

Course Virtual Machine Manual (Part of Tutorial 1)

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IMPORTANT DISCLAIMER

- The virtual machine in the Lab **can be deleted any time. Do not expect the machine or the data you created in it to be there at the next lecture.**
- As a rule of thumb, you should **learn how to reinstall the machine** as explained in this document every time you access the lab.
- We recommend you **use the same computer** for each session or you will be forced to reinstall the machine.
- Before finishing a session you should always **send all important information to yourself via email**, or using other cloud services of your choice.
For **code**, we suggest to use **github** that will be taught during the course.
- **PRIVACY and SECURITY:**
 - The machine is an insecure object. Everyone can read it if not deleted.
You must not insert or save private information, passwords and other sensitive data in the course virtual machine.
 - **You agree NOT to use the machine for criminal acts for which you will be retained the sole responsible. The machine creation is logged to your user and the activity can be extracted by system administrators if requested by legal authorities.**

The course "Virtual Machine"

- A *Virtual Machine* is a *software emulation* of an *hardware machine*.
(you'll learn more about this during the course)
- The name is usually shortened into **VM**
- A VM usually consist of two files:
 - A *machine definition file*, that specifies the machine configuration
 - A *disk image file*, which is a software representation of an hardware harddisk.
- For better user experience, the teacher set up a fine-tuned machine for the course, that contains all we will need. You should learn the installation steps because the virtual machines we will be using can be wiped at any time for security reasons.

1. Installation

- A. In a Lab machine
- B. On your Laptop

A. Installing in a **Lab machine**

A.1. Getting the machine

- I placed it for you in some shared storage:
S:\Courses\fysik\MNXB01
- **Select** and **copy** the folder called
LubuntuVM
- Create a folder called MNXB01 in the folder
C:\Temp
- **Paste** the LubuntuVM folder inside
C:\Temp\MNXB01\
- It might take some time, so listen to me while the
copy transfer is ongoing.
- Feeling lost? Follow the detailed guide at slide [51](#)
or ask the teachers for help.

A. Installing in a Lab machine

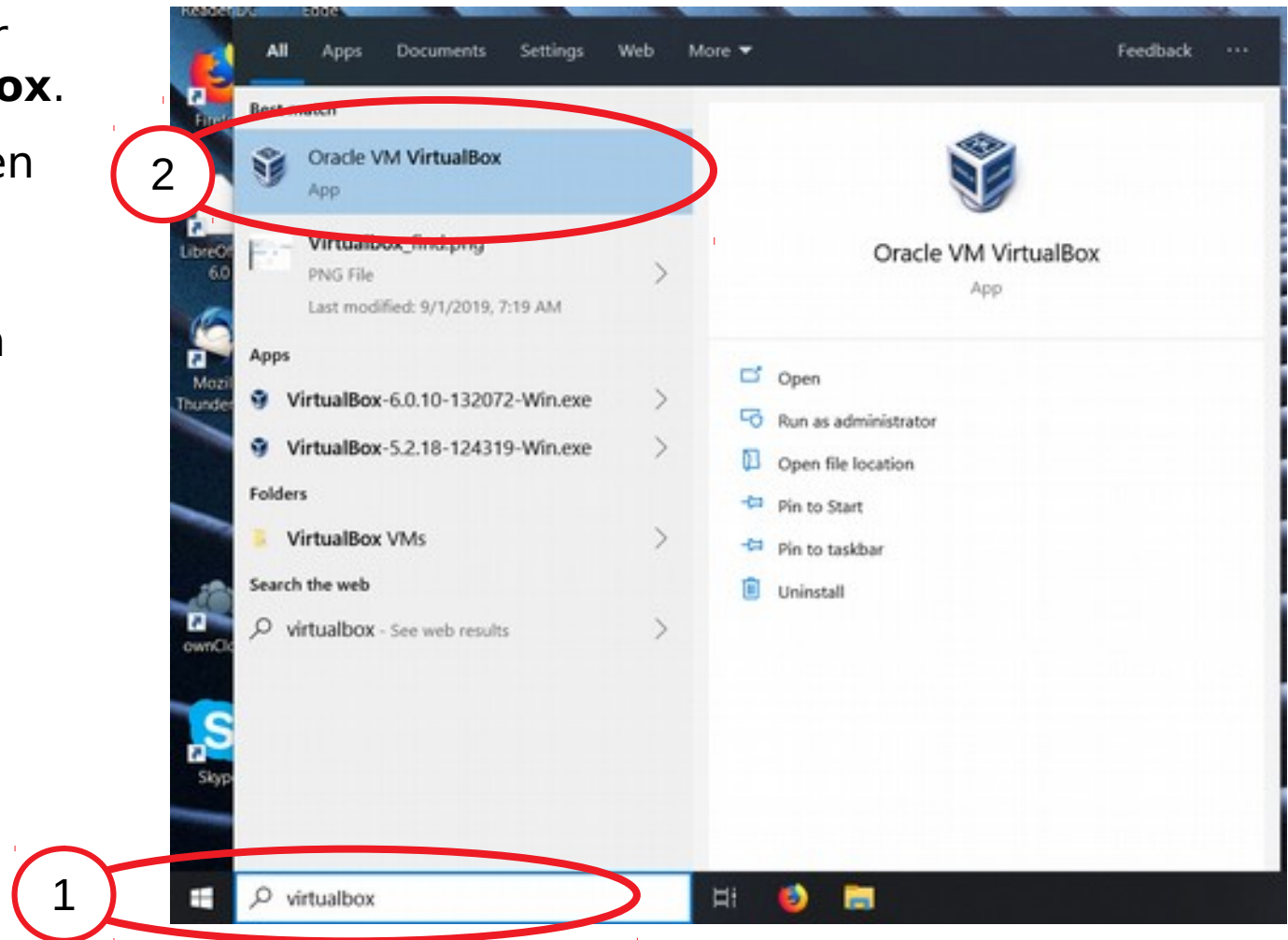
A.2 Open VirtualBox


We will use an hypervisor software called **VirtualBox**.

Luckily it has already been installed by a system administrator in the LAB

A.2.1 Find the application called **VirtualBox**.

You can search it by writing the name in the search bar in Windows 10 or click on the windows logo and browse the existing applications.



A.2.2 Click on the icon  to *open (or run or execute)* the VirtualBox application

A. Installing in a **Lab machine**

A.3. Add the course custom VM to the hypervisor

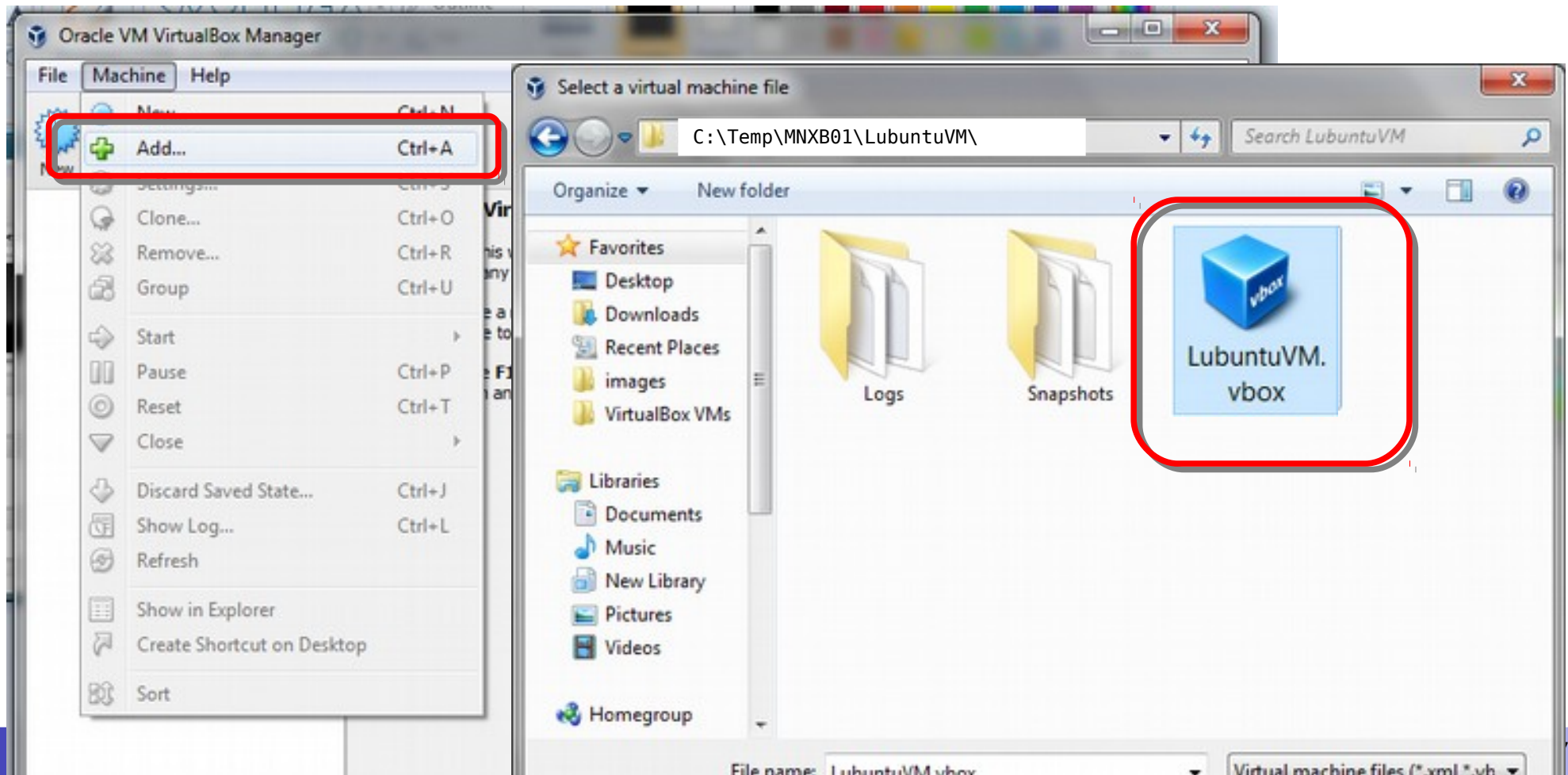
A.3.1 Open the machine with VirtualBox:

Machine → Add...

and select the file

C:\Temp\MNXB01\LubuntuVM\LubuntuVM.vbox

(the blue icon)



B. Installing on your laptop

B.1. Getting the VM

- (Recommended, faster) Ask the teacher for a USB stick that contains the machine
 - Or Download it from <http://www.hep.lu.se/staff/paganelli/fileshare/LubuntuVM.zip> and extract the zip file.
NOTE: the download and extraction might be slow.
- **OBS!**: The machine requires at least 20GB of space so make sure you have enough room on your harddisk.

B. Installing **on your Laptop**

B.2. Download VirtualBox

We will use an hypervisor software called **VirtualBox**.

B.2.1 Download and install version 6.x from the official Oracle VirtualBox webpage:

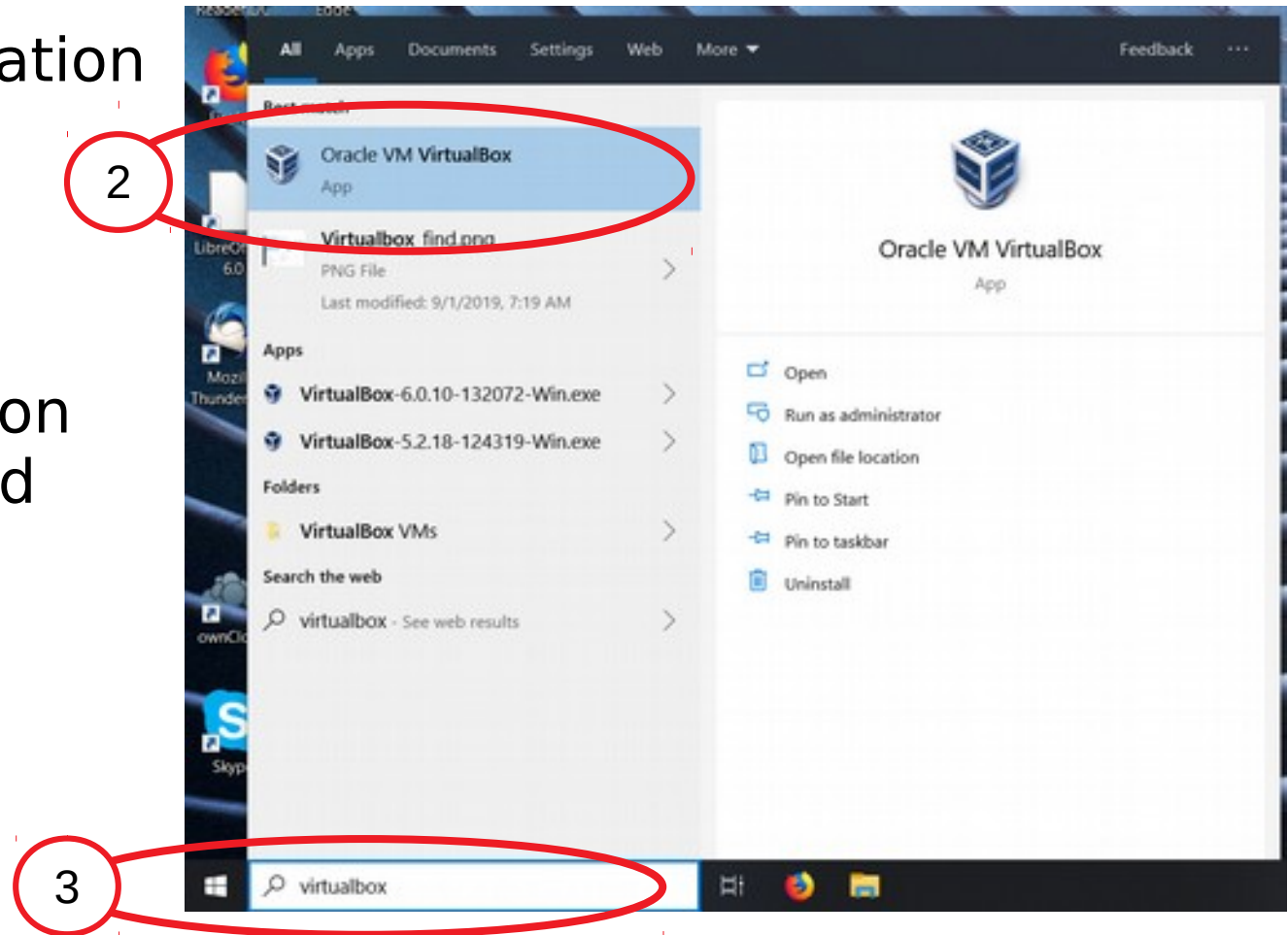
<https://www.virtualbox.org/wiki/Downloads>

It is recommended to reboot your laptop once done.
If you're already on linux, it might be available in the repositories.

B. Installing on your Laptop

B.2. Install and open VirtualBox

B.2.2 Find the application called **VirtualBox**. You can search it by writing the name in the search bar in Windows 10 or click on the windows logo and browse the existing applications.



B.2.3 Click on the icon the



to *open* (or *run* or *execute*) VirtualBox application

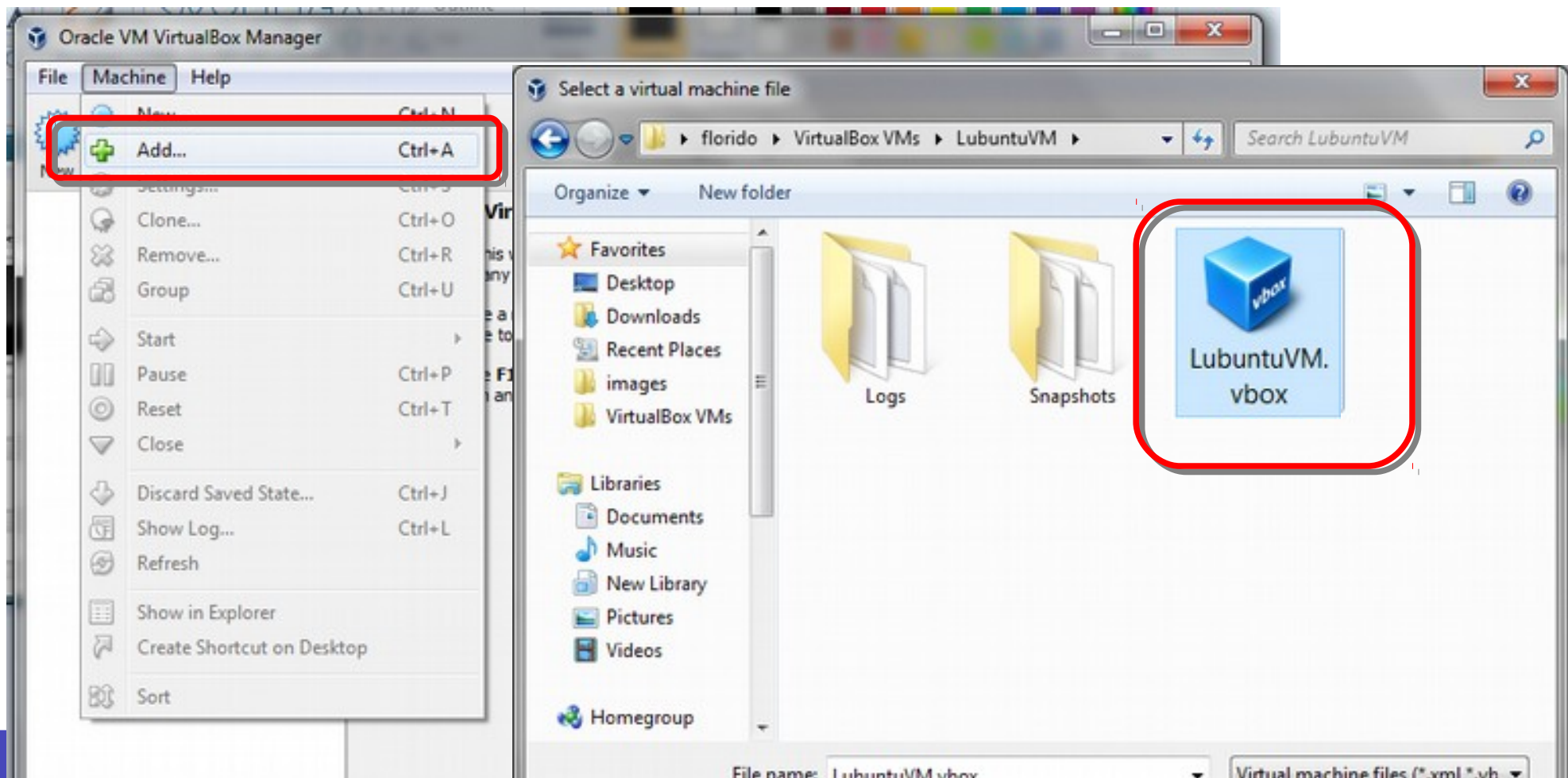
B. Installing on your laptop

B.3. Add the course custom VM to the hypervisor

B.3.1. Open the machine with VirtualBox:

Machine → Add...

and find the file `LubuntuVM.vbox` (the blue icon) on your disk. It should be where you copied from usb/extracted the files.



