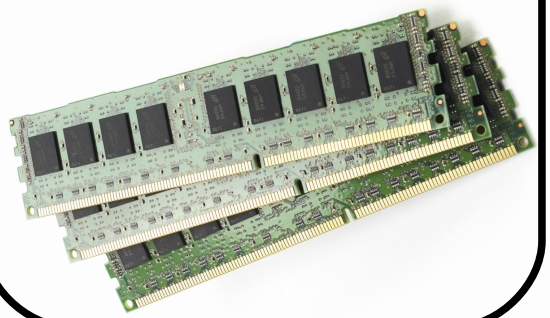
CPU, Processor

Arithmetics, Logic



RAM

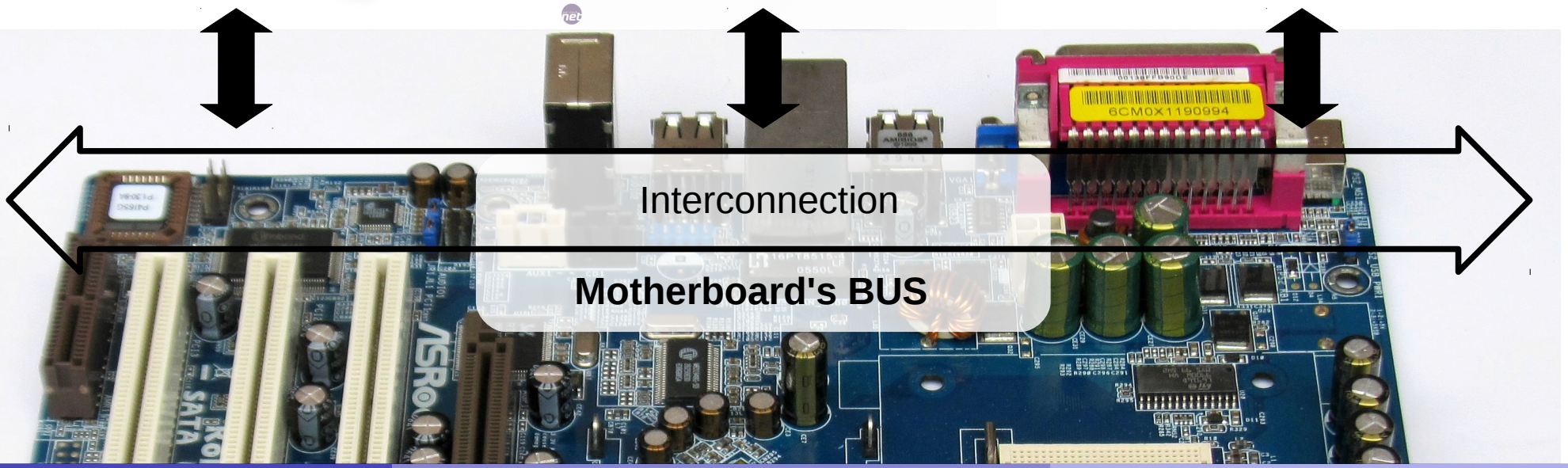
Memory used only when machine **powered on**



DEVICES

Input/Output

Long term memory persists also when machine powered off



Interconnection

Motherboard's BUS

Hardware: electronic components of a computer

- Arithmetics and Logic: CPU (Central Processing Unit)
- Memory:
  - Short term storage: RAM (Random Access Memory) only works when powered
  - Long term storage: magnetic discs / USB dongles / cloud storage . Works also when not directly powered.
- Interconnection: BUS(PCIE,SATA,USB)
- Interaction with external world: devices like Network cards, Screen, Keyboard, Touch screen...

Software

- Anything that is designed to **run** or **execute** in a computer , that is, the information that is processed by the hardware.
- Can be of different kinds:
  - **System software**: used to interact directly with the hardware, usually as an *interface* between the hardware and other kind of software.
    Examples: device drivers, operating systems, firmware...

  - **User software:** something with which a user interacts directly to perform a task. Also called **Programs** or **Applications** (shortened: **Apps**). It is usually run inside an operating system.

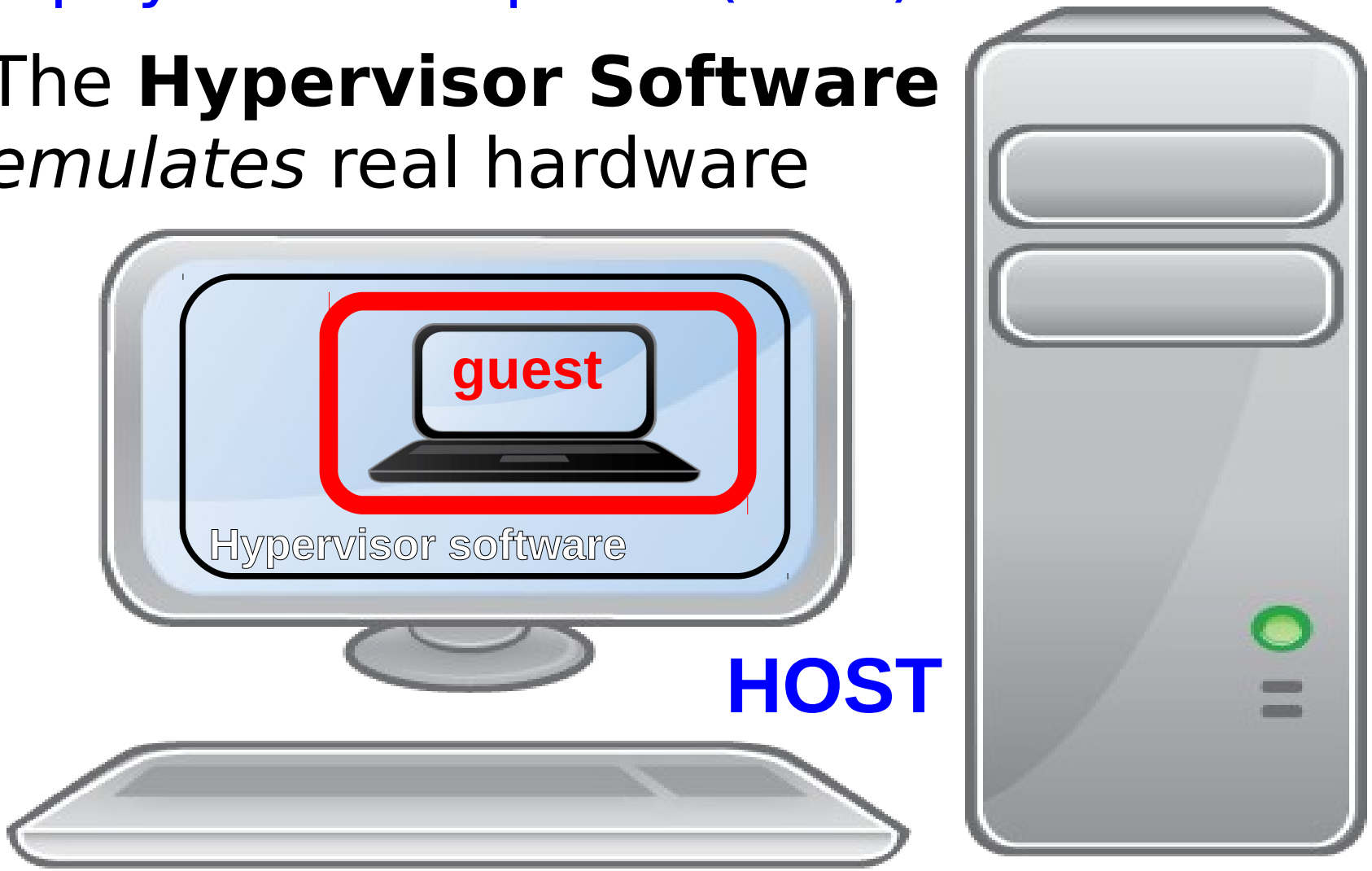
  - **Development software**: software that is used to develop and create other software.
    Examples: SDK (Software Development Kit), libraries, compilers...

Hardware-Software equivalence

- Everything that can be modelled via software can be created in hardware and vice-versa
- This poses the foundation for machine **simulation** and **emulation**
  - **Simulation**: software that behaves exactly like some piece of hardware, internally and externally. For prototyopes and testing
  - **Emulation**: write software that whose external behaviour is like a piece of hardware. The internals can differ. It ”pretends” to be some hardware.

Virtualization

- Running a virtual computer (guest) inside a physical computer (host)
- The **Hypervisor Software** *emulates* real hardware



Virtualization

- Running a computer (guest) inside a computer (host)
- The guest machine is usually called Virtual Machine.
- The Host machine manages the guest machine using something called Hypervisor
- The host offers software simulated or emulated hardware, plus it can offer **real** hardware to the guest machine
- The guest machine sees all the software simulated/emulated/virtualized hardware as it was real hardware, but it can also be aware that it is virtualized to boost performance

Ex. 1: Install the course custom VM

For better user experience, the teacher set up a fine-tuned machine for the course, that contains all we will need.

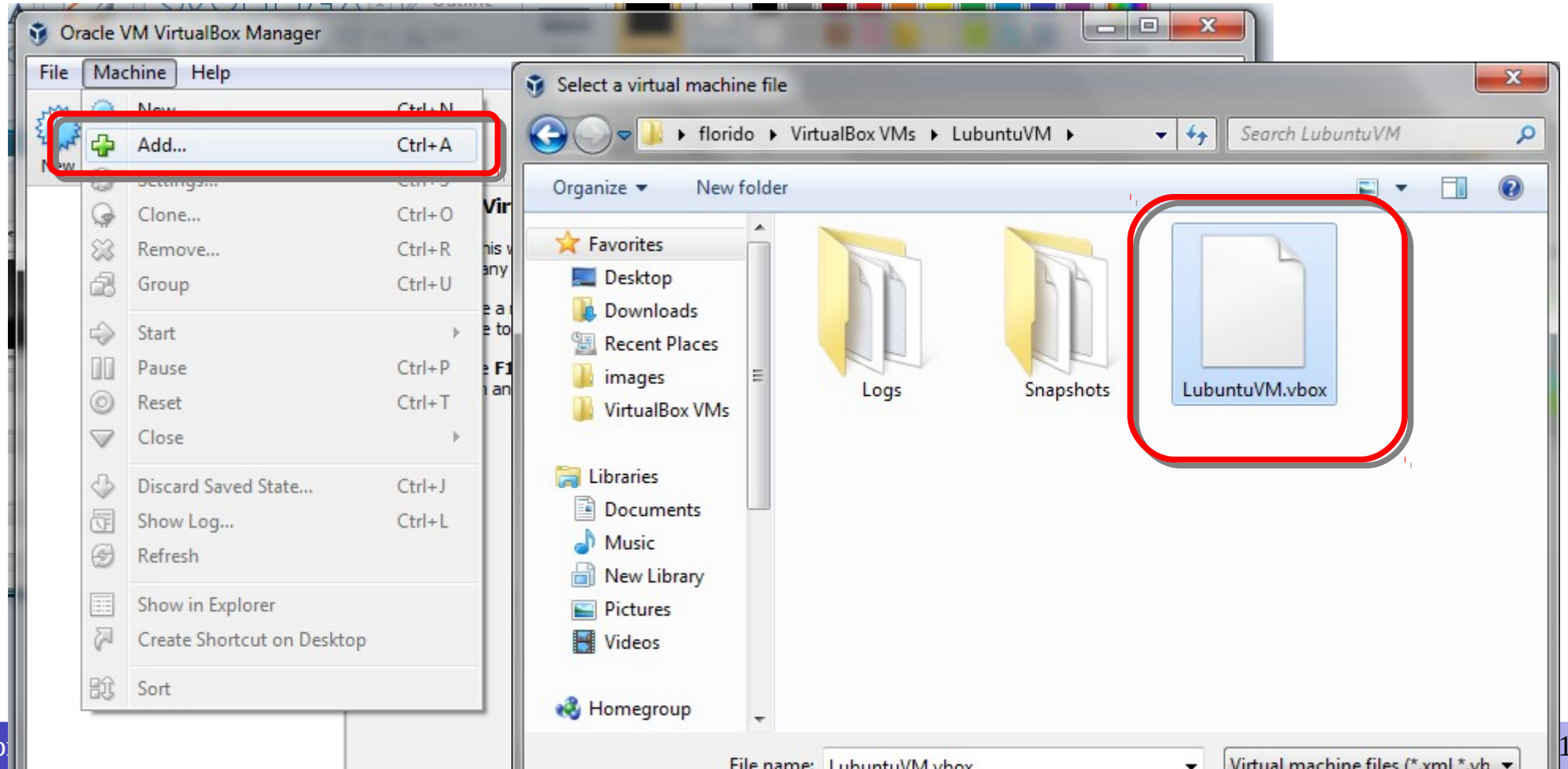
1. Download it from/copy link (we already did this):
   http://www.hep.lu.se/staff/paganelli/fileshare/LubuntuVM.zip
to `C:\VirtualBox\`

2. Extract it into (right click, extract to...):
`C:\VirtualBox\LubuntuVM\`

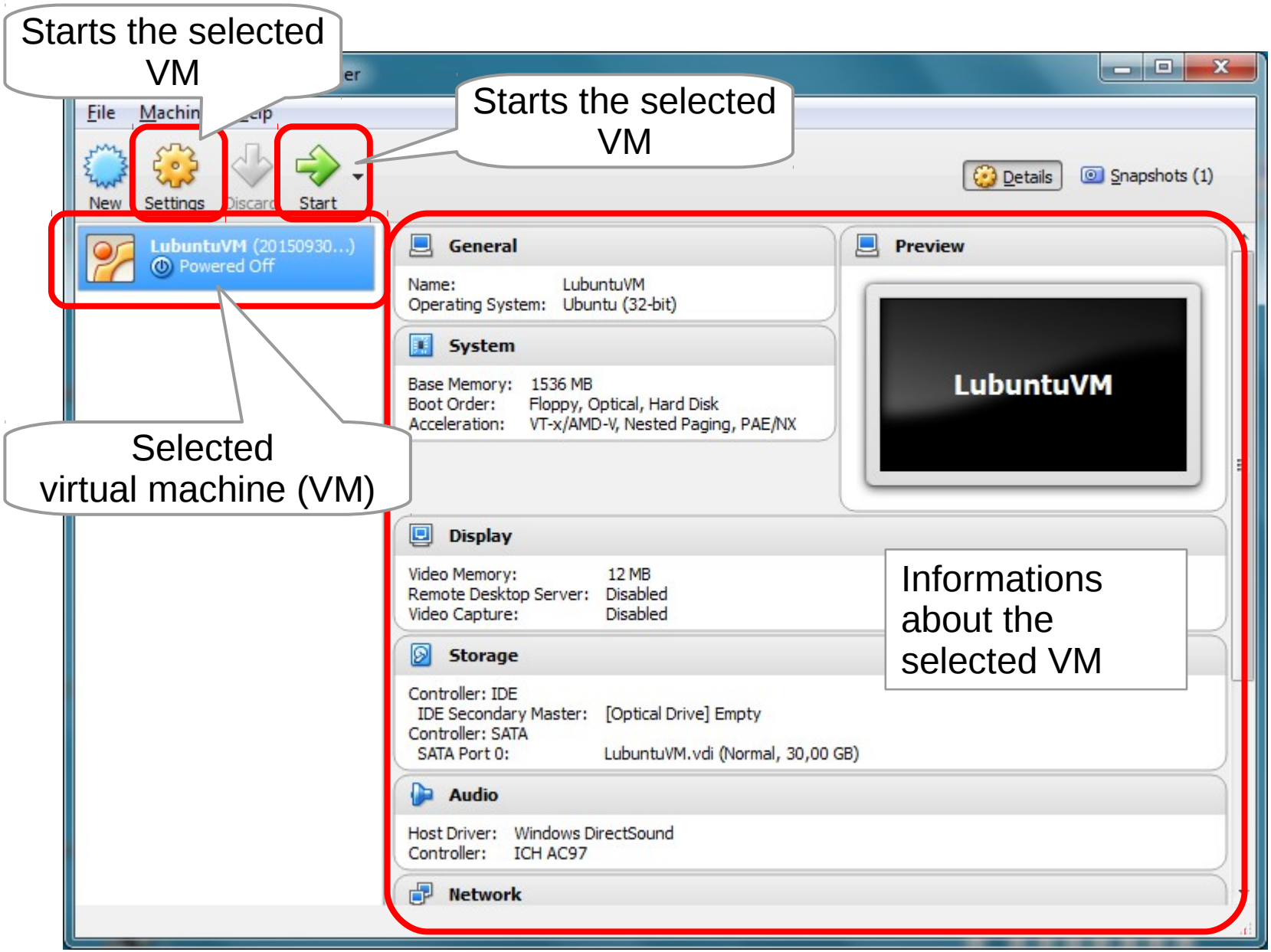
3. Open VirtualBox: 

Ex. 1: Install the course custom VM

3. Open the machine with VirtualBox:
   Machine → Add…
   and select
`C:\VirtualBox\LubuntuVM\LubuntuVM.vbox`
   (the blue icon)

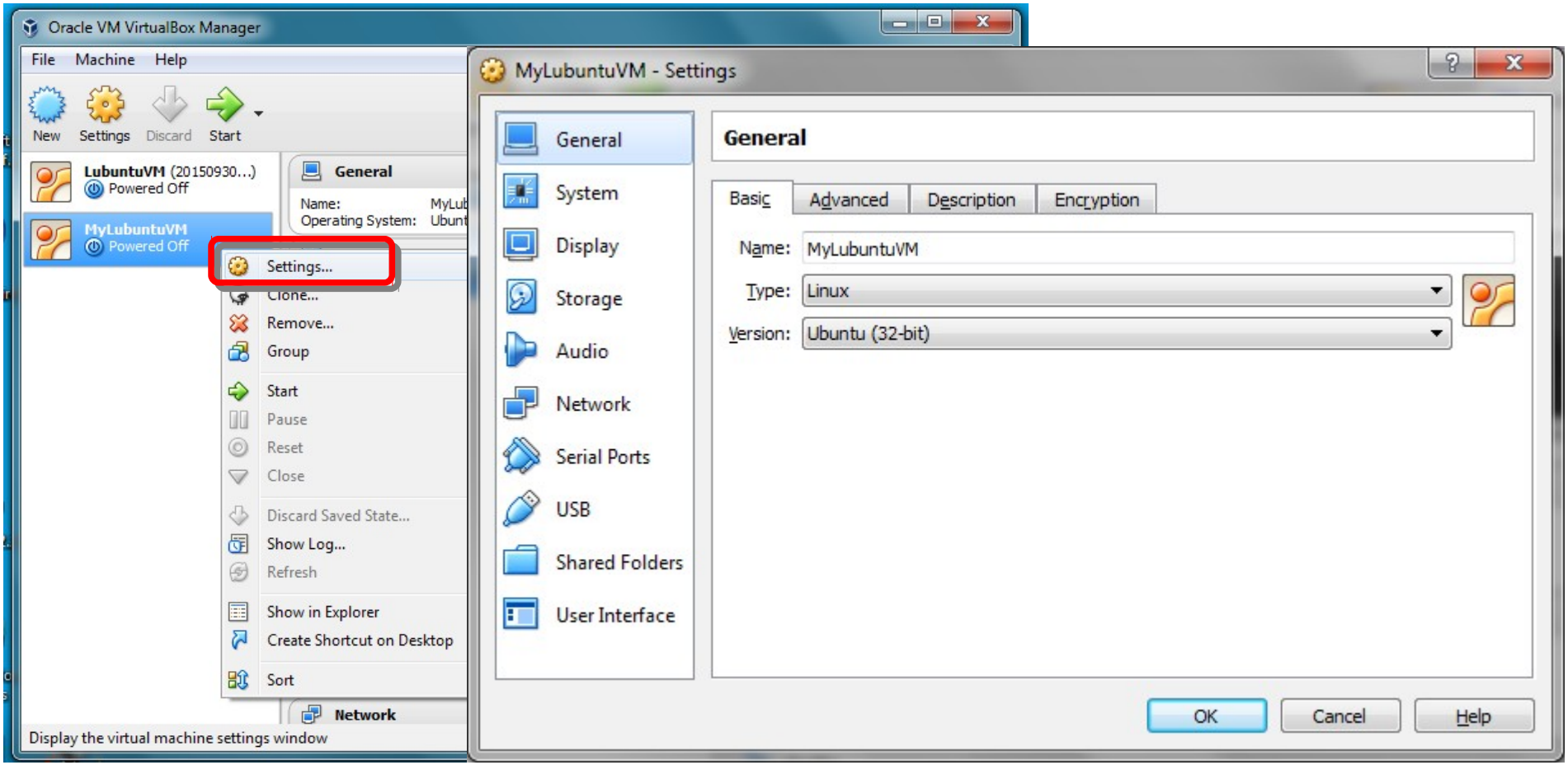


VirtualBox interface explained

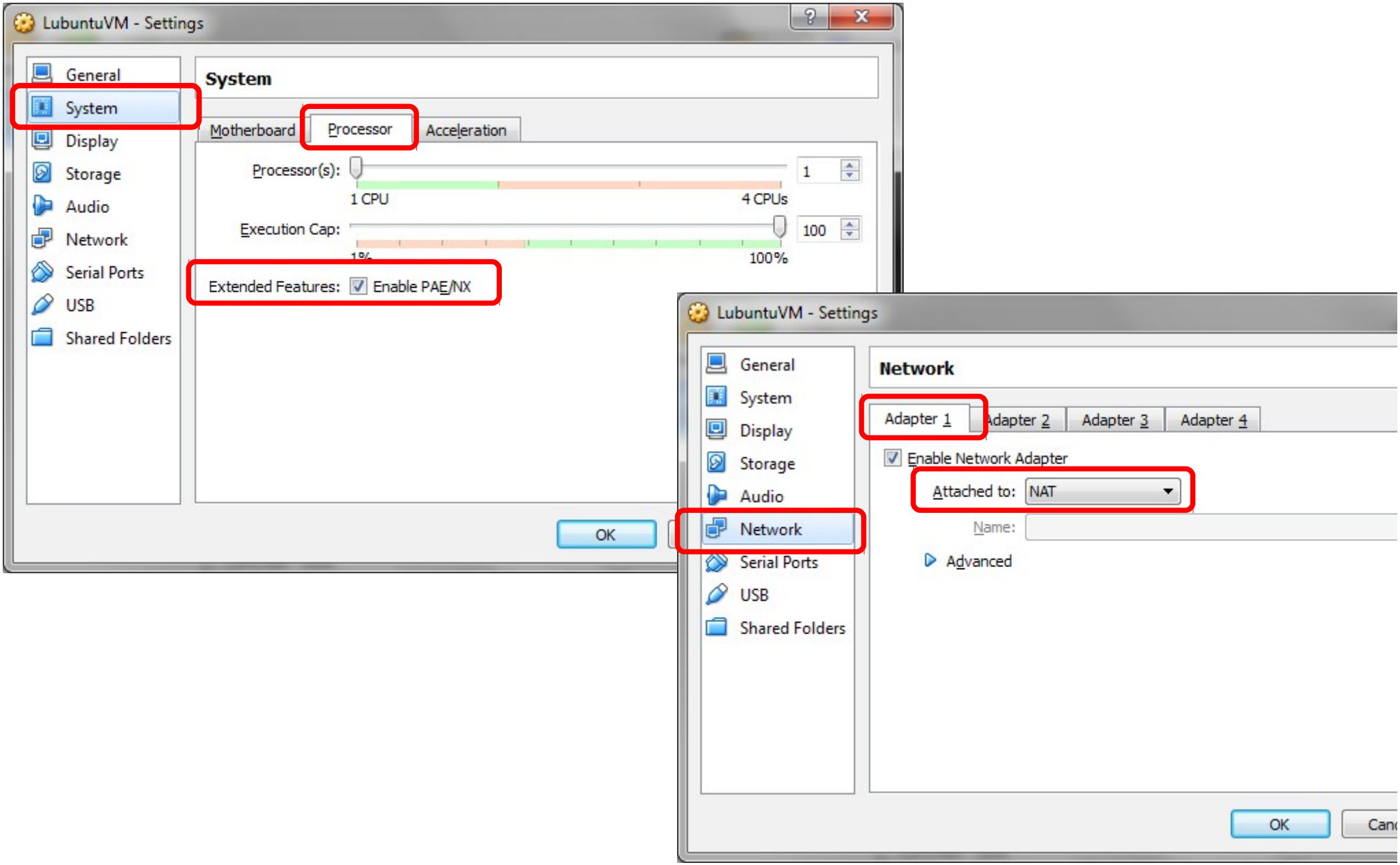


Ex 1.2: Review the virtual machine virtual hardware

- Right-click on the machine LubuntuVM and select ”Settings...”
- Browse around the hardware options. Any comments?

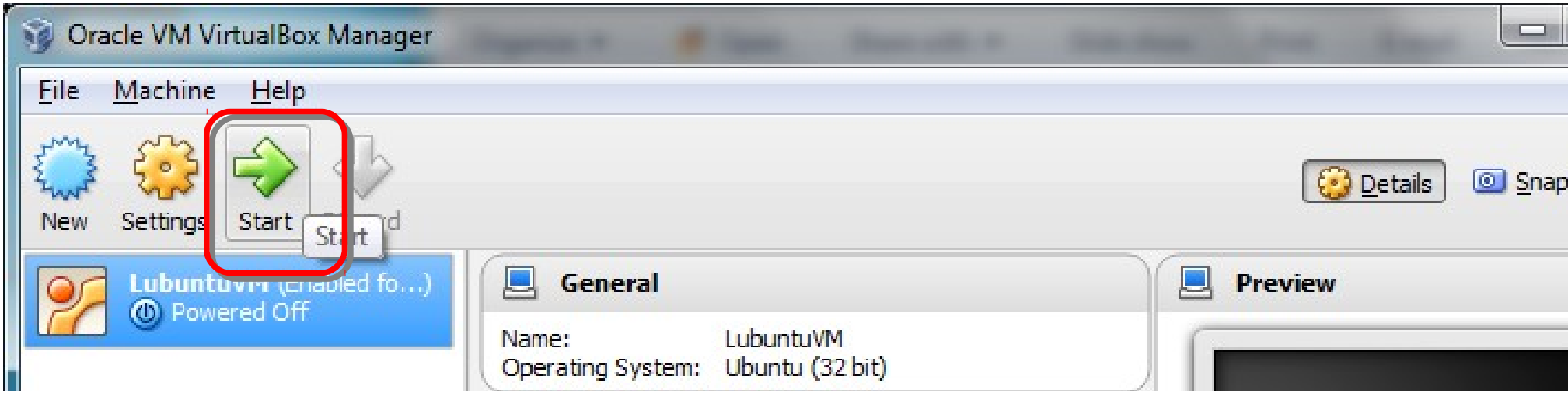


Enable PAE and NAT



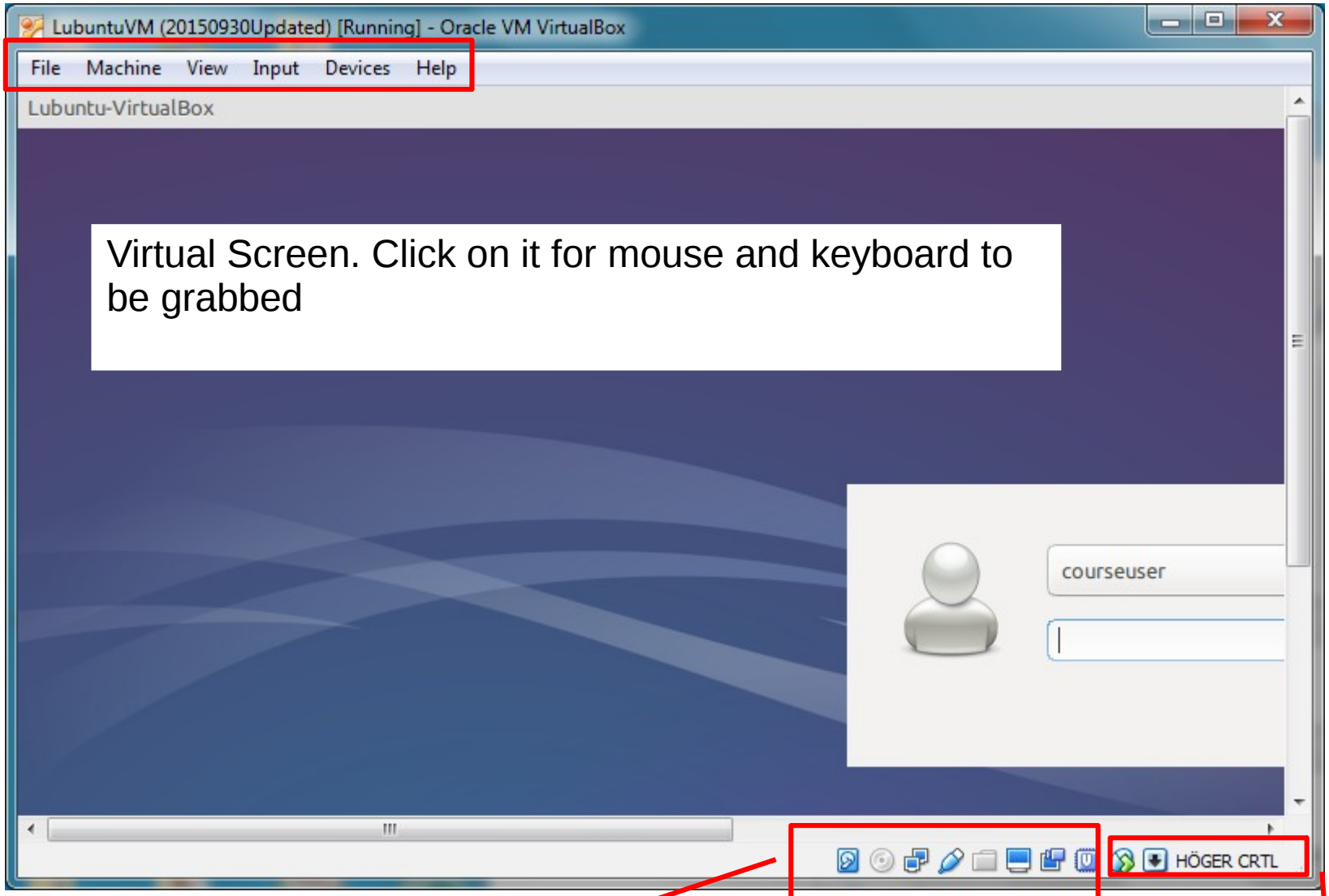
Ex. 3: Start the machine

- Click on the Start arrow.



VirtualBox interface explained 2

Machine menu.
Try to go Fullscreen Using the View menu!
Shortcut: RightCtrl + F

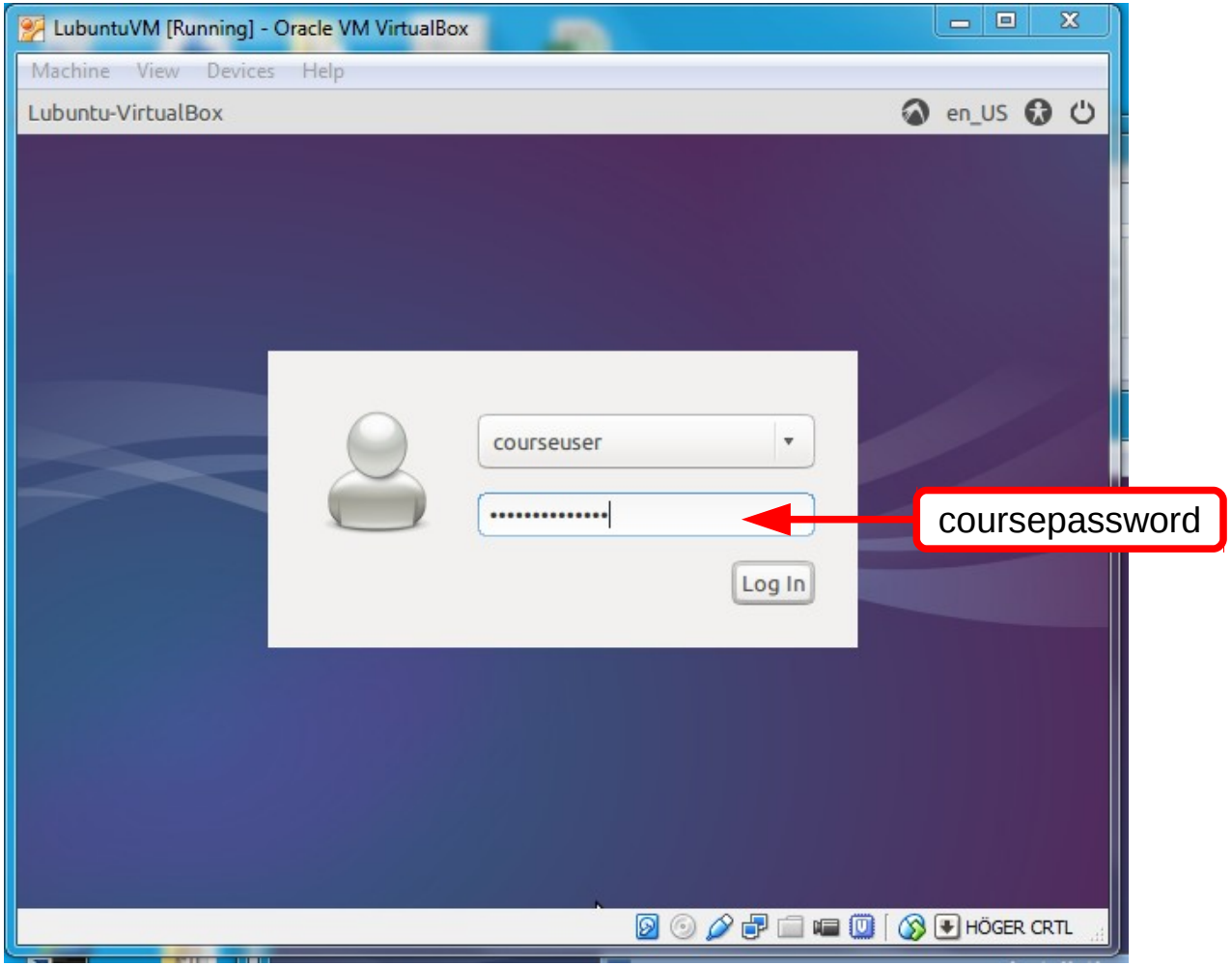


Hardware status, hover on it to see description

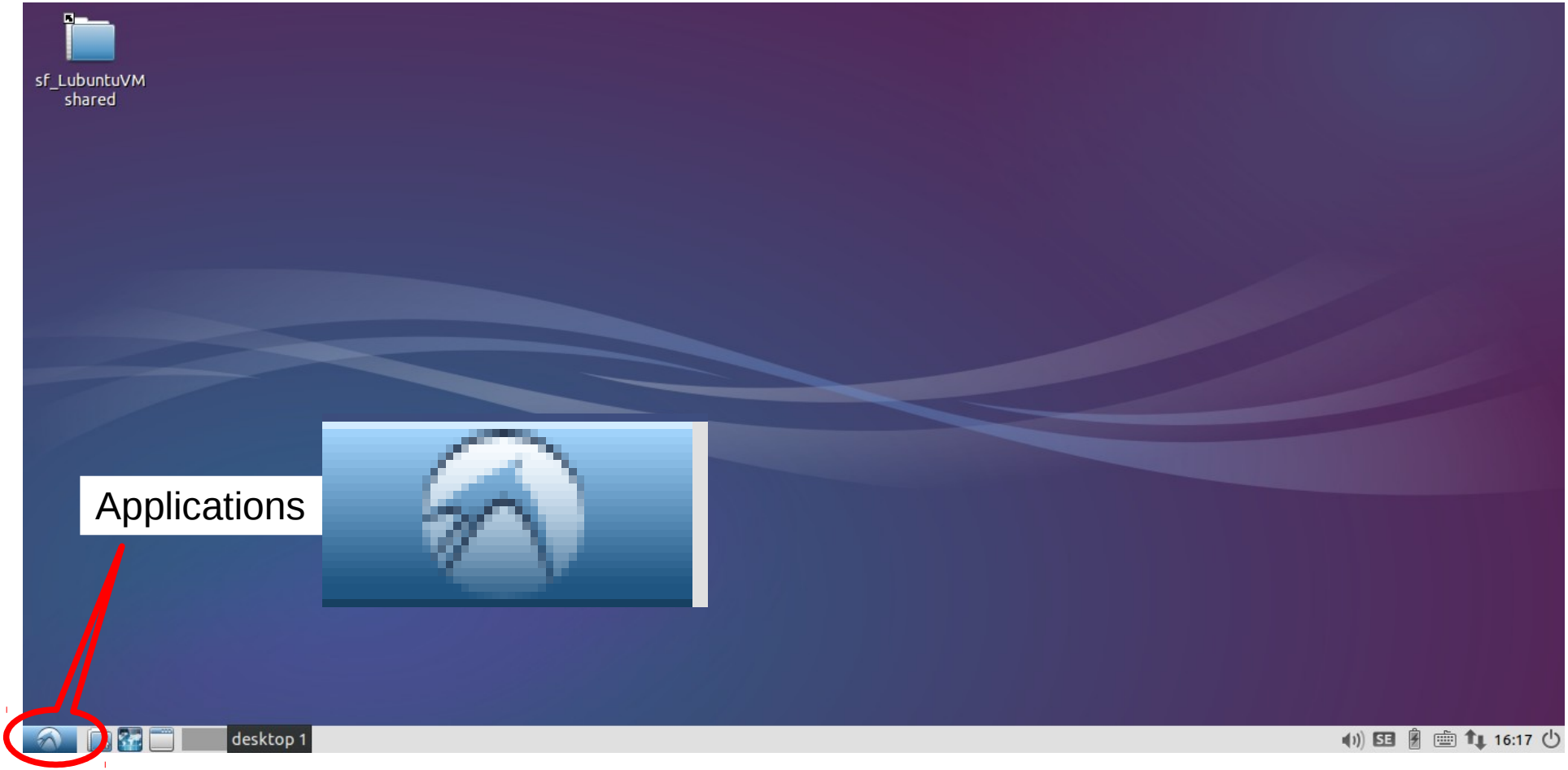
Keyboard and mouse status. Use right control to ungrab

Ex. 4: First steps in lubuntu usage

Login using the user name courseuser and password coursepassword



Ex. 4.1: Moving around the desktop



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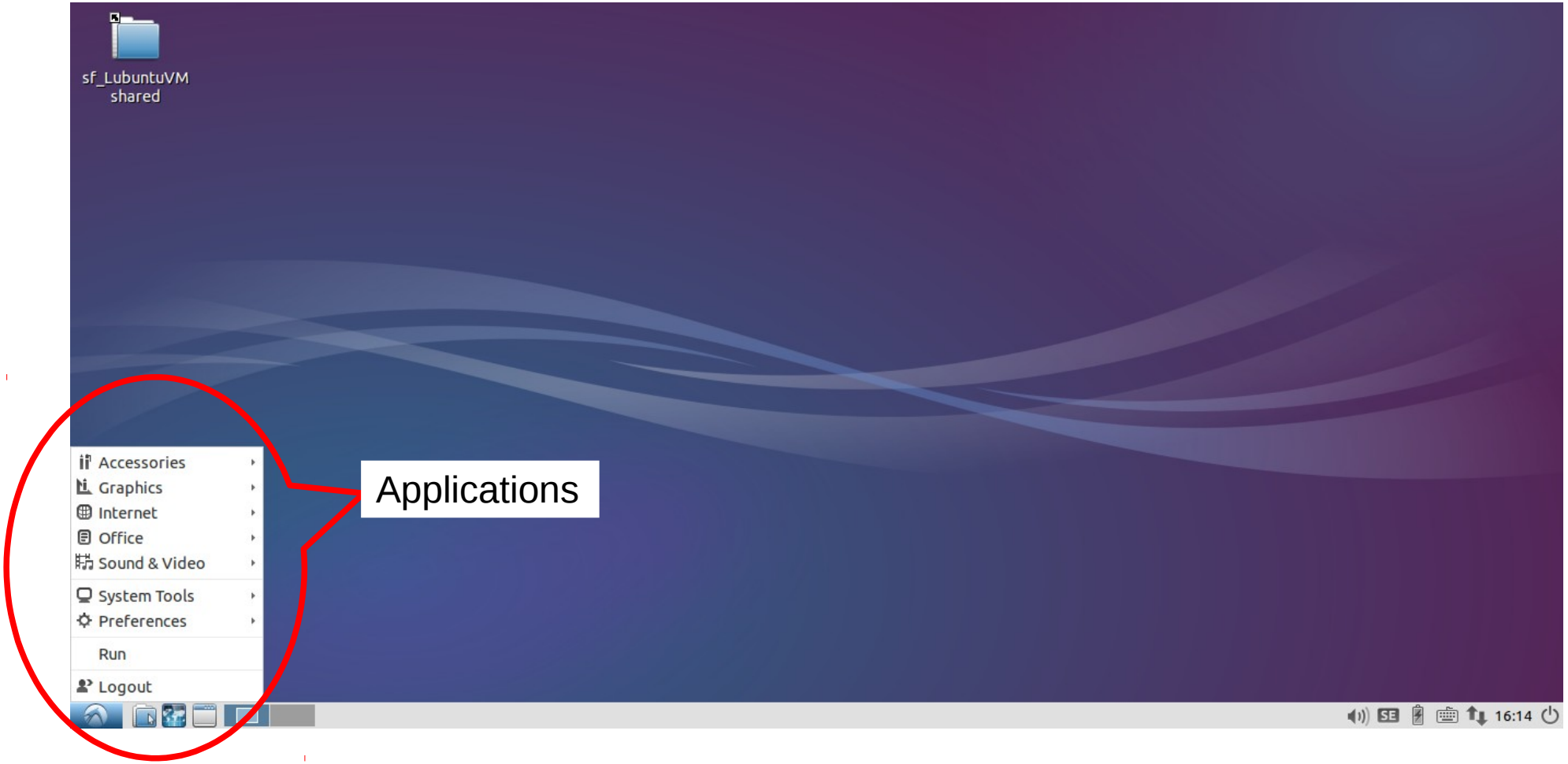

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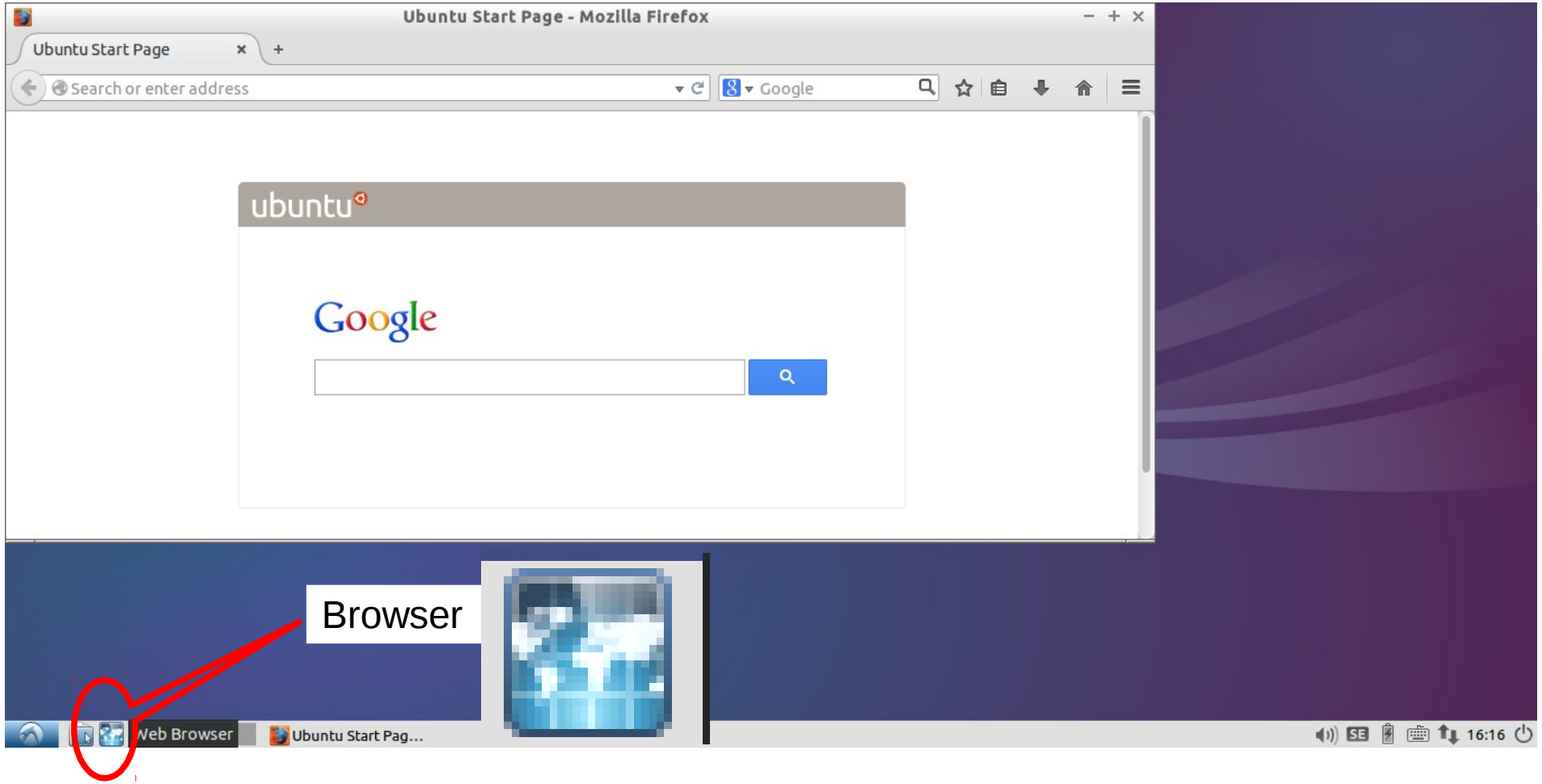

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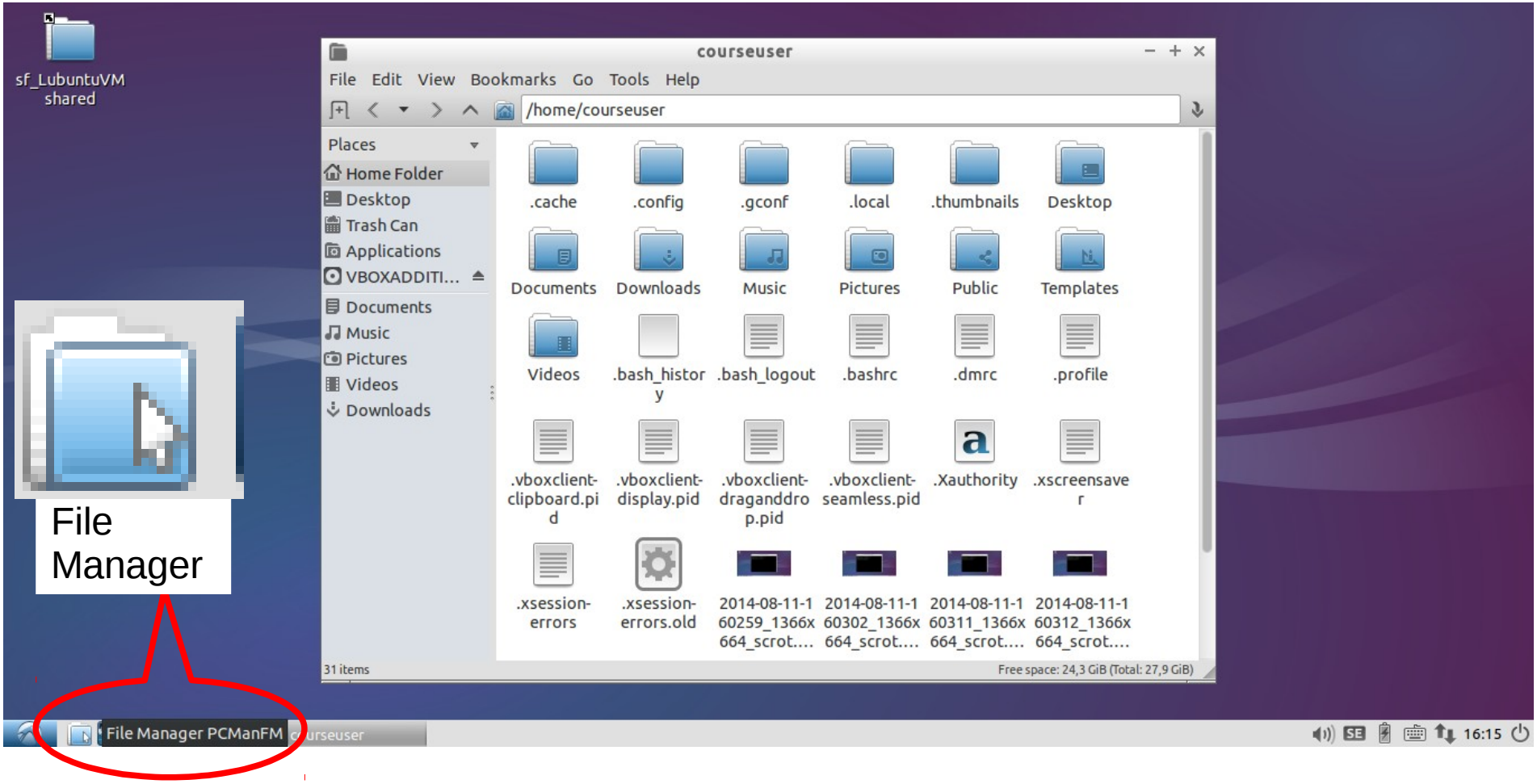
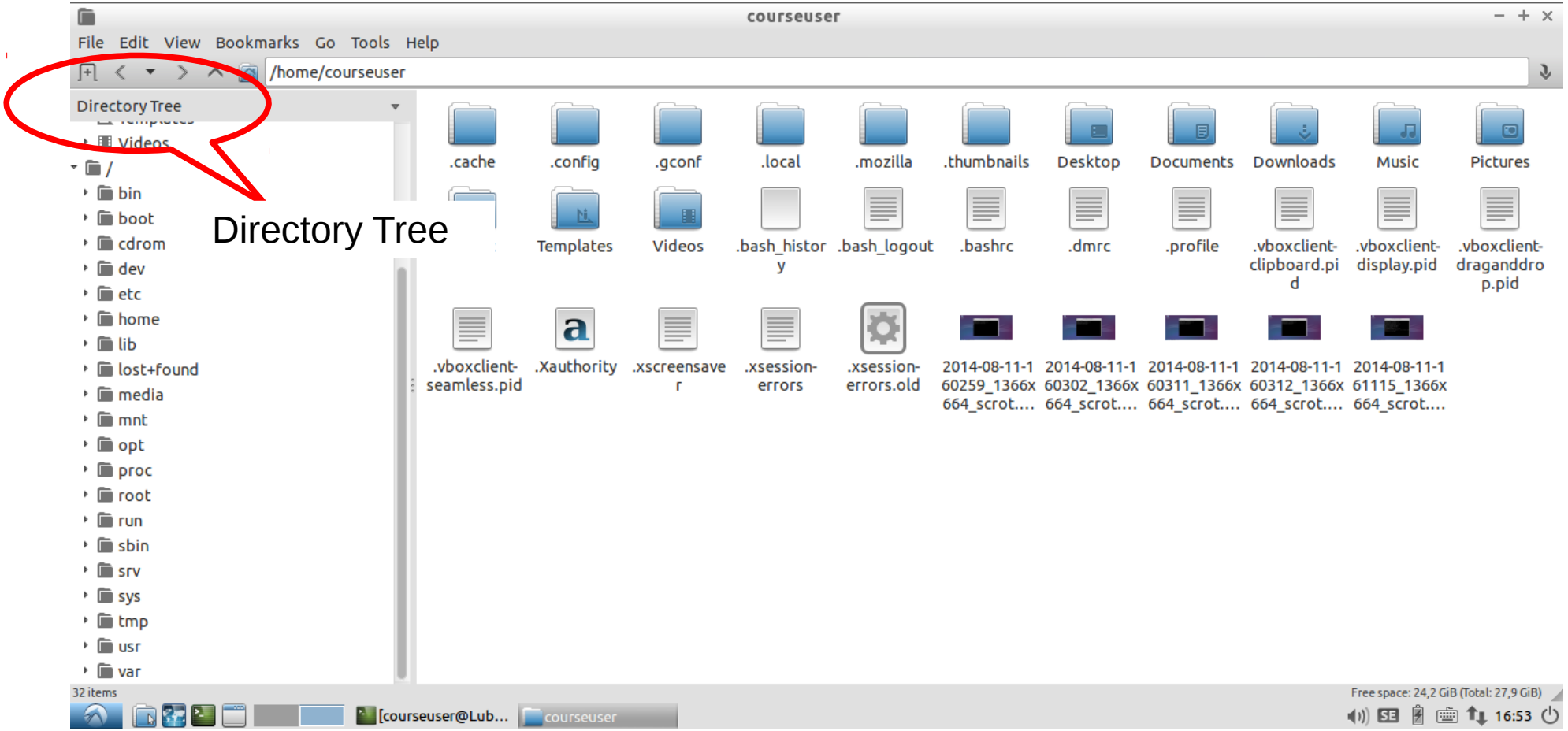


Ex. 4.2: Moving around the desktop

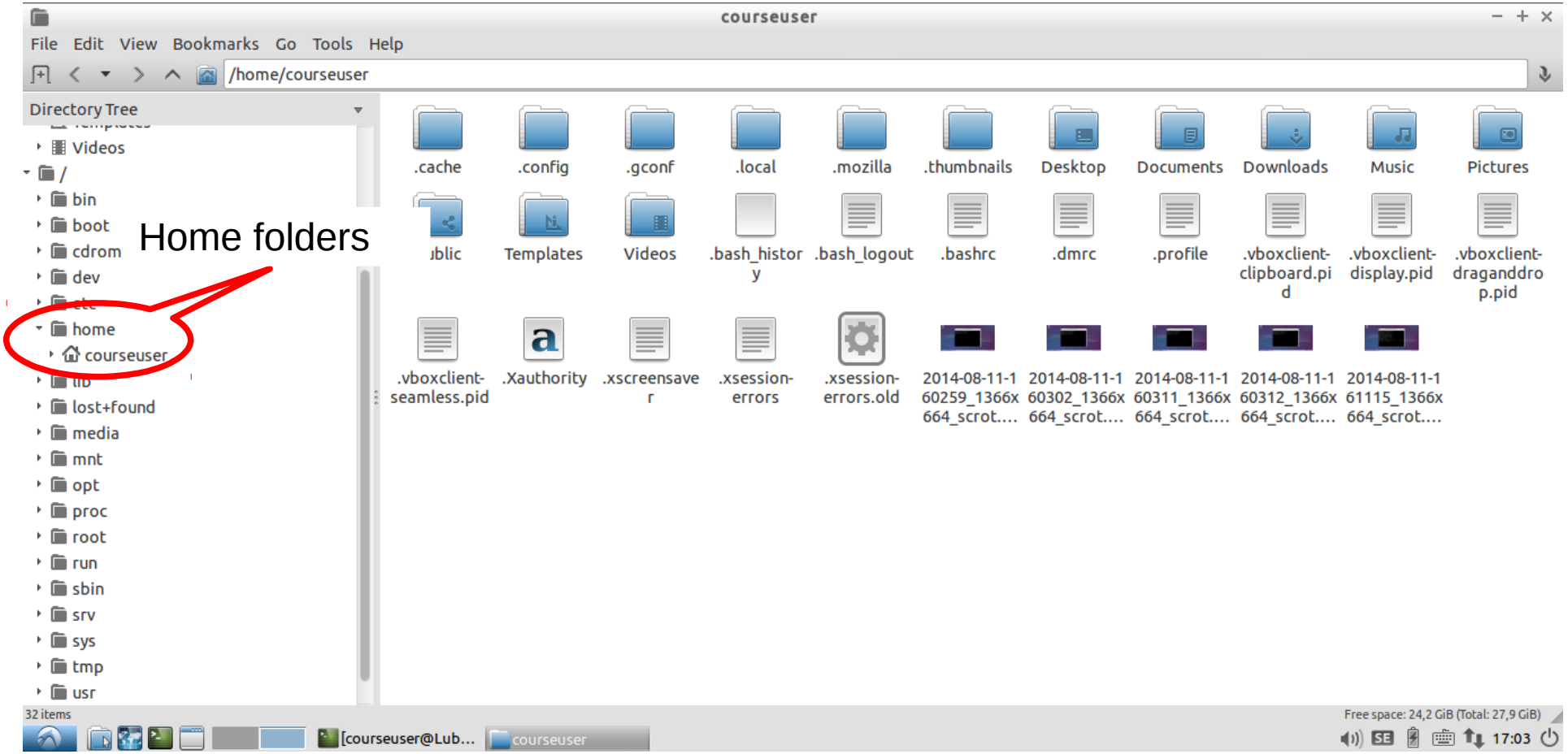
Organization of files in Linux



the filesystem ”root”: /
Home directory: /home/courseuser

Ex. 4.2: Moving around the desktop

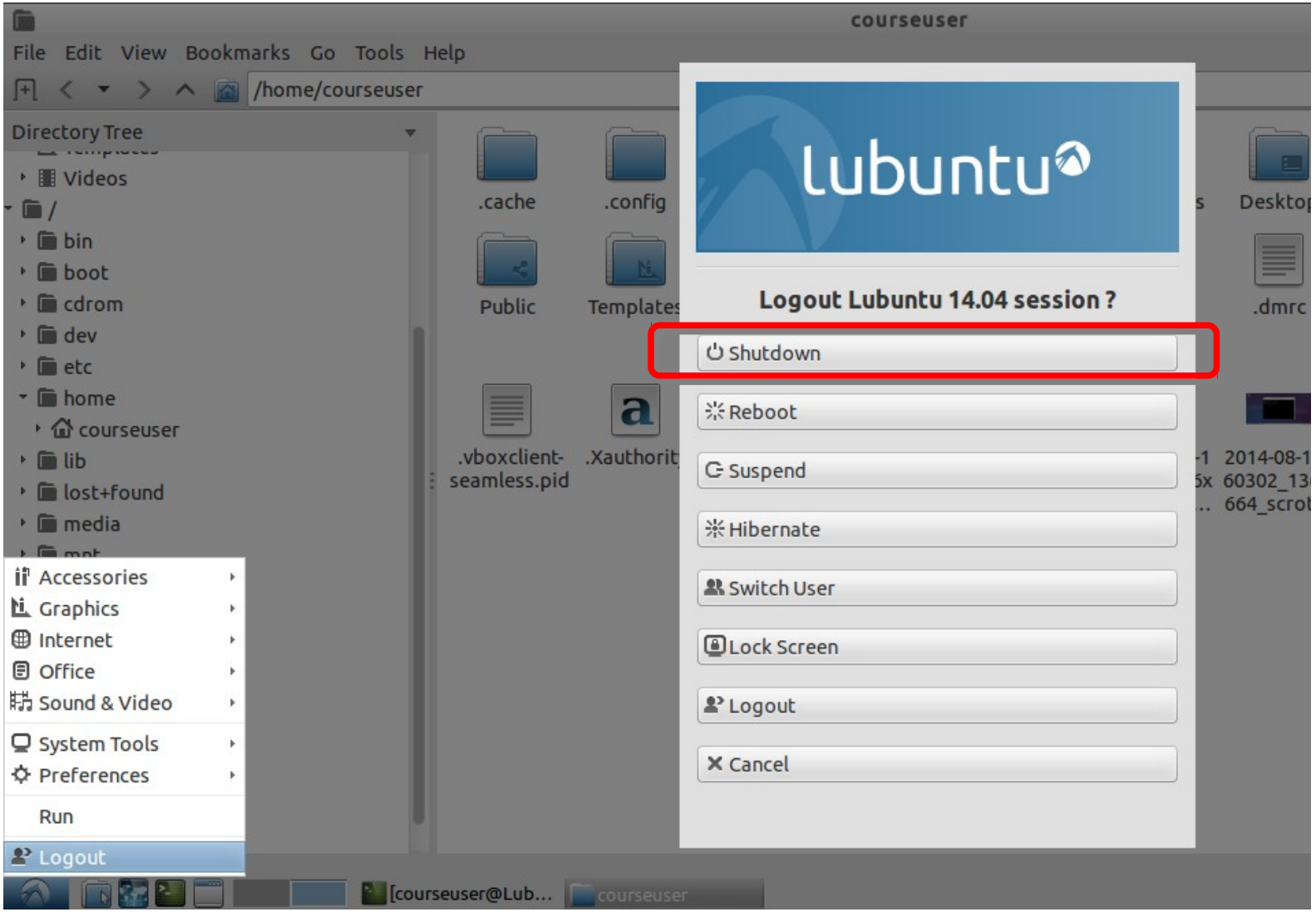
Organization of files in Linux



the filesystem ”root”: /
Home directory: /home/courseuser

Ex. 5: Logout dialog: Shutdown

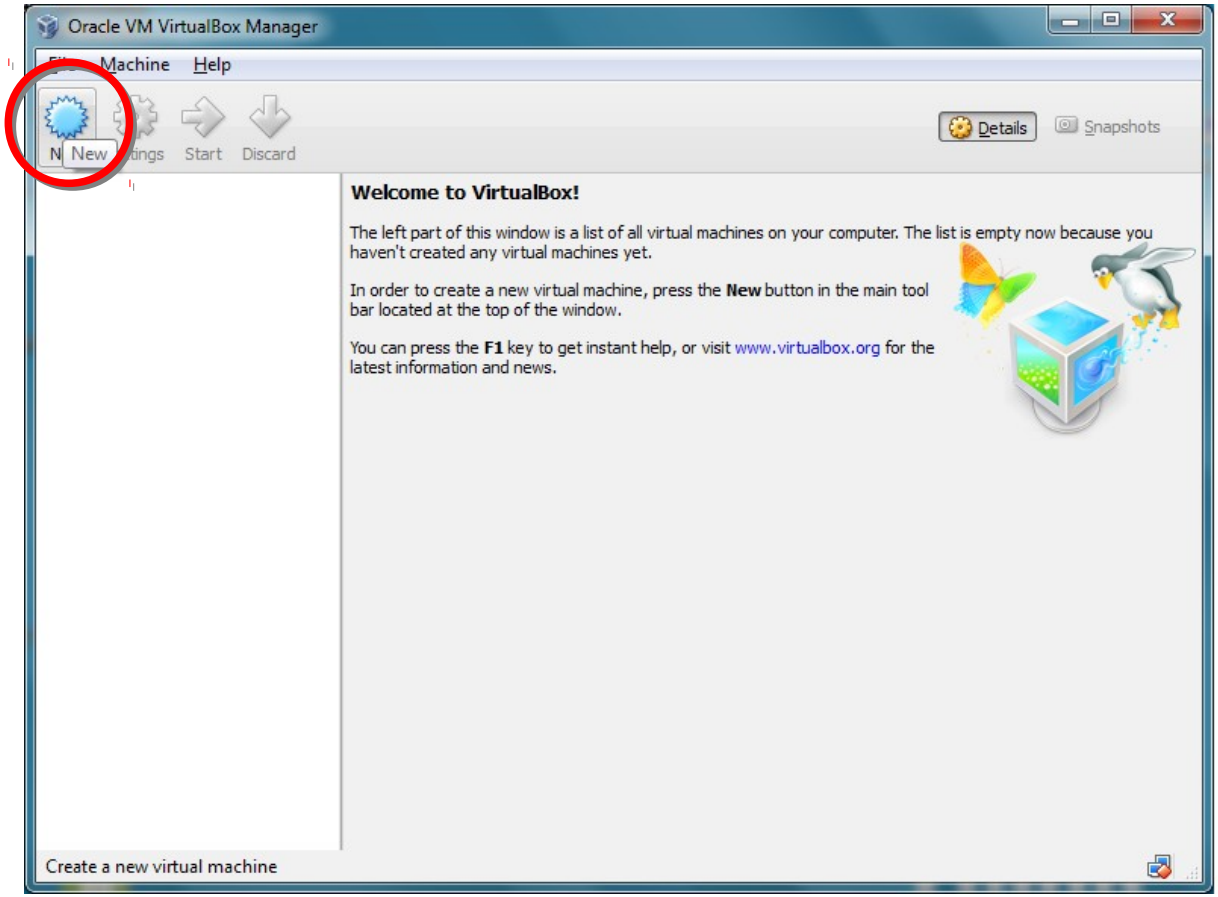
5.1 Poweroff the machine.



Ex. 6: Create a virtual machine

Goal: create a virtual machine to run Lubuntu Linux.