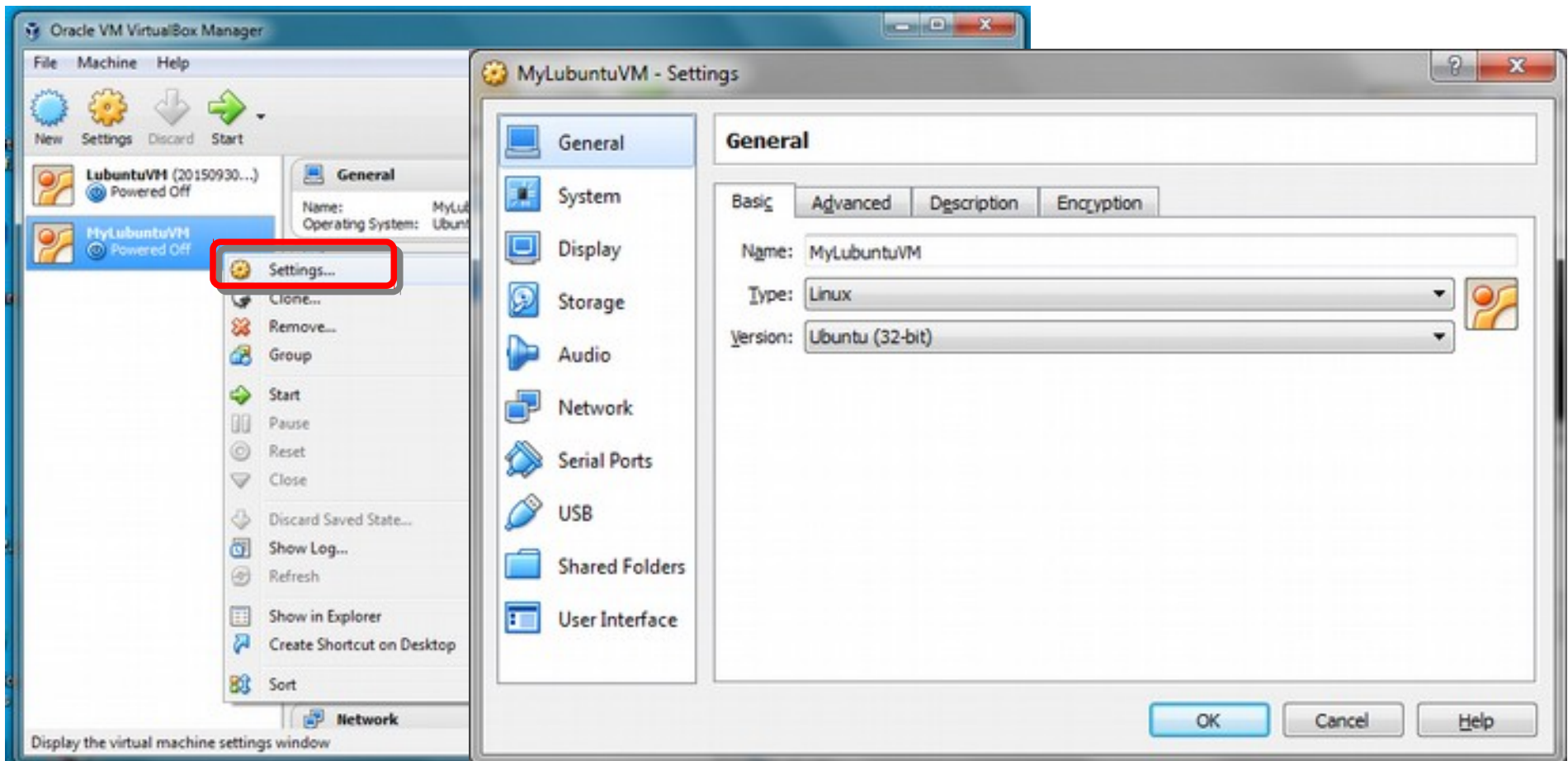
2. Quick VirtualBox Manual

2.1.VirtualBox interface explained

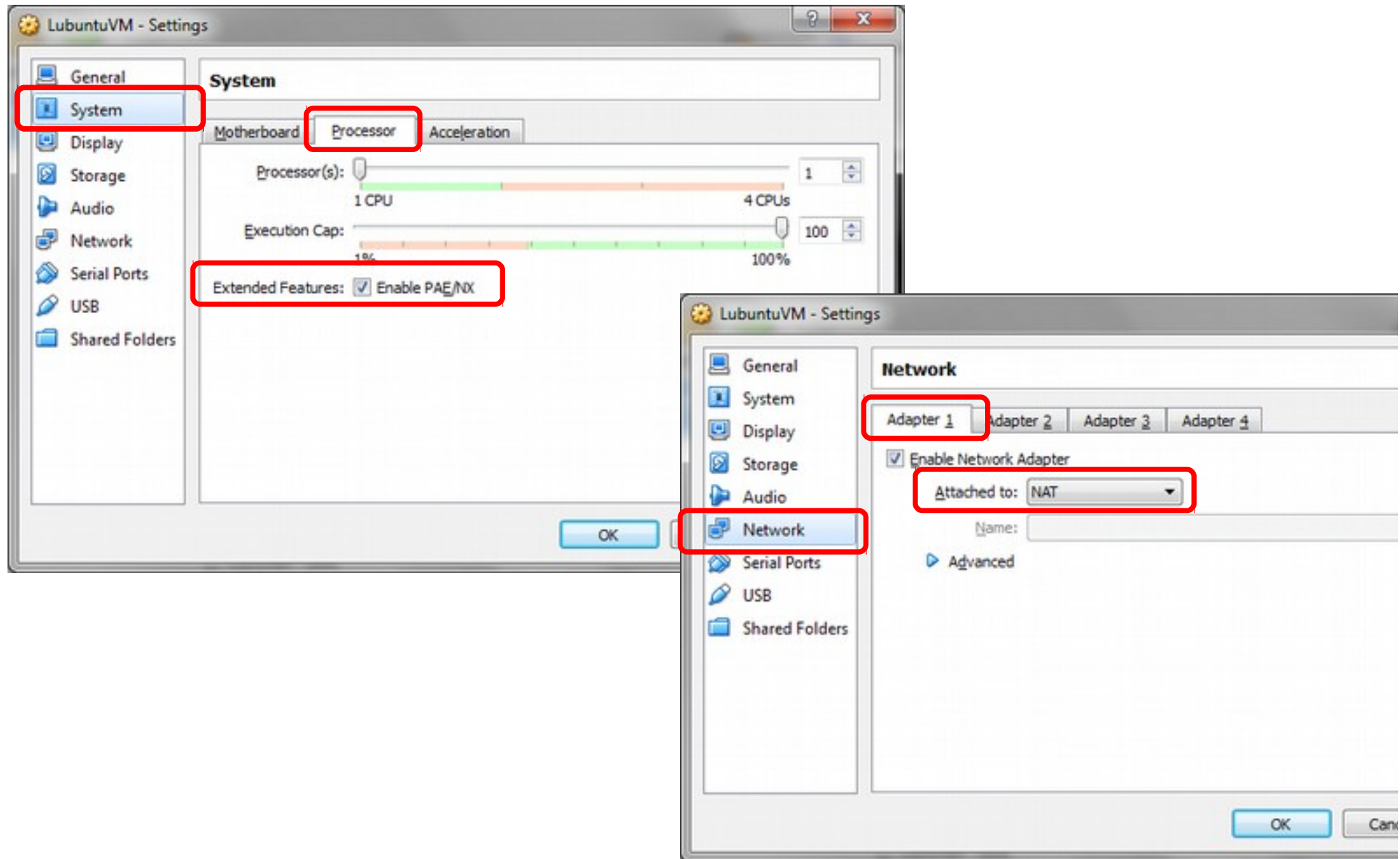
The screenshot shows the VirtualBox main window. At the top left, there is a menu bar with 'File', 'Machine', and 'Help'. Below it is a toolbar with icons for 'New' (blue gear), 'Settings' (yellow gear), 'Discard' (grey arrow), and 'Start' (green arrow). A red box highlights the 'Settings' and 'Start' icons, with a callout bubble pointing to them that says 'Shows details about the selected VM' and 'Starts the selected VM' respectively. Below the toolbar is a list of virtual machines. One VM, 'LubuntuVM (20150930...)', is selected and highlighted with a red box. A callout bubble points to it with the text 'Selected virtual machine (VM)'. To the right of the VM list is a 'Details' pane, also outlined in red. It contains several sections: 'General' (Name: LubuntuVM, Operating System: Ubuntu (32-bit)), 'System' (Base Memory: 1536 MB, Boot Order: Floppy, Optical, Hard Disk, Acceleration: VT-x/AMD-V, Nested Paging, PAE/NX), 'Display' (Video Memory: 12 MB, Remote Desktop Server: Disabled, Video Capture: Disabled), 'Storage' (Controller: IDE, IDE Secondary Master: [Optical Drive] Empty, Controller: SATA, SATA Port 0: LubuntuVM.vdi (Normal, 30,00 GB)), 'Audio' (Host Driver: Windows DirectSound, Controller: ICH AC97), and 'Network'. A callout bubble points to the entire 'Details' pane with the text 'Informations about the selected VM'. In the top right corner of the window, there are buttons for 'Details' and 'Snapshots (1)'. A preview window on the right shows a black screen with the text 'LubuntuVM'.

2.2. Review the VM virtual hardware

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



2.3. Enable PAE and NAT



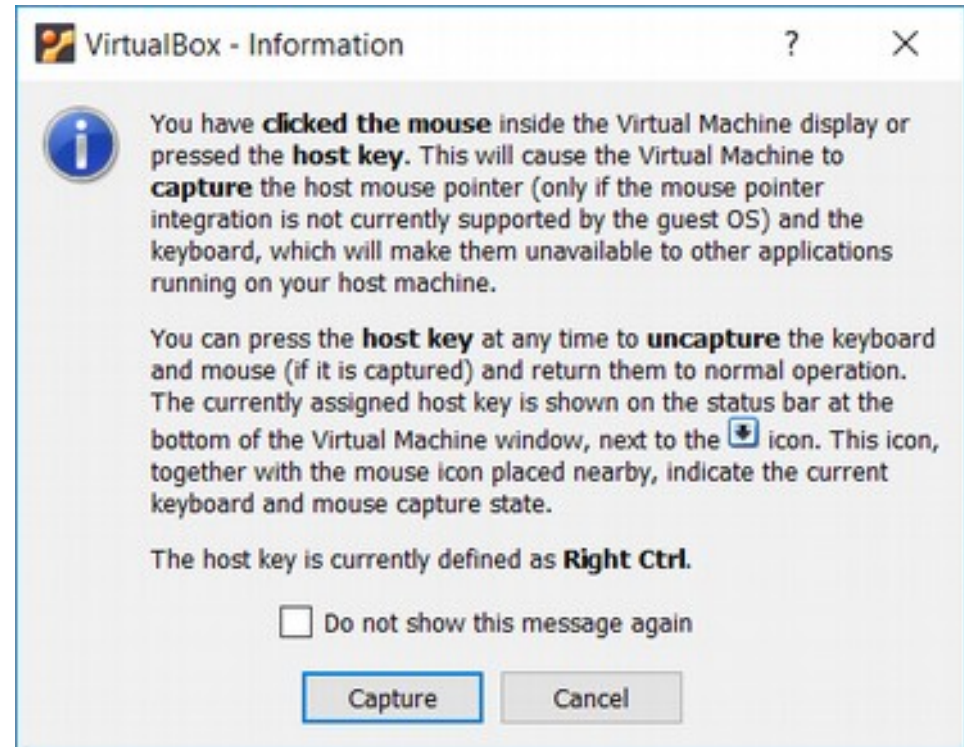
2.4. Host Key **Right Ctrl**, your best friend

This dialog will appear when you click inside the VM screen. It informs you that the host mouse pointer and keyboard will be grabbed by the virtual machine after you press *Capture*, sometimes making it impossible to interact with the host.

To give back control to the host you should press the **Host Key**. By default, the host key is the **Right Ctrl** key.

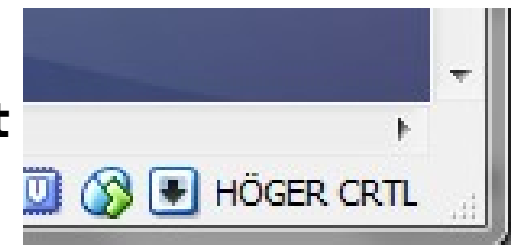
Note that on Apple machines the Host key may be different.

You can review and redefine the Host Key and other shortcuts in File→ Preferences→ Input



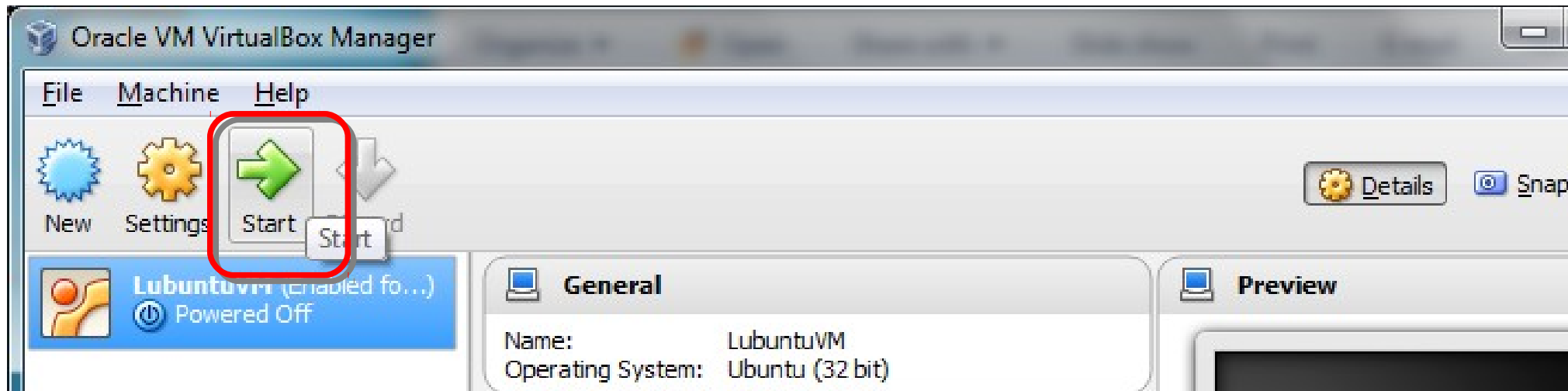
The host key is usually shown in the **lower right** corner of the machine window.

(seems the developer was confused, it should be CTRL!)



2.5. Start the machine

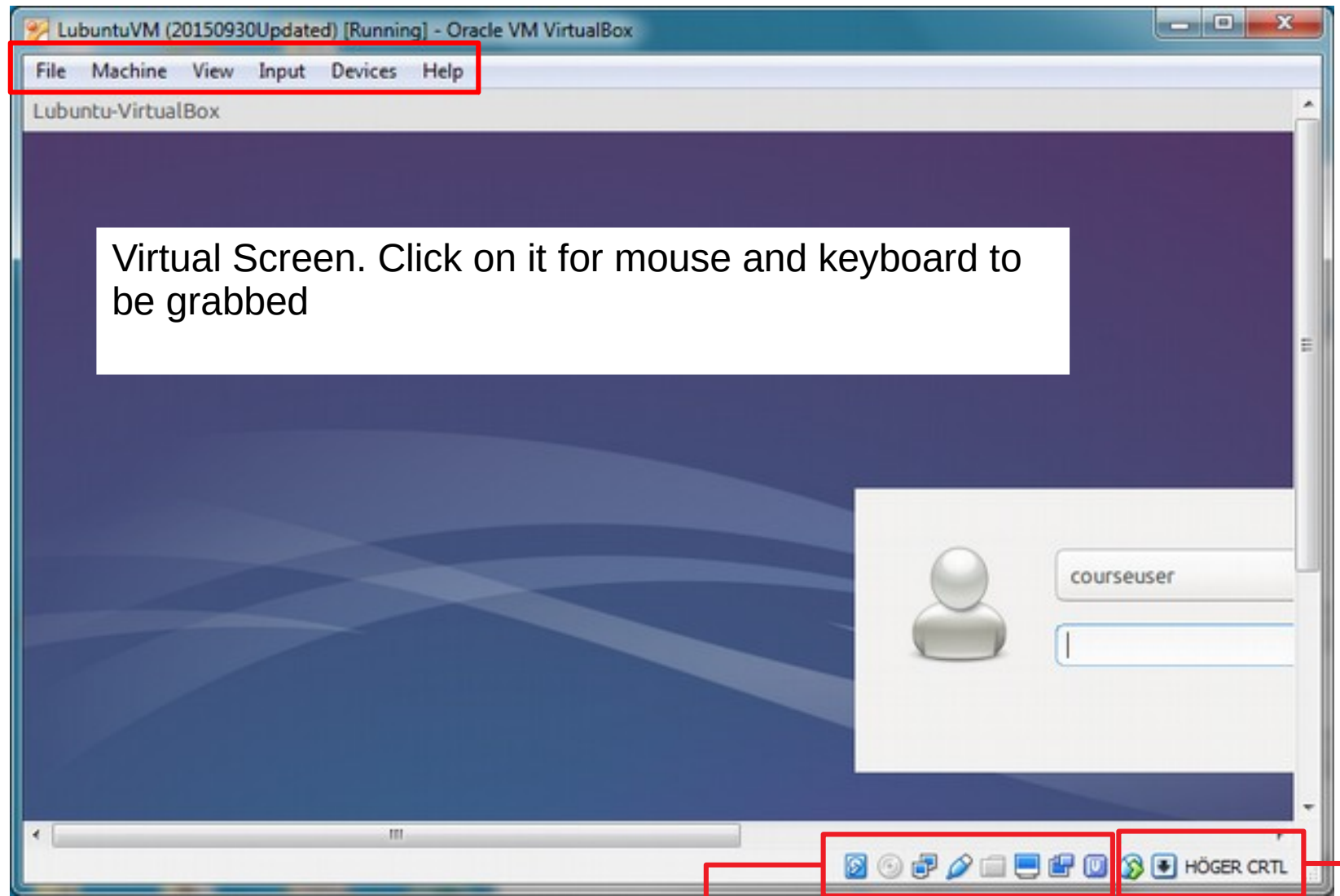
- Click on the Start arrow.



2.6. VirtualBox interface explained 2

The running machine interface

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

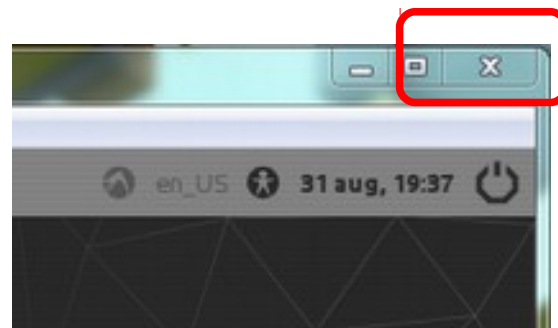


Hardware status, move the mouse pointer over it to see a description tooltip

Keyboard and mouse status. Use right (höger) Ctrl to ungrab

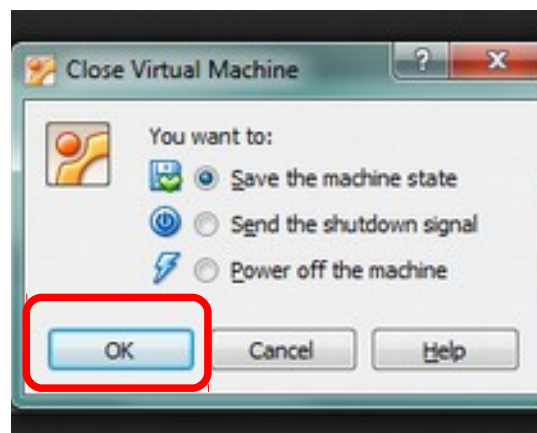
2.7.1 Freezing the machine state thanks to virtualization

- Have no time to finish the assignments? No problem! You can freeze time by using the property that a Von Neumann Machine is a finite state machine.
- Close the machine window



2.7.2. Freezing the machine state thanks to virtualization

- On the dialog that appears, click on *"Save the machine state"*

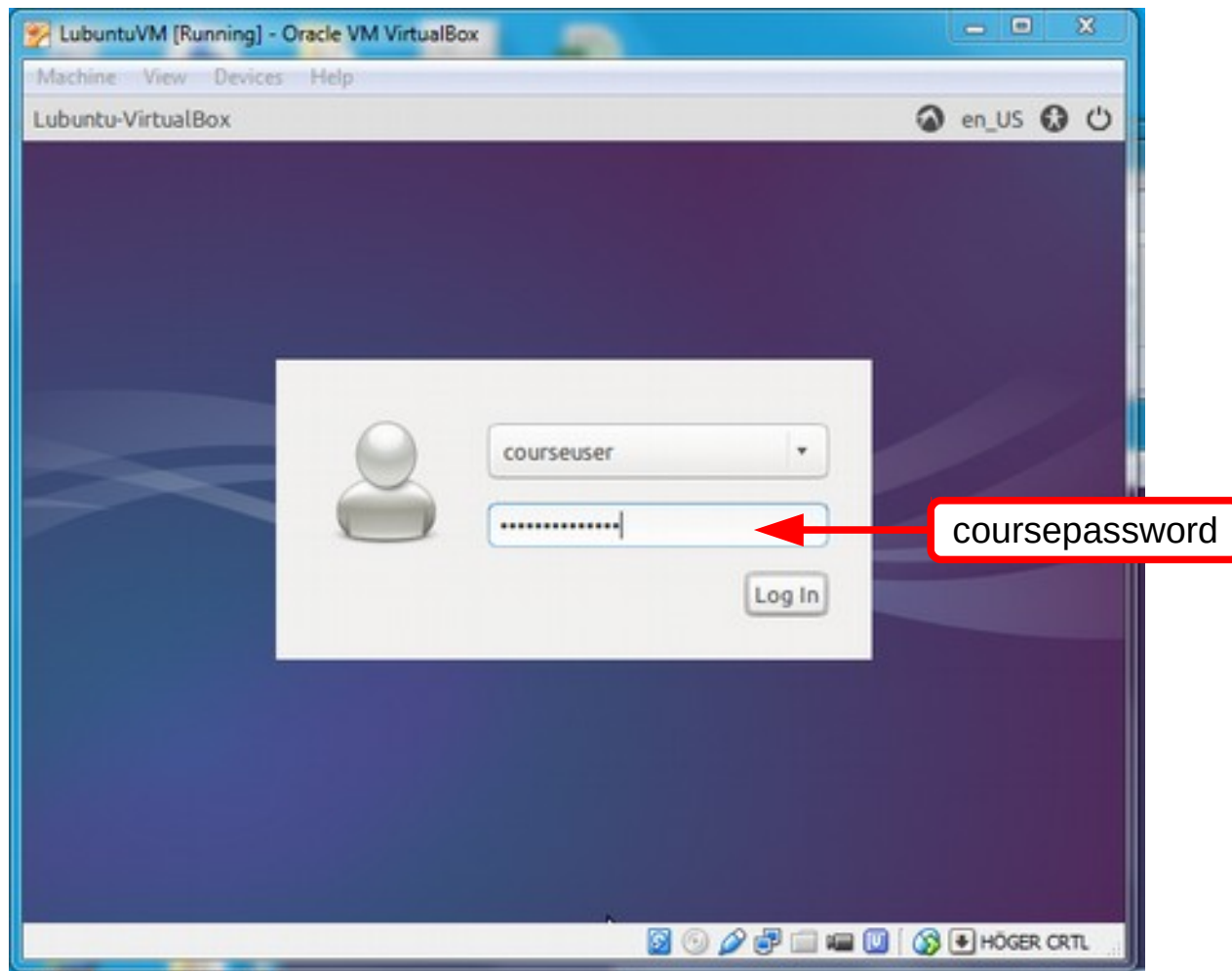


- The machine is now hibernated. All your work is saved as you could stop time.
 - All the RAM content is saved to disk.
- Start the machine again. What happens?
 - All the RAM is reloaded into memory and the machine is in the same state as when we last closed it.

3. The Lubuntu Desktop Environment

3.1. First steps in lubuntu usage: **login**

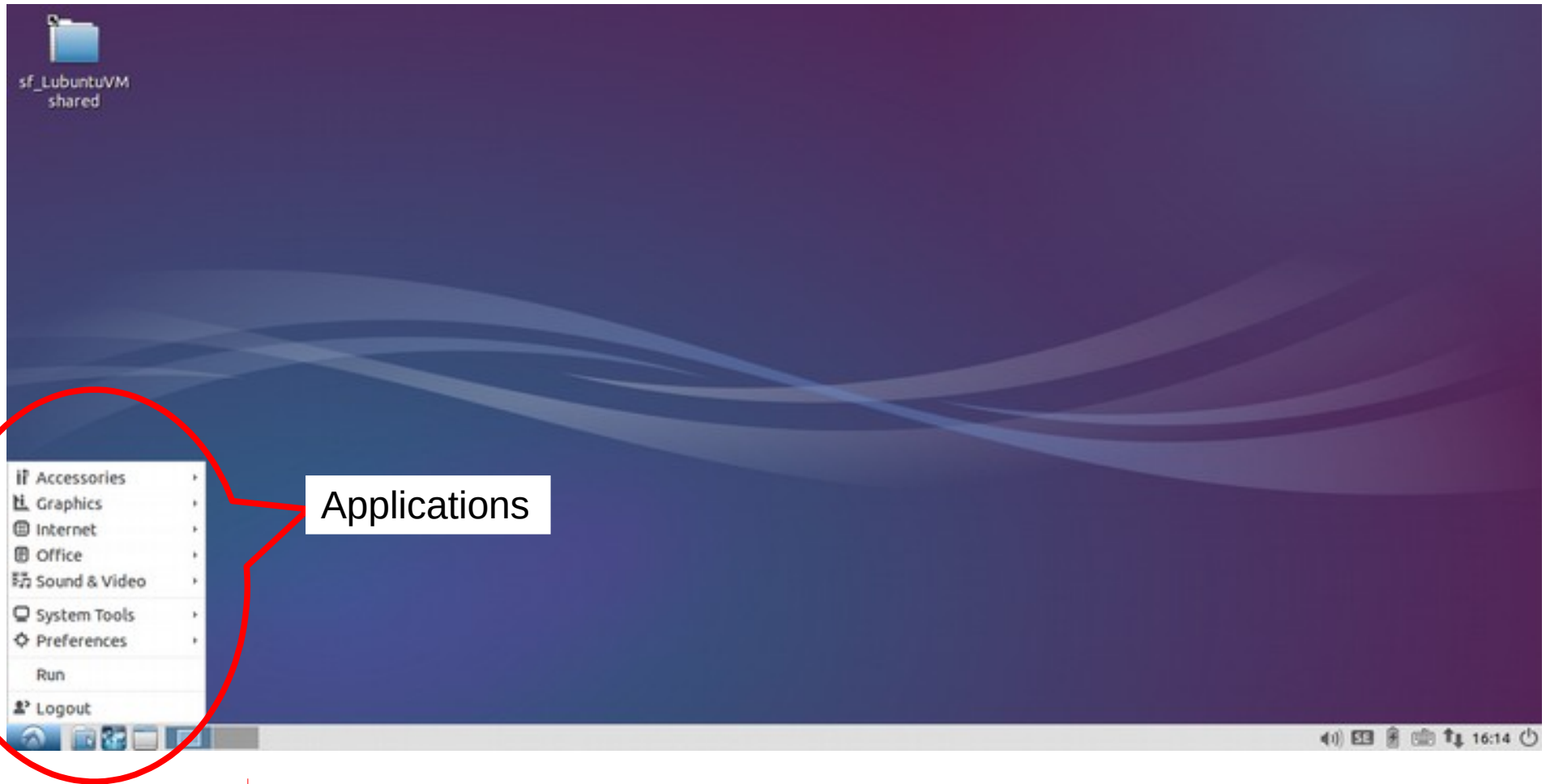
Login using the user name courseuser and password coursepassword



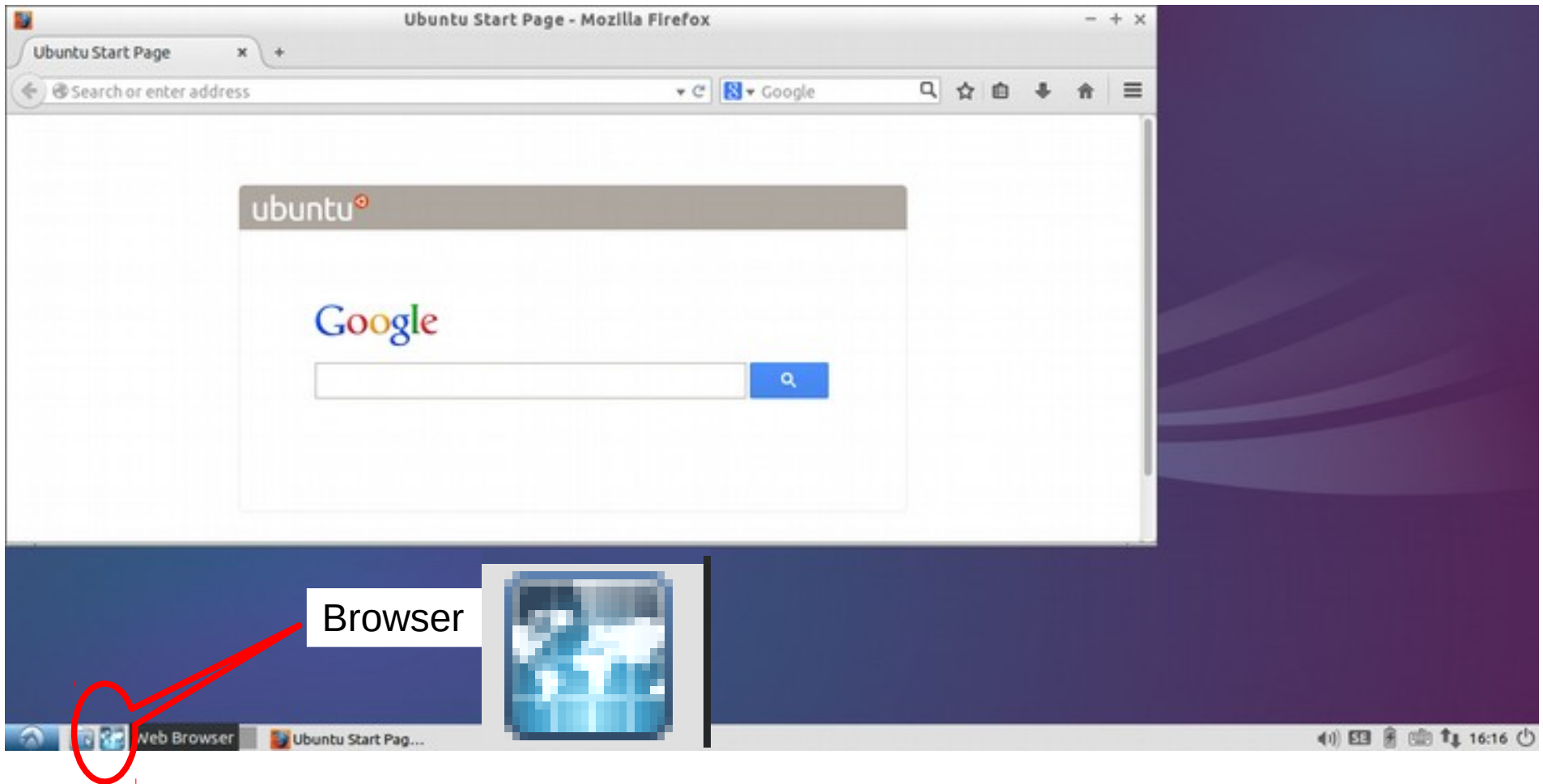
3.2.1. Moving around the desktop: **applications**



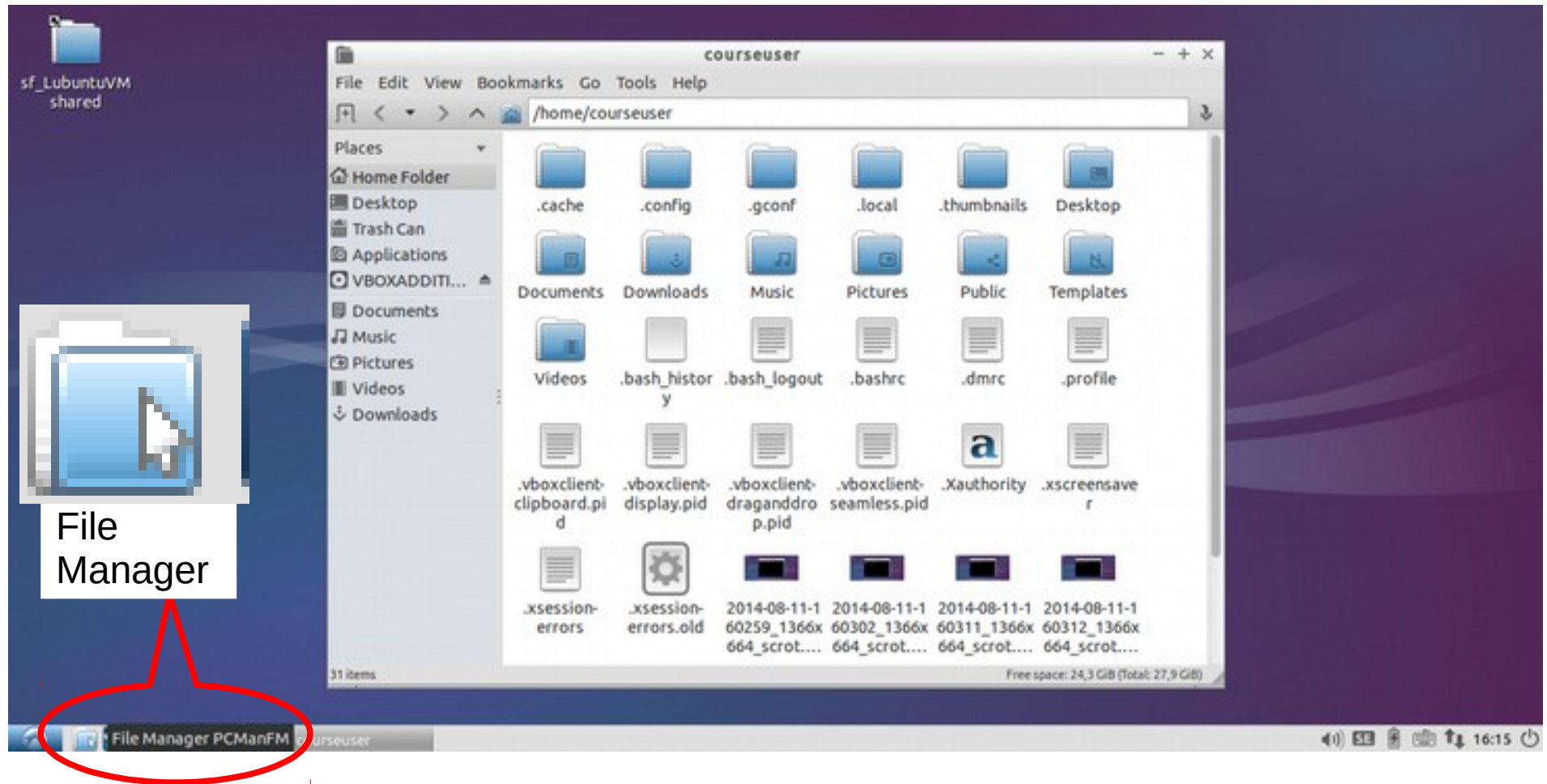
3.2.2. Moving around the desktop: **applications**