6.1.Open virtualbox . Click on ”New”



Ex. 6: Create a virtual machine

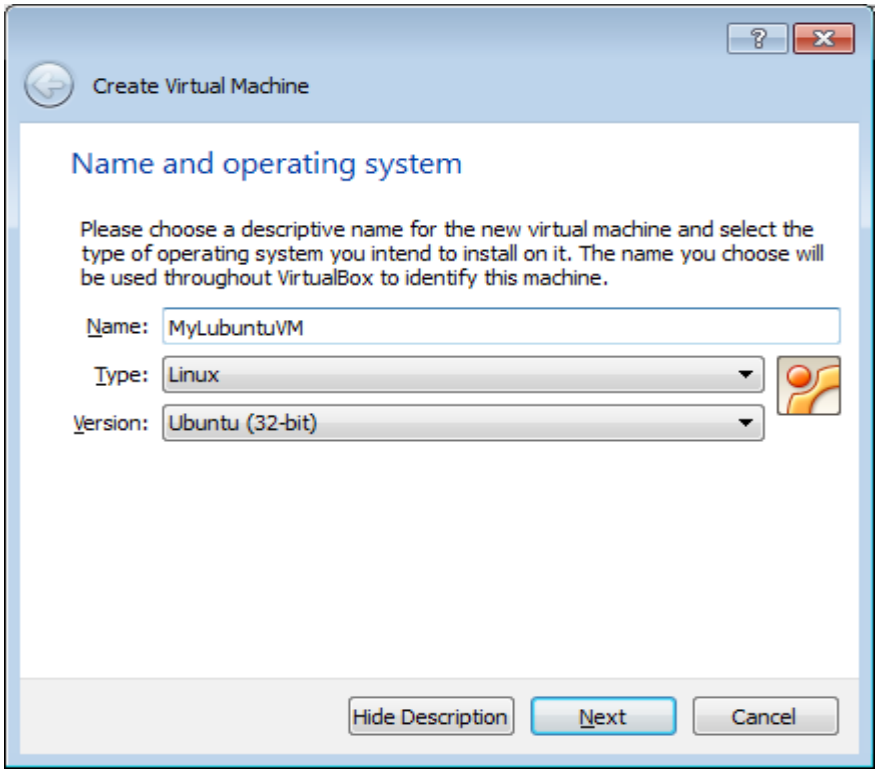
Follow the instructions in
https://www.virtualbox.org/manual/ch01.html#gui-createvm
using the following information:

VM Name	MyLubuntuVM
Operating System Type	Linux
Version	Ubuntu (32 bit)
memory (RAM)	1536 MB (that is, 1,5 Gigabytes)

When you reach step 4 in the tutorial at the link, go to slide ”virtual disk creation”.

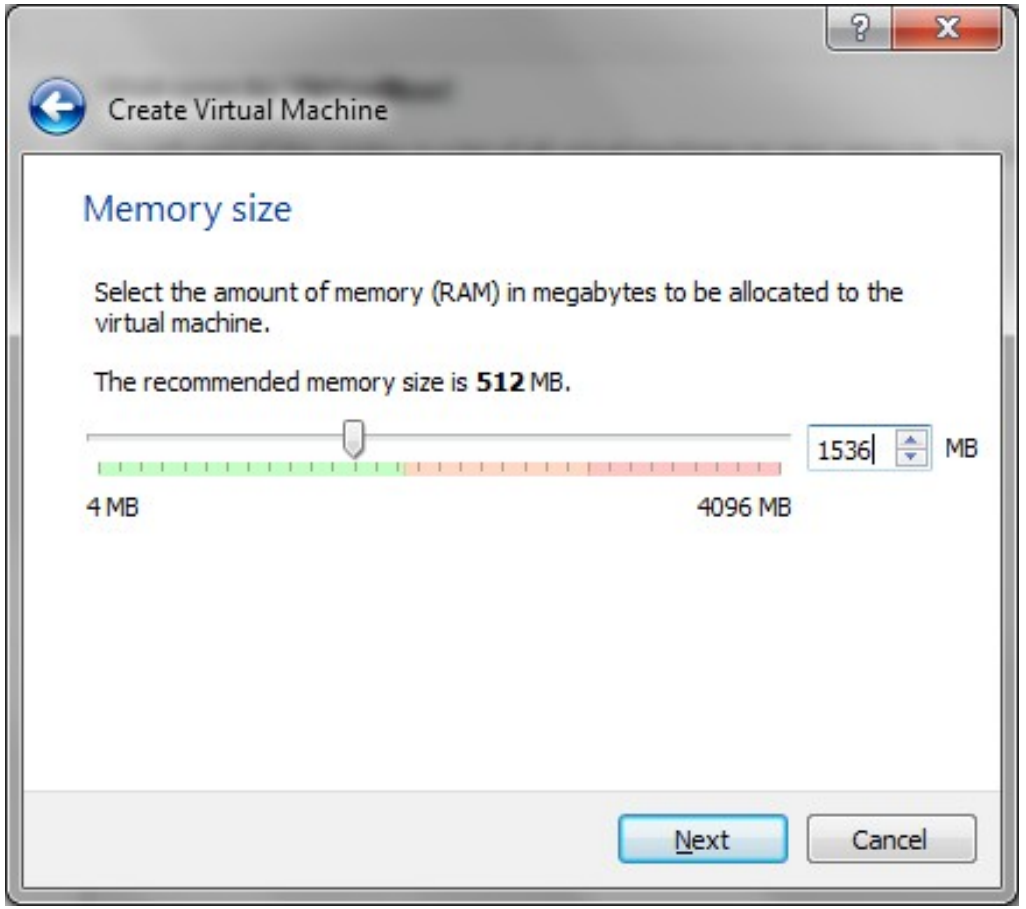
Ex. 6: Create a virtual machine

6.2 Insert the following information when asked:



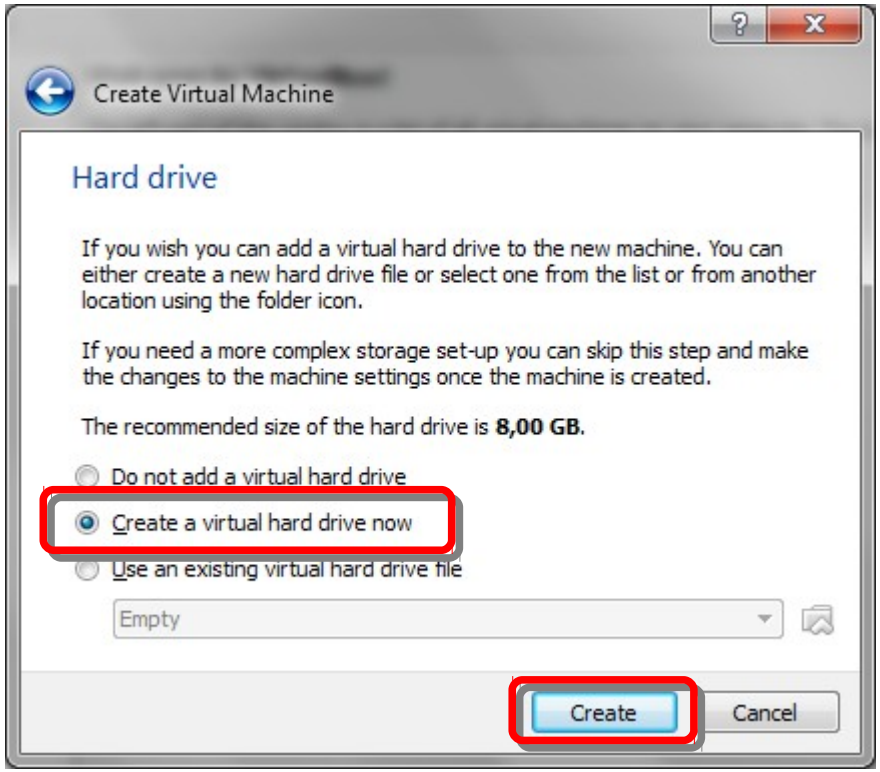
Ex. 6: Create a virtual machine

6.3 Set memory size.
Suggested: 1536 MB
(1.5GB as a multiple of 8)



Ex. 6: Create a virtual machine creating a virtual disk

6.4 Create a **new virtual harddisk** for the machine, click create as shown in the picture.



Ex. 6: Create a virtual machine creating a virtual disk

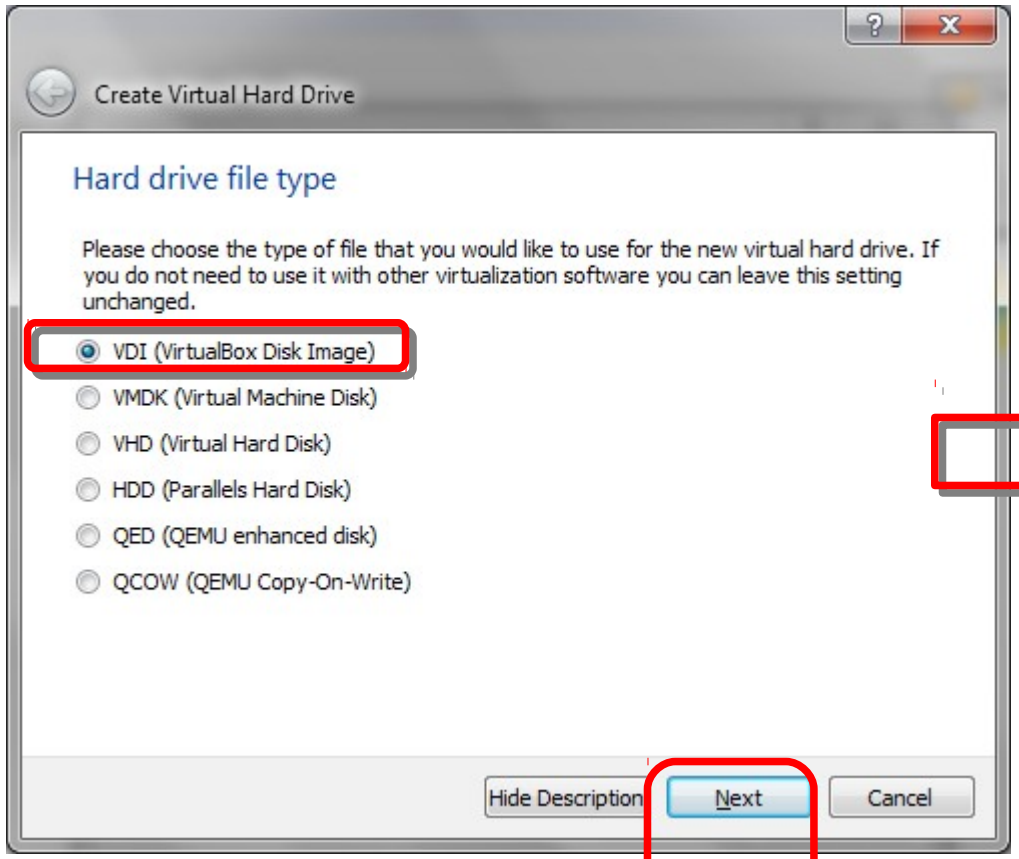
- Create a **new virtual harddisk** for the machine (step 4 in https://www.virtualbox.org/manual/ch01.html#gui-createvm)
- When asked, choose
  ”Create a virtual hard drive now” and click ”Create”
- Use the following parameters:

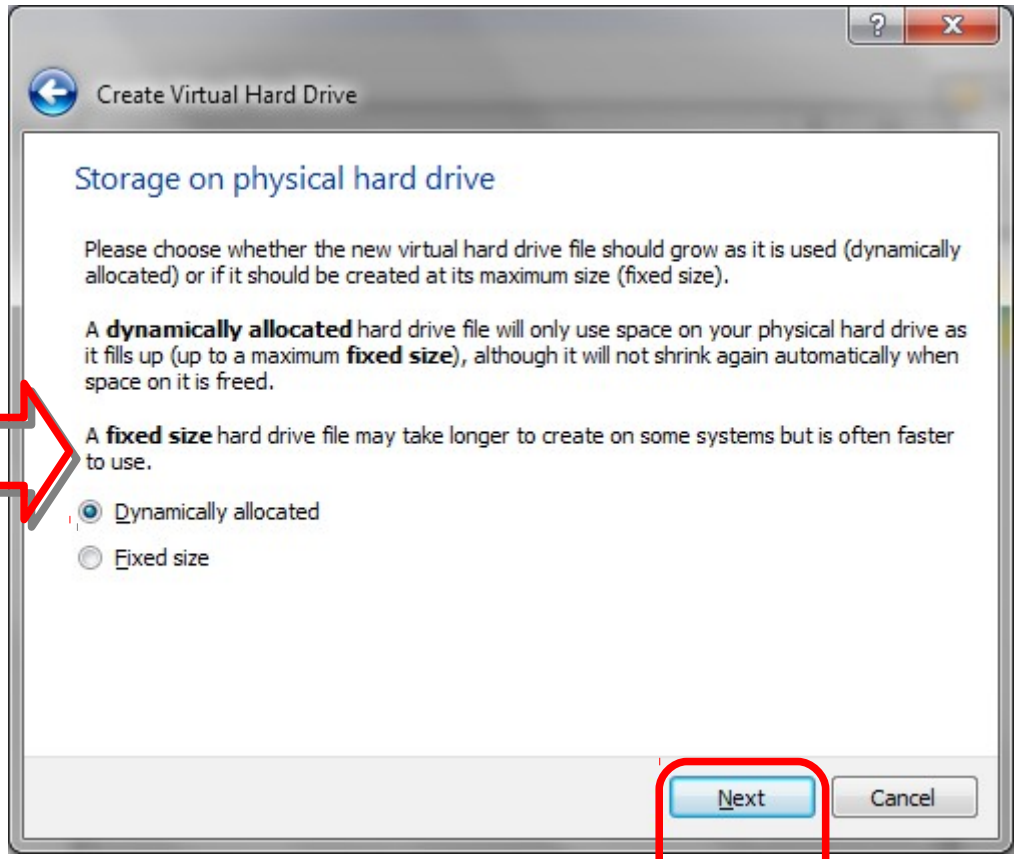
Disk Type	VDI (VirtualBox Disk Image)
Storage on physical hard drive	Dynamically allocated
Name	MyLubuntuLinux
Size	30,00 GB

Ex. 6: Create a virtual machine creating a virtual disk

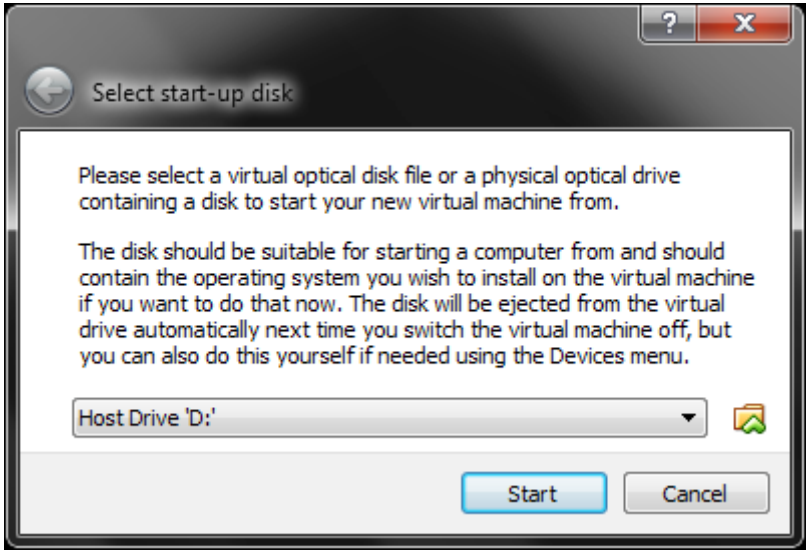
6.5. Select VDI as disk type

6.6. Choose ”Dynamically allocated” (saves disk space)





Ex. 6: Create a virtual machine - Missing boot device

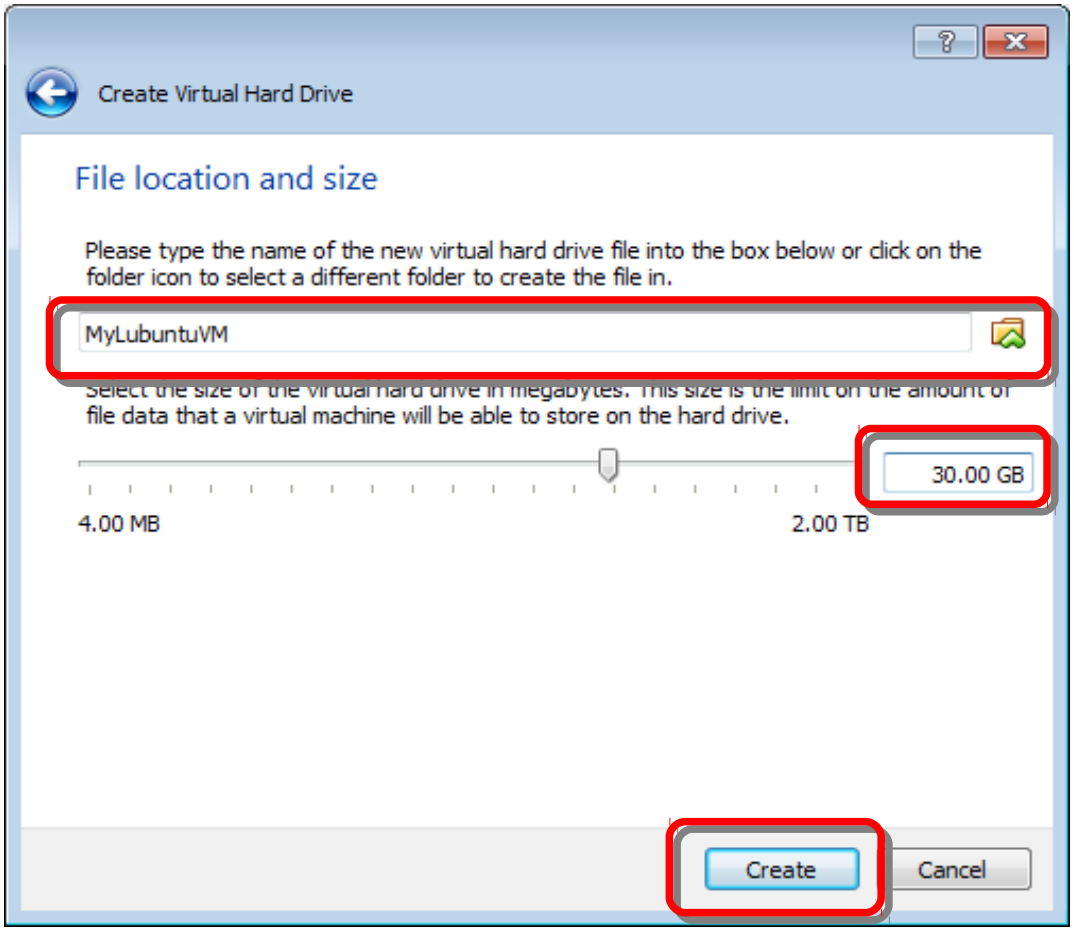


Ex. 6: Create a virtual machine creating a virtual disk

6.7. Change the harddisk path to be:

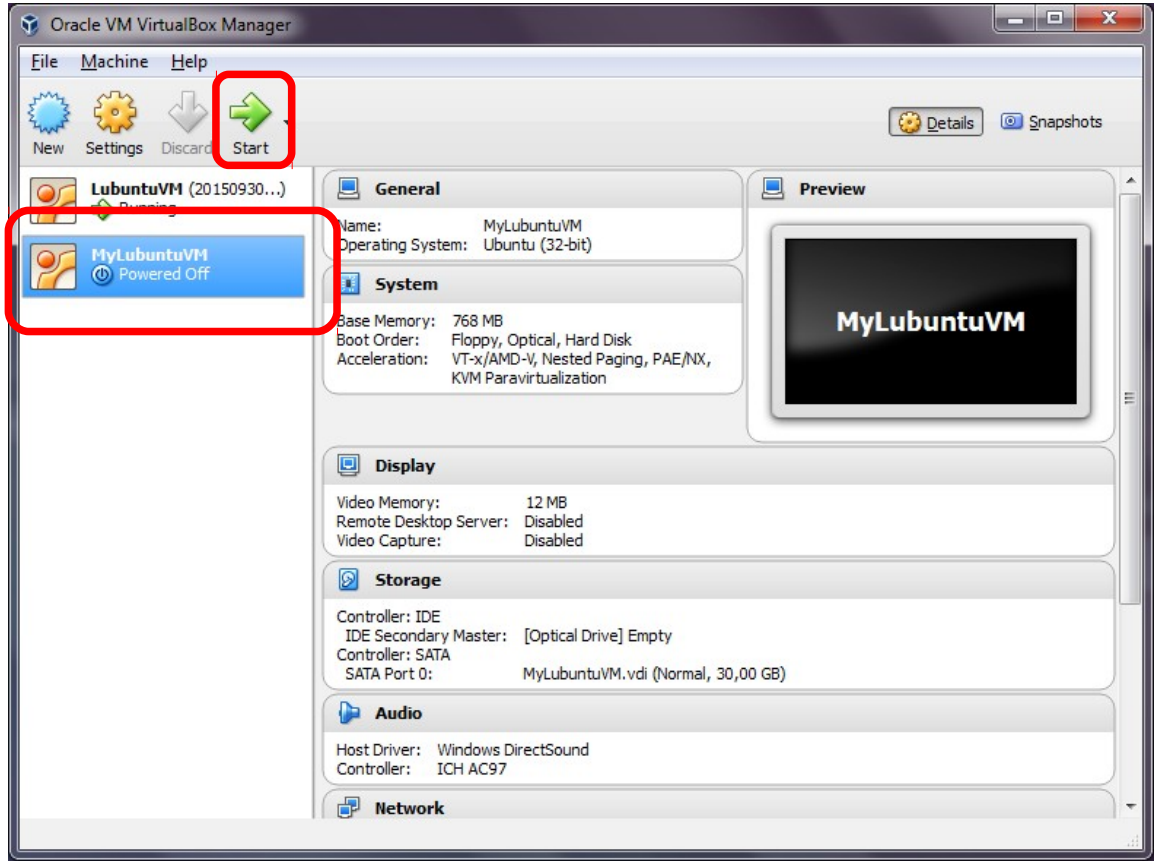
`C:\VirtualBox\MyLubuntuVM\MyLubuntuVM.vdi`

6.8. Set the disk size as shown in the picture and create the disk:



Ex. 6: Create a virtual machine - start it!

6.9. Select and Start the virtual machine. What happens? Discuss with the teacher.



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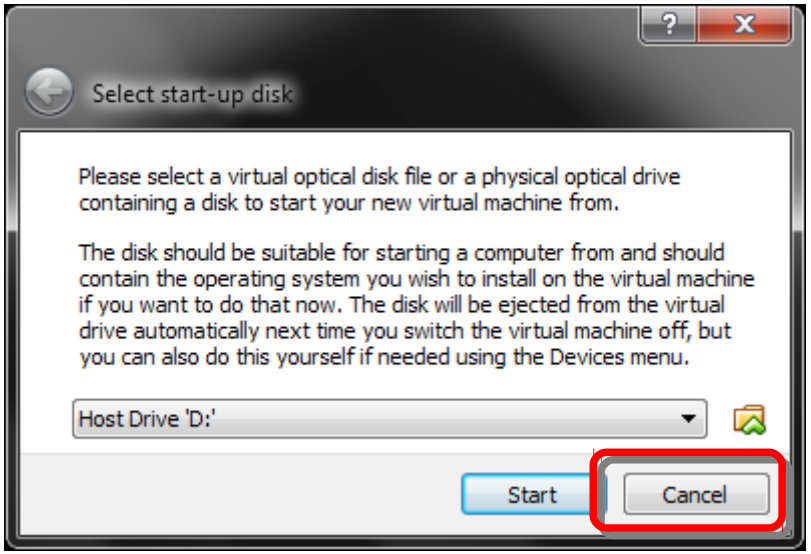
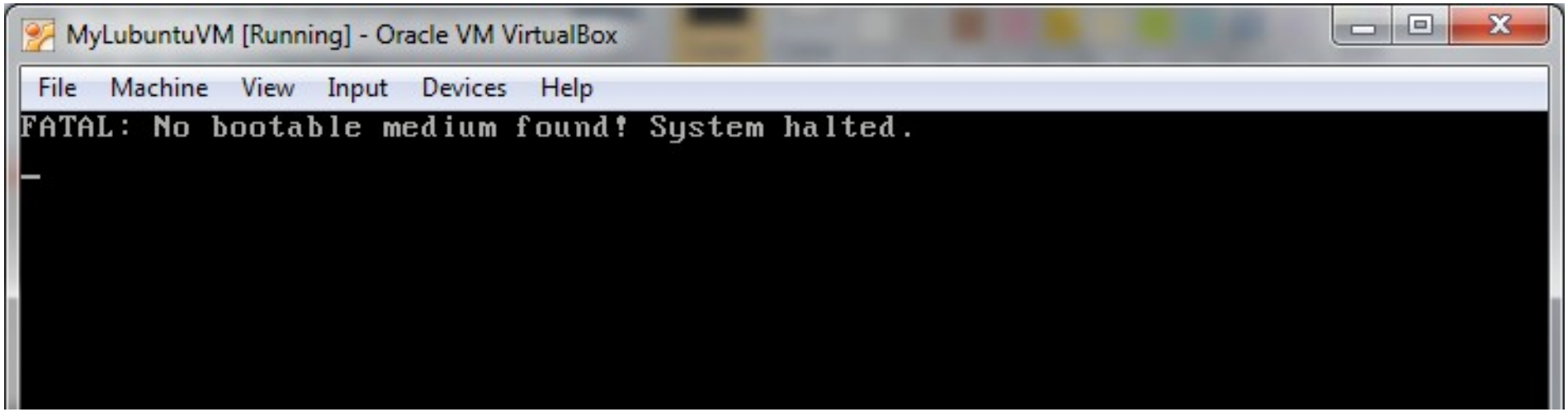
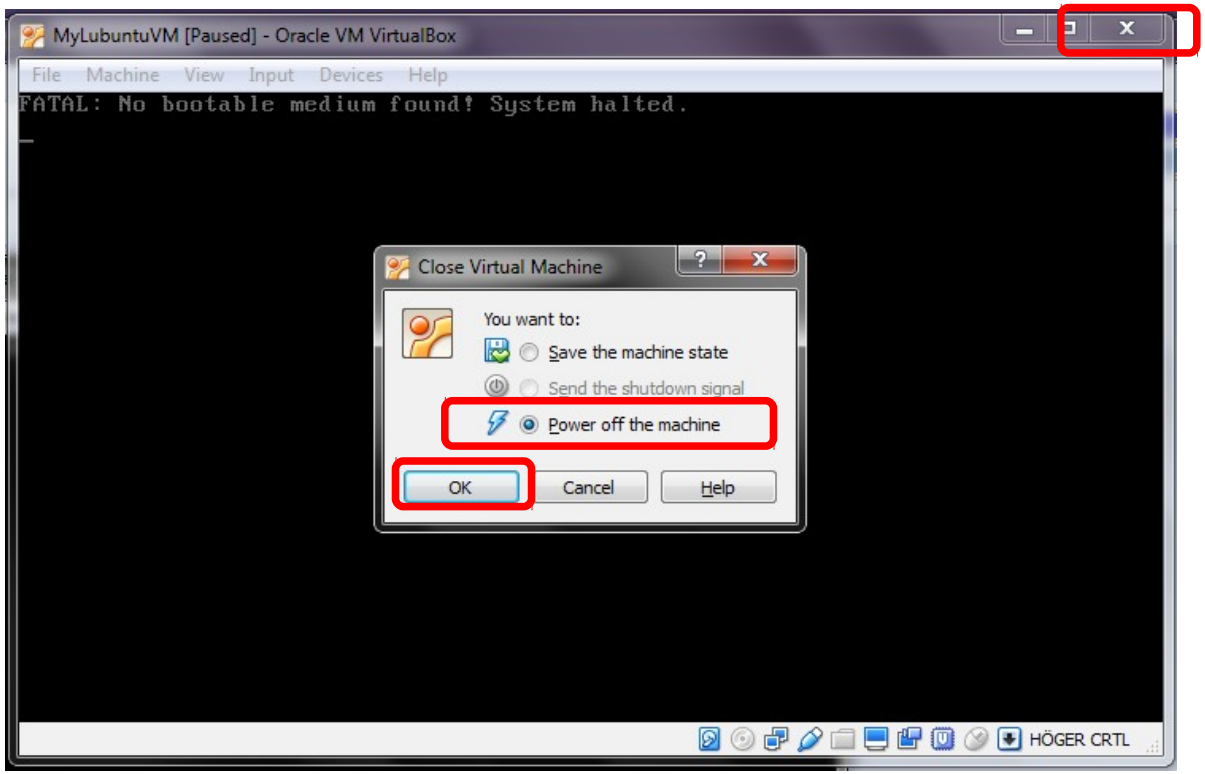




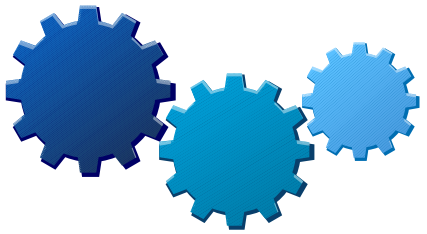
Ex. 6: Create a virtual machine - stop it!

6.10. Close the virtual machine by clicking the close window (X) button. Choose *power off the machine* and then OK when asked.



OBS! : Only use this method if the machine has no operating system installed. This method may cause errors on the virtual machine disk.

The operating system

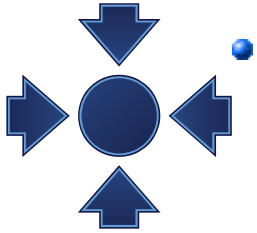


- Is a **collection of programs** running in your computer all the time it is turned on.
- **Orchestrates** the interaction between all components of a computer.
- Usually allows the machine to run **multiple programs** at the same time (multitasking).
- It is meant to bring the machine “closer” to the **user**.
- It is usually **installed** on a **long-term storage memory** , typically an HardDisk or a ROM (for example in mobile phones), but can be on a CD, a USB pen...

Examples of operating systems

- Microsoft Windows
- Mac OS X
- UNIX
- GNU/Linux
- Android
- Symbian
- ...

Basics of operating systems



- **Kernel**: a program more important than the others. It's a **software** that is the **core** of an operating system.

- **Drivers** or **Modules**: set of programs that allow the kernel to interact directly with the **hardware**

- **User interfaces**: set of programs allowing the users to communicate with the computer and use **software**.

GNU/Linux or Linux

- One of the **full community based** accessible operating system, based on UNIX (proprietary)
- GNU (GNU's not Unix!) project: community that wrote many of the **drivers, basic tools and user interfaces**.
  Founder Richard Stallman (father of Free Software)
- Linux: the operating system whose **kernel** was developed by Linus Thorwalds

<<-- Tux the penguin,
the GNU/Linux mascotte

Linux, why we're using it

- Popular **free (as in free beer)** alternative to many proprietary operating systems
- **Free access** (as **free software**) to source code: anybody has **right to**
  - **Run the programs**
  - **Read and modify the programs**
  - **Redistribute modifications to friends**
  - **Propose changes to the community for everybody to benefit**
- Components developed by many universities (e.g. MIT) on a free-for-all knowledge basis
- Accessible libraries to build software upon
  - most of scientific software is written on it
- After 20 years, it still ”scales” better than others on cheap hardware – used for intensive computation
  - Many universities install it on workstations, clusters, servers...
- Huge community based effort to keep it up to date and to keep it accessible for everybody

What is a Linux **Distribution**
What are **Software repositories**

- A **selection of software** that runs on top of a GNU/Linux operating system. This includes:
  - Installation tools (to install the operating system in a computer)
  - Software installation programs (to add new software to a computer)
  - **Configuration** and **management** software
  - Graphical interfaces
  - Office programs alternatives
  - Development tools
  - Communication software
  - Scientific software
  - Videogames
  - .....

- Bound to a place on the internet where such software is available, often called **software packages repository** or in short **repository**.

Popular Linux distributions


- **Debian**, community based
  - **Ubuntu**, **Kubuntu**, **Lubuntu** based on Debian, commercially maintained by Canonical
    - Derivatives: Linux Mint ...
- **Arch** Linux: community based

- **RedHat**: first commercial open source Linux
    - Derivatives: Mandrake Linux, ...
  - **CentOS**, community based
  - **Scientific Linux**, developed at CERN



- **Novell SuSE**: commercial Linux
  - **OpenSuSE**: community based SuSE

- Lots more: http://distrowatch.com/

Lubuntu: the one we will use

- Best user community effort backed up by the Canonical company, although with lots of criticism by other communities
- Probably the easiest for you to try at home
- L stands for lightweight, that means that we doesn't require a very powerful computer.

Linux installation: basic concepts

- The operating system usually comes in a **DVD** image, that one can put on a DVD or on a USB pen. The image contains also an **installer software**.

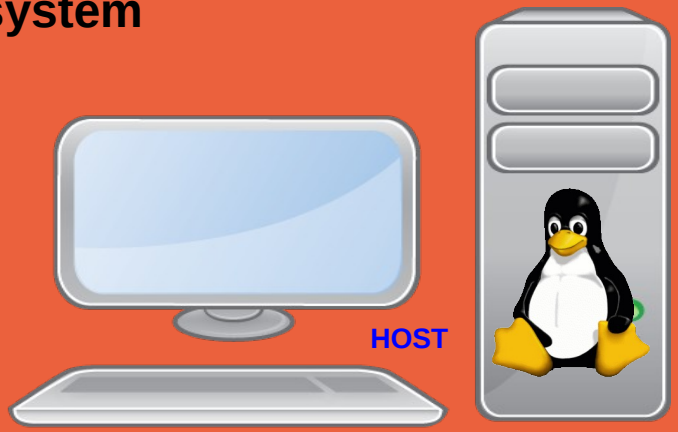
- The operating system is usually **installed on an hard disk**.

- Popular operating systems like Windows and OSX **do not like to share the hard disk** with other systems: this poses installation problems.
  - The Linux community has found many solutions to this limitation, in order for Linux to be installed together with other systems.

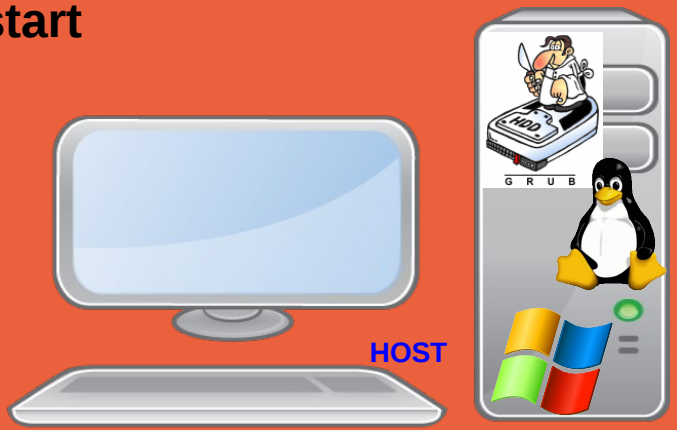
Linux installation: three strategies

Requires to be administrator

1. Linux as the *only* operating system



3. Dual boot with GRUB2: two systems installed, but only *one* runs at every restart



Admininstrator must install Virtualization software

2. Virtual Machine: operating systems running *at the same time*

Linux installation: three strategies

1 **Single operating system:** Linux deletes everything on the disk and it becomes the one and only operating system for that computer

- Costraint: user must own the computer (administrator)

2 **Virtual Machine**: Run Linux in a virtual machine where it is the one and only system. The virtual machine is run on an hypervisor that is running in the existing OS.

- Constraint: User must be able to **install software**, i.e. VirtualBox hypervisor

3 **Dual boot:** Linux shares the disk with other operating systems. Requires an alternative boot loader (e.g. GRUB2), a small program that is loaded **BEFORE** any other installed system. This program must be installed at the beginning of the disk.

- Constraint: user must own the computer (administrator)

Today's tutorial continued

- Download of Lubuntu Linux
- Installation of Lubuntu Linux
- Installing software from repositories
- Reboot
- Software update
- Customizing the work environment
- Repositories and other installation methods

Download Lubuntu LTS*

a) Go to
https://help.ubuntu.com/community/Lubuntu/GetLubuntu/LTS

b) Right-click on the link ”PC 32bit” 

c) choose ”save link as...”

d) Select a location where there is enough space, like
`C:\VirtualBox\`

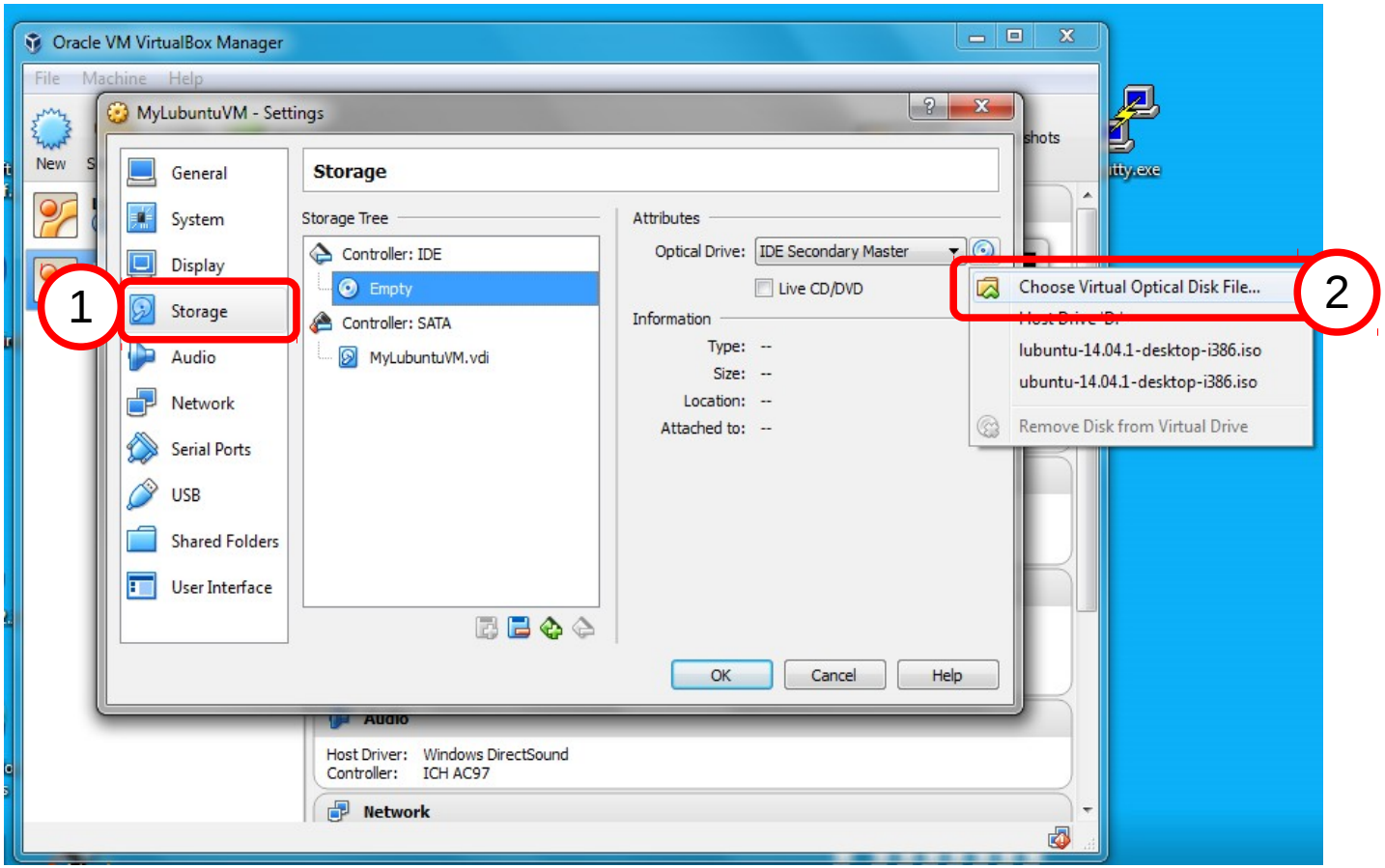
e) Remember the above location!

Direct link:
http://cdimage.ubuntu.com/lubuntu/releases/trusty/release/lubuntu-14.04.4-desktop-i386.iso

* LTS stands for Long Term Support. Means the system is ensured to be stable (no crash/malfunction) while using it.

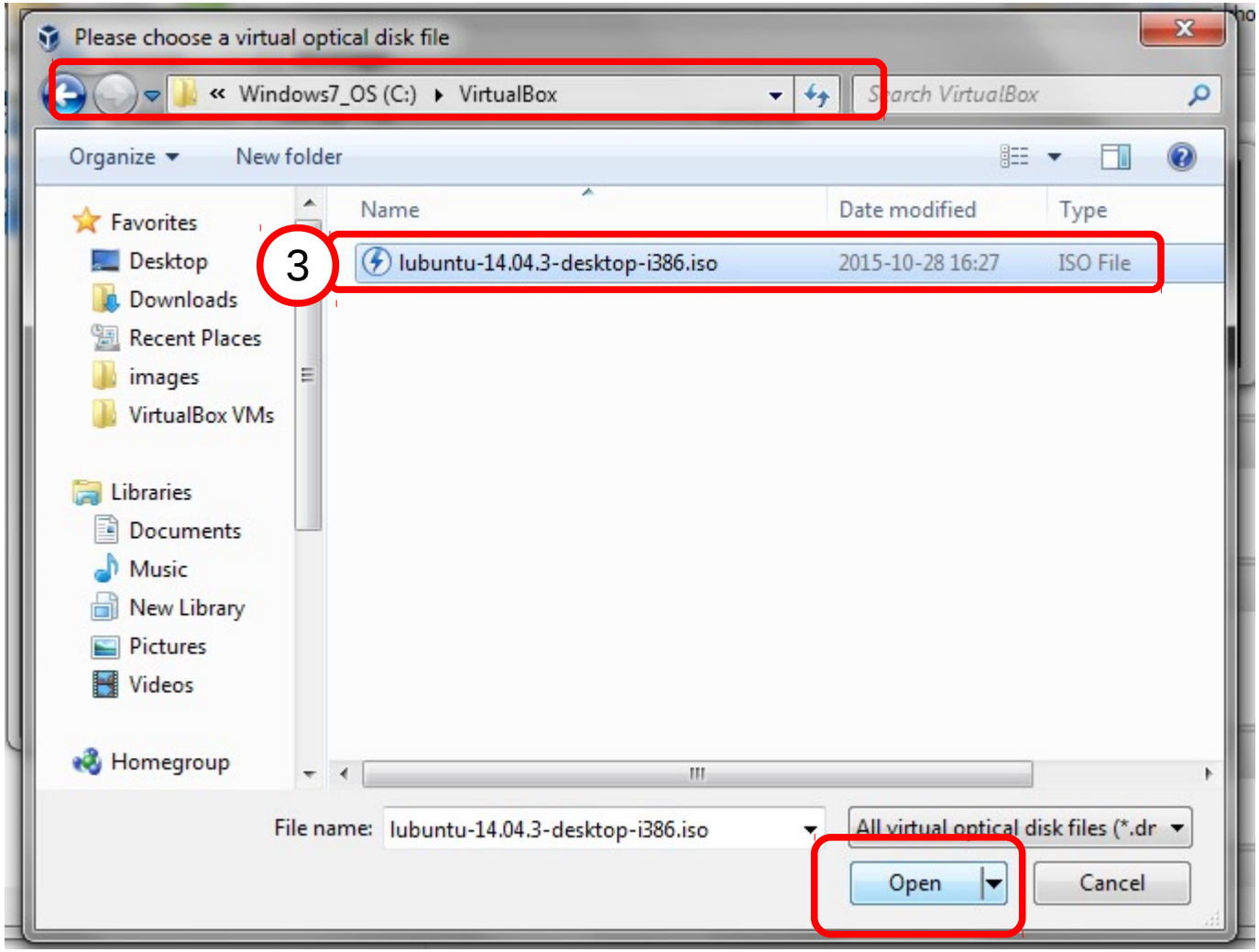
Ex. 7: Install Lubuntu in MyLubuntuVM

7.1 Add the ISO file just downloaded to MyLubuntuVM



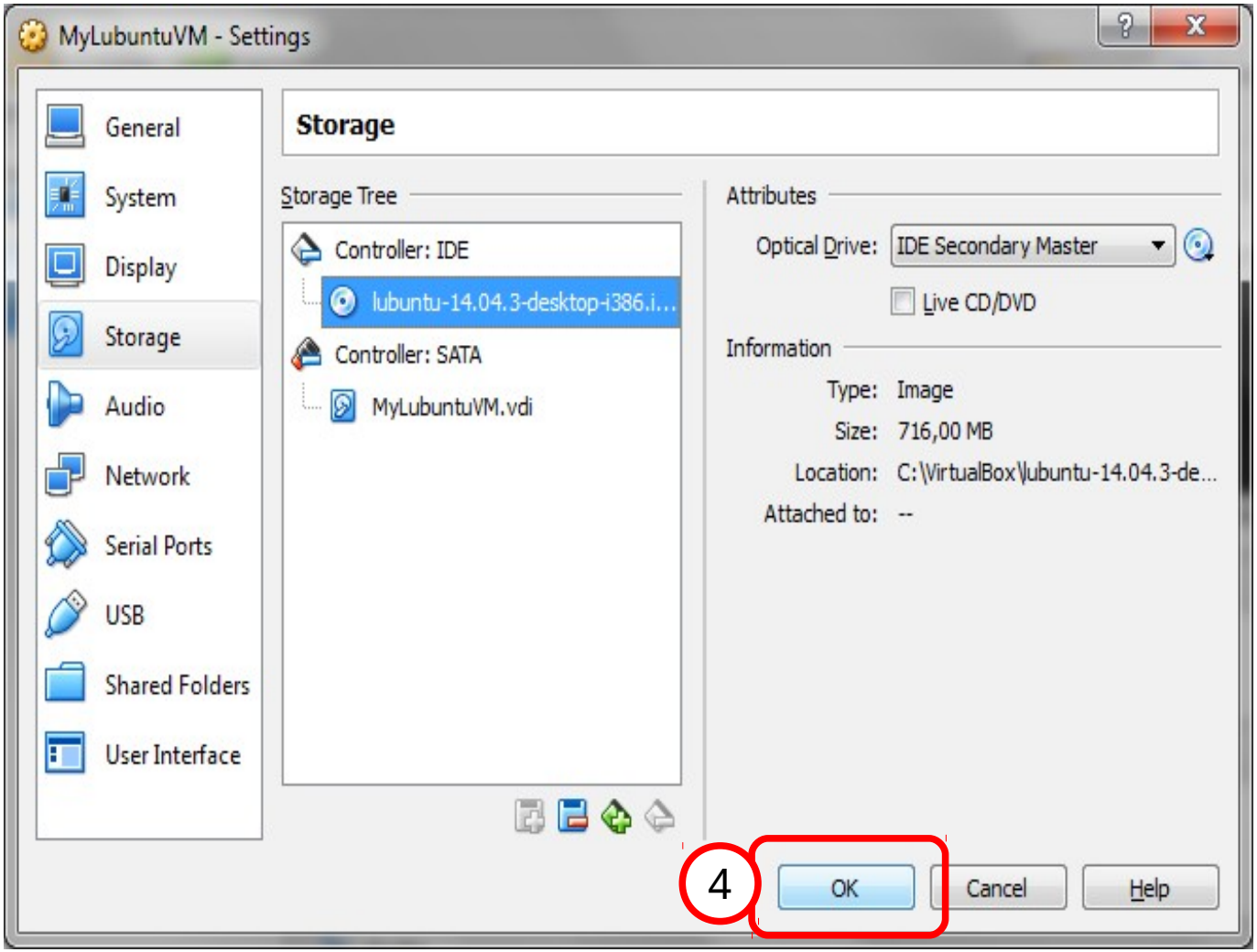
Ex. 7: Install Lubuntu in MyLubuntuVM

7.2 Select the ISO file downloaded



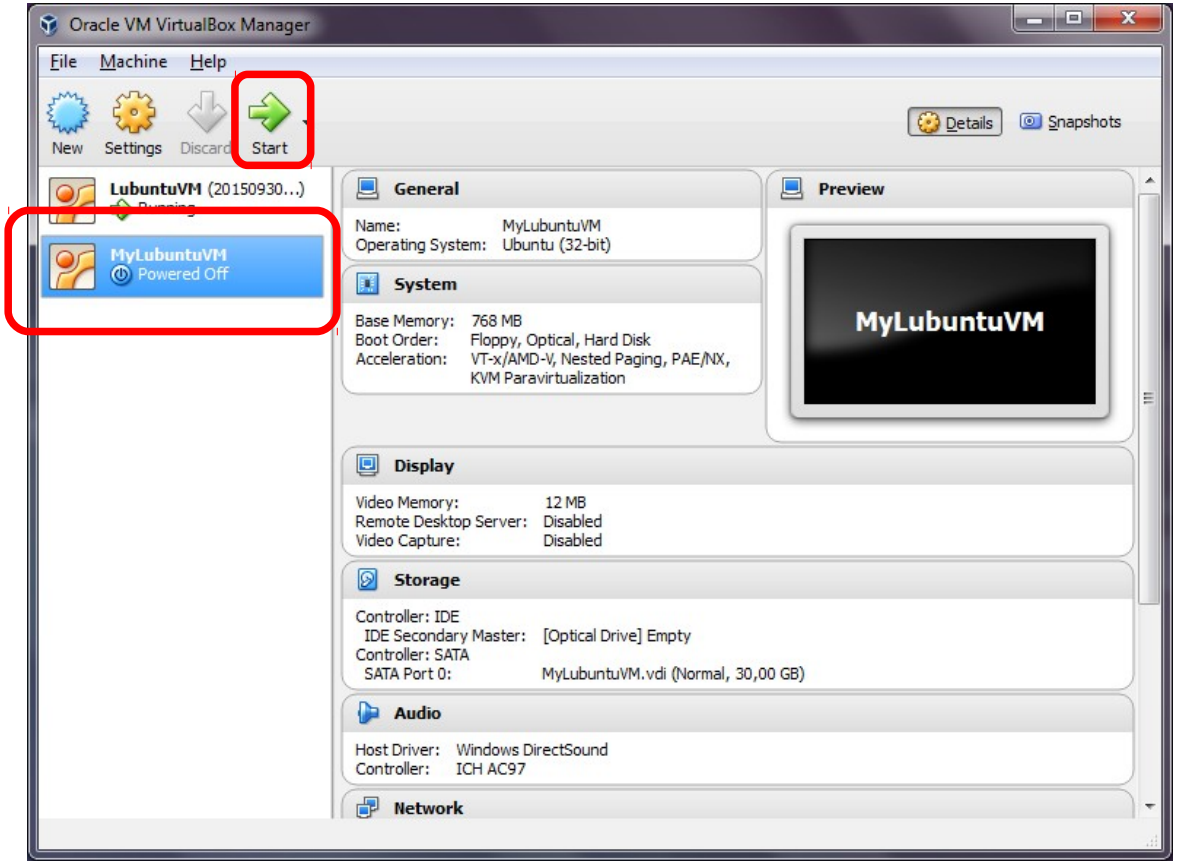
Ex. 7: Install Lubuntu in MyLubuntuVM

7.2 Select the ISO file downloaded



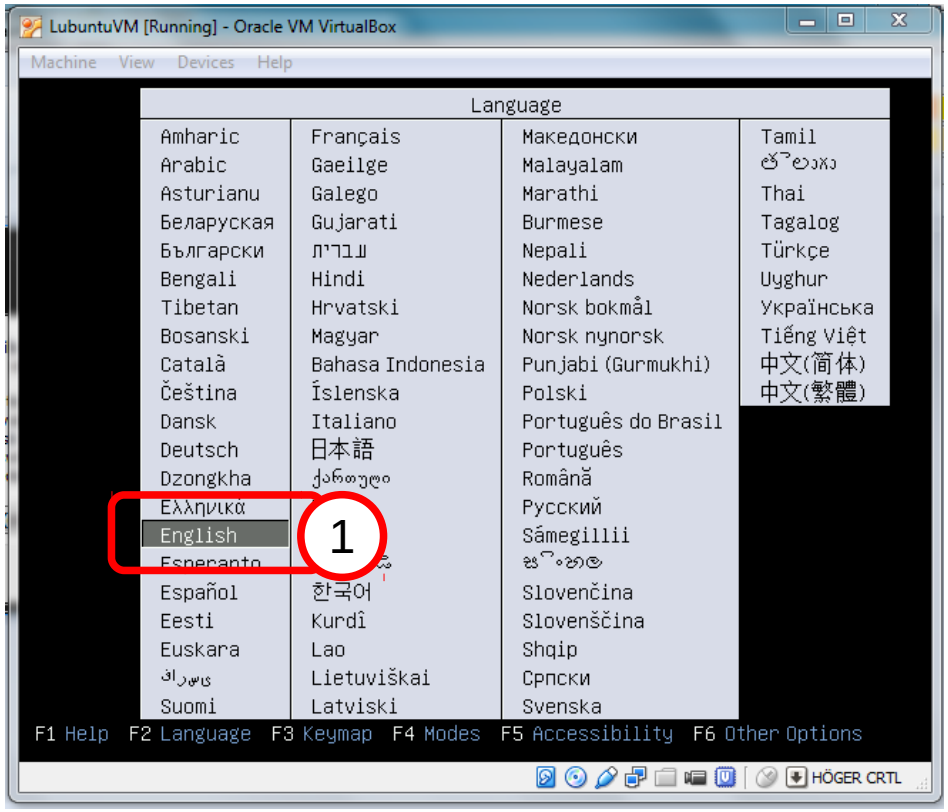
Ex. 7: Install Lubuntu in MyLubuntuVM - start it!

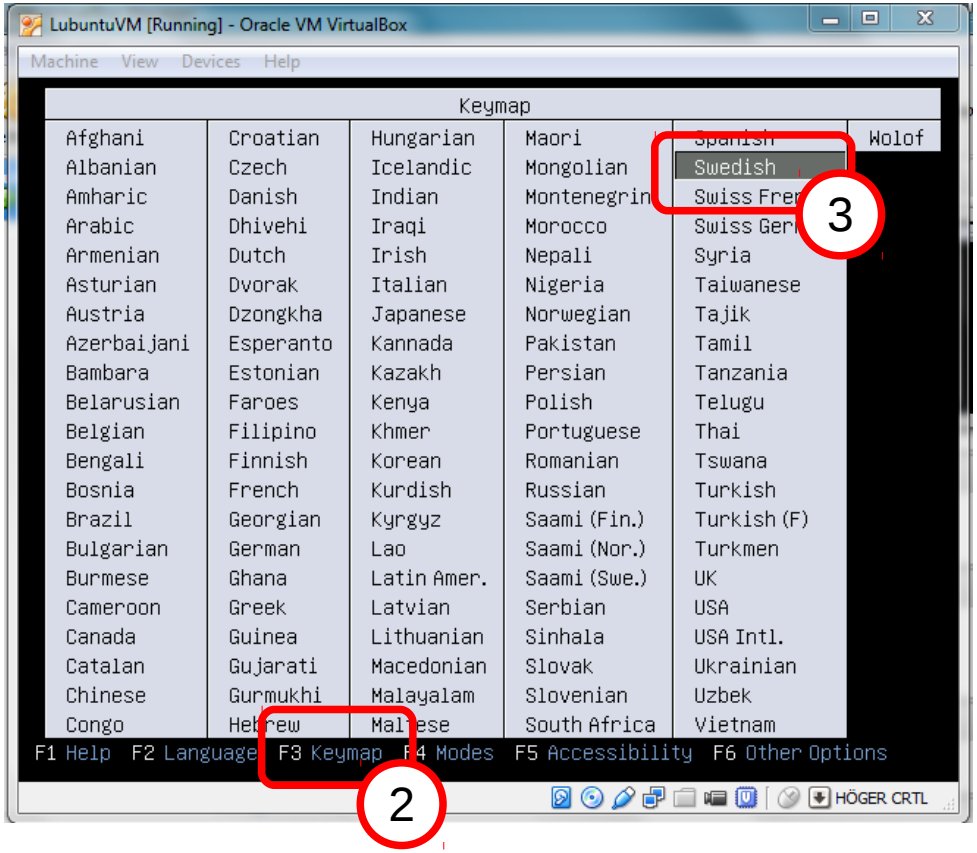
7.3 Select and Start the virtual machine.



Ex. 7: Install Lubuntu in MyLubuntuVM

7.4 Select English as installation language, press F3 and change keyboard to Swedish.





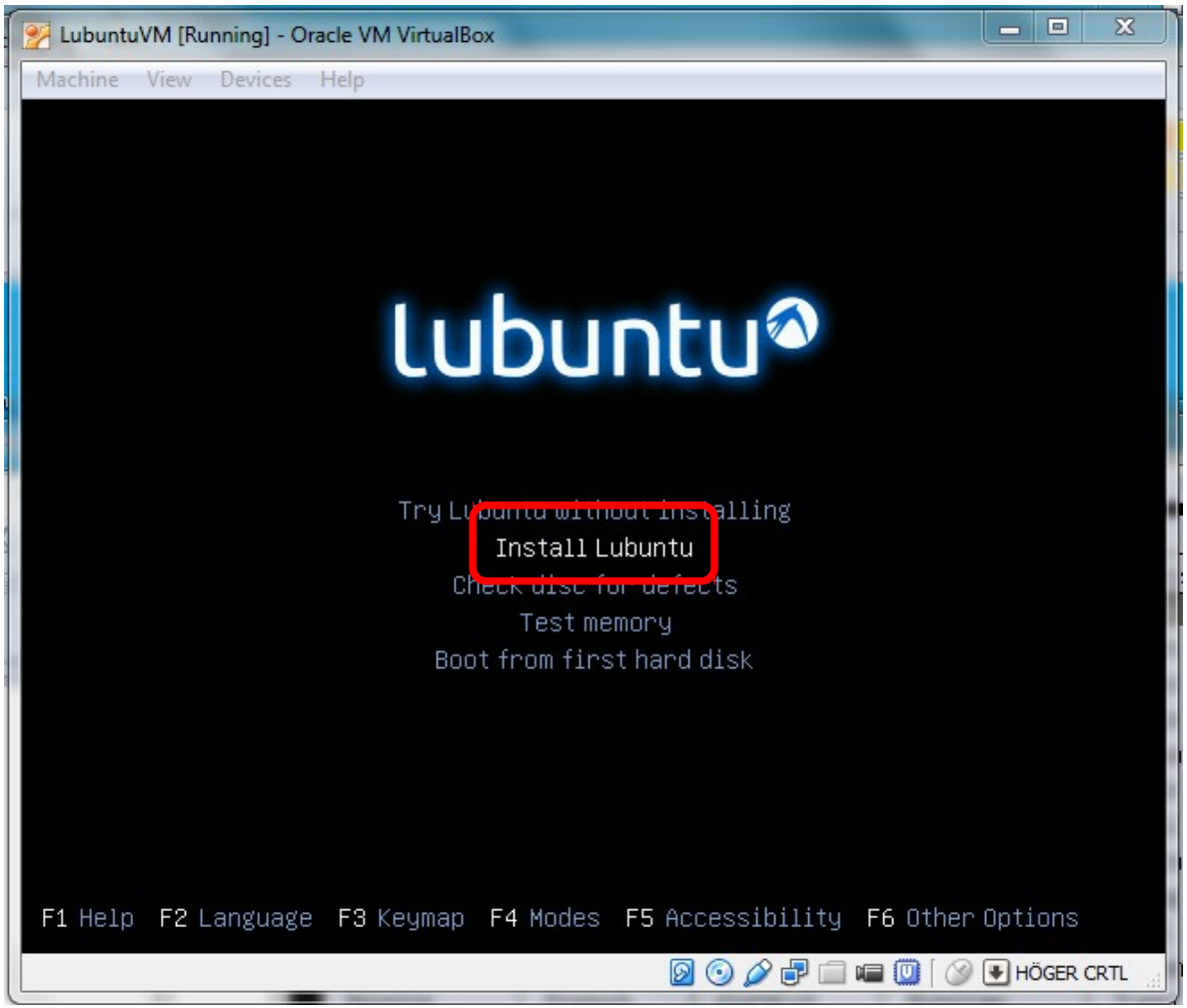
Ex. 7: Install Lubuntu in MyLubuntuVM

- Start the virtual machine with the Start button with the arrow.
- At the lubuntu prompt:
  - Choose ”English”
  - Press F3. Select the Swedish keyboard.
  - Select ”Install lubuntu”
- Follow the on-screen instructions. When prompted, insert the informations/choices in the following table:

Installation dialog	Click continue button twice
Installation type dialog	Select ”Erase disk and install ubuntu” and click continue
User name	courseuser
Computer name	Lubuntu-VirtualBox
User name	courseuser
password	coursepassword (insert twice)

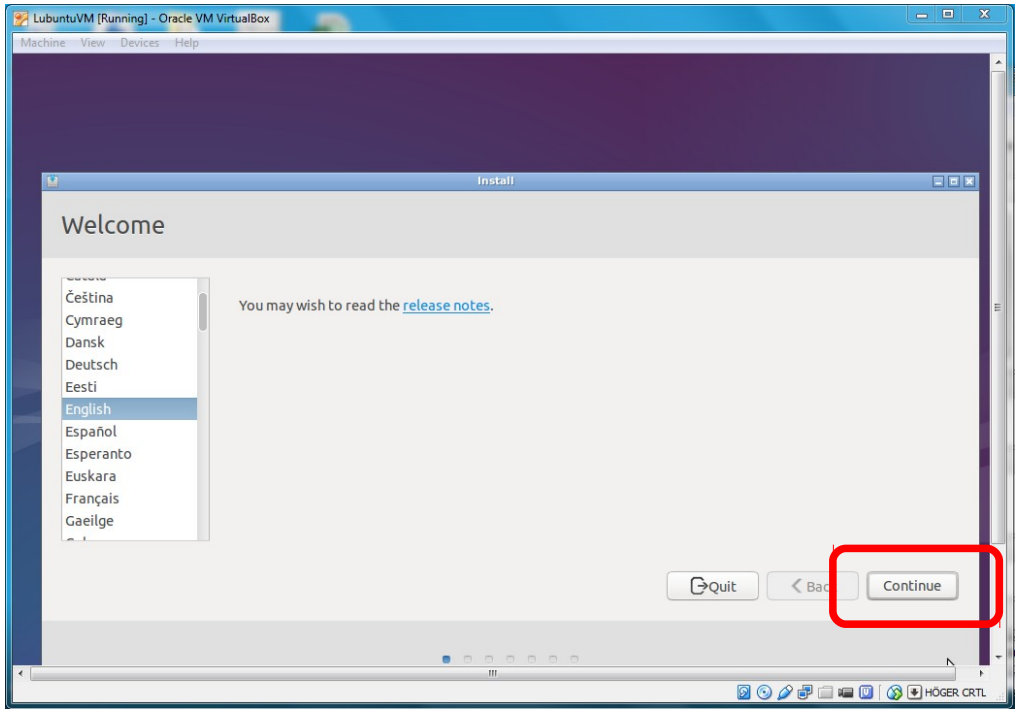
Ex. 7: Install Lubuntu in MyLubuntuVM

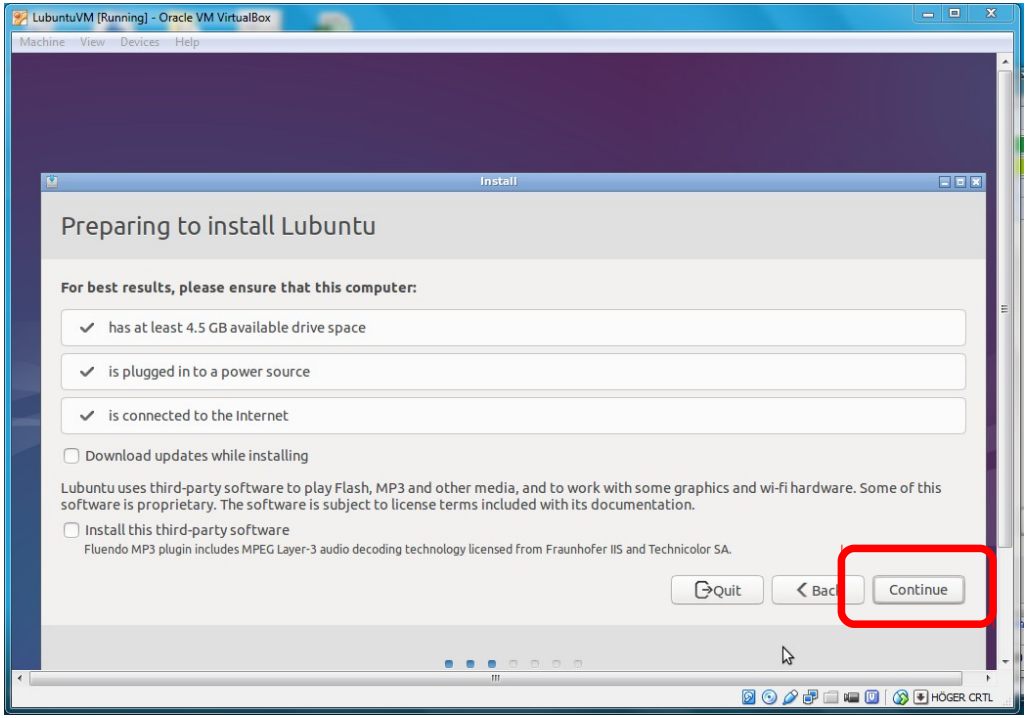
7.5 Select *Install Lubuntu* and press enter.