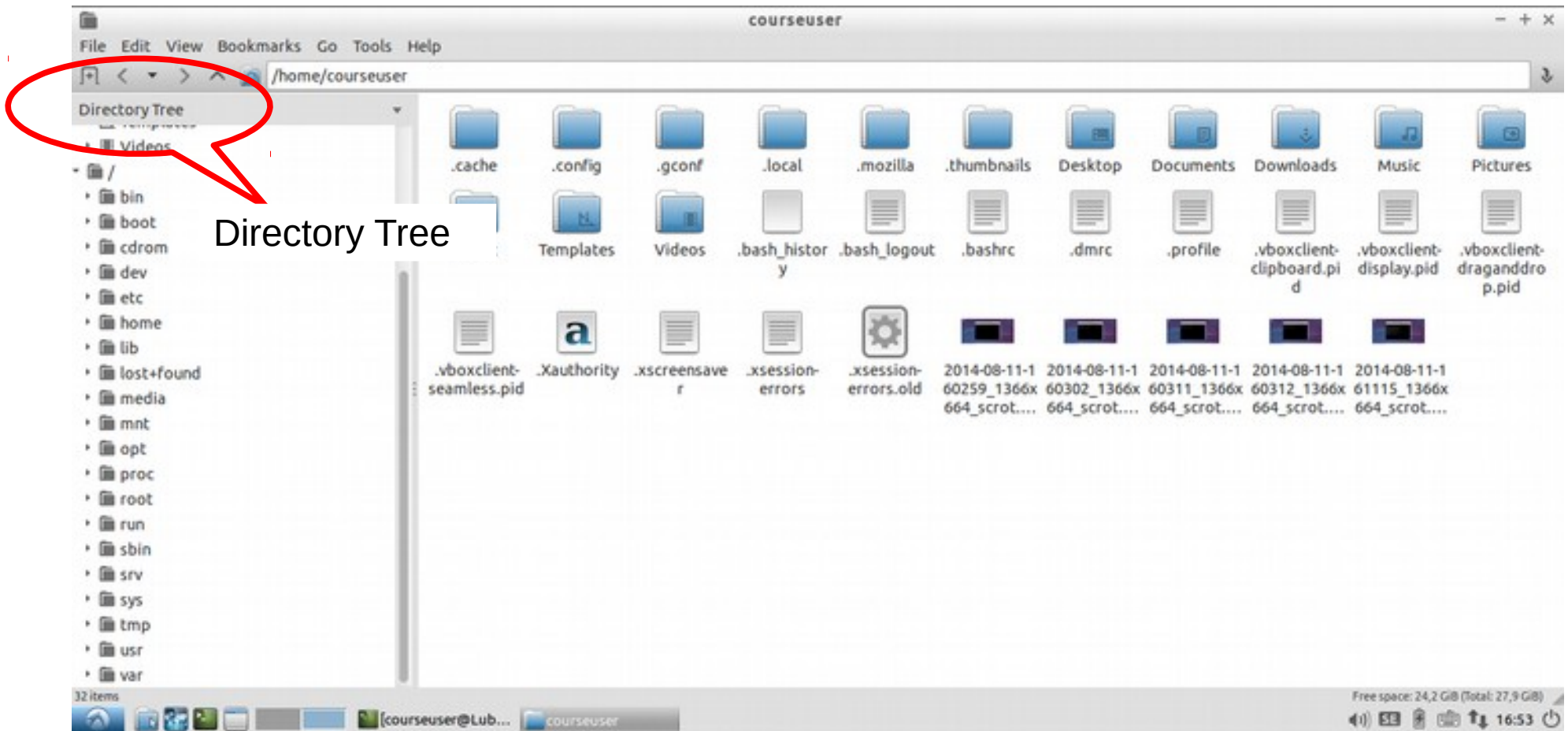
3.3. Moving around the desktop: web browser (Firefox)



3.4.1. Moving around the desktop: file browser (File Manager)

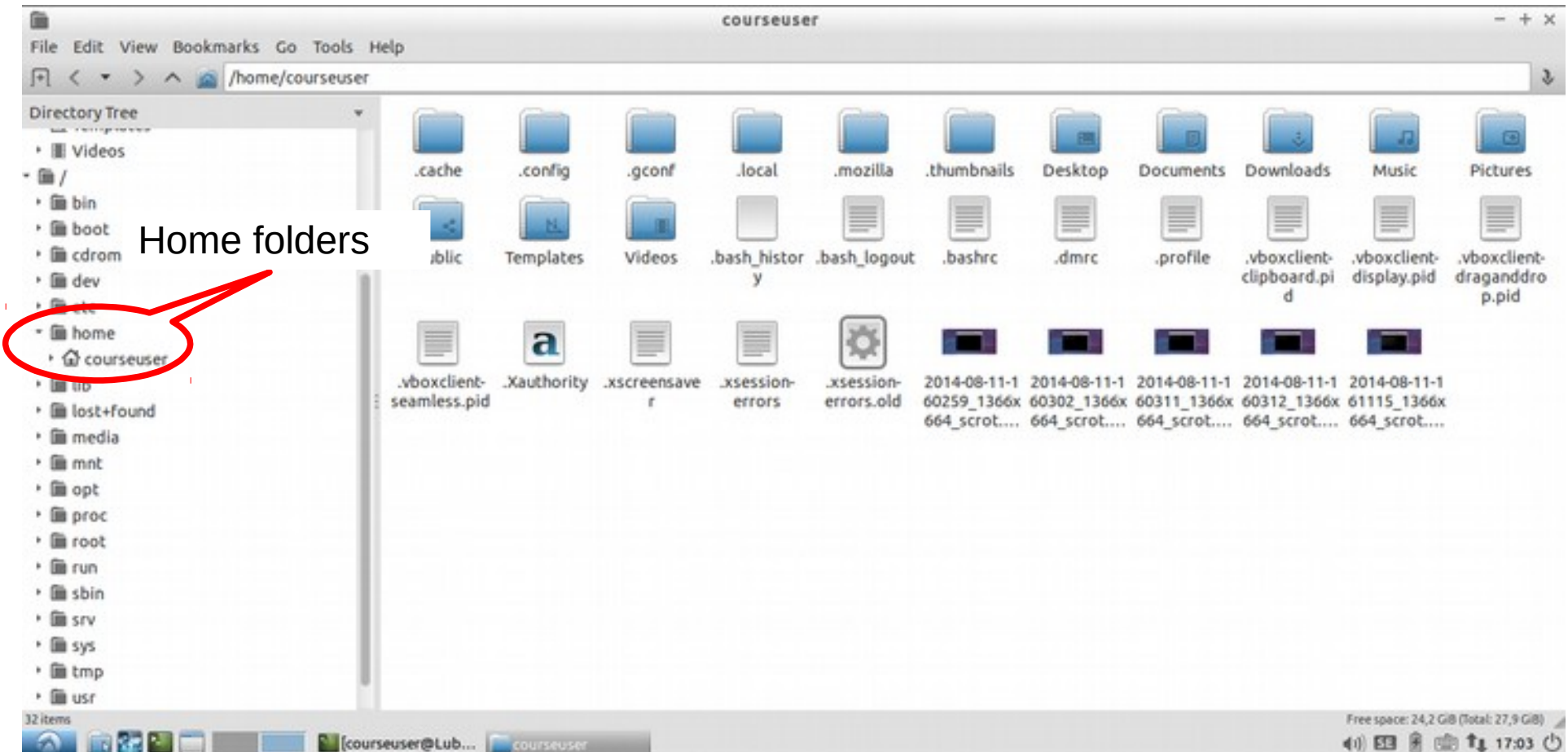


3.4.2. Moving around the desktop: Organization of files in Linux



Switch to "Directory Tree" view.
Note the start of the filesystem, called the "root",
identified by the "slash" symbol: /

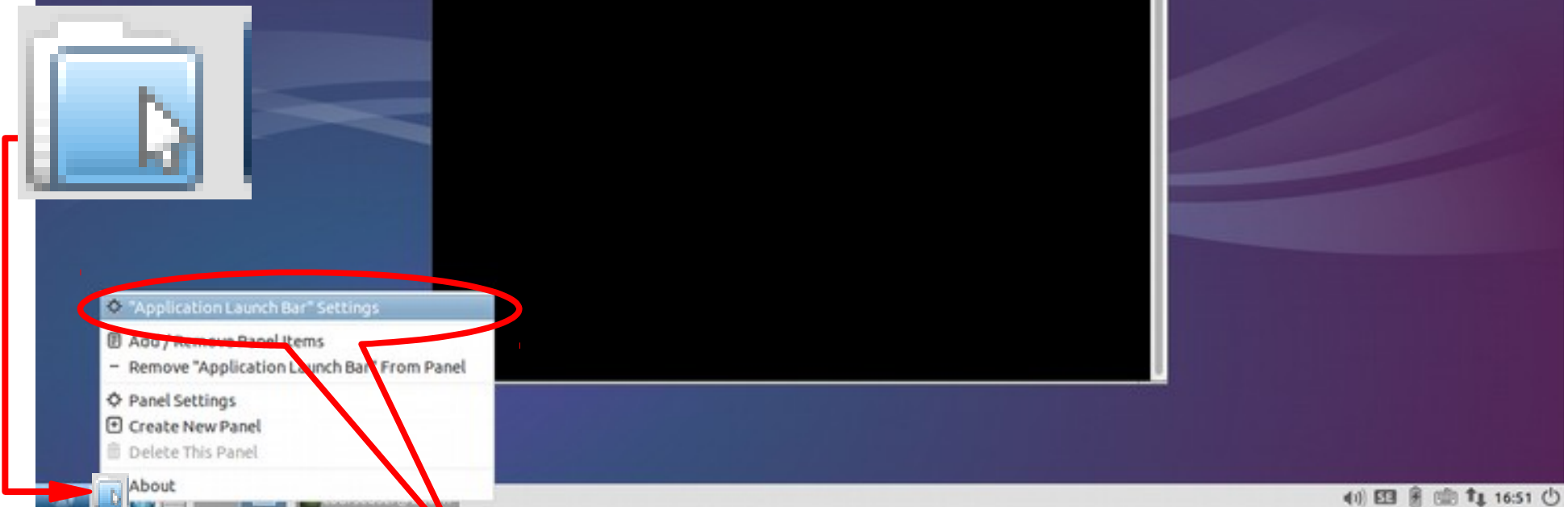
3.4.3. Moving around the desktop: Organization of files in Linux



/home/courseuser – The home directory, one folder for each user, contains the user's personal files.

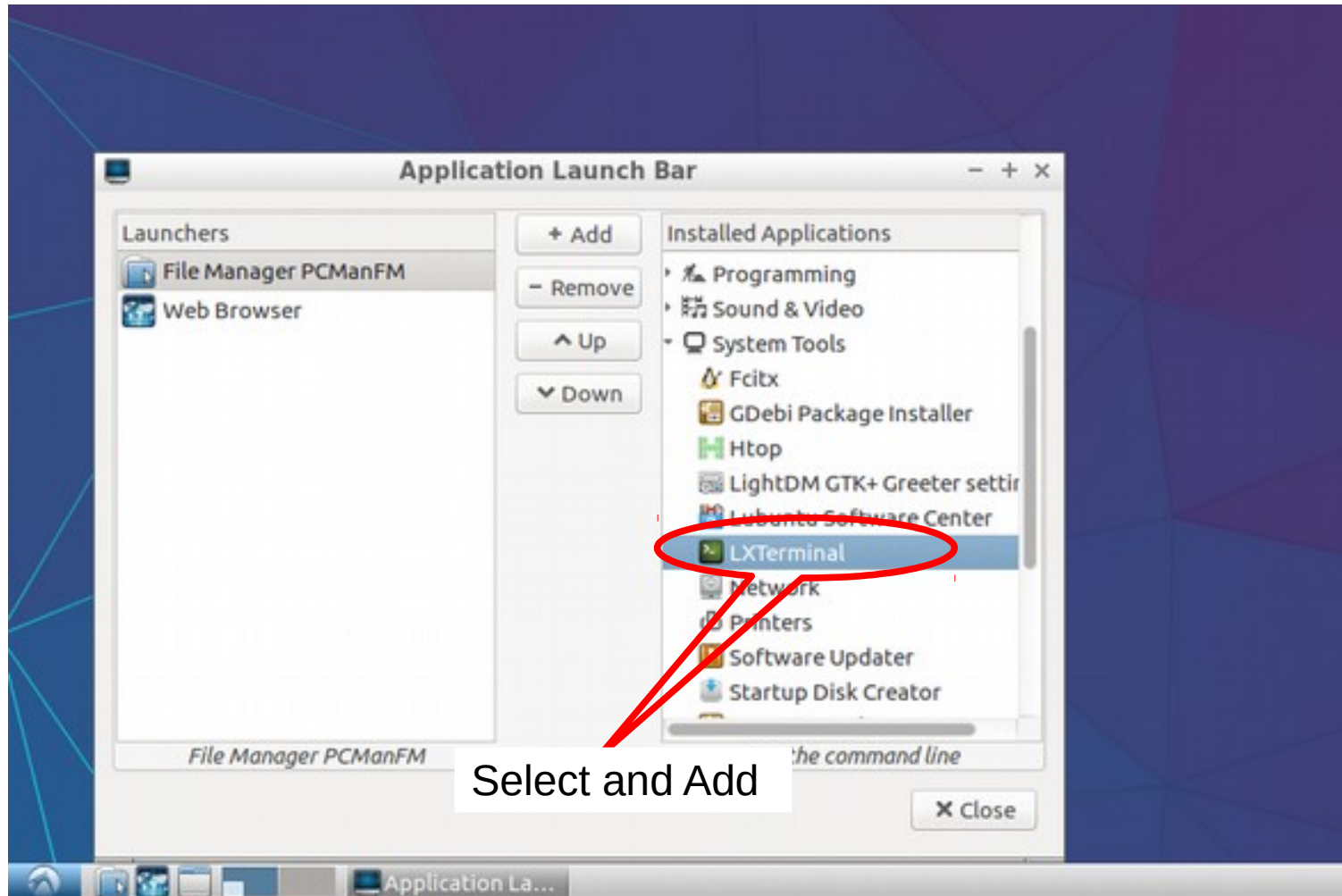
3.5.1. Customizing the desktop: Application Shortcuts

1. Right click on the
filemanager icon



Click on "Application Launch Bar" settings

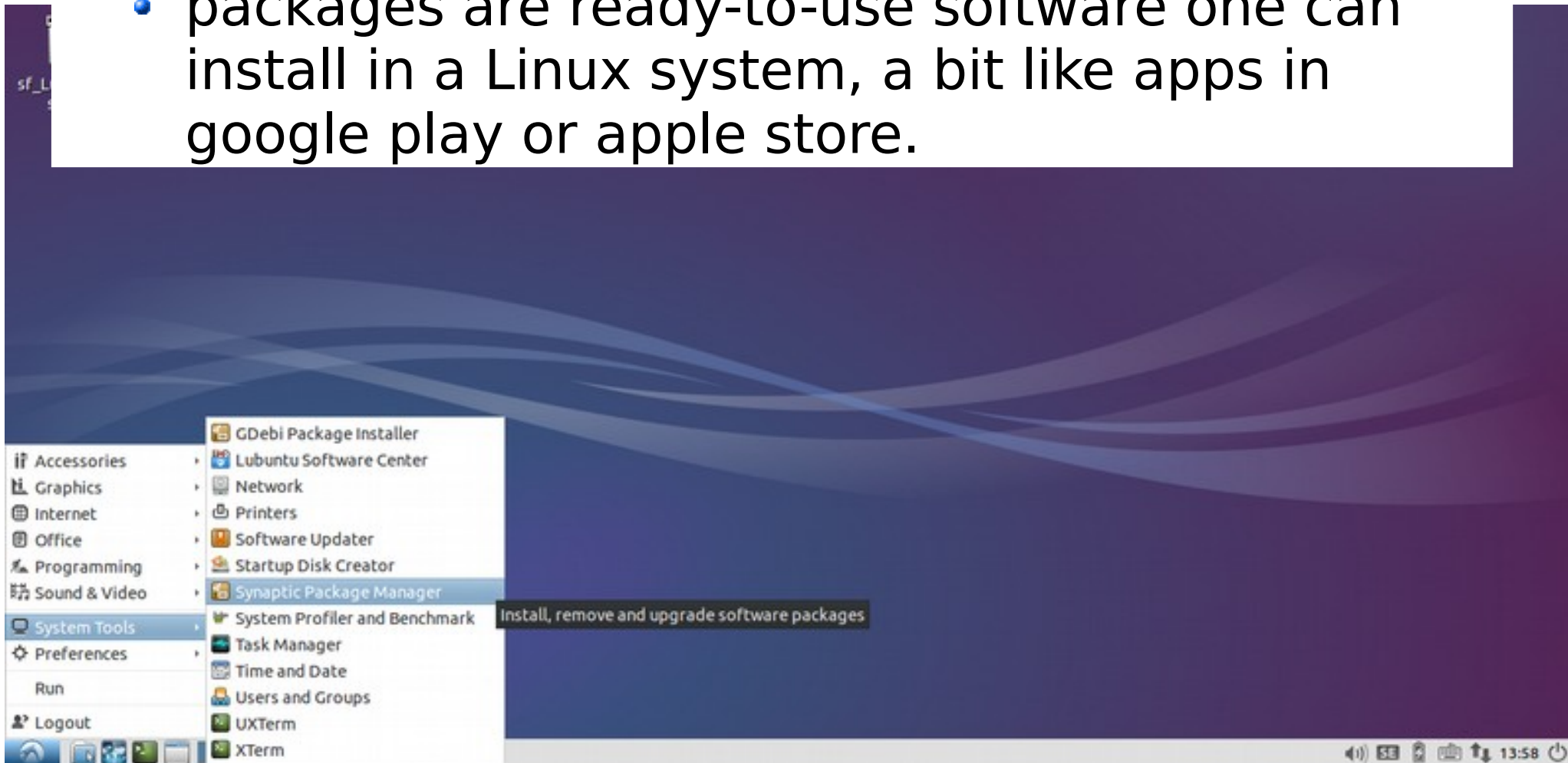
3.5.2. Customizing the desktop: Application Shortcuts



Add LXTerminal to Launchbar – we’re going to use it a lot!