Ex. 7: Install Lubuntu in MyLubuntuVM

7.6 Click on continue twice



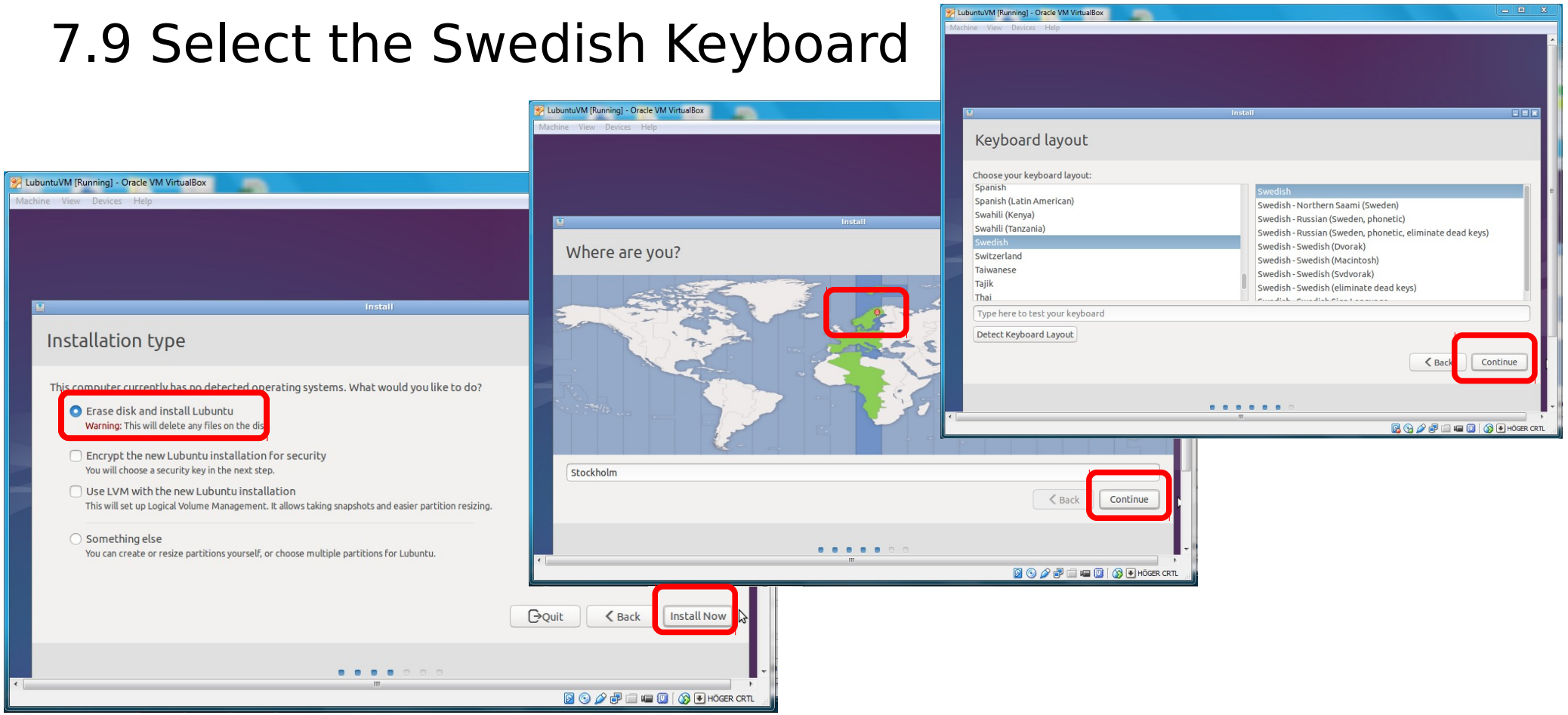


Ex. 7: Install Lubuntu in MyLubuntuVM

7.7 Choose installation type ”Erase disk and install ubuntu” and click ”Install Now”

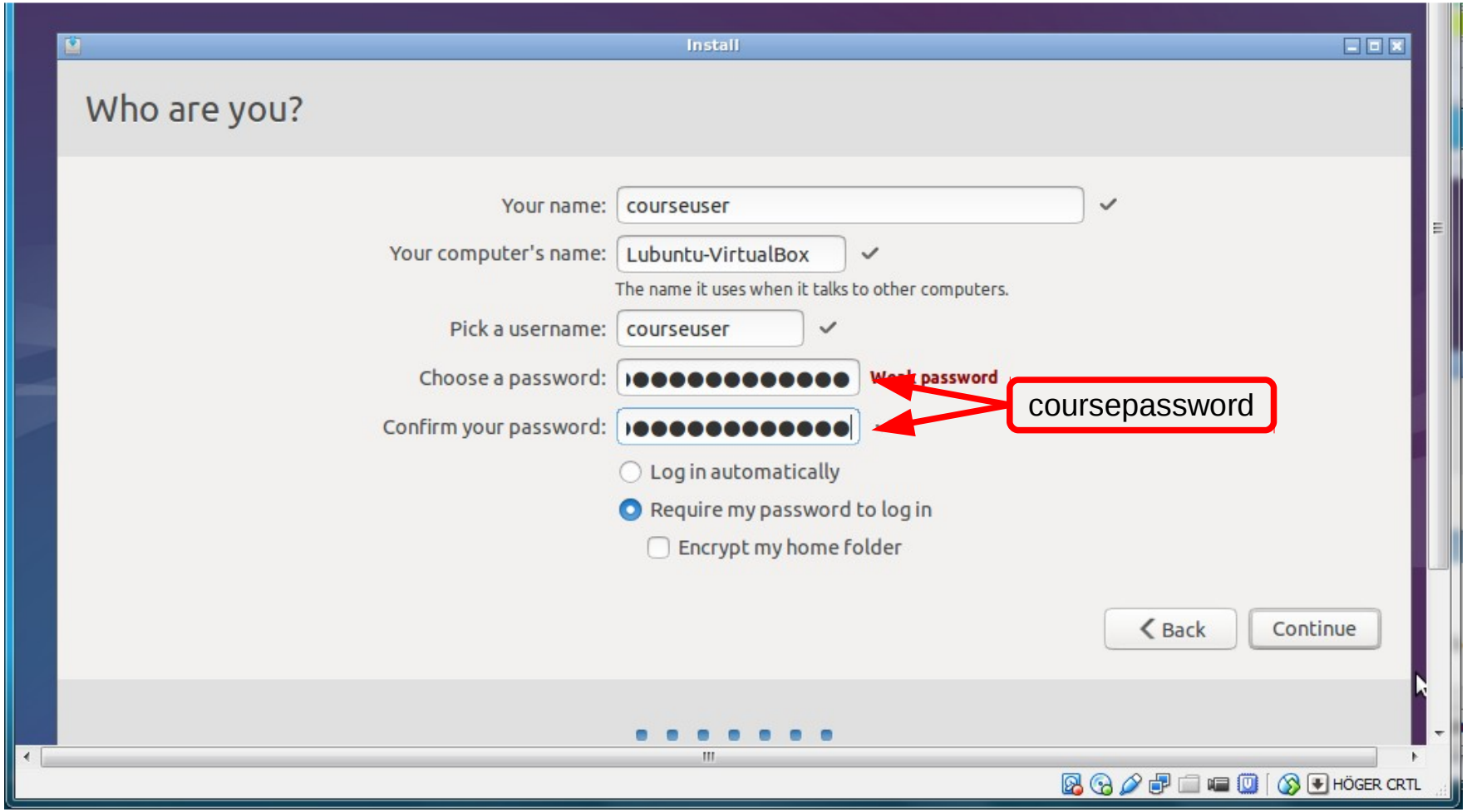
7.8 Select the Stockholm timezone

7.9 Select the Swedish Keyboard



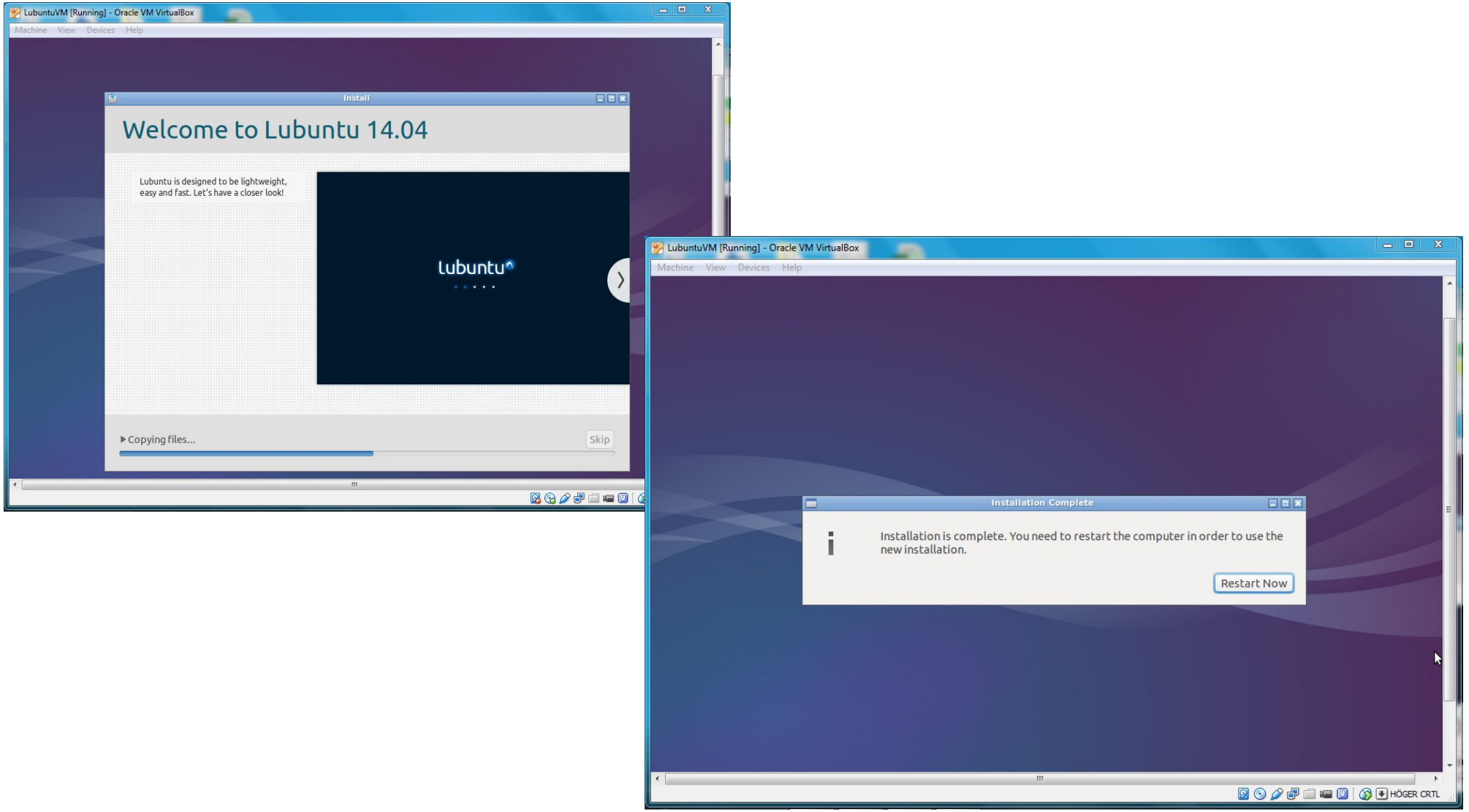
Ex. 7: Install Lubuntu in MyLubuntuVM

7.10 Insert computer name and username/password as in the picture:

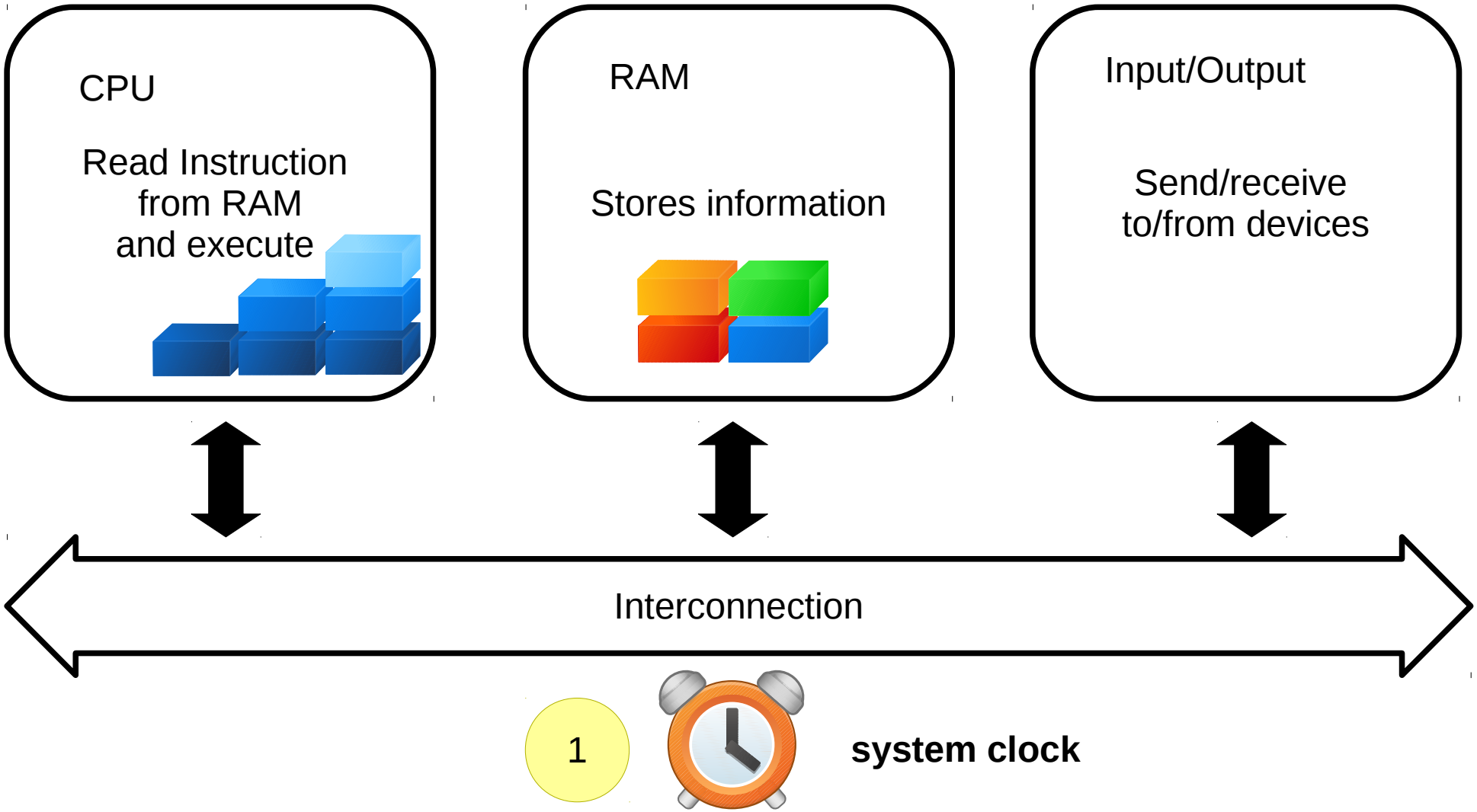


Ex. 7: Install Lubuntu in MyLubuntuVM

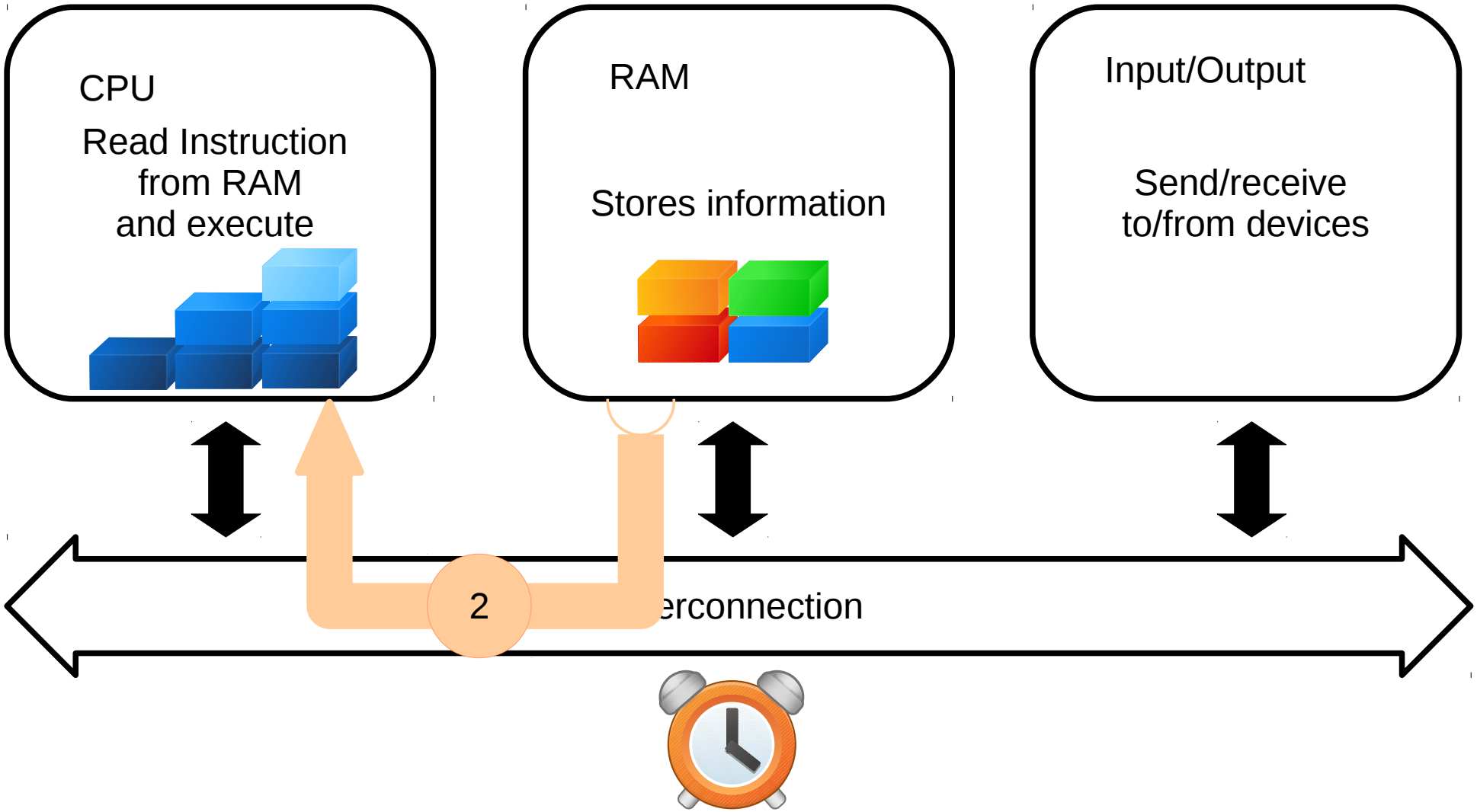
7.11 Let's wait for installation to complete!



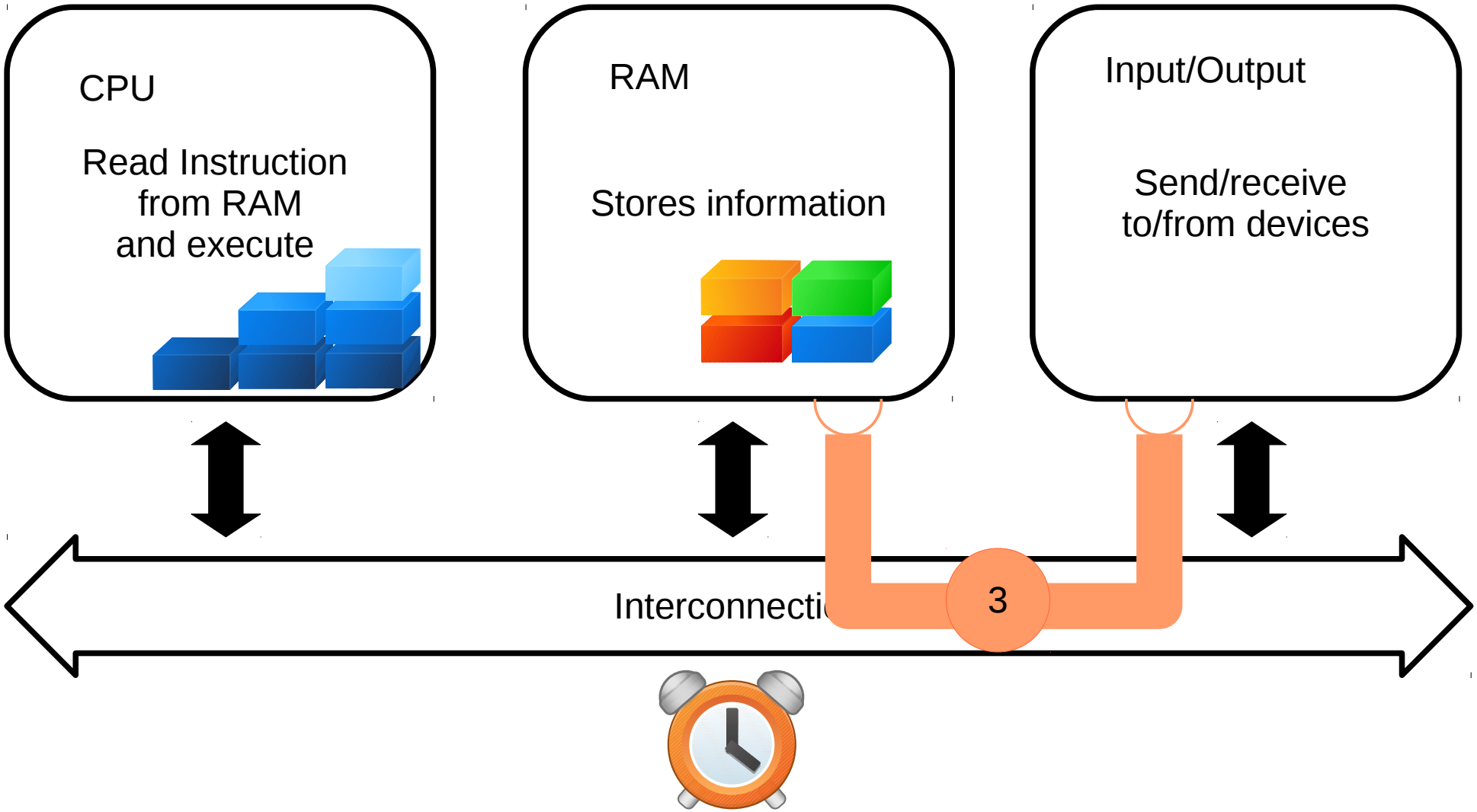
How does it work?
The computing cycle



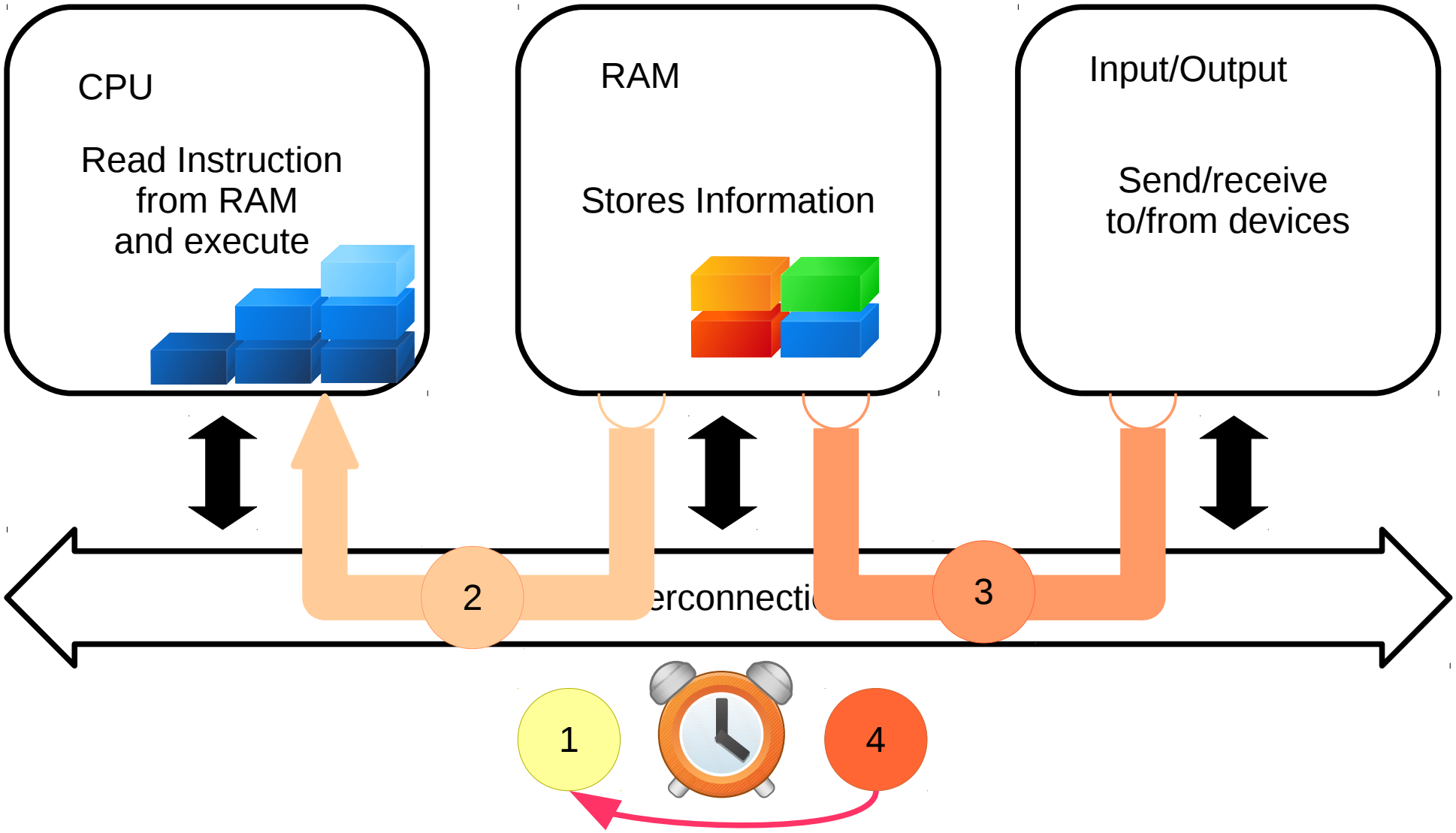
How does it work?
The computing cycle



How does it work?
The computing cycle



How does it work?
The computing cycle



How does it work?
The computing cycle

The execution cycle and the clock

1) clock ticks
2) CPU reads content of RAM(instructions) into registries and executes
3) Execution might dispatch information over the bus
4) Wait for next clock cycle

The execution is **always serial**, but gives us a feeling of parallel tasks because of speed.

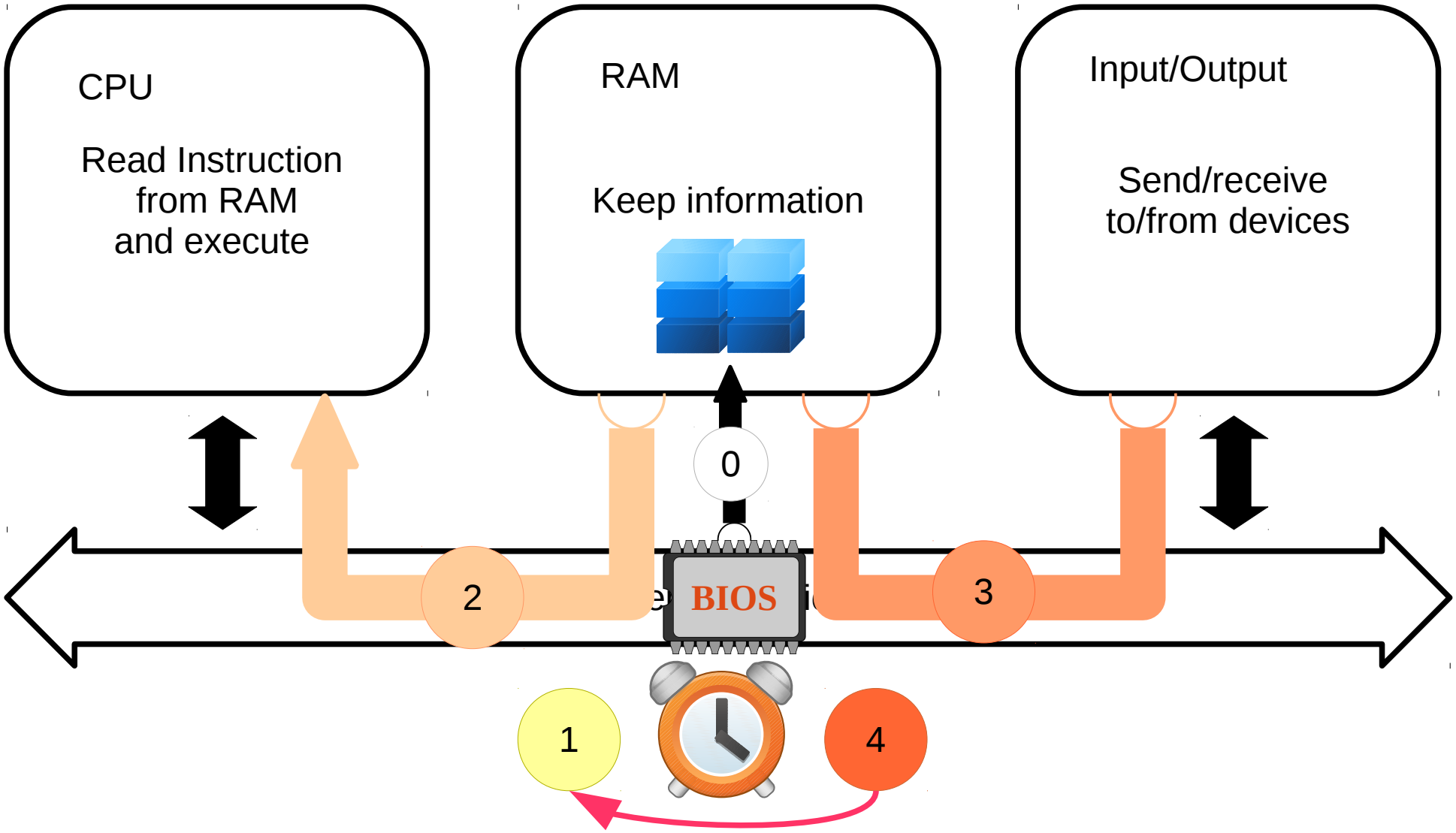
It might require more than one clock cycle to execute an instruction.

But... How does it start?

- When a computer is turned on, the first thing it does is to **boot**
- **Boot**, or the bootstrap sequence, is a set of operations done in order to start the the computing cycle as described before.
- A small program is copied into the RAM as soon as the computer starts, and this is executed by the machine.
- This program is usually stored in a long term memory chip and is called **BIOS**

But... how does it start?!?

BIOS: Basic Input/Output System
to bootstrap the computer



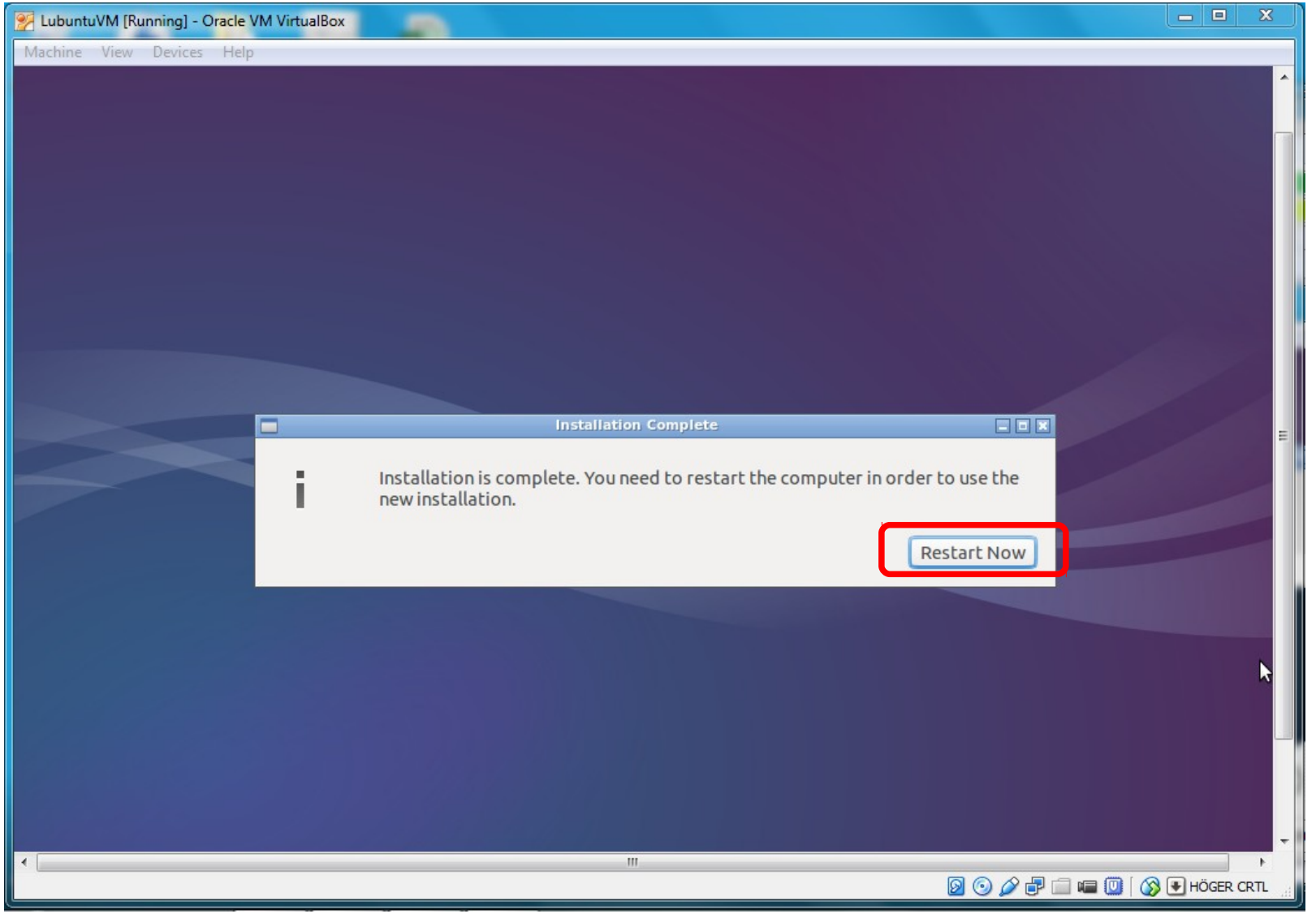
But... how does it start?!?

BIOS: Basic Input/Output System
to bootstrap the computer

0. The BIOS loads a small program (a set of intructions and the data needed) into the RAM.
When the clock starts, the CPU will start executing as explained.

Ex. 7: Install Lubuntu in MyLubuntuVM

7.12 If installation completed, Restart Now!

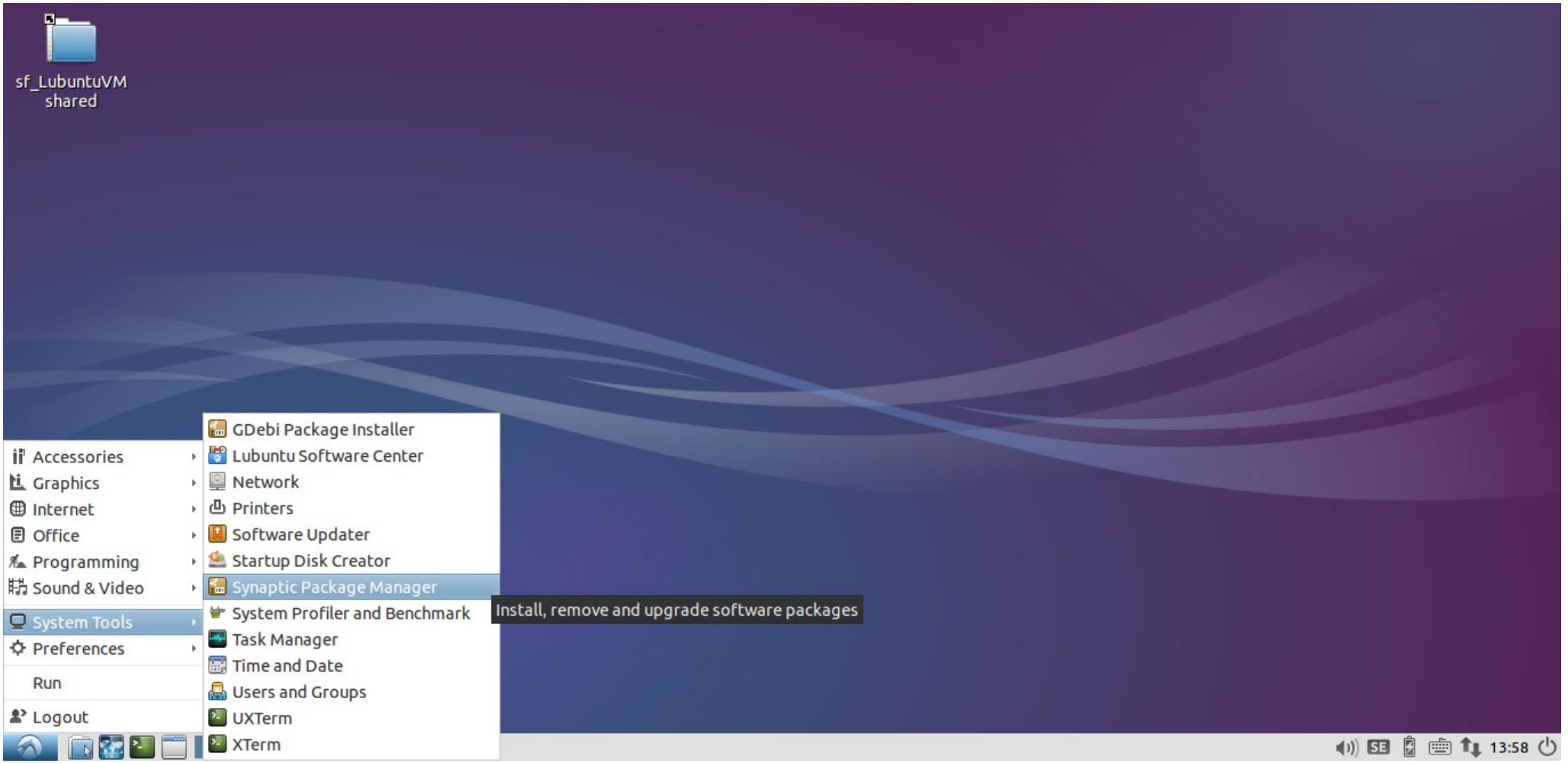


Ex. 8: Installing software Enhancing the virtual machine

- Did you notice how small is the screen? This is because **video drivers** for the **virtual video card** are missing.
- Lubuntu is aware it is running in a virtual machine, but needs to know **how to access the virtual hardware**.
- We will install the so-called **guest additions**

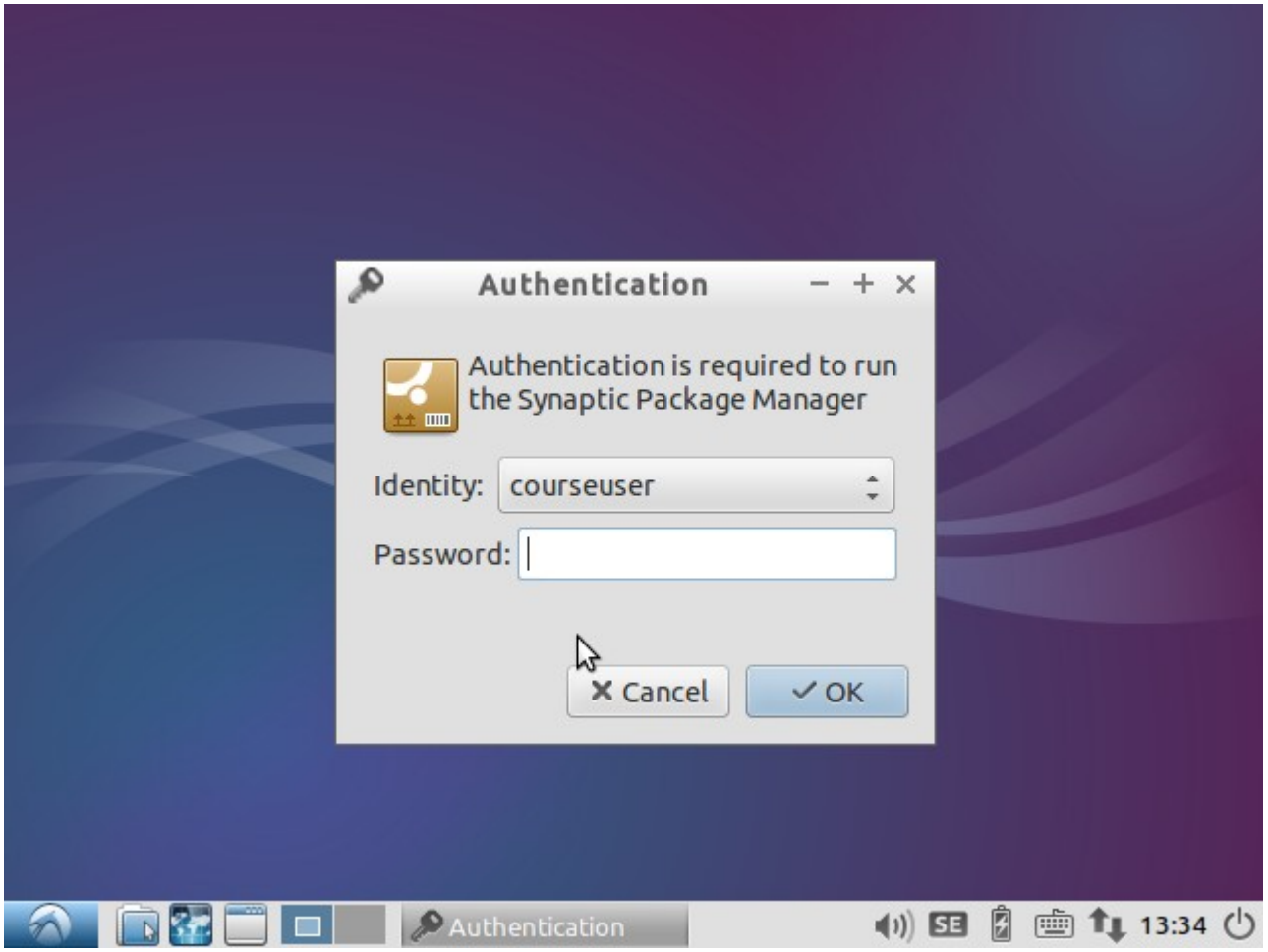
Ex. 8.1: Installing software from repositories

- Scientist: Synaptic, search for libraries, packages



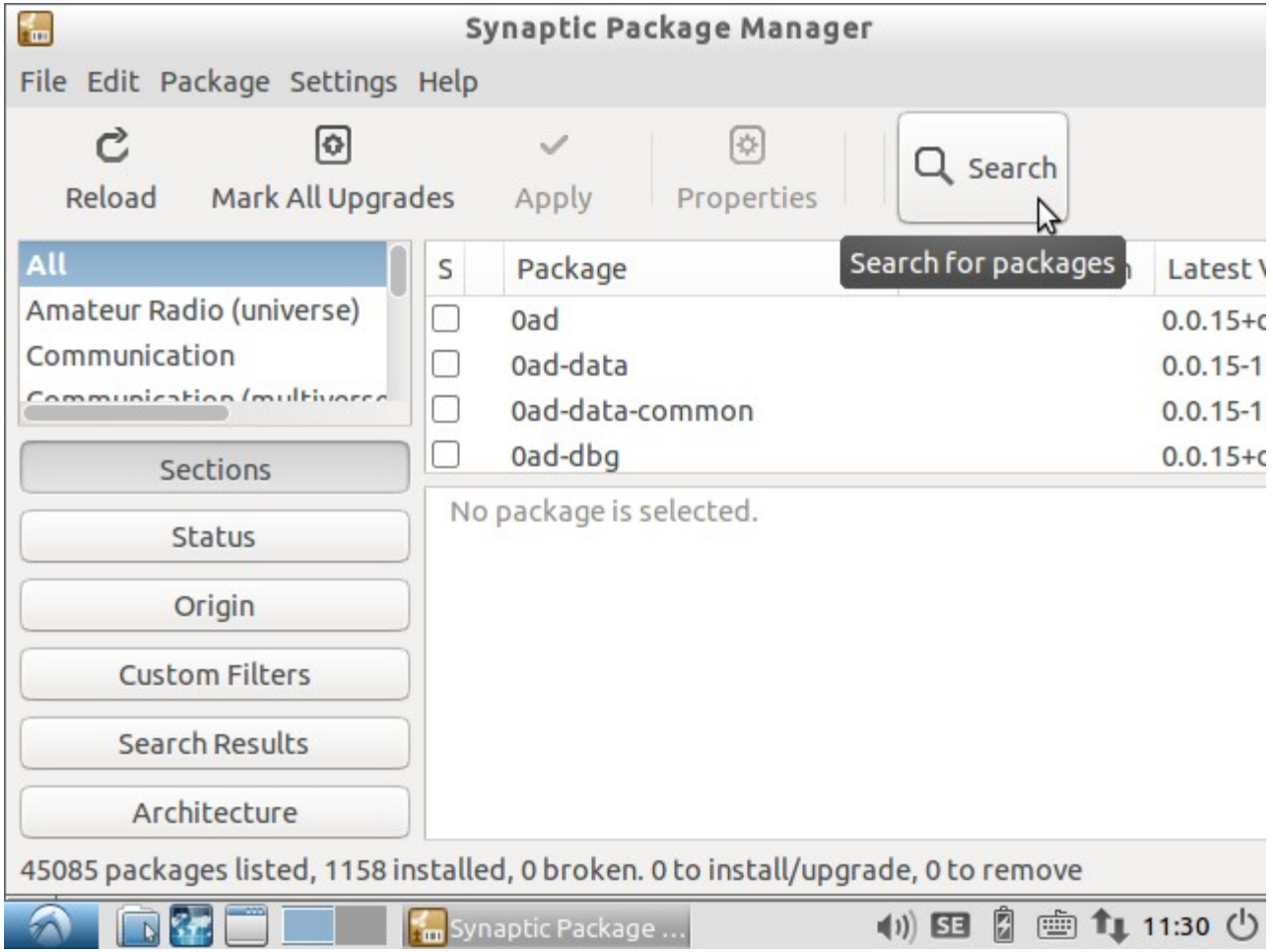
Ex. 8.1: Installing software from repositories

- Adding software requires superuser privileges



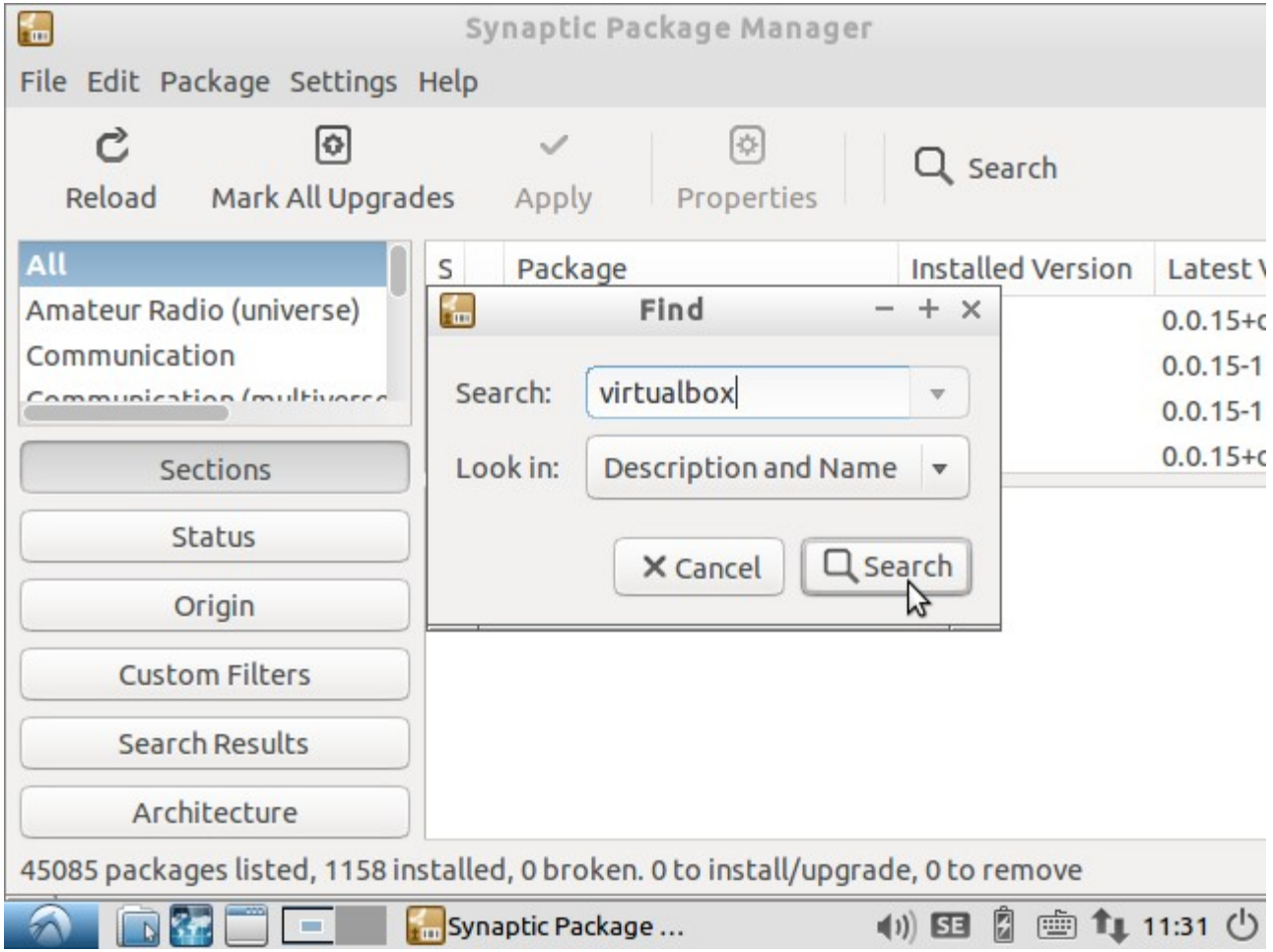
Ex. 8.1: Installing software from repositories

Installing guest additions



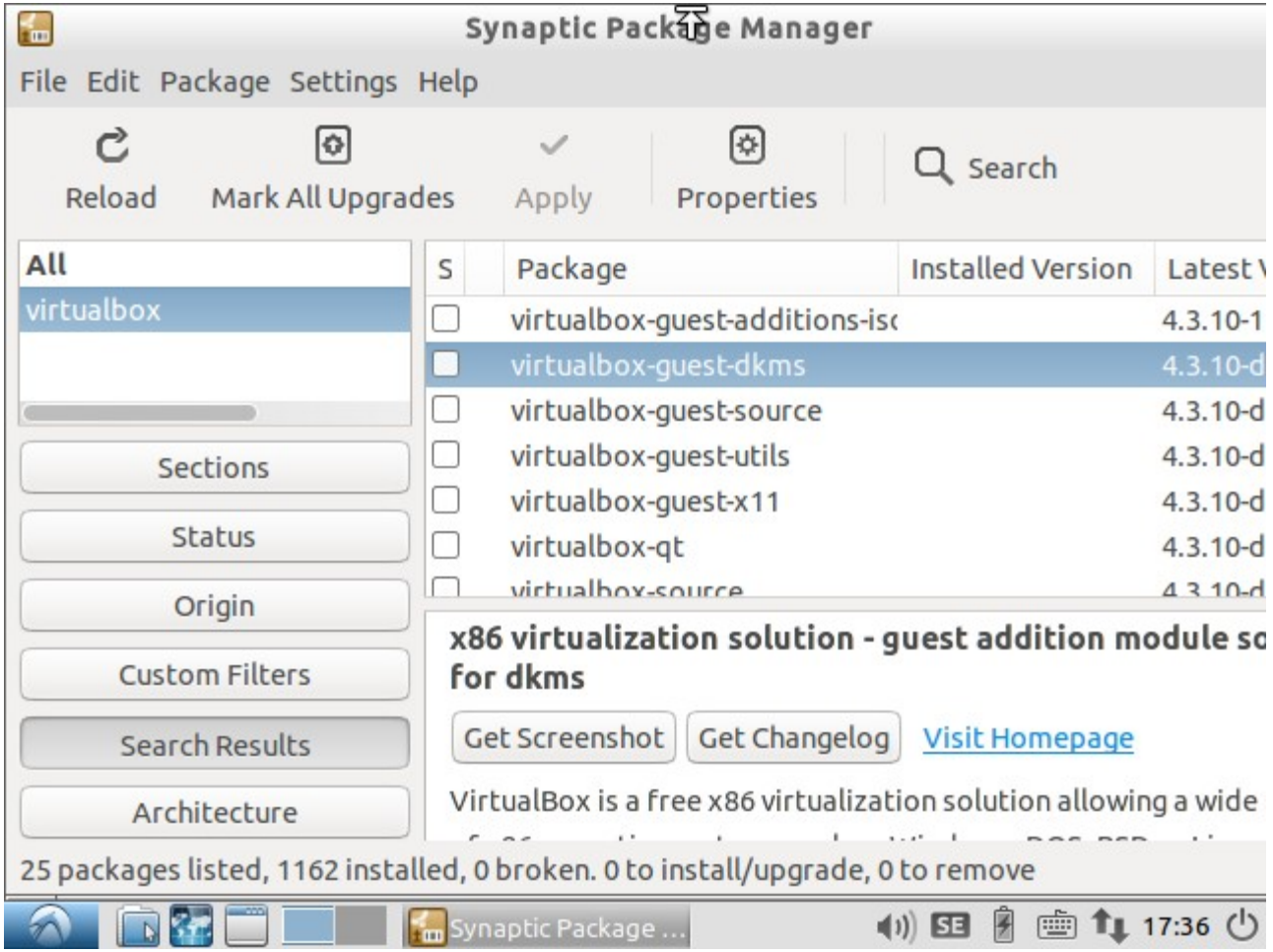
Ex. 8.1: Installing software from repositories

Installing guest additions



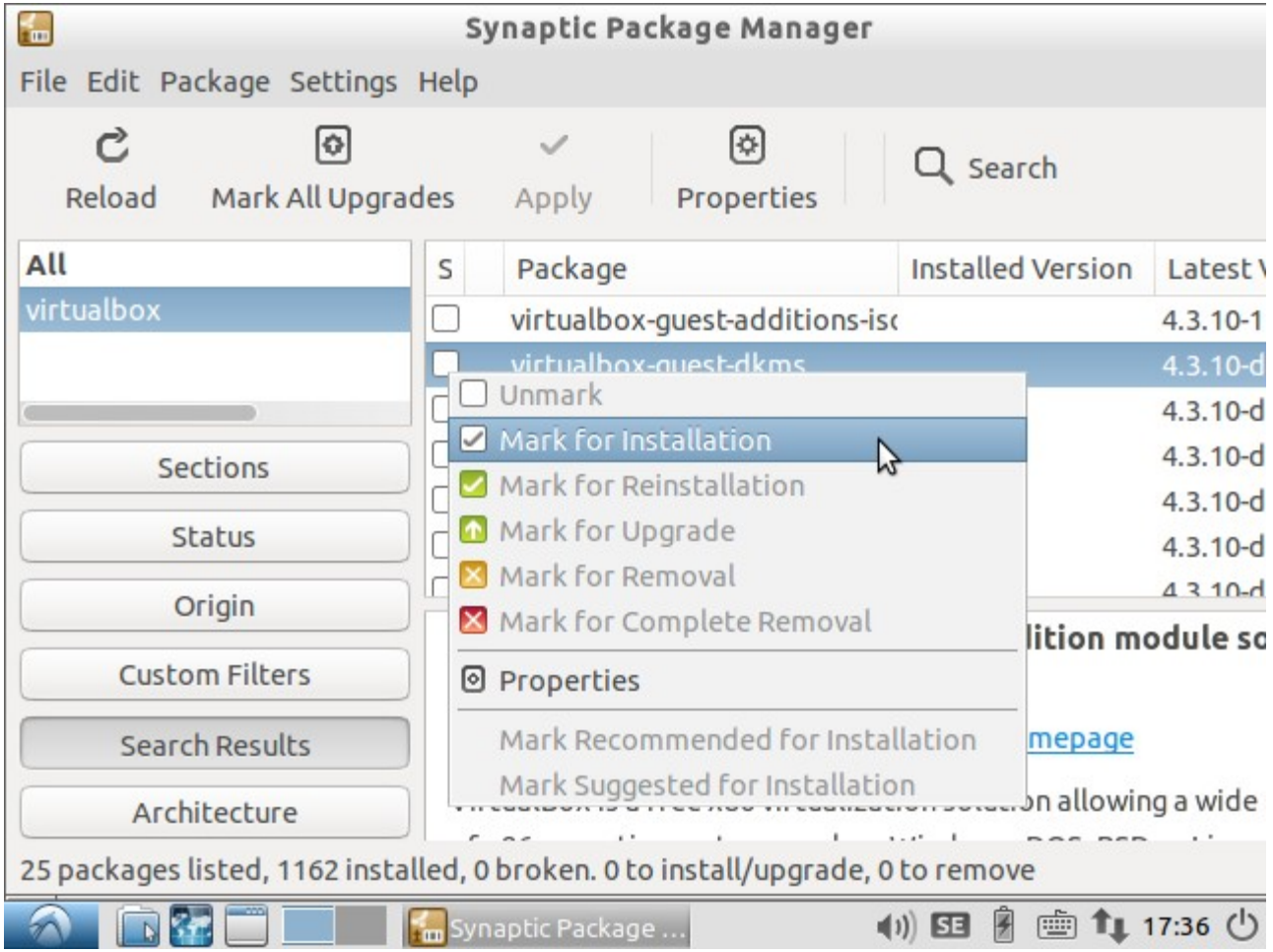
Ex. 8.1: Installing software from repositories

Installing guest additions



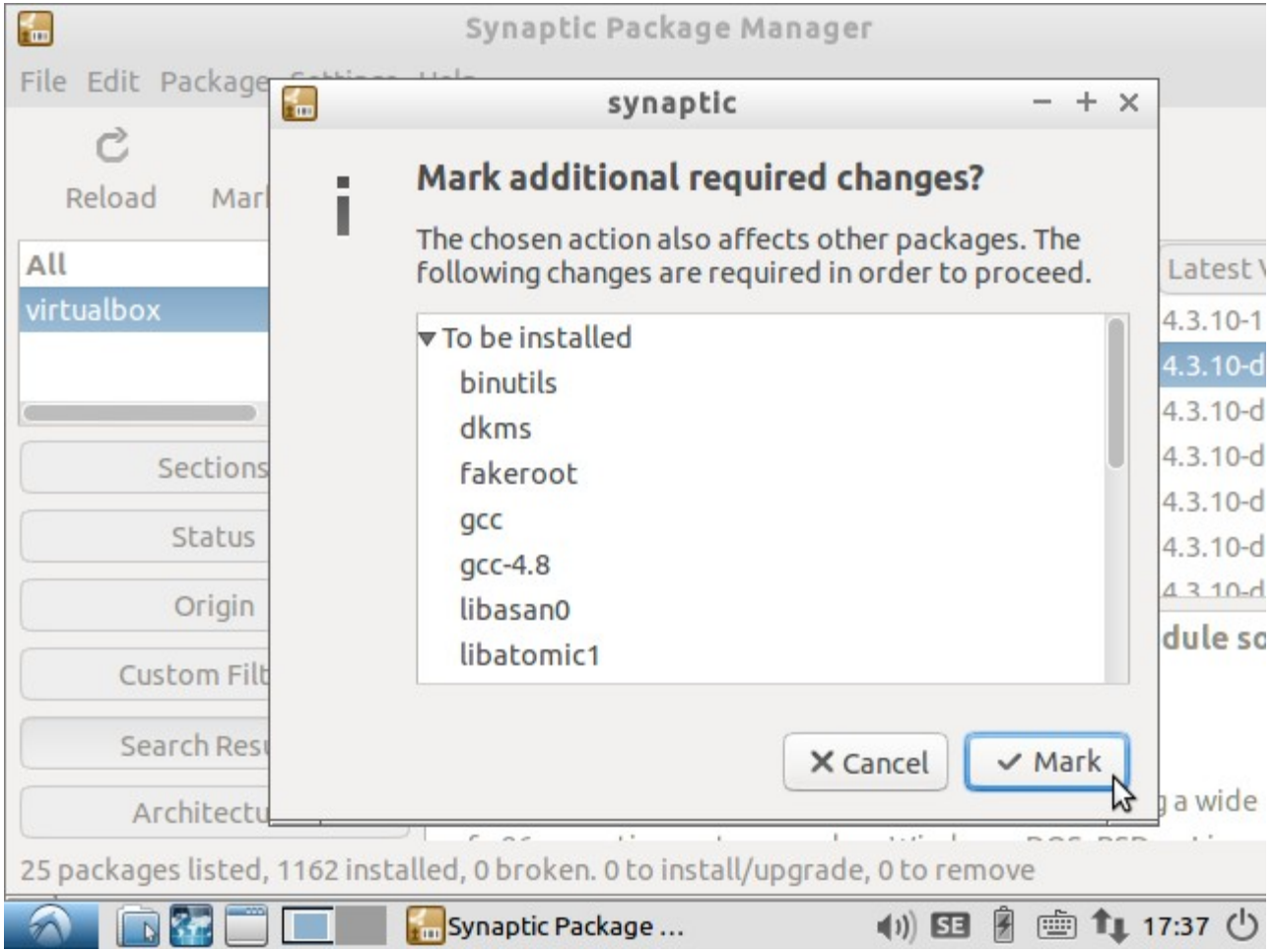
Ex. 8.1: Installing software from repositories

Installing guest additions



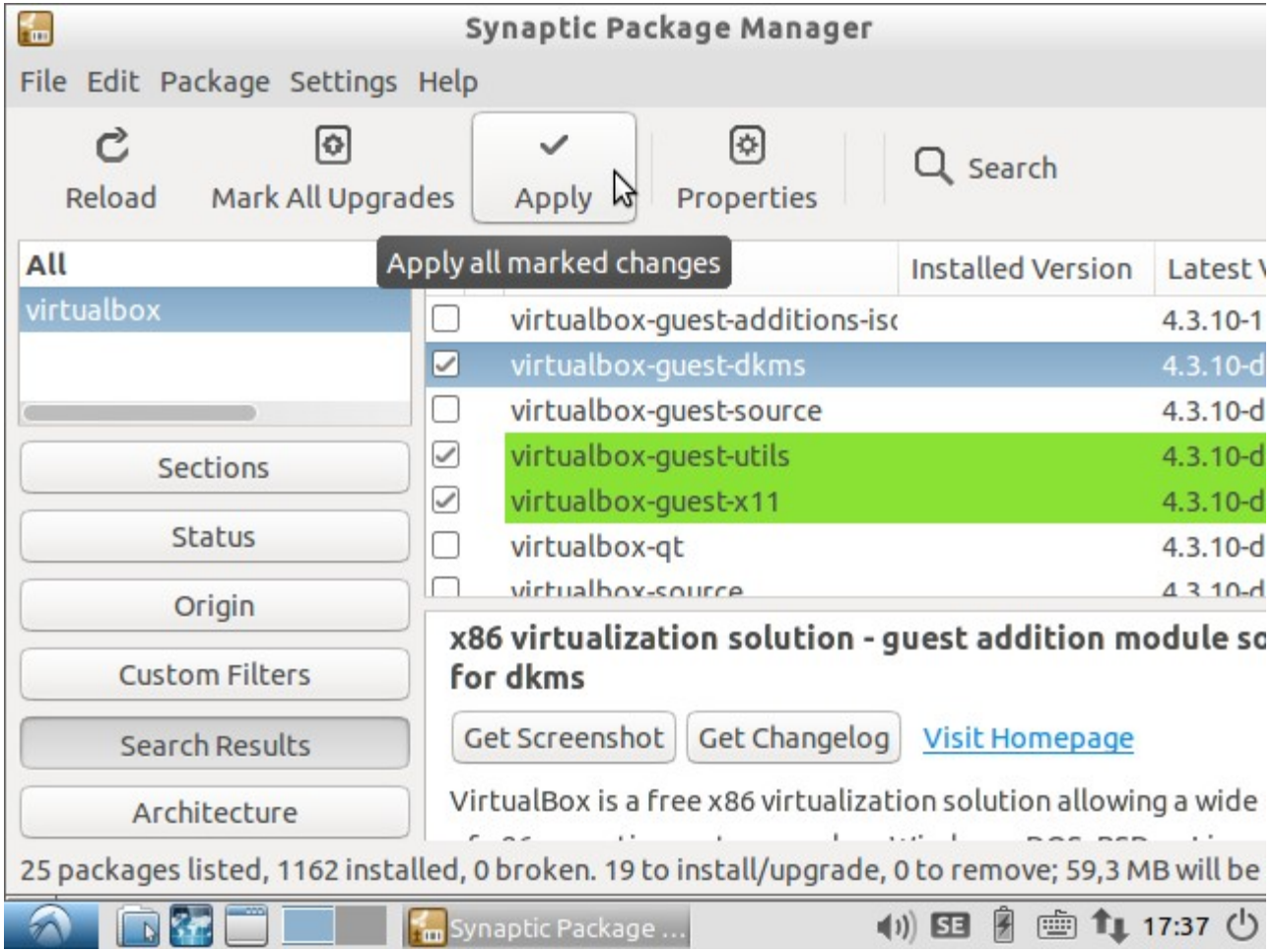
Ex. 8.1: Installing software from repositories