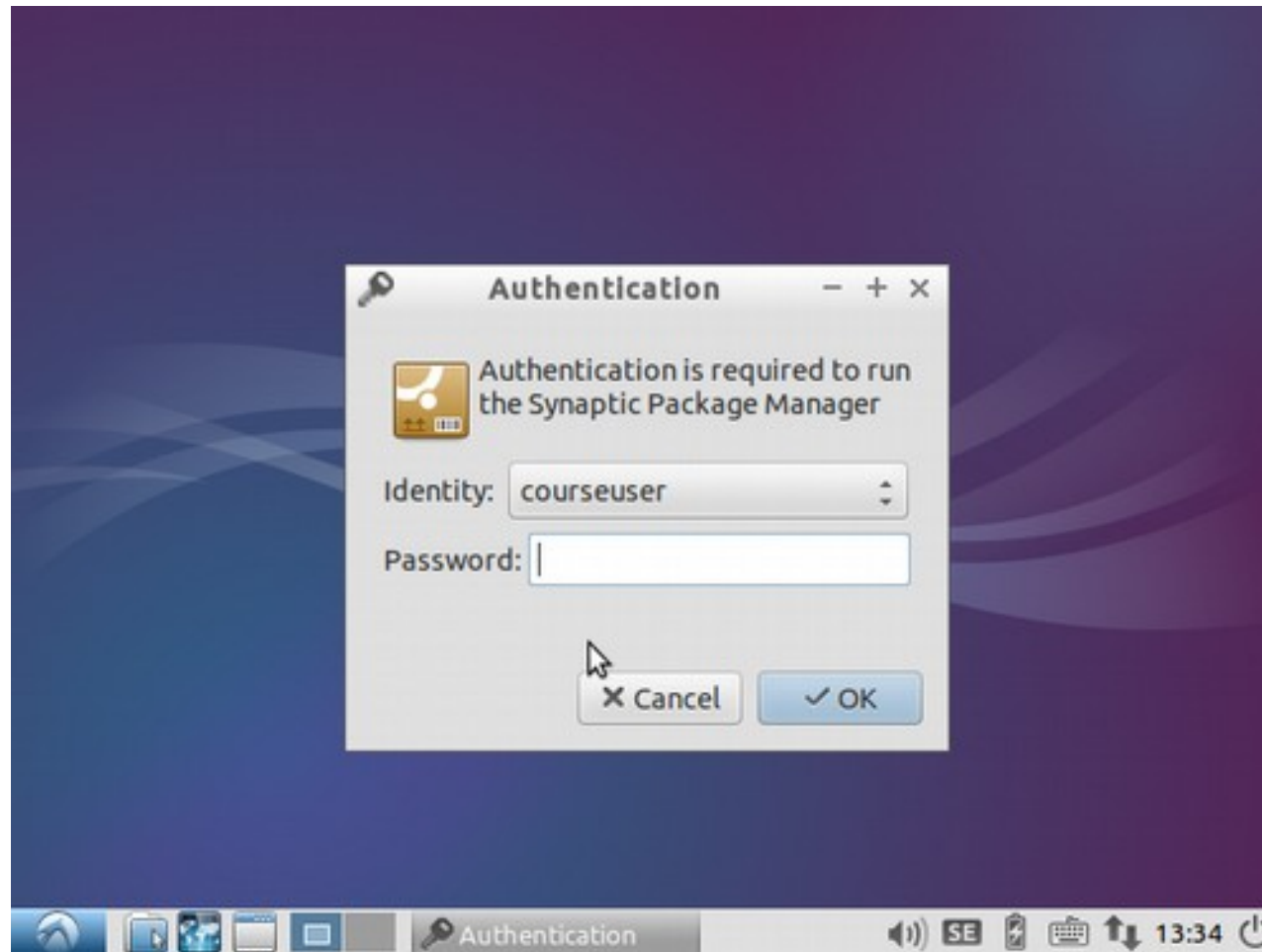
3.6.1. Installing software from repositories

- Synaptic: tool to search "packages"
 - packages are ready-to-use software one can install in a Linux system, a bit like apps in google play or apple store.

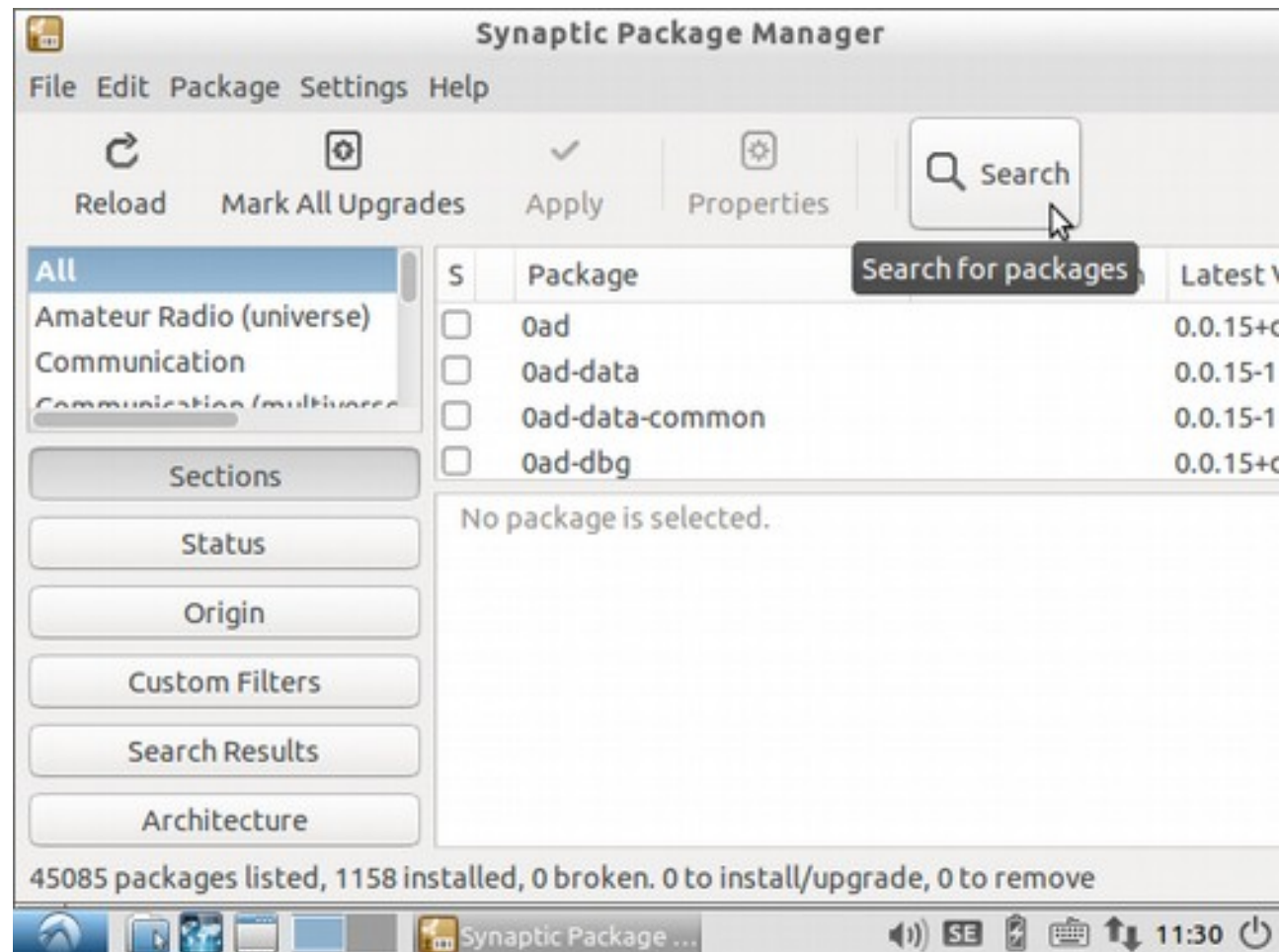


3.6.2. Installing software from repositories

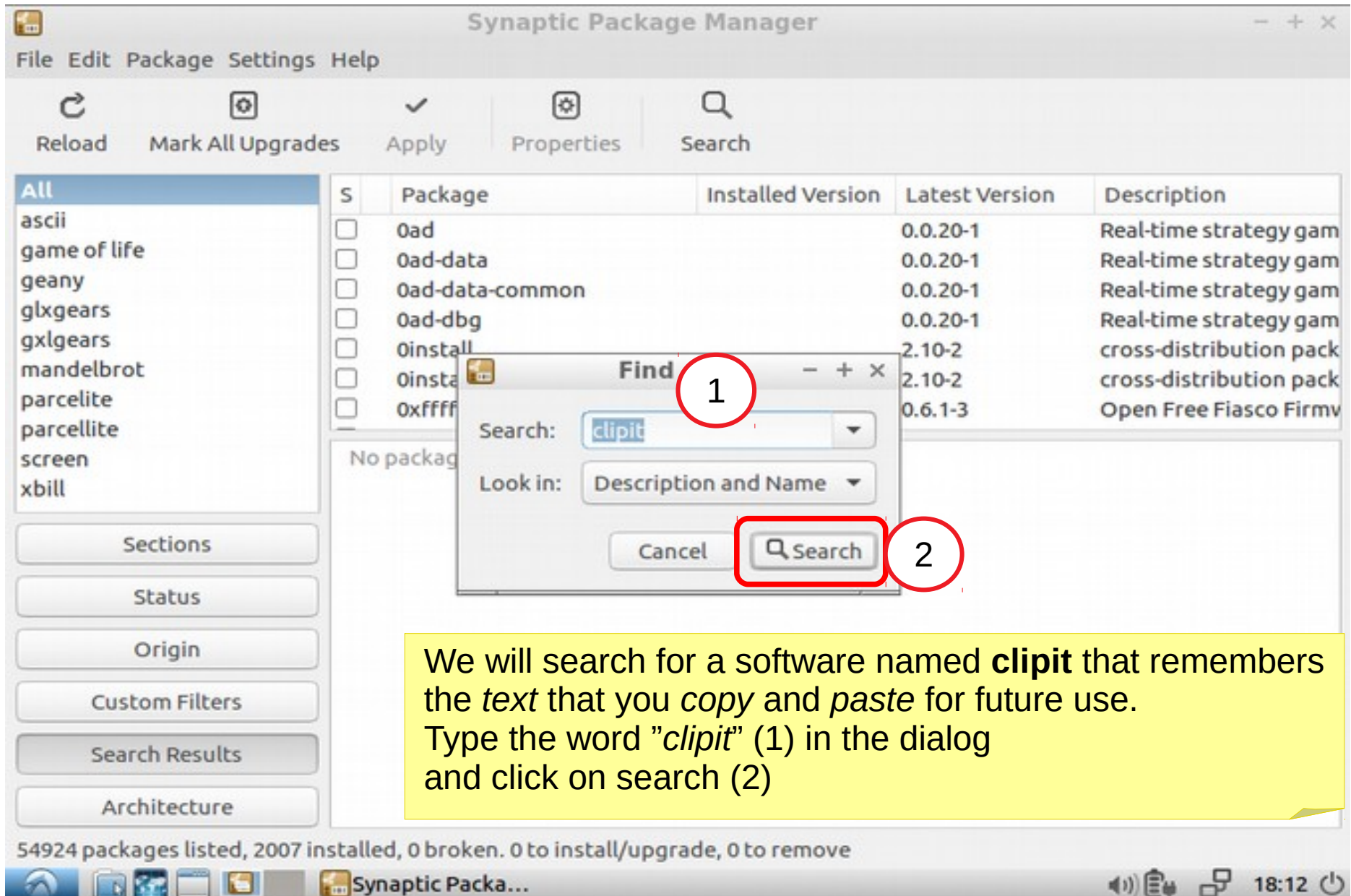
- Adding software requires superuser privileges, one must authenticate again.



3.6.3. Installing software from repositories: Search for software



3.6.4. Installing software from repositories: search cont.



The screenshot shows the Synaptic Package Manager interface. A 'Find' dialog box is open in the foreground. The search field contains the text 'clipit', which is circled with a red '1'. The 'Look in:' dropdown menu is set to 'Description and Name'. The 'Search' button is circled with a red '2'. The background shows a list of packages with columns for 'Package', 'Installed Version', 'Latest Version', and 'Description'. The status bar at the bottom indicates '54924 packages listed, 2007 installed, 0 broken. 0 to install/upgrade, 0 to remove'.

S	Package	Installed Version	Latest Version	Description
<input type="checkbox"/>	0ad		0.0.20-1	Real-time strategy gam
<input type="checkbox"/>	0ad-data		0.0.20-1	Real-time strategy gam
<input type="checkbox"/>	0ad-data-common		0.0.20-1	Real-time strategy gam
<input type="checkbox"/>	0ad-dbg		0.0.20-1	Real-time strategy gam
<input type="checkbox"/>	0install		2.10-2	cross-distribution pack
<input type="checkbox"/>	0install		2.10-2	cross-distribution pack
<input type="checkbox"/>	0xffff		0.6.1-3	Open Free Fiasco Firmv

54924 packages listed, 2007 installed, 0 broken. 0 to install/upgrade, 0 to remove

We will search for a software named **clipit** that remembers the *text* that you *copy* and *paste* for future use. Type the word "clipit" (1) in the dialog and click on search (2)

3.6.5. Installing software from repositories: found software list

The screenshot shows the Synaptic Package Manager window. The title bar reads "Synaptic Package Manager". The menu bar includes "File", "Edit", "Package", "Settings", and "Help". The toolbar contains icons for "Reload", "Mark All Upgrades", "Apply", "Properties", and "Search".

On the left, a sidebar lists package categories: "All", "ascii", "clipit", "game of life", "geany", "glxgears", "gxlgears", "mandelbrot", "parcelite", "parcellite", and "screen". Below these are buttons for "Sections", "Status", "Origin", "Custom Filters", "Search Results", and "Architecture".

The main window displays a table of packages:

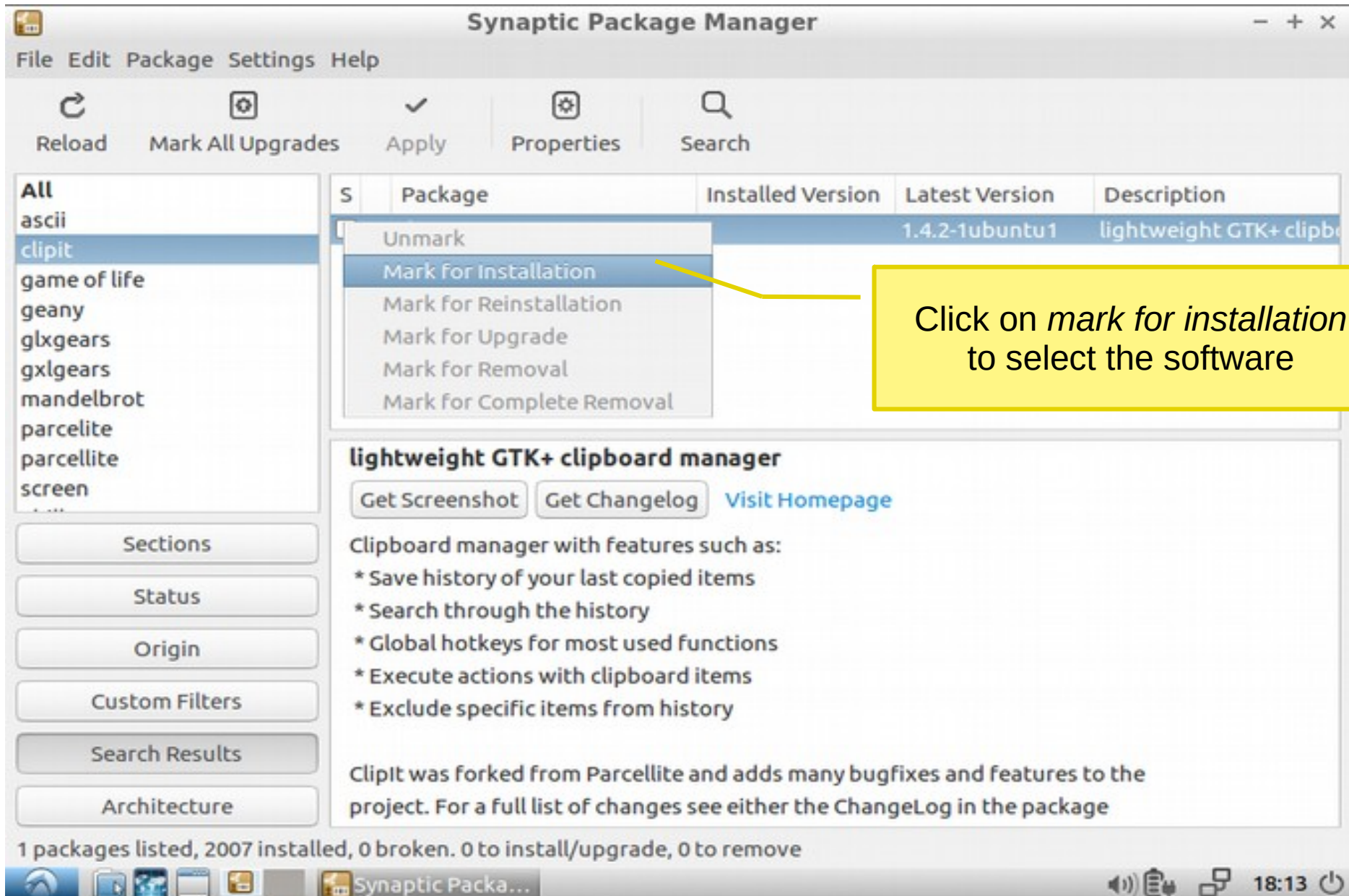
S	Package	Installed Version	Latest Version	Description
<input type="checkbox"/>	clipit		1.4.2-1ubuntu1	lightweight GTK+ clipb...

A yellow callout box with a pointer to the checkbox in the first row contains the text: "Tick this box to select the software to install".

Below the table, the details for the selected package "clipit" are shown. The title is "lightweight GTK+ clipboard manager". There are buttons for "Get Screenshot", "Get Changelog", and "Visit Homepage". The description reads: "Clipboard manager with features such as: * Save history of your last copied items * Search through the history * Global hotkeys for most used functions * Execute actions with clipboard items * Exclude specific items from history". A note at the bottom states: "ClipIt was forked from Parcellite and adds many bugfixes and features to the project. For a full list of changes see either the ChangeLog in the package".

At the bottom of the window, a status bar indicates: "1 packages listed, 2007 installed, 0 broken. 0 to install/upgrade, 0 to remove".

3.6.6. Installing software from repositories: select software to install



The screenshot shows the Synaptic Package Manager window. The 'clipit' package is selected in the left-hand list. A context menu is open over the package, with 'Mark for Installation' highlighted. A yellow callout box points to this option with the text: 'Click on *mark for installation* to select the software'. The main window displays a table of packages with columns for 'S', 'Package', 'Installed Version', 'Latest Version', and 'Description'. The 'clipit' package is listed with 'Installed Version' as '1.4.2-1ubuntu1' and 'Description' as 'lightweight GTK+ clipboard manager'. Below the table, there is a detailed view for the selected package, including buttons for 'Get Screenshot', 'Get Changelog', and 'Visit Homepage', and a list of features.

S	Package	Installed Version	Latest Version	Description
	clipit	1.4.2-1ubuntu1	1.4.2-1ubuntu1	lightweight GTK+ clipboard manager

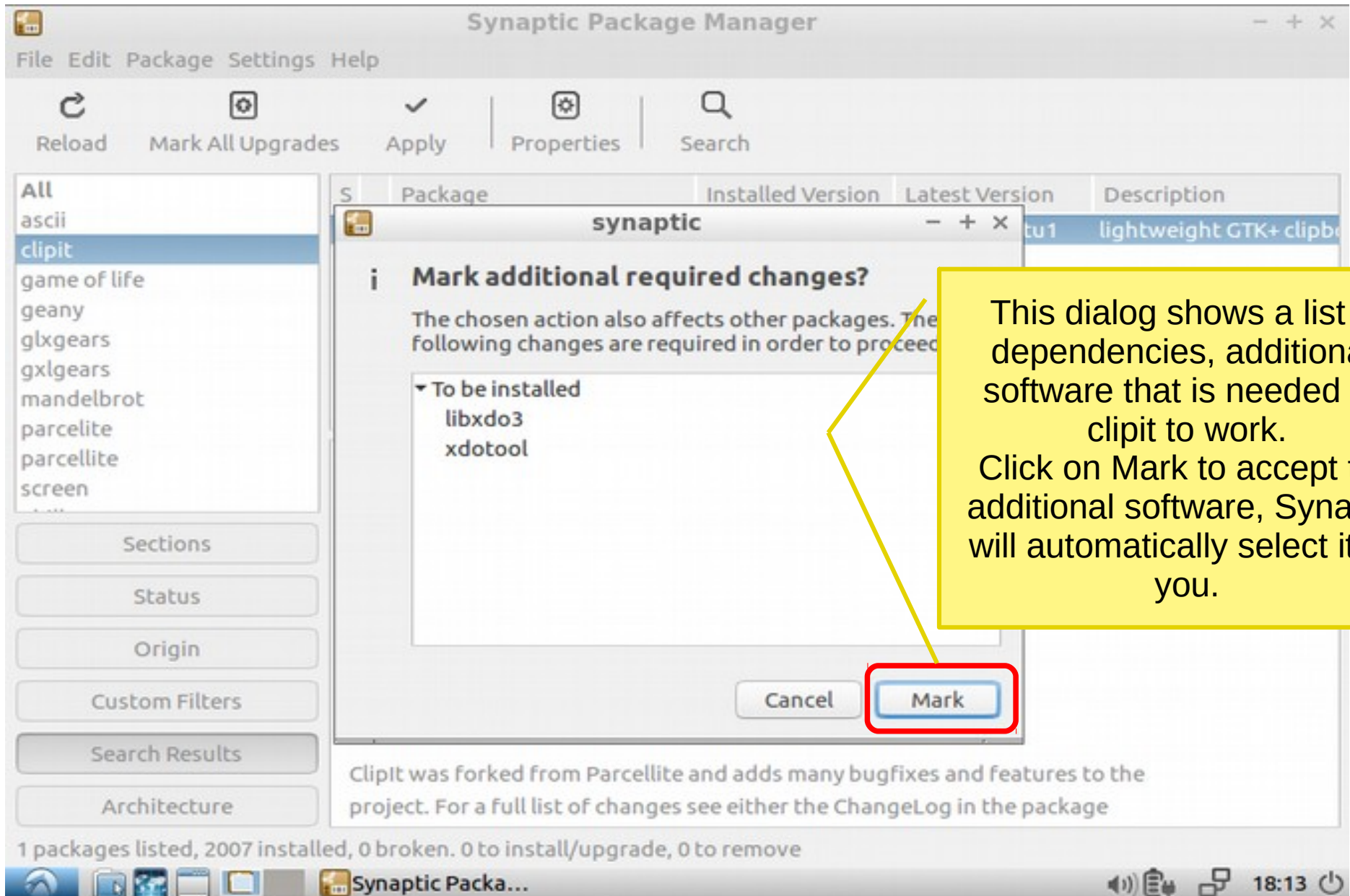
lightweight GTK+ clipboard manager

- * Save history of your last copied items
- * Search through the history
- * Global hotkeys for most used functions
- * Execute actions with clipboard items
- * Exclude specific items from history

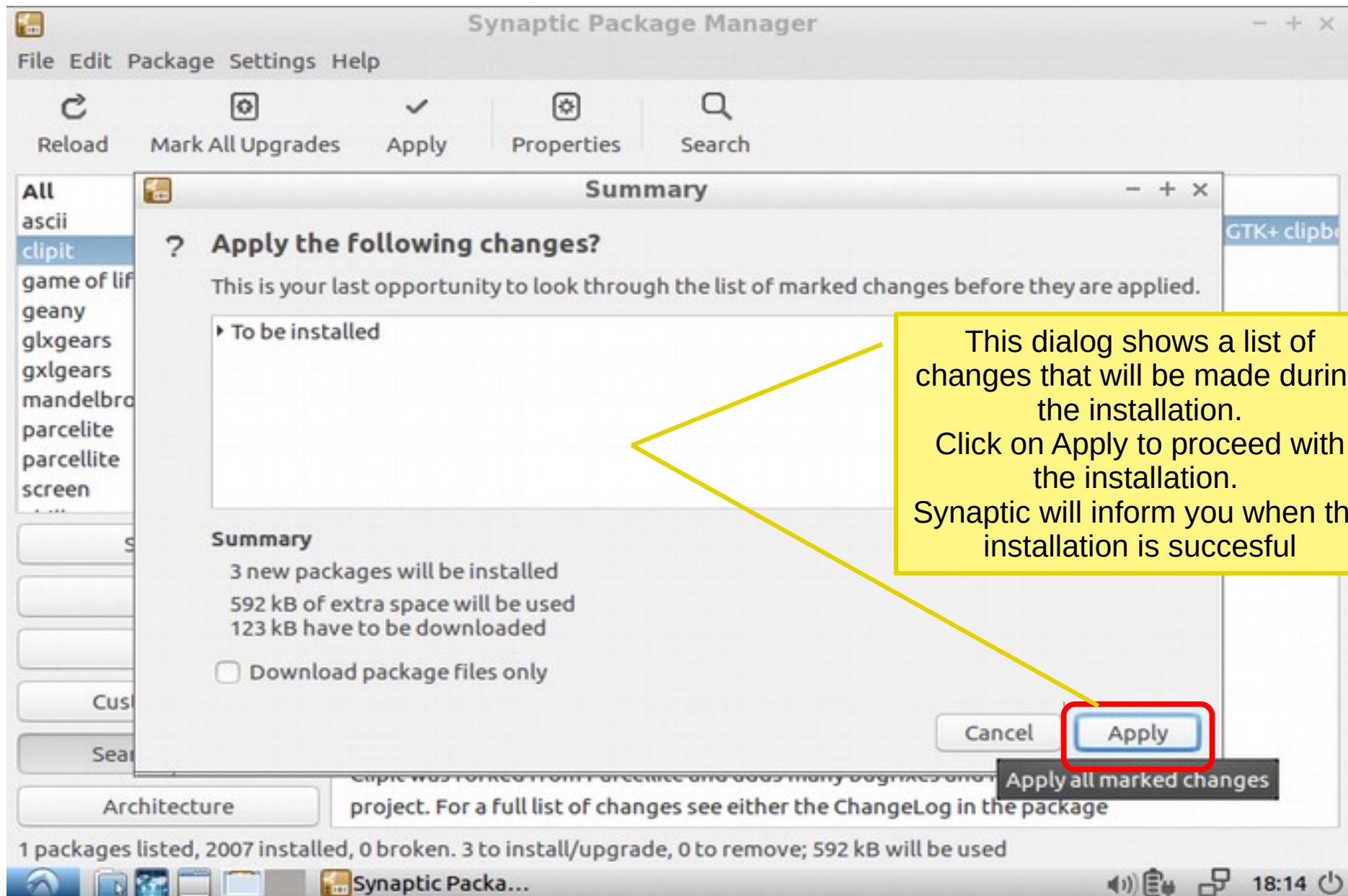
ClipIt was forked from Parcellite and adds many bugfixes and features to the project. For a full list of changes see either the ChangeLog in the package

1 packages listed, 2007 installed, 0 broken. 0 to install/upgrade, 0 to remove

3.6.7. Installing software from repositories: dependencies, additional sw required by the selected one to work



3.6.8. Installing software from repositories: start installation



3.7.1. Using clipit

The screenshot shows the Synaptic Package Manager window. The package list on the right includes:

S	Package	Installed Version	Latest Version	Description
<input checked="" type="checkbox"/>	clipit	1.4.2-1ubuntu1	1.4.2-1ubuntu1	lightweight GTK+ clipb...

The application menu is open, showing the following categories and items:

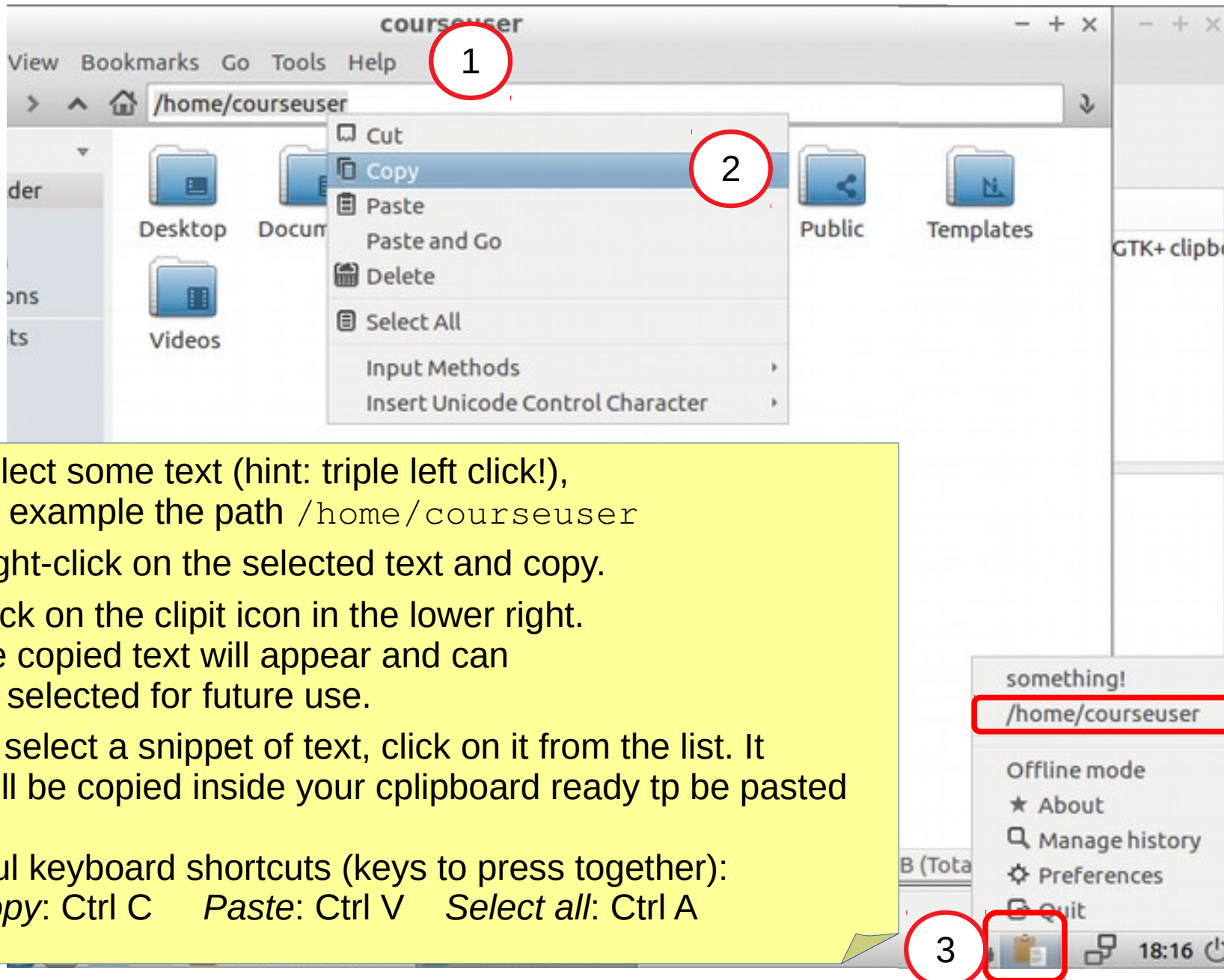
- Accessories
 - Archive Manager
 - Character Map
 - Clipit
 - Disks
 - File Manager PCManFM
 - Calculator
 - Image Viewer
 - Leafpad
 - NEdit "Nirvana Text Editor"
 - Vim
 - Xpad
- Education
- Graphics
- Internet
- Office
- Programming
- Sound & Video
- System Tools
- Preferences
- Run
- Logout

Two yellow callout boxes provide instructions:

1. Open the application menu and find Clipit
2. Click on Clipit icon to open it

A black box labeled "Clipboard Manager" is positioned over the Clipit icon in the application menu. The system tray at the bottom shows the time as 18:14.