Installing guest additions



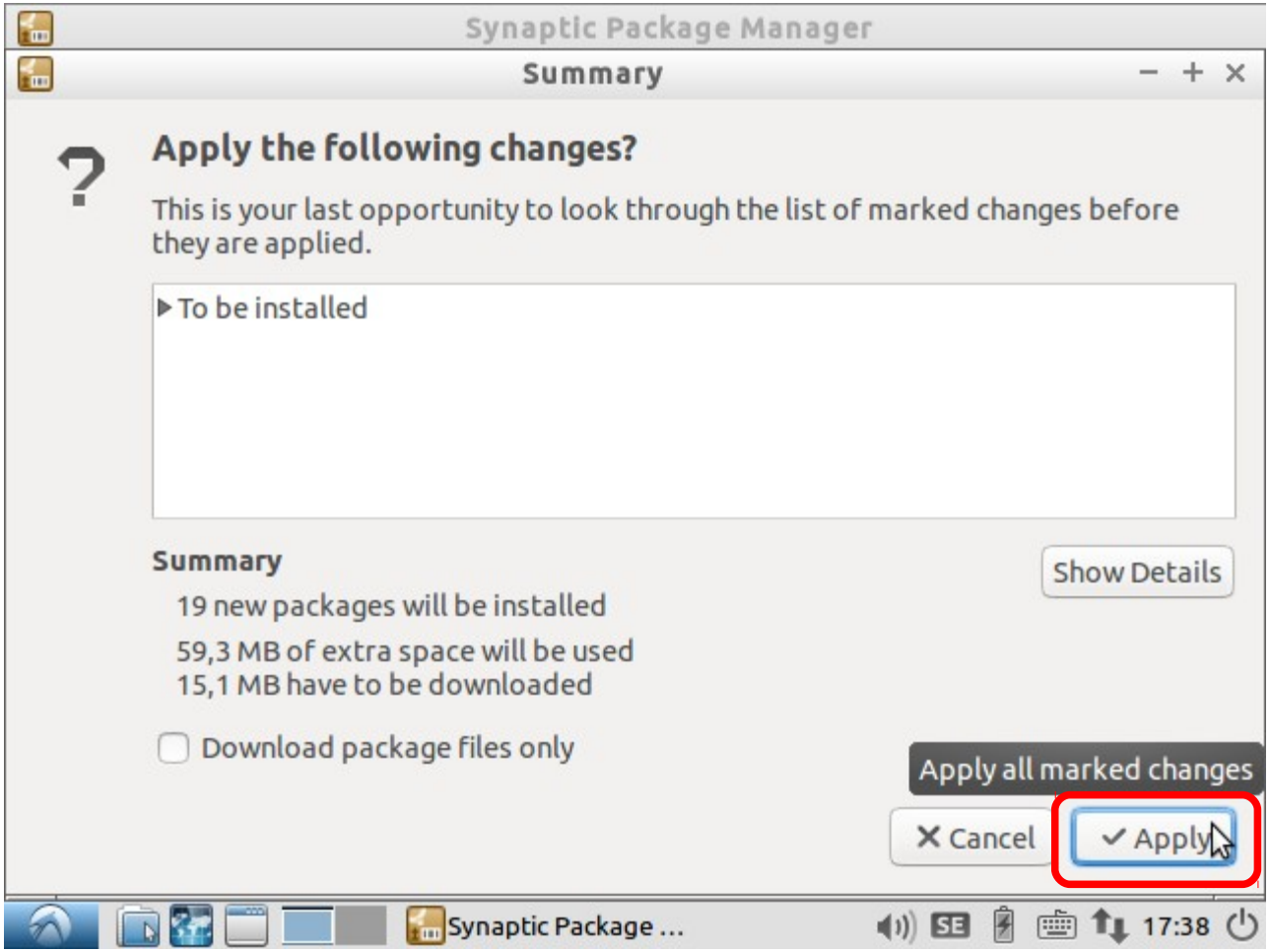
Ex. 8.1: Installing software from repositories

Installing guest additions



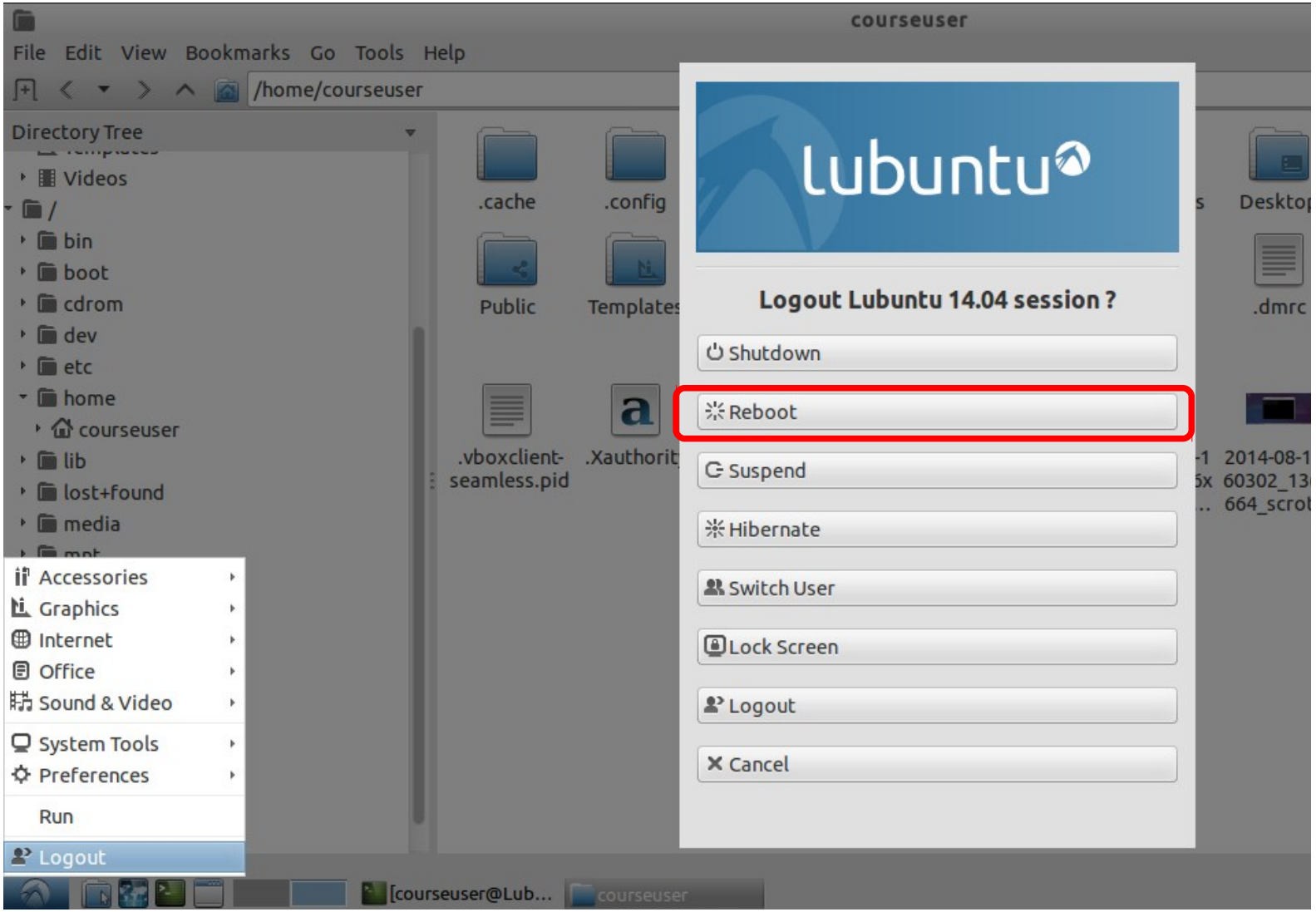
Ex. 8.1: Installing software from repositories

Installing guest additions

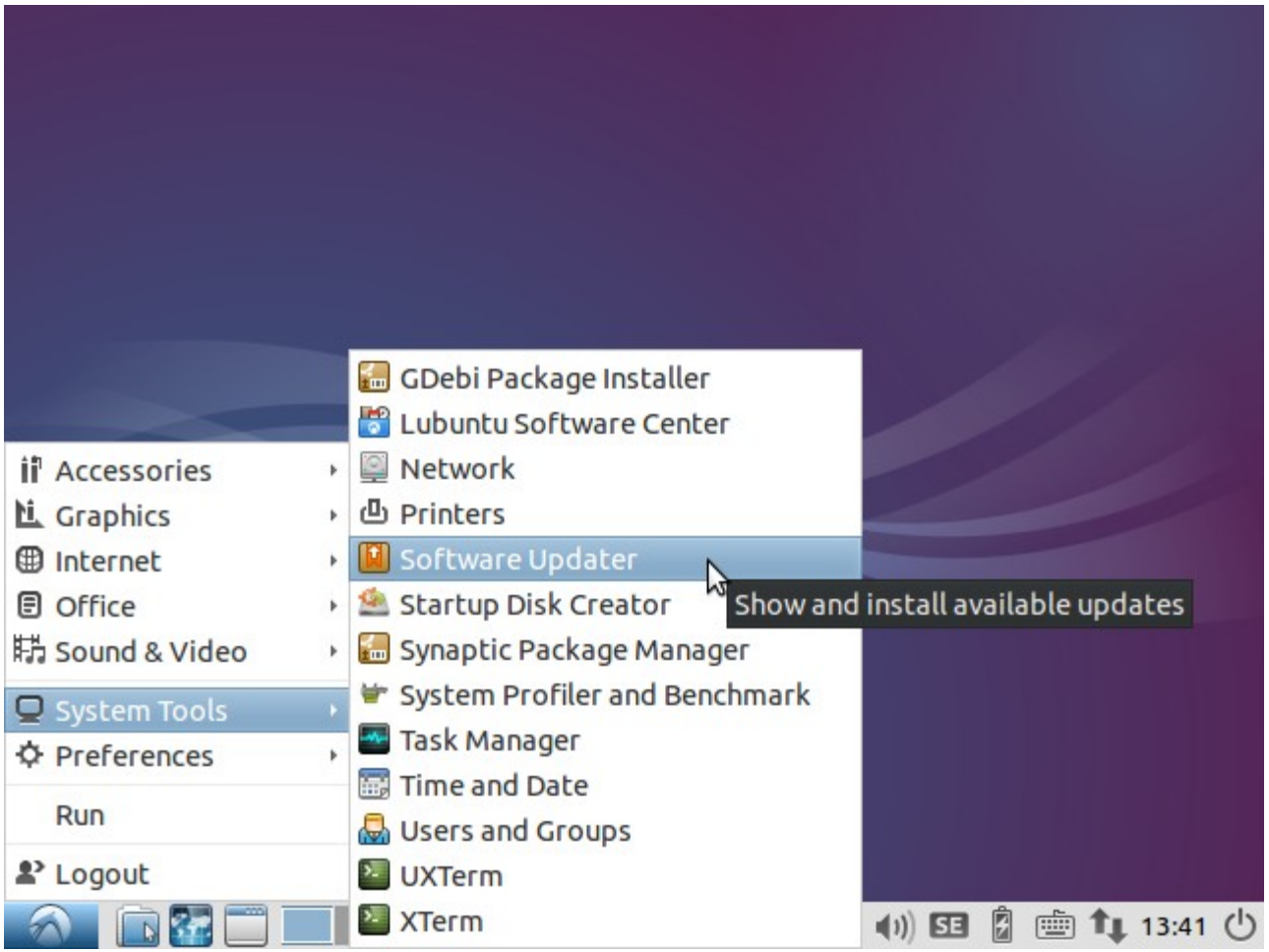


Ex. 9: Logout dialog: Reboot

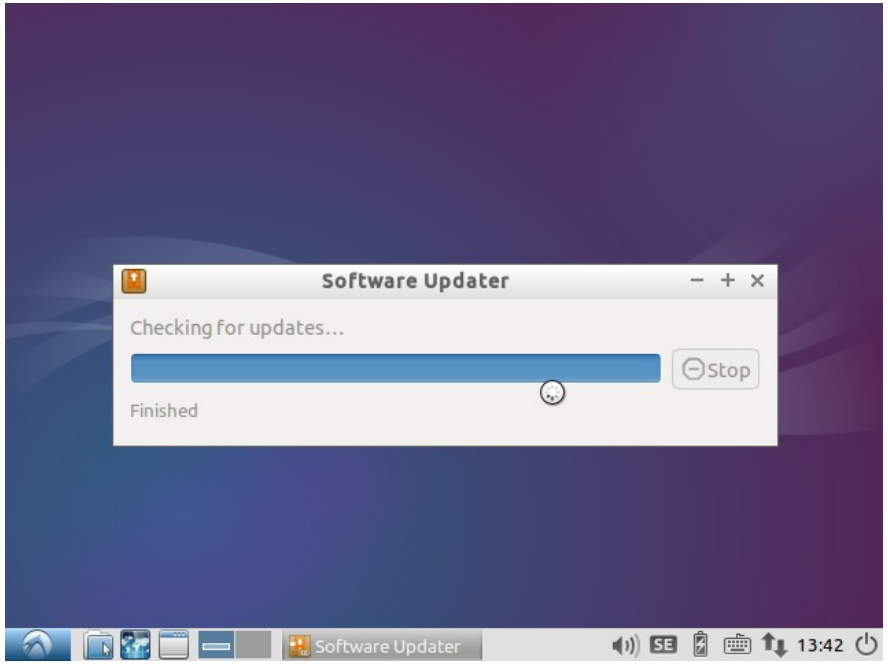
9.1 Reboot the machine.

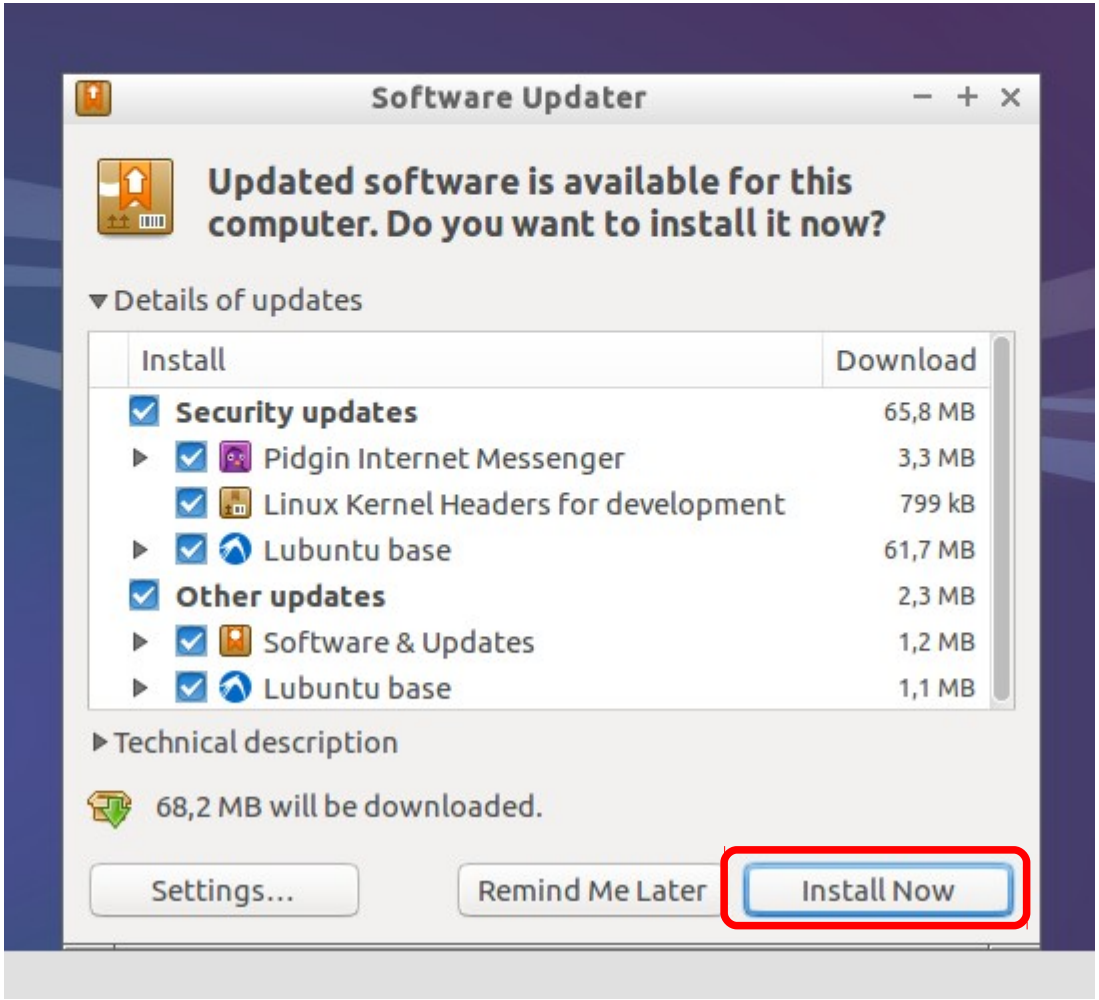


Ex. 10: Software update



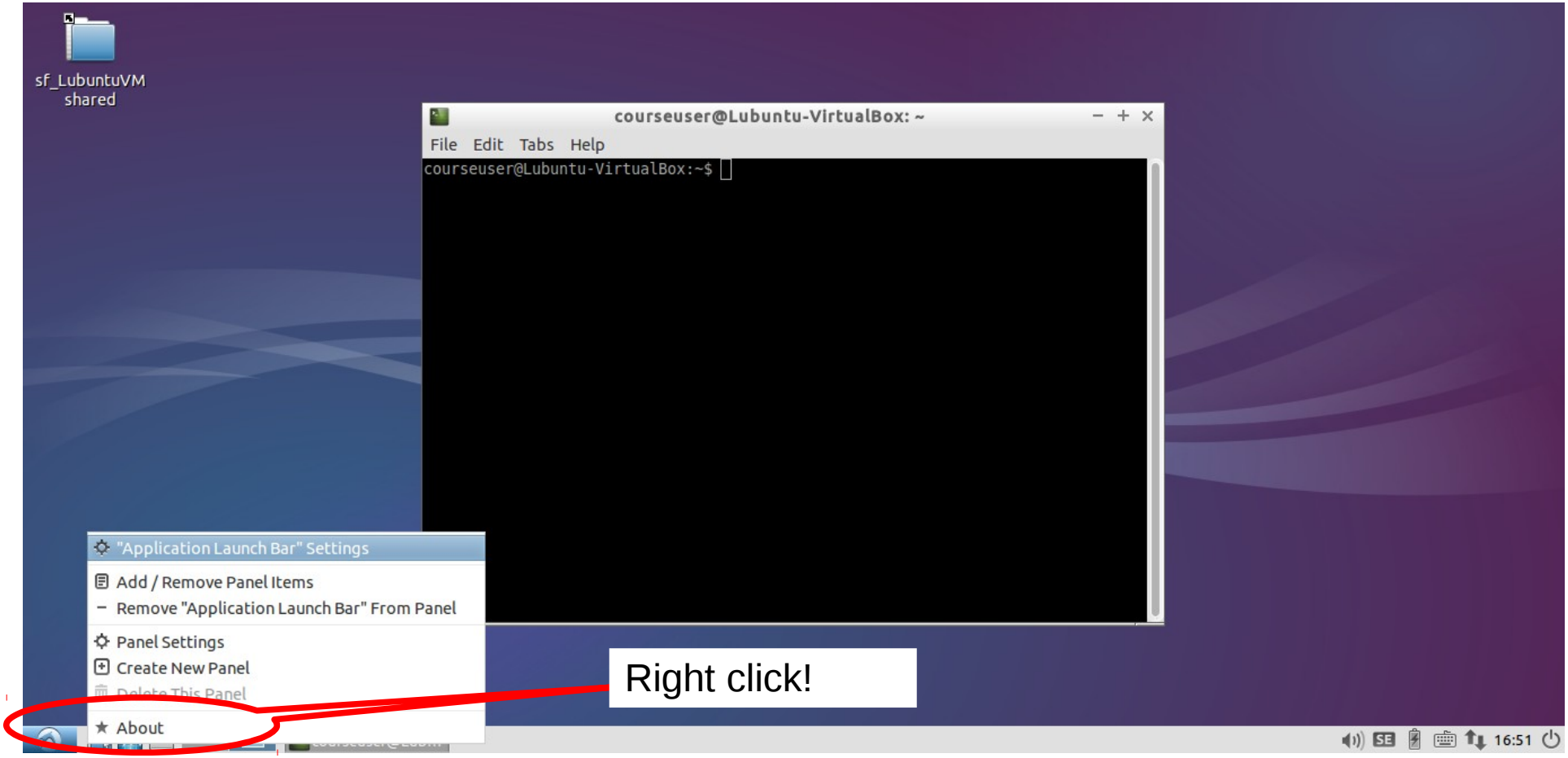
Ex 10: Software update





Ex. 11: Customizing the desktop

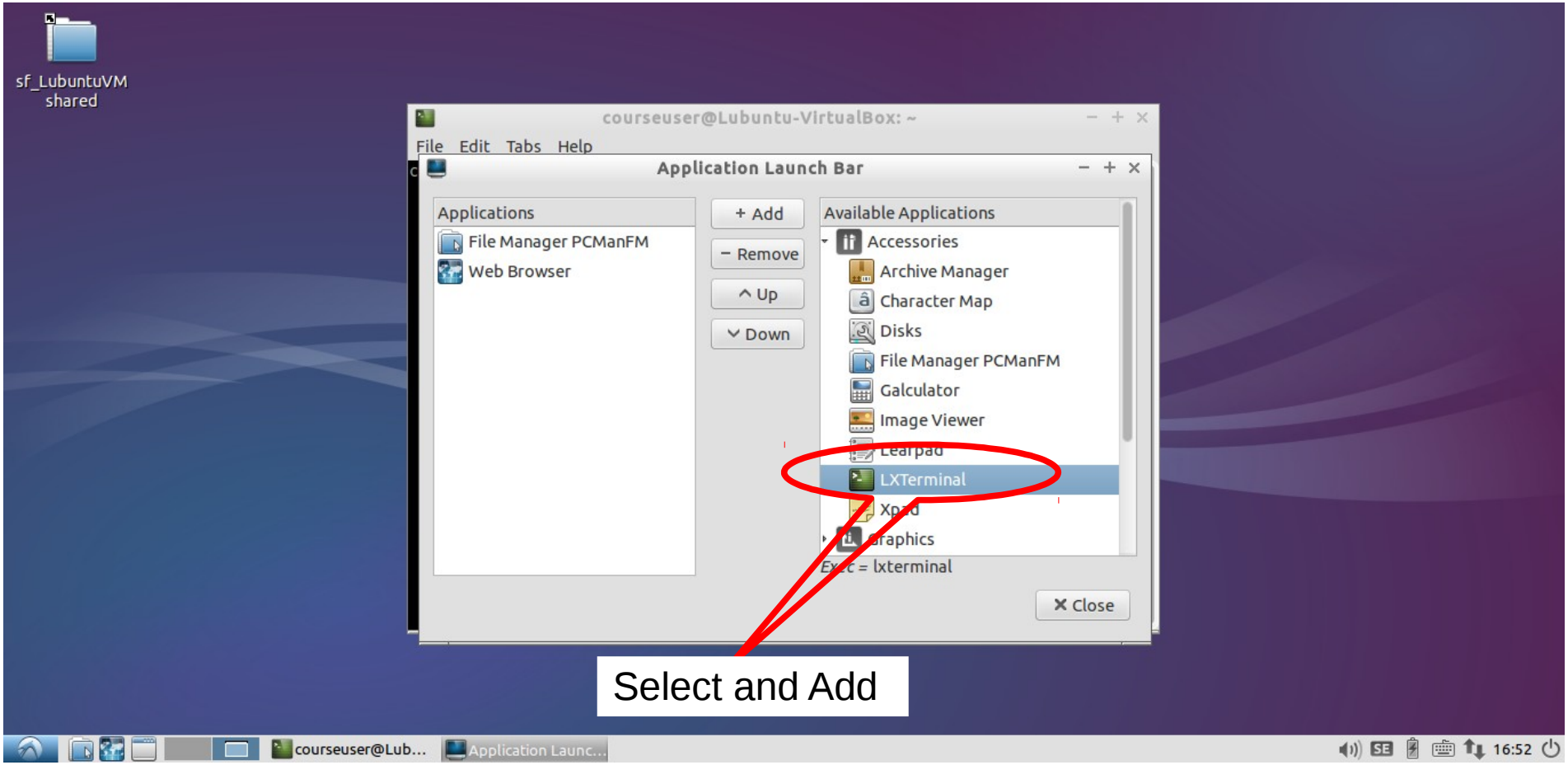
Customization of the desktop: application shortcuts



Click on ”Application Launch Bar” settings

Ex. 11: Customizing the desktop

Customization of the desktop: application shortcuts

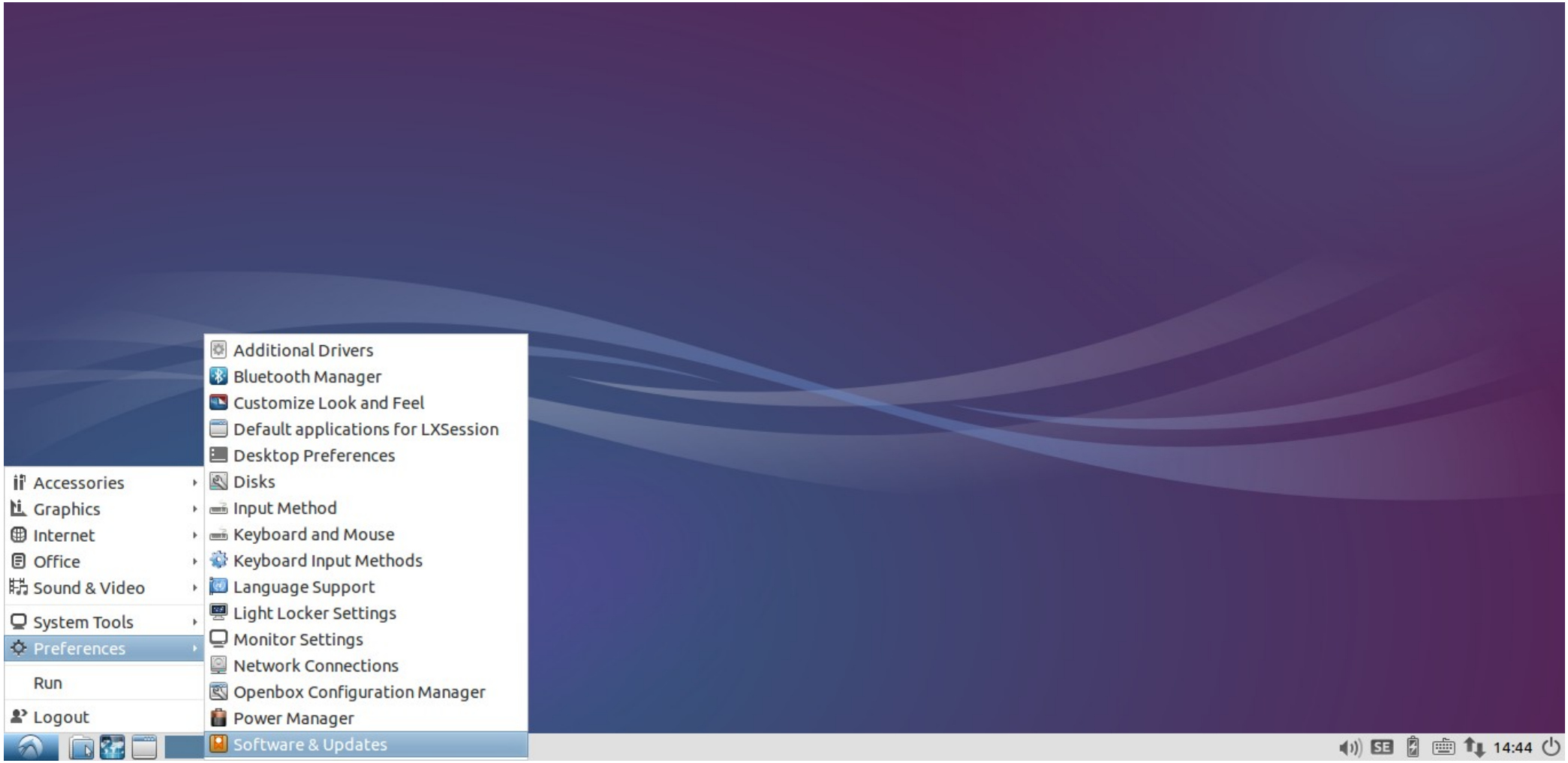


Add LXTerminal to Launchbar

Exercise: Install the geany editor

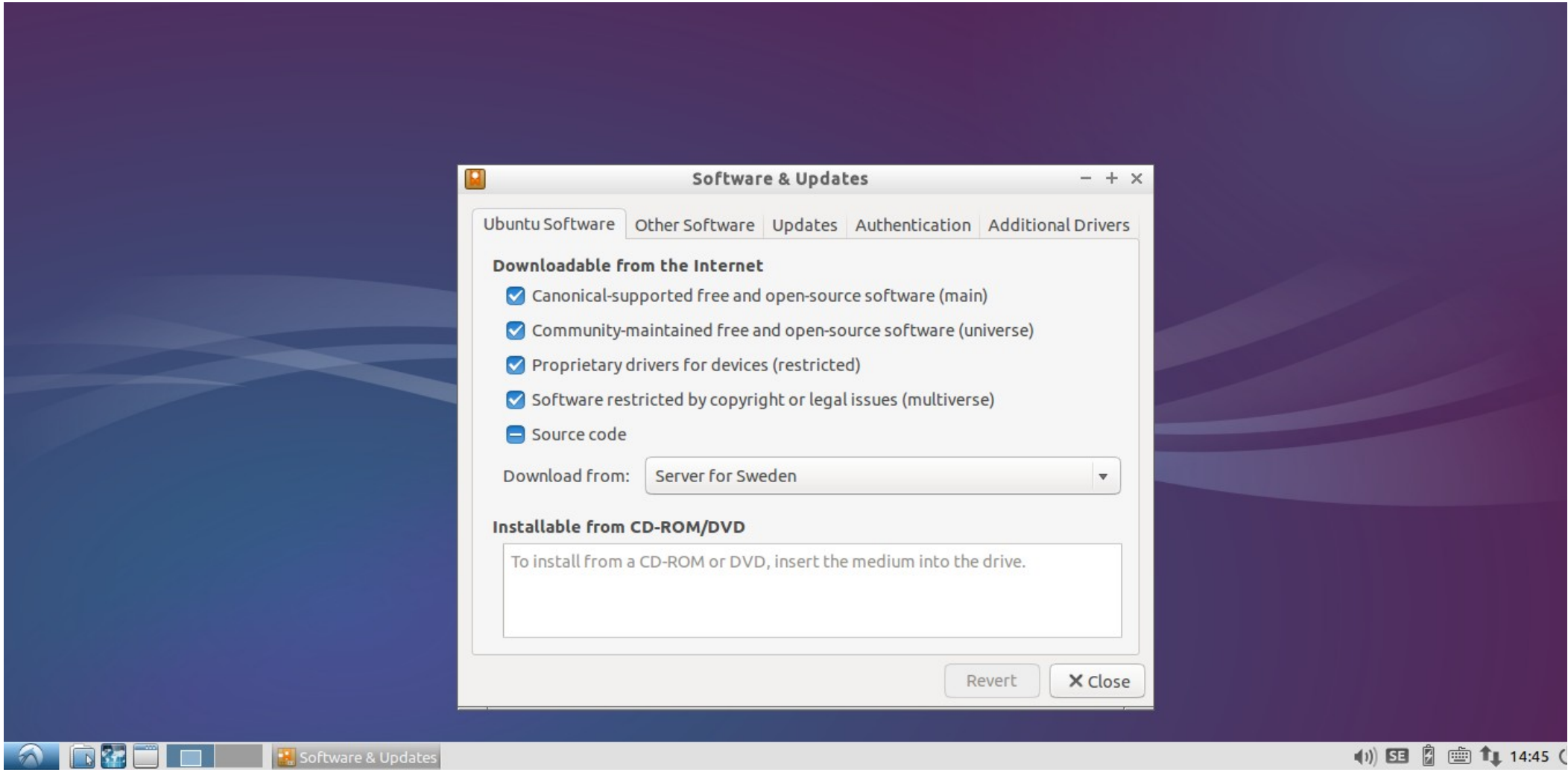
- Use synaptic
- Find the geany text editor and install it.
- Test that it works by finding it in the applications menu.
- Remove the geany package (hint: search for it in synaptic and untick the checkbox!)
- Test that is removed: the icon should not be anymore in the menu.
- What happen if you remove it while you're using it? Discuss with the teacher.

Ex. 12: Software Repositories

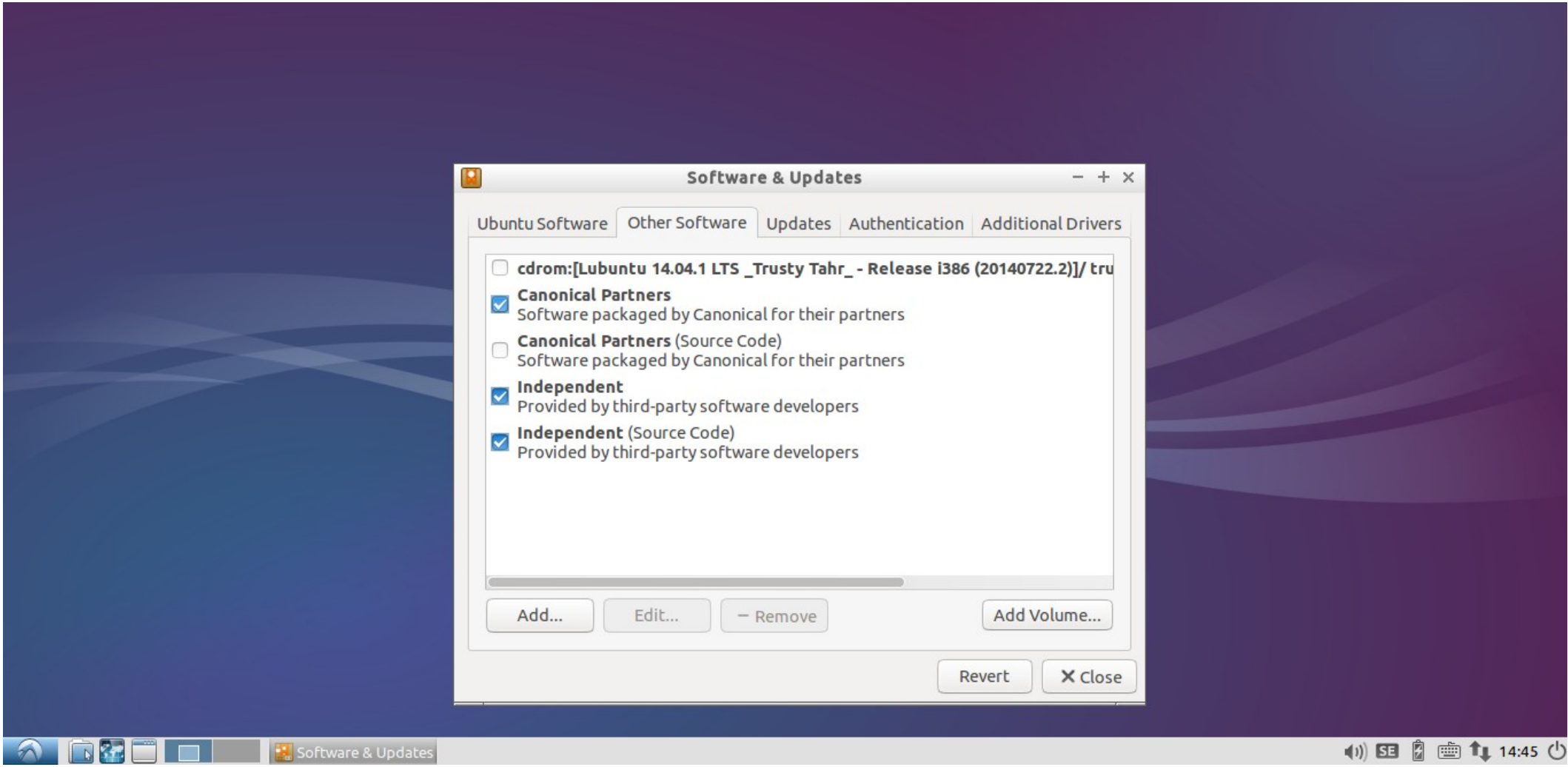


What were repositories? Click here for the slide about repositories

Ex. 12: Software Repositories

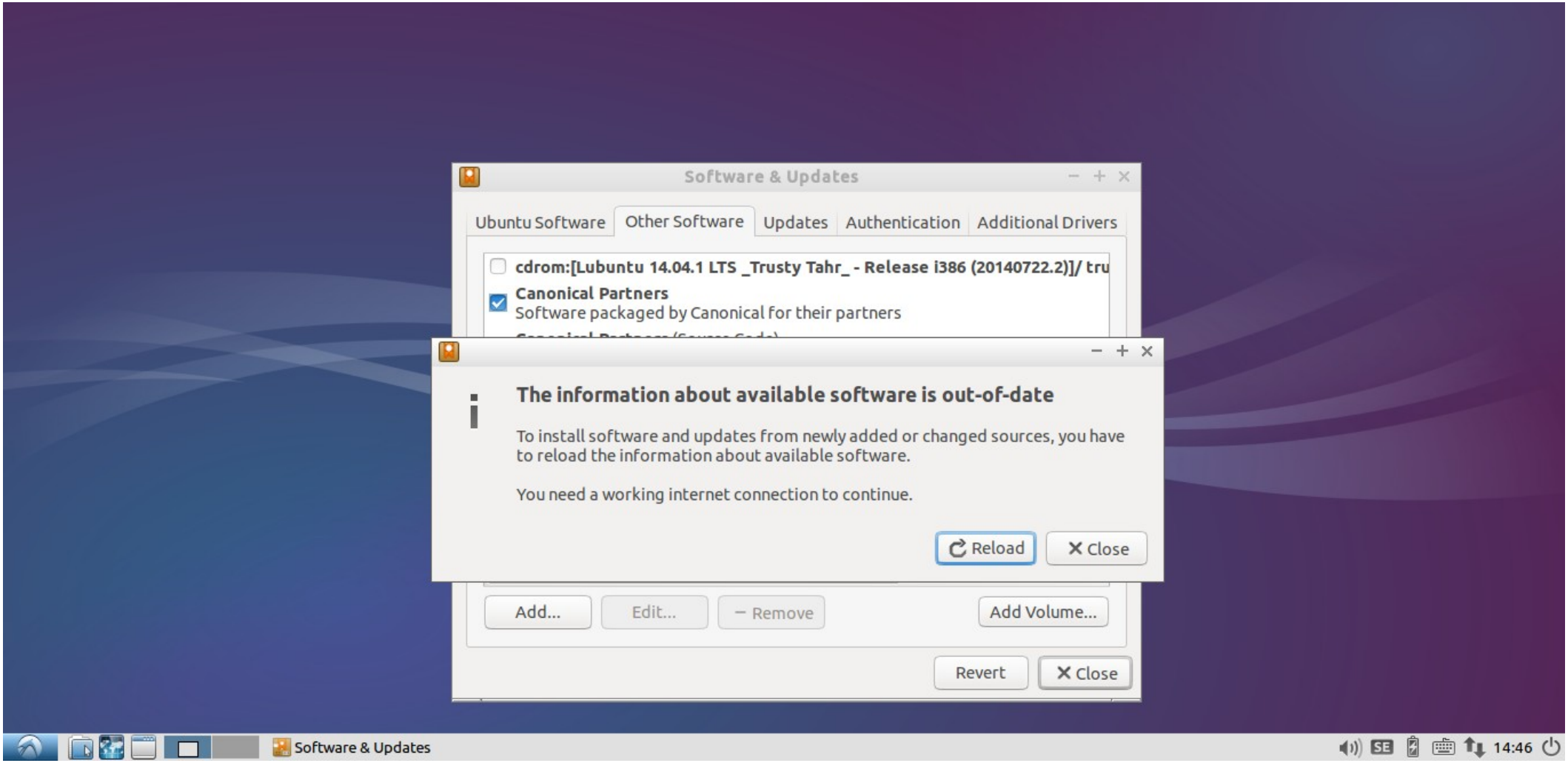


Ex. 12: Software Repositories

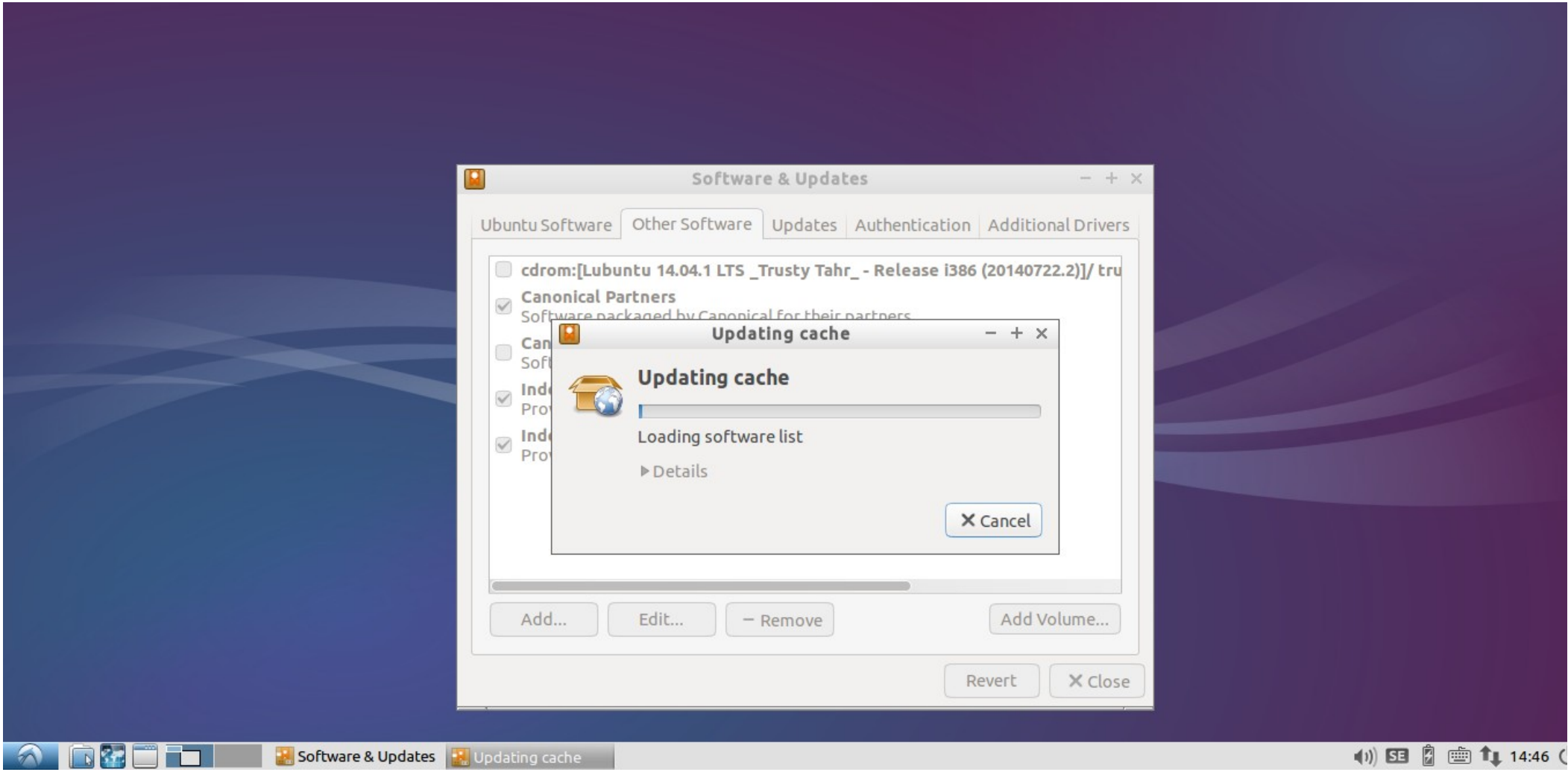


Tick ”Canonical Partners”. You might need to enter the password.

Ex. 12: Software Repositories



Ex. 12: Software Repositories



CLI installation methods

- **CLI** (Command Line Interface)

  You'll see a short example tomorrow. But here's a list of common commands:

  - Search for a package:
    `apt-cache search <something>`
  - Install a package:
    `apt-get install <packagename>`
  - Remove a package:
    `apt-get remove <packagename>`
  - Update package list:
    `apt-get update`
  - Software update:
    `apt-get upgrade`

Advanced installation methods

- **Compile** and **install** your own software.
- **Compile:** You will see this during the course.
- **Install:** copy files somewhere
- It **does not require administrative privileges**, so you can do everywhere!

Homework

Read about the different installation strategies (slides 53-54, 100-107).

Install your own Linux and send a picture and a small description on:

http://training.lunarc.lu.se/course/view.php?id=15&section=1

Play with the environment of the course virtual machine. Contact me at

http://training.lunarc.lu.se/mod/forum/view.php?id=336

Linux installation: three strategies

1. **Single operating system:** Linux deletes everything on the disk and it becomes the one and only operating system for that computer
   - Difficulty: easy
   - Costraint: user must own the computer (administrator)
   - Pros:
     - Performance: Linux can take all the resources available on the machine
   - Cons:
     - The machine can only run Linux programs.

Method 1 prerequisites

1.1. Make sure you are using an hard disk that you can **completely wipe**. **No data but Lubuntu will be left on the disk after installation!! You will lose everything!**

1.2. Download the Lubuntu ISO as seen in the tutorial.

1.3. Burn the ISO on a CD/DVD or on a USB stick. There are several ways to do this, search Ubuntu mainpage or the internet to find how. Start here:
http://www.ubuntu.com/download/desktop/install-ubuntu-desktop

1.4. Boot the machine from the ISO. Usually it is enough to insert the burned CD or the USB pen and start the machine.

1.4. Install Linux as we've seen in the course. Remember, **everything on the hard disk will be removed**!!

Linux installation: three strategies

2 **Virtual Machine**: Run Linux in a virtual machine where it is the one and only system. The virtual machine is run on an hypervisor that is running in the existing OS.

- Difficulty: Medium
- Constraint: User must be able to install software, i.e. VirtualBox hypervisor
- Pros:
  - The machine can run program s for the existing OS **and** linux, **at the same time**
- Cons:
  - No need to touch the existing OS boot: all is taken care by the Virtualization Hypervisor
  - Performance loss due to virtualized hardware.

Method 2 prerequisite: Download and install Virtualbox

https://www.virtualbox.org/wiki/Downloads

- 1.1. Download *VirtualBox <some version> for Windows hosts*
- 1.2. double click on the Virtualbox file just downloaded and follow the installation procedure on screen.
- 1.3. install linux as seen during the tutorial.

Linux installation: three strategies

3 **Dual boot:** Linux shares the disk with other operating systems.
Requires an alternative boot loader (e.g. GRUB2), a small program that is loaded **BEFORE** any other installed system.
This program must be installed at the beginning of the disk.

- Difficulty: Hard
- Constraint: user must own the computer (administrator)
- Pros:
  - Performance: Linux can take all the resources available on the machine
  - The machine can run programs for windows and linux, at the cost of a reboot
- Cons:
  - Rewriting the initial part of the disk usually prevents windows to boot properly. One needs to be very aware of what he is doing.
  - Only one operating system can control the machine at time: requires reboot to switch from one operating system to the other.

Method 3 prerequisites

DISCLAIMER: USE THIS METHOD ONLY IF YOU UNDERSTAND WHAT YOU'RE DOING. YOU RISK DESTROYING YOUR EXISTING DATA.

1.1. Download the Lubuntu ISO as seen in the tutorial.

1.2. Burn the ISO on a CD/DVD or on a USB stick. There are several ways to do this, search Ubuntu mainpage or the internet to find how. Start here:
http://www.ubuntu.com/download/desktop/install-ubuntu-desktop

1.3. Make space on the harddisk to fit linux. You usally need at least 40GB. To do that on windows, read about it here:
http://technet.microsoft.com/en-us/magazine/gg309169.aspx

1.4. Decide how to install linux: using GRUB, using Windows bootloader... and follow the procedures. More information here:
https://help.ubuntu.com/community/WindowsDualBoot

1.4.a **Legacy BIOS**: For Windows up to Windows 7, I suggest to use windows boot loader and a tool called EasyBCD. A guide here:
http://askubuntu.com/questions/325402/booting-win7-12-04-what-do-i-need-for-easybcd

1.4.b **UEFI BIOS**: If you have Windows 8 or 10, those support a new booting method called UEFI. This is a very annoying technology and setup is more complicated.

Read this: https://help.ubuntu.com/community/UEFIBooting

Follow the instructions here:http://www.everydaylinuxuser.com/2015/11/how-to-install-ubuntu-linux-alongside.html

1.5. Install linux as described in the course, but targetting the correct partition/disk you made space for on the disk. **Do not choose ”erase entire disk” when prompted.**

Linux installation: Recommendations

During this course we will use **method 2 (Virtual Machine)**, as it is supposed to work on every platform.

Methods 1 and 3 are only recommended to those who want to learn about the boot process or plan to use Linux for intense computation, or simply to switch to Linux as their main operating system (It's fun! :D).

References

- Lubuntu installation official documentation https://help.ubuntu.com/community/Lubuntu/InstallingLubuntu
- Lubuntu official documentation / How Tos https://help.ubuntu.com/community/Lubuntu/Documentation
- Virtualbox https://www.virtualbox.org/
- Lubuntu Desktop
- The Sociotechnical Boundaries of Hardware and Software: A Humpty Dumpty History, Brent K. Jesiek, http://bst.sagepub.com/content/26/6/497

Pictures references (not complete)

- https://openclipart.org/
- http://members.peak.org/~jeremy/superlative/pix/babbageMachine.jpg
- http://en.wikipedia.org/wiki/Eadweard_Muybridge
- http://commons.wikimedia.org/wiki/File:ASRock_P4i65G_motherboard_view.jpg
- http://elaanisvital.com/final_png/icon_-35.png
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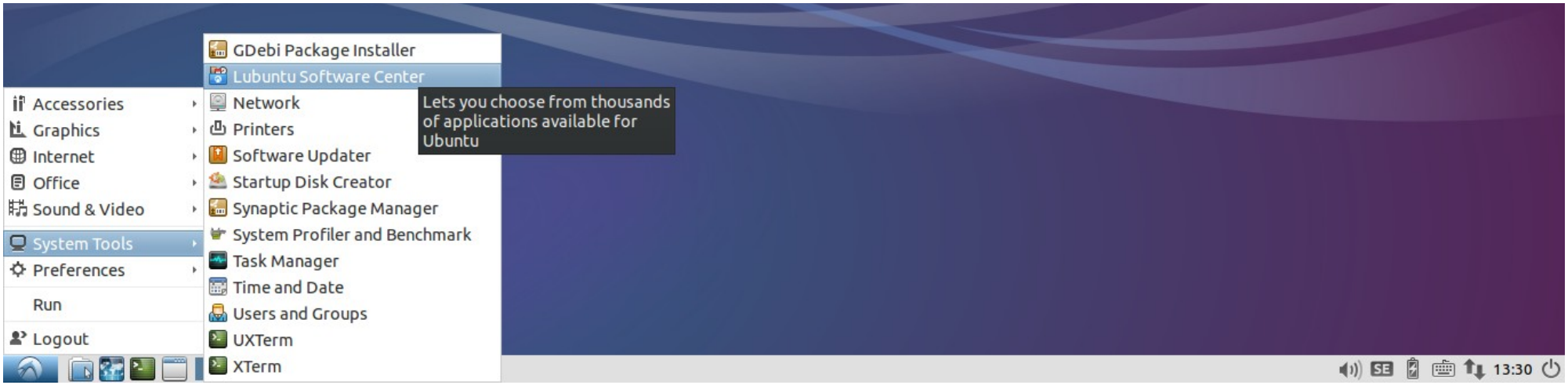
Backup slides

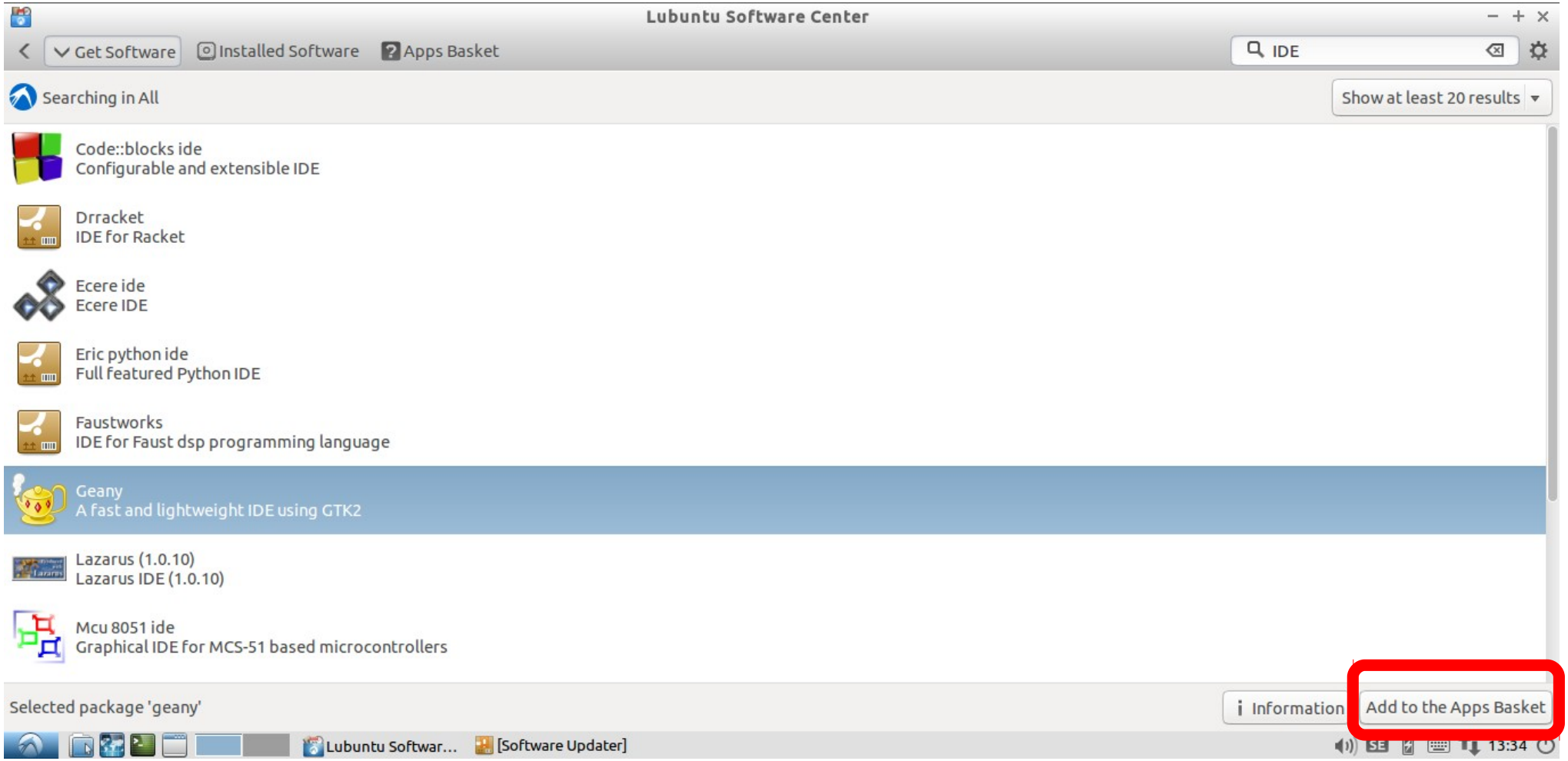
Ex. 13: Other installation methods

- Normal user: Lubuntu Software Center



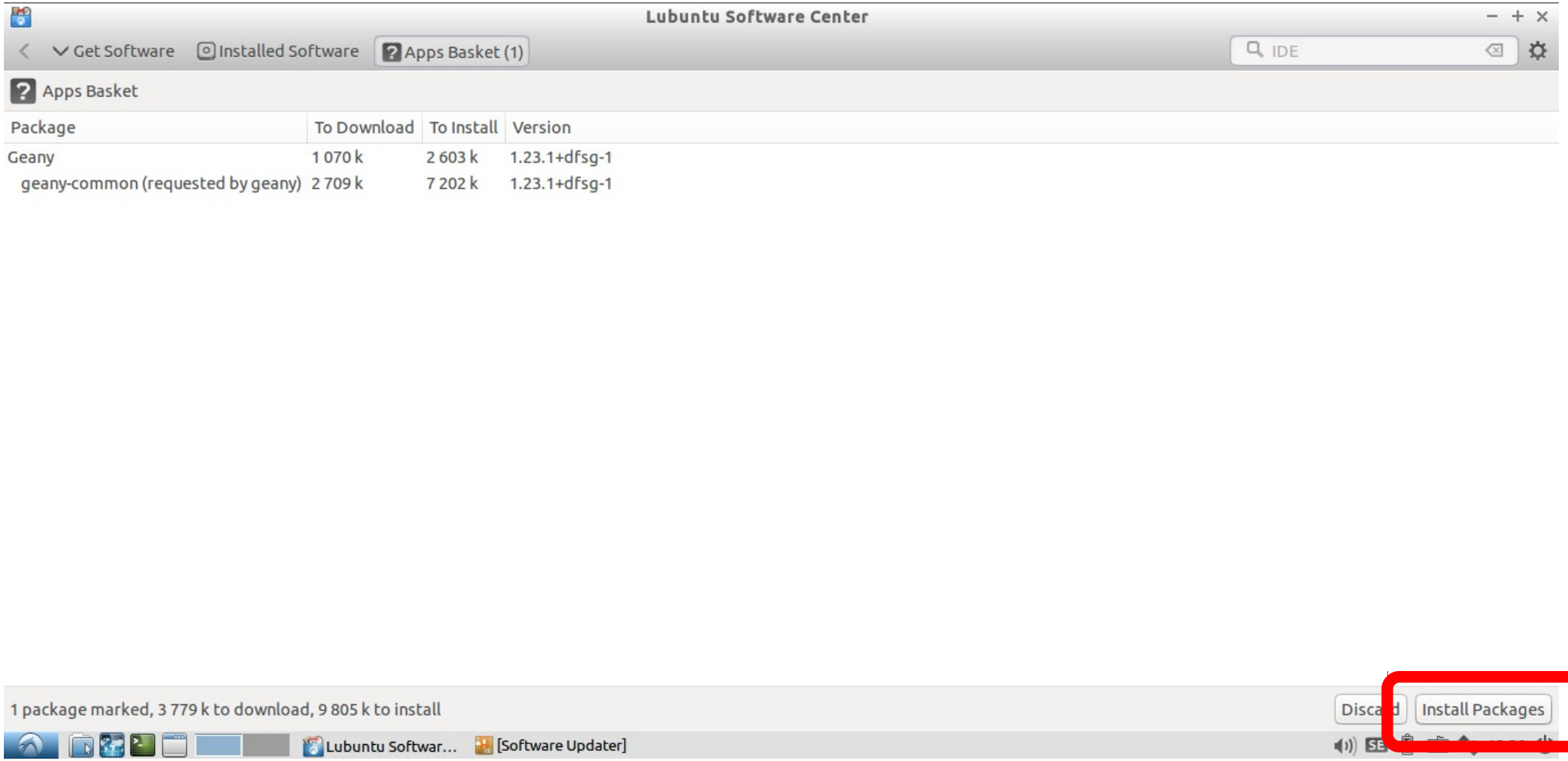
Ex. 13: Other installation methods

- Installing Geany editor



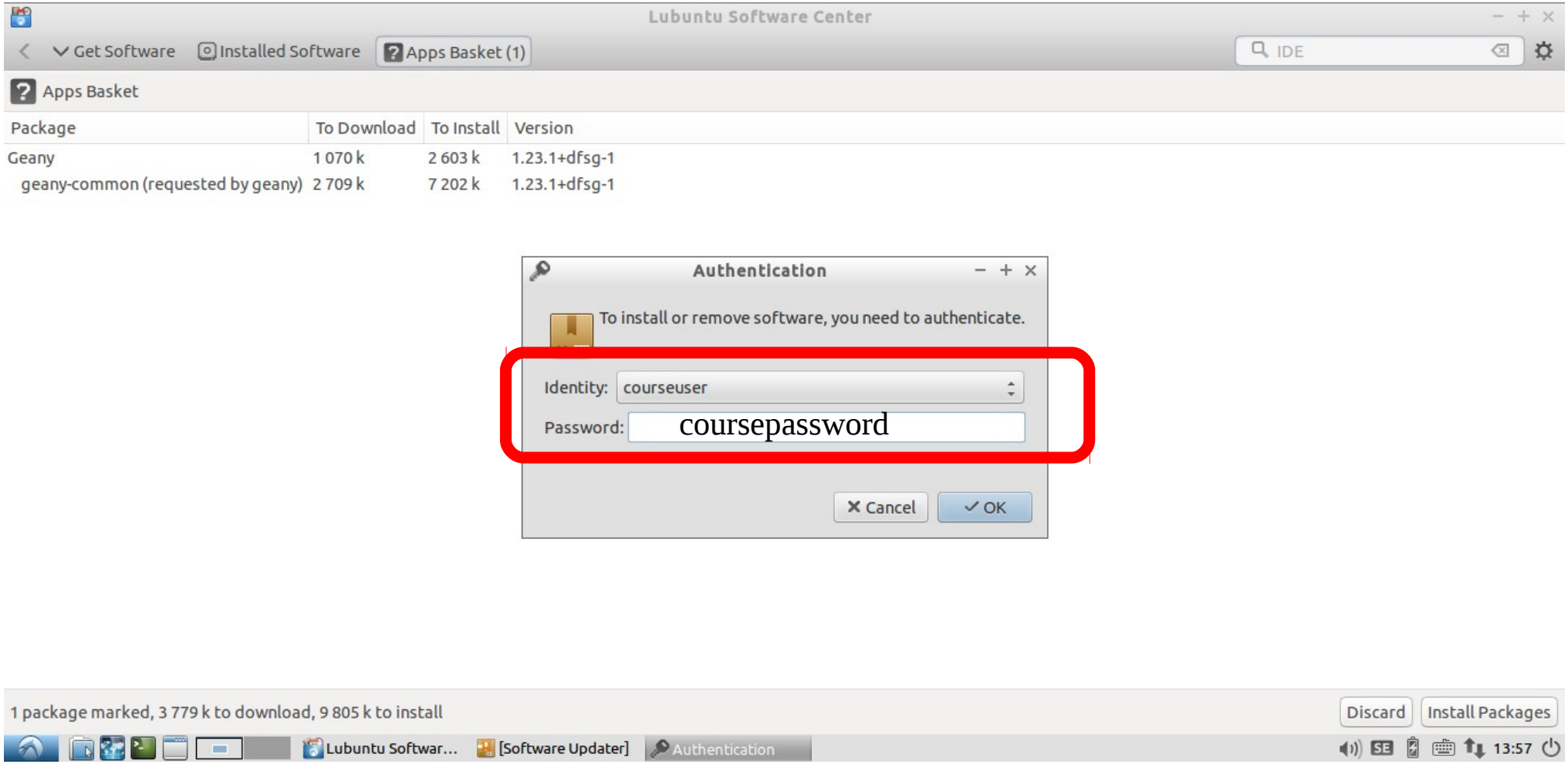
Ex. 13: Other installation methods

- Installing Geany editor



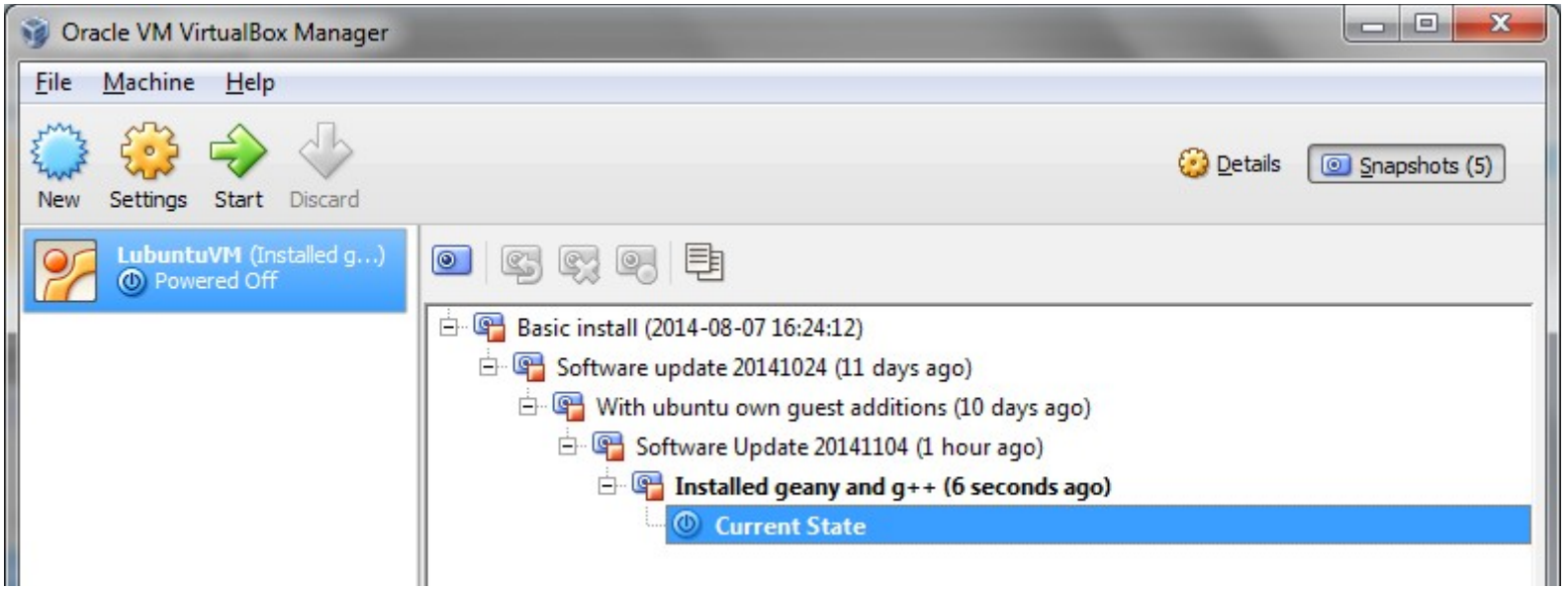
Ex. 13: Other installation methods

- Installing Geany editor



Snapshots in the custom VM

- A **snapshot** is the state of the virtual machine in a defined point in time. (See slide about states)
- Snapshots can be created, activated, or deleted by using the higlighted button
- Once a snapshot is set as starting point, the machine execution will start from that point.
- Try to save the current state by pressing the create snapshot button!
- For various technical reasons, the best is to snapshot when the VM is shutdown.



Snapshots in the custom VM

- Using the buttons, one can move the machine back and forth in time.
- Let's try to restore a state!
  - Select a snapshot
  - Press the restore snapshot button