3.7.2. Using clipit

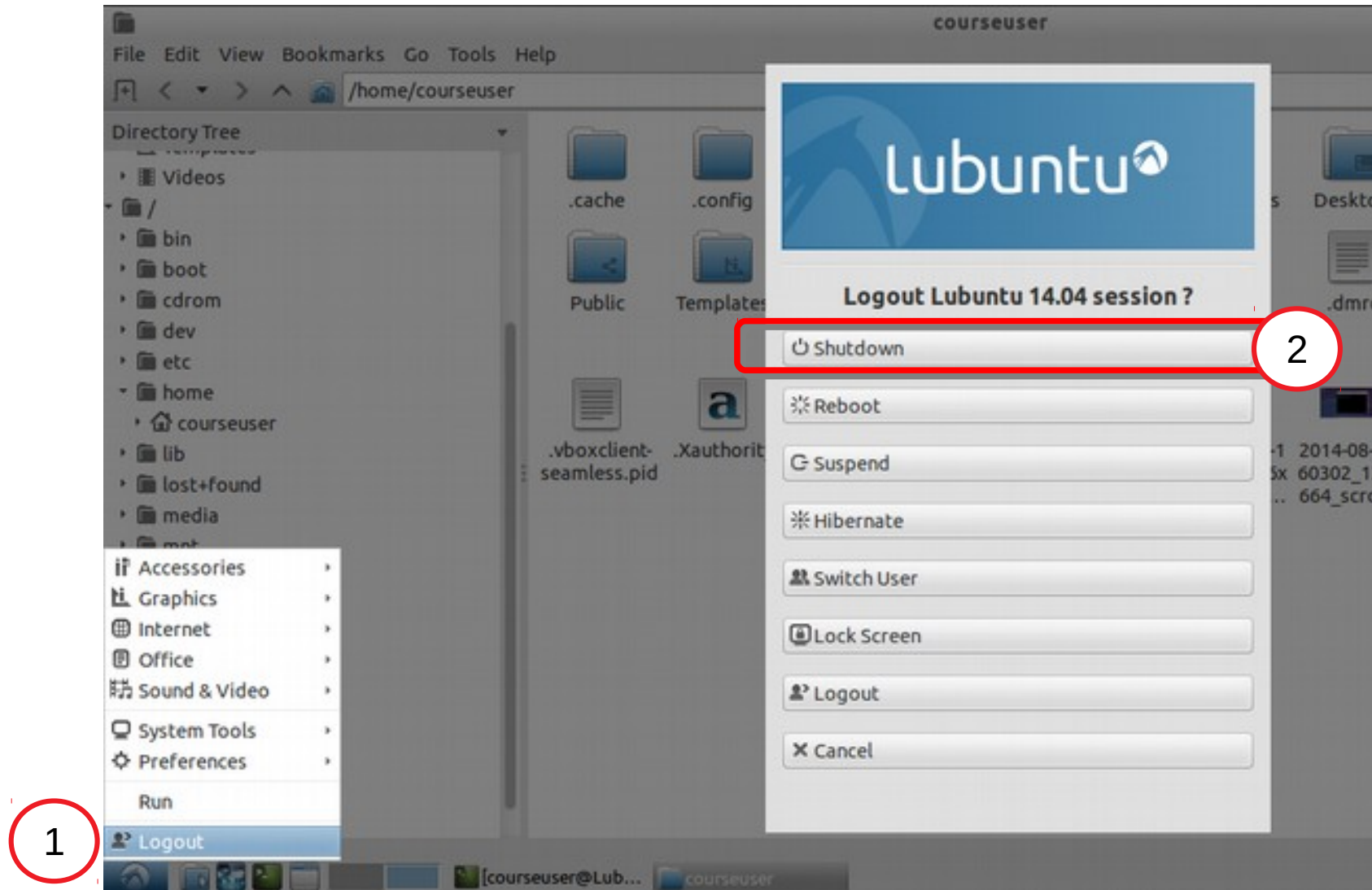


1. Select some text (hint: triple left click!), for example the path `/home/courseuser`
2. Right-click on the selected text and copy.
3. Click on the clipit icon in the lower right. the copied text will appear and can be selected for future use.
4. To select a snippet of text, click on it from the list. It will be copied inside your clipboard ready to be pasted

Useful keyboard shortcuts (keys to press together):
Copy: Ctrl C *Paste*: Ctrl V *Select all*: Ctrl A


3.8. Logout dialog: System Shutdown

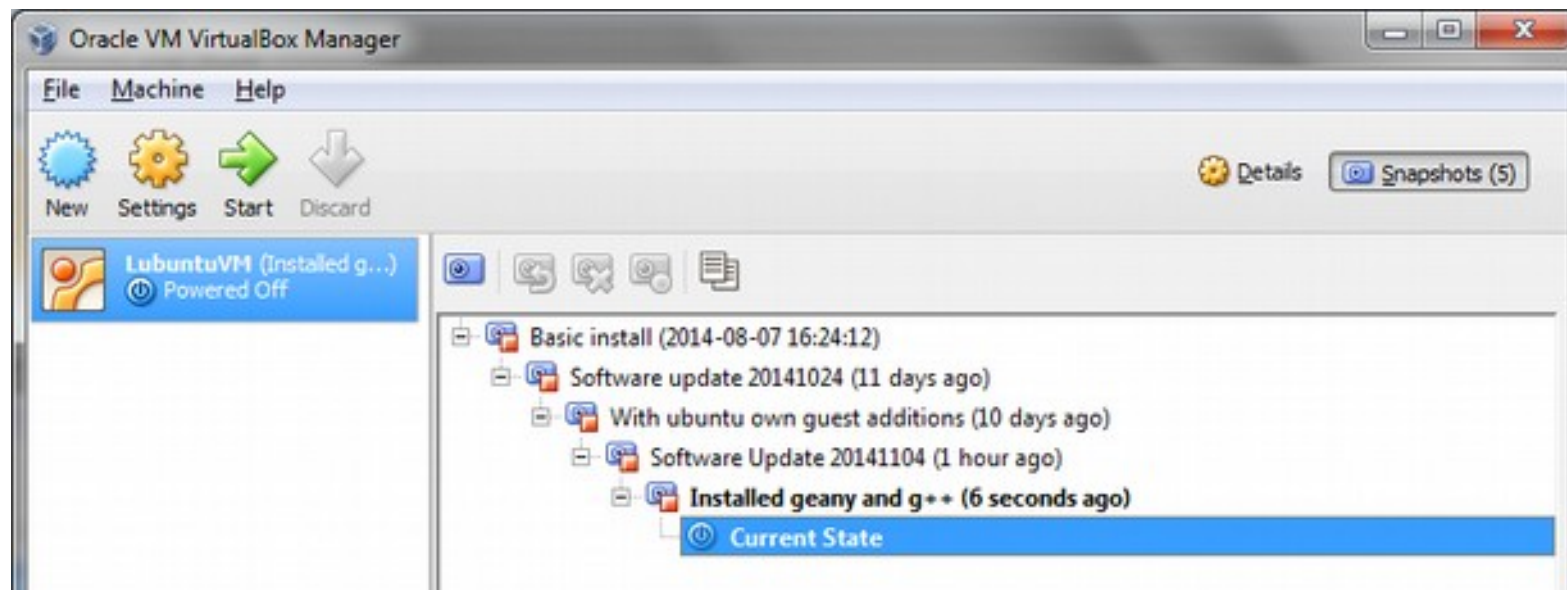
Ask the operating system to power off the machine.



4. Snapshots, or how to save changes to the machine and travel in time
(more useful for laptop users)

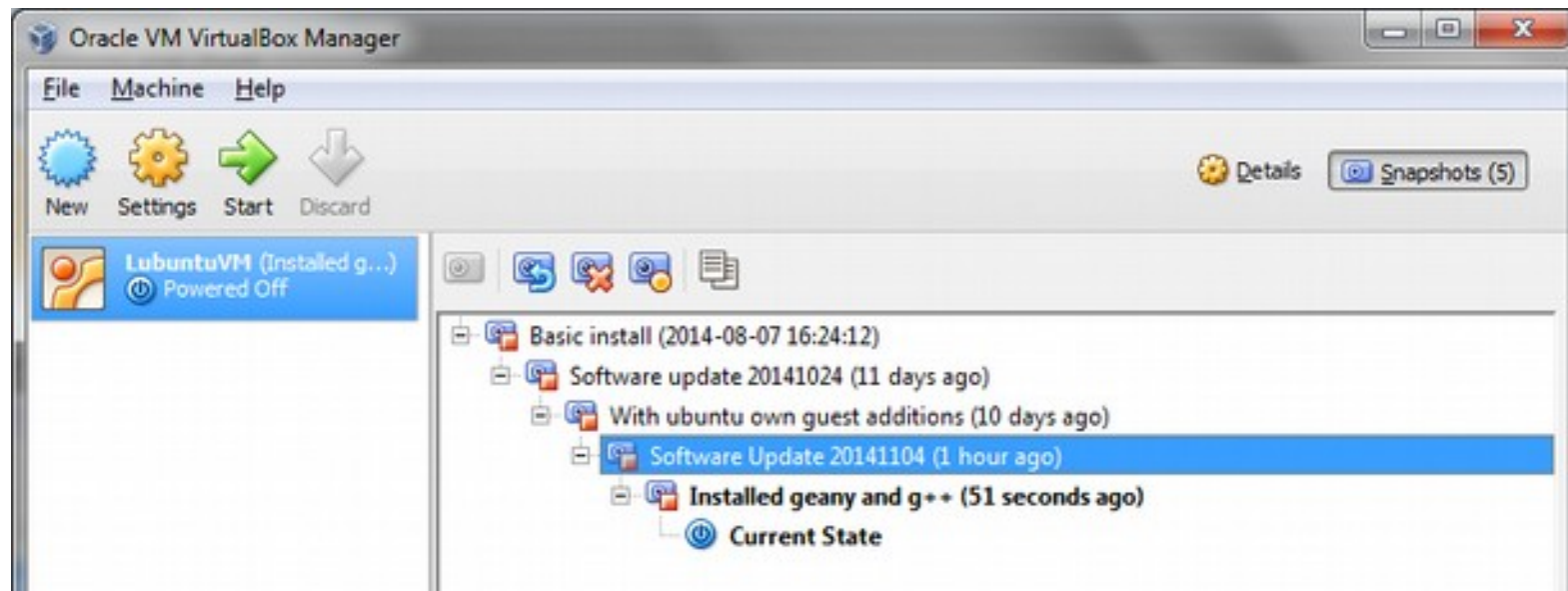
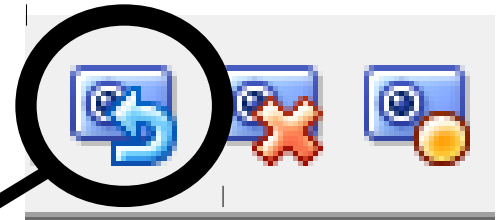
4.1. Snapshots in the custom VM

- 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 Snapshots interface. You can access it by clicking the snapshots button as shown below. (may be different depending on Virtualbox versions)
- 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 "take a snapshot" button! 
- For various technical reasons, the best is to snapshot when the VM is shutdown, but you may as well do it as it's running.



4.2. 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



5. Advanced Topics

CLI software installation methods

- **CLI** (Command Line Interface)

Here's a list of common commands to manage software via command line in Ubuntu:

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

Advanced software installation methods

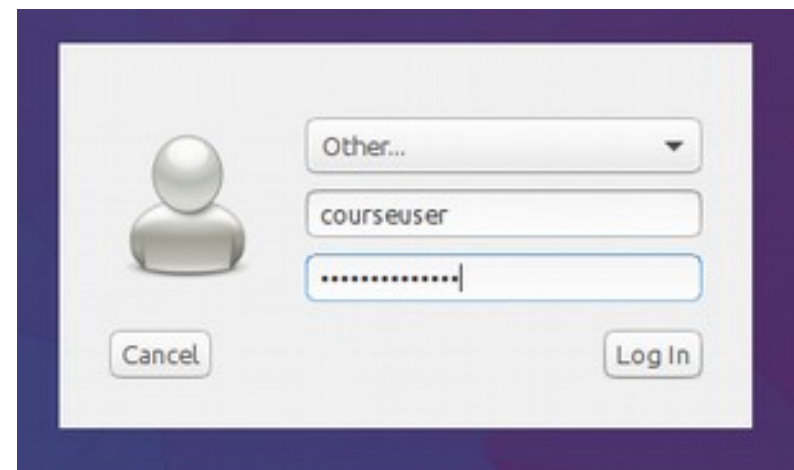
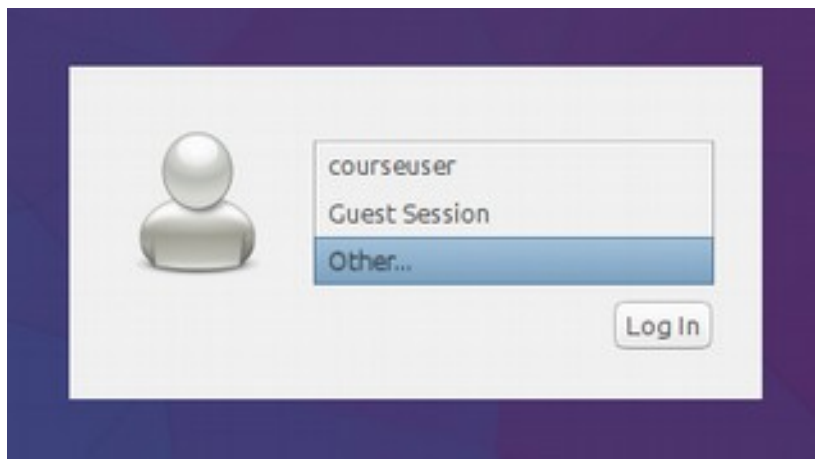
- **Compile** and **install** your own software.
 - **Compile:** You will see this during the course.
 - **Install:** copy files somewhere
- It **does not require administrative privileges**, so you can do everywhere!
- It's the typical way of installing your own software on a computer cluster.

Appendix A

Known problems

Can't login after screen lock

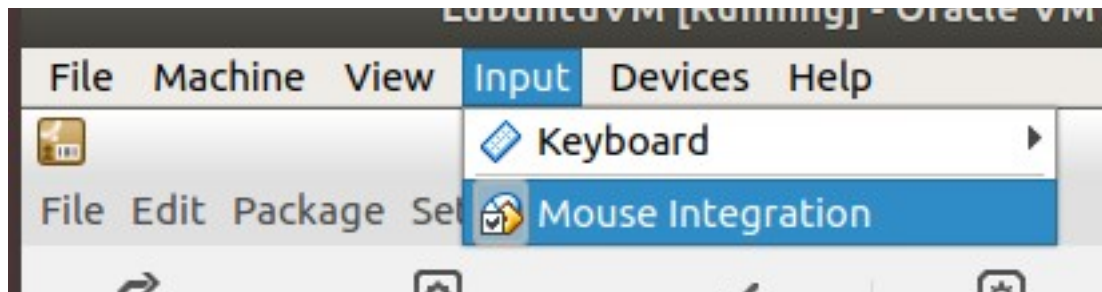
- Sometimes you are presented the login dialog but you can't login even if the password is correct. It is a bug. Do the following:
 1. Click on the username.
 - 2: Select "Other"
 3. Type `courseuser` and press Enter
 4. Type `coursepassword` and press Enter



Mouse pointer disappears

- Sometime the mouse pointer disappears or looks strange or garbaged. It's a video driver bug. To solve it, search and click the Virtualbox machine menu

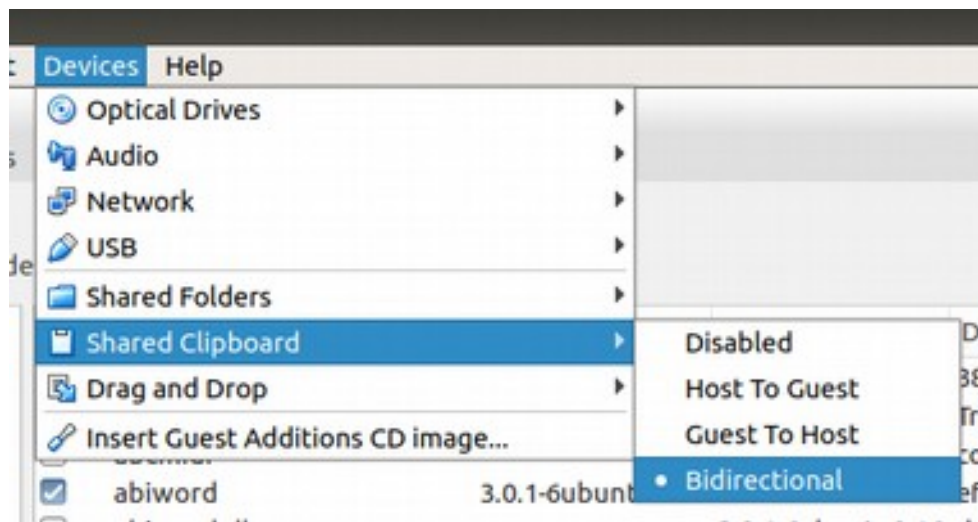
Input → "Mouse Integration"



- Note: this will force you to press Right Ctrl to escape the virtual machine focus with the mouse. Also the mouse might feel like too fast. You can restore mouse integration when the mouse reappears.
- Mouse integration allows the host mouse to be shared with the virtual machine mouse.

Copy paste from host to guest

- It is possible to copy paste text or other objects from the host machine to the guest (VM). But you need to explicitly enable it.
- Find the VM menu
Devices → Shared Clipboard
 - And select "bidirectional"
 - The changes might be effective only after restarting the virtual machine.



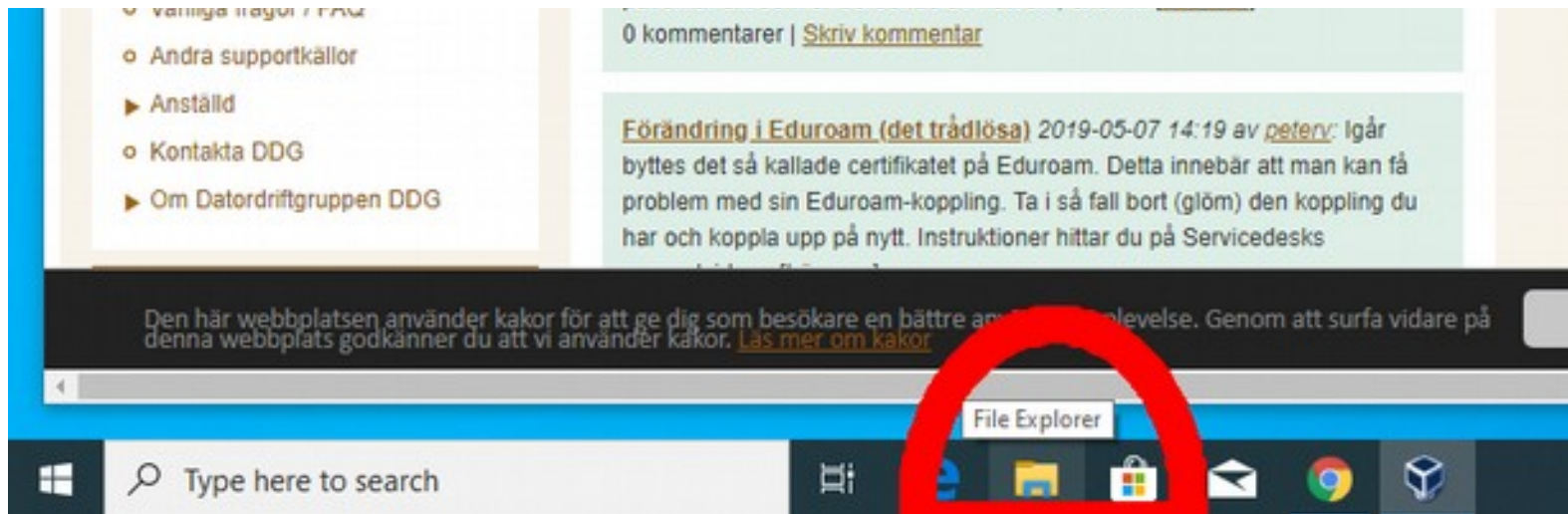
Appendix B

Windows 10 Lab

Copying the virtual machine step-by-step

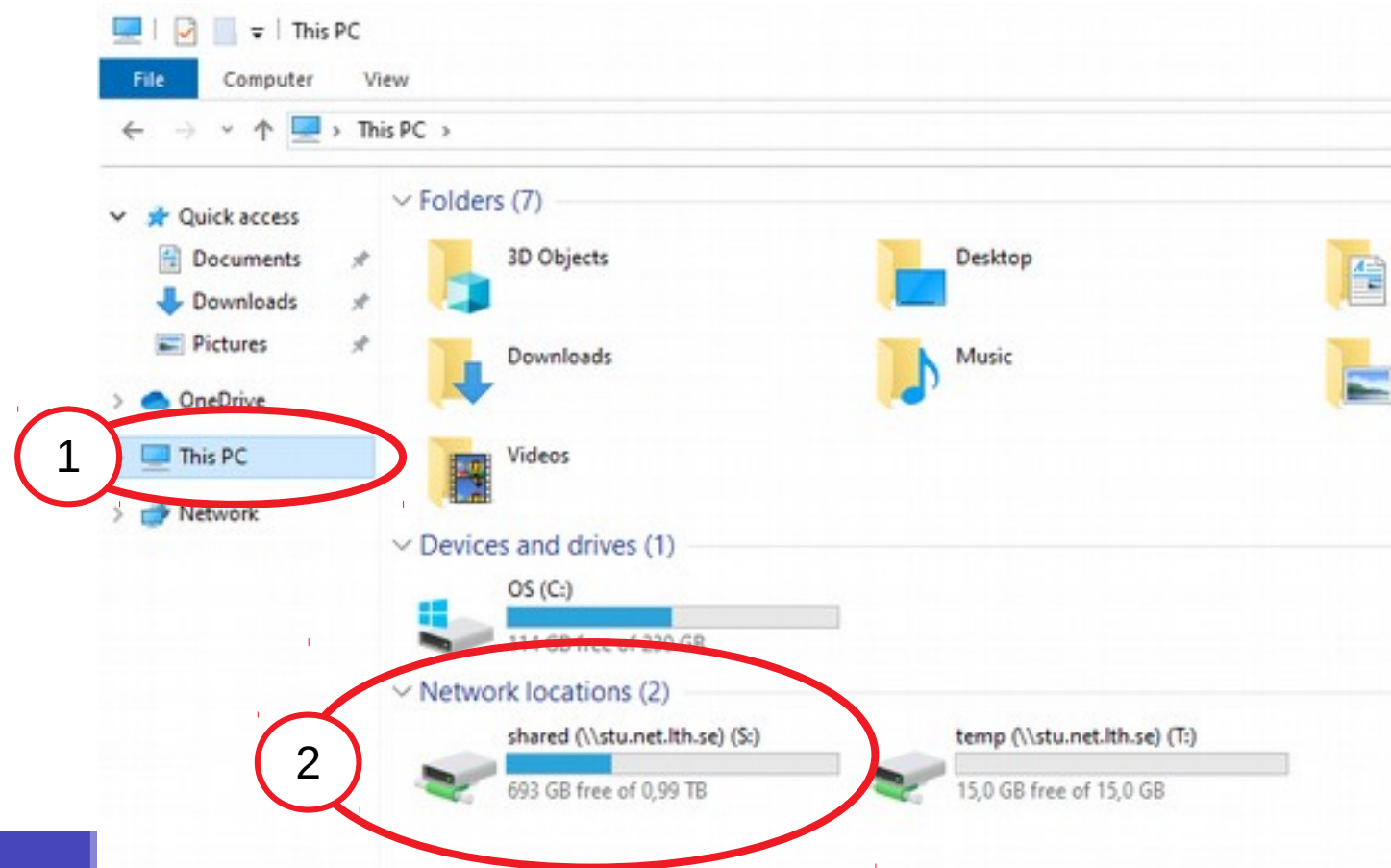
Preparing the course VM in the lab

1. Open the Windows File explorer. It's located in the favorites bar at the bottom of the desktop:



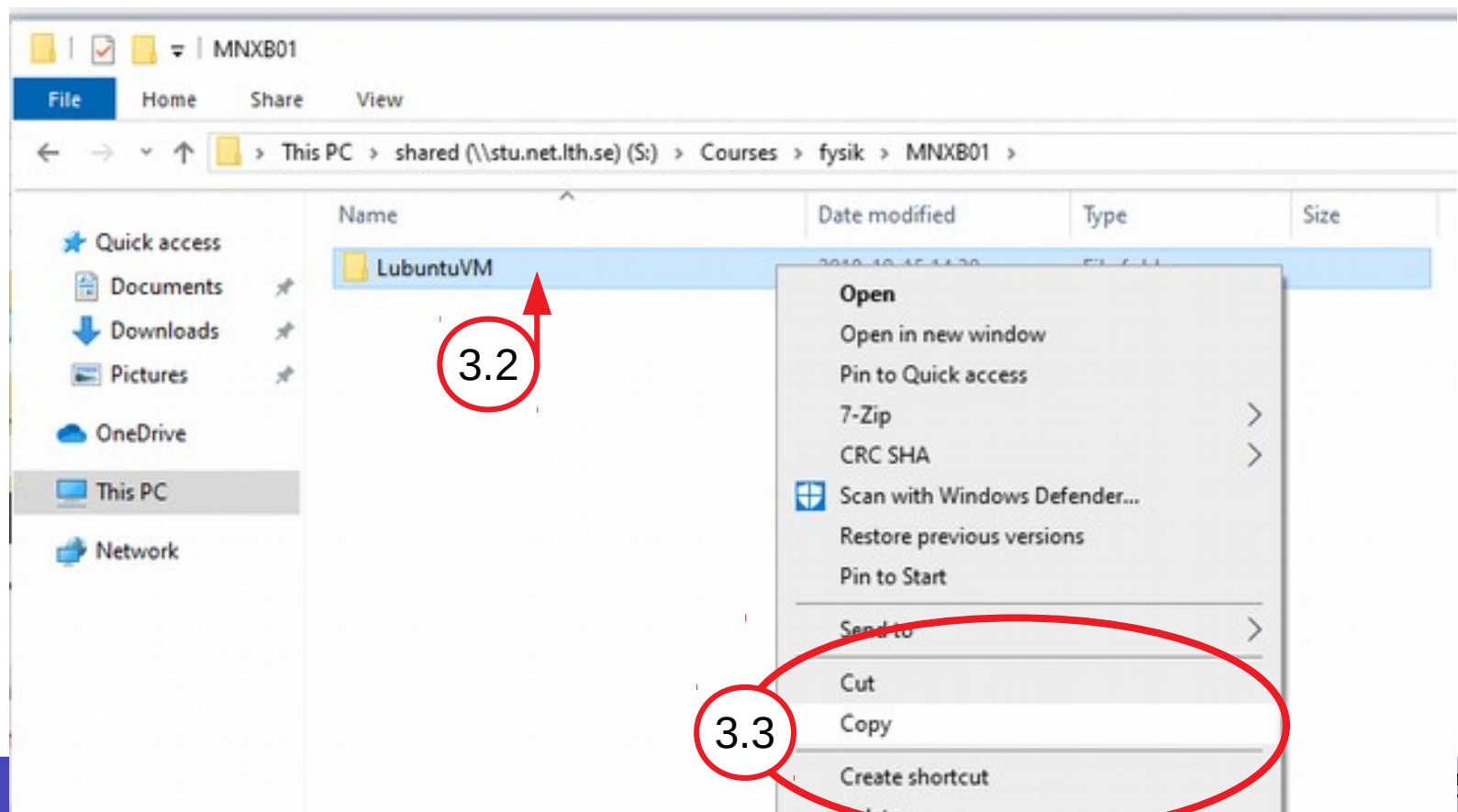
Preparing the course VM in the lab

2. Double click on the `S:\` network located storage (2). You can see the storages by clicking on "This PC"(1) in the left column of the File Explorer.



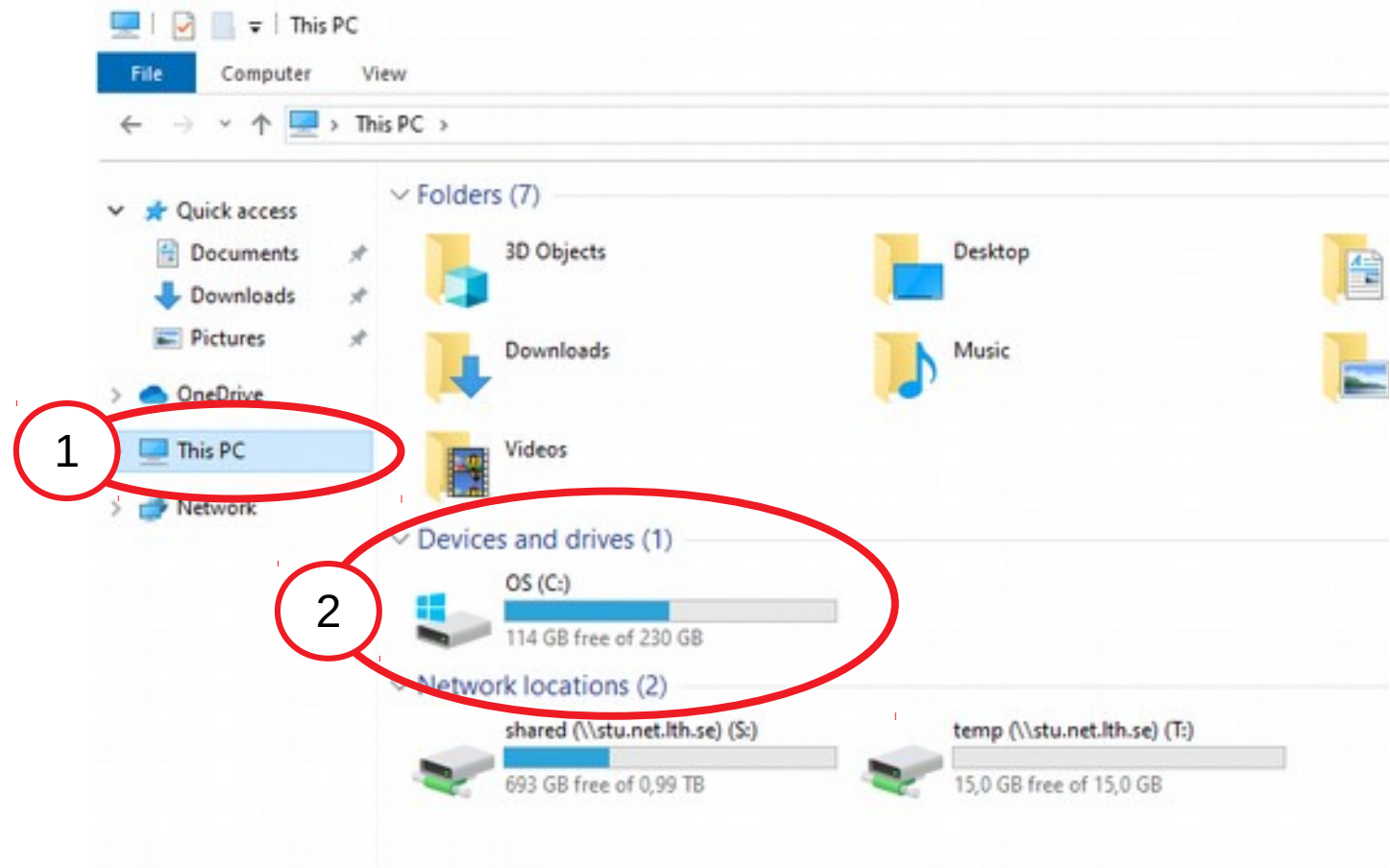
Preparing the course VM in the lab

- 3.1. In this order, double click on the folders:
"Courses", "fysik", "MNXB01"
- 3.2. Select (left click) the folder LubuntuVM
- 3.3. Right click on the folder, select and click "copy"



Preparing the course VM in the lab

4. From "This PC" (1) double click on the storage unit OS (C:) (2)

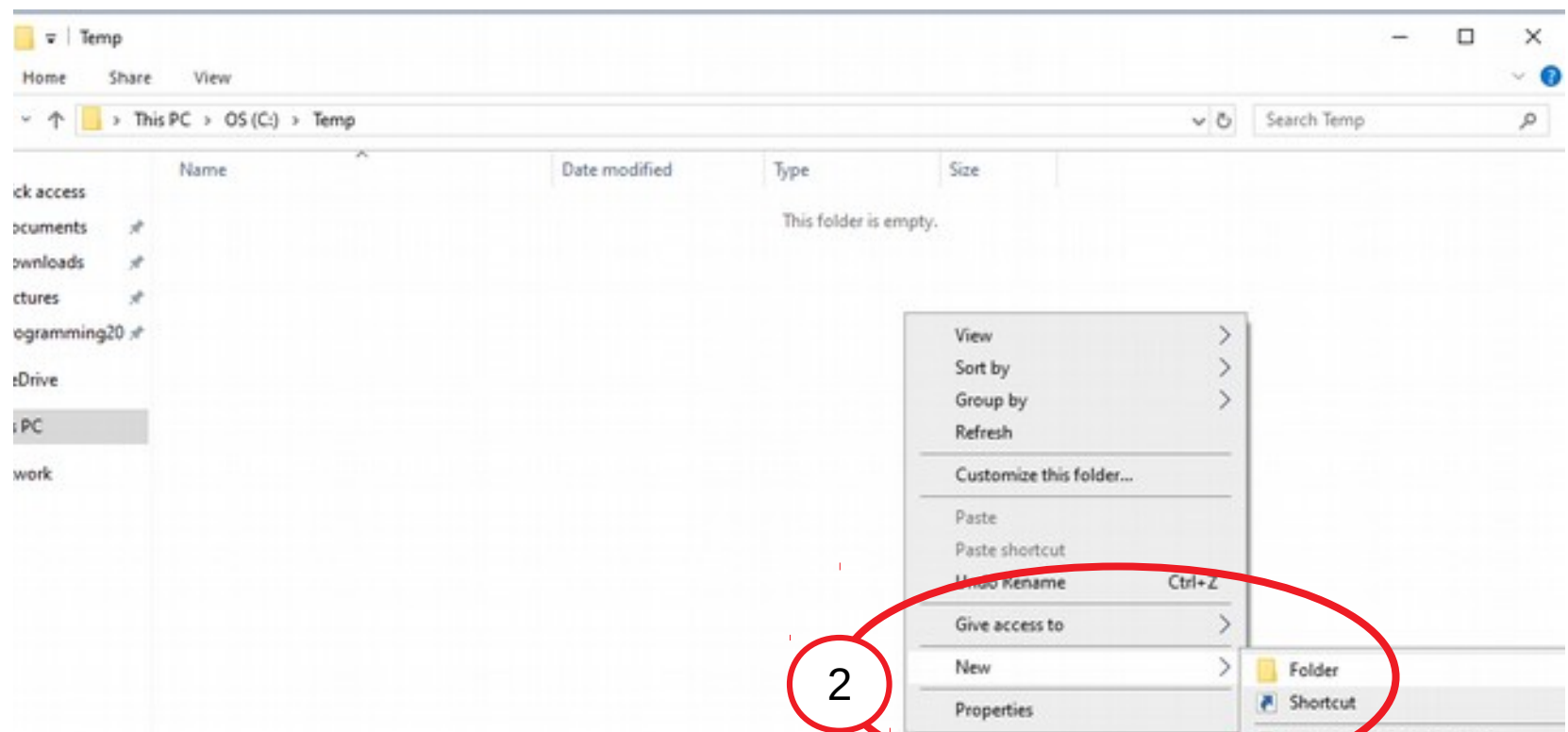


Preparing the course VM in the lab

5.1 Click on the folder TEMP

5.2 Right click on the white space in the TEMP folder, a menu will appear. Select "New" and then click on "Folder"

5.3 Type the folder name **MNXB01** and press ENTER



Preparing the course VM in the lab

6.1 Double click on the newly created folder MNXB01.

6.2 Right click in the white space in the folder MNXB01, select and click on "Paste"

The virtual machine files are now being copied. Once the copy is done, you're ready to go back to slide 6

