MNXB01-2016

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



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



States



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



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Hardware: electronic components of a computer



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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...



- 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)

Ma	chine Help		Select a virtual machine file
0	New	Ctrl+N	
r 🔂	Add	Ctrl+A	Search LubuntuVM > - + Search LubuntuVM >
0.0	ocangs	carro	Organize 🔻 New folder
Ģ	Clone	Ctrl+0	
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æ	Group	Ctrl+U	Desktop
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\bigtriangledown	Close		
ъ	Discard Saved State	Ctrl+J	Ca Libraries
周	Show Log	Ctrl+L	Documents
A	Refresh	Stri' E	J Music
0	(tenes)		New Library
	Show in Explorer		Pictures
S	Create Shortcut on Desktop		Videos
Ð	Sort		Homegroup

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?

😚 Oracle VM VirtualBox Manager		
File Machine Help	😳 MyLubuntuVM - Settings	? <mark>x</mark>
New Settings Discard Start	General General	
LubuntuVM (20150930) Powered Off Name: MyLui Operating System: Ubun	Basic Advanced Description Encryption	
Powered Off Setting	Display Name: MyLubuntuVM	
Clone	Storage Type: Linux	- 2
Group	Audio	_
Start Pause	Network	
© Reset ↓ Close	Serial Ports	
Discard Saved State	USB USB	
Brefresh	Shared Folders	
Show in Explorer Create Shortcut on Desktop	User Interface	
Sort		
Display the virtual machine settings window	OK	el <u>H</u> elp

Enable PAE and NAT

😳 LubuntuVM - Settings	2 - 2	
General System Display Storage Audio Network Serial Ports USB Shared Folders	Acceleration 4 CPUs 4 CPUs 100 ÷ 100% 100% 100% 100% 100% 100% 100% 100% 100 ÷ 100% 10	35 Network Adapter 1 Mapter 2 Adapter 3 Adapter 4 Fnable Network Adapter Attached to: NAT Name: Advanced OK Can
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Ex. 3: Start the machine

Click on the Start arrow.



VirtualBox interface explained 2



Ex. 4: First steps in lubuntu usage

Login using the user name courseuser and password coursepassword



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sf	f_LubuntuVM shared					
- 10						
۱۲ ا	Graphics		Applications			
⊕ ₽	Internet Office					
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Organization of files in Linux

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32 items		[courseuser@Lub	courseuser	_							Free space: 24,2 Gi	iB (Total: 27,9 GiB)

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

Organization of files in Linux

i				courseuse	r						- + ×
File Edit View Bookmarks Go Tools H	lelp										
F < > > < in /home/courseuser											3
Directory Tree											
Videos								E	- ÷	99	
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▶ 🛅 mnt											
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the filesystem "root": / Home directory: /home/courseuser

Ex. 5: Logout dialog: Shutdown

5.1 Poweroff the machine.



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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:

Create	2 Virtual Machine
Name	and operating system
Please of type of be used	hoose a descriptive name for the new virtual machine and select the operating system you intend to install on it. The name you choose will throughout VirtualBox to identify this machine.
<u>N</u> ame:	MyLubuntuVM
<u>Type</u> :	Linux 👻 🏏
Version:	Ubuntu (32-bit)
	Hide Description Next Cancel

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)

	? ×			?
Create Virtual Hard Drive		Create Virtual Hard Driv	re	
Hard drive file type		Storage on physical	hard drive	
Please choose the type of file that you would like you do not need to use it with other virtualization unchanged.	to use for the new virtual hard drive. If software you can leave this setting	Please choose whether the allocated) or if it should be	e new virtual hard drive file sh created at its maximum size (ould grow as it is used (dynamically fixed size).
VDI (VirtualBox Disk Image) VMDK (Virtual Machine Disk)	ц.	A dynamically allocate it fills up (up to a maximum space on it is freed.	d hard drive file will only use s fixed size), although it will n	pace on your physical hard drive as ot shrink again automatically when
 VHD (Virtual Hard Disk) 		A fixed size hard drive file	e may take longer to create or	n some systems but is often faster
HDD (Parallels Hard Disk)		Dynamically allocated		
QED (QEMU enhanced disk)		Eixed size		
QCOW (QEMO Copy-on-write)				
Hide De	escription Next Cancel			Next Cancel
	6.5			6.6
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Ex. 6: Create a virtual machine -Missing boot device

	? ×
Select start-up disk	
Please select a virtual optical disk file or a physical optica containing a disk to start your new virtual machine from.	l drive
The disk should be suitable for starting a computer from contain the operating system you wish to install on the v if you want to do that now. The disk will be ejected from drive automatically next time you switch the virtual mach you can also do this yourself if needed using the Devices	and should irtual machine the virtual nine off, but s menu.
Host Drive 'D:'	•
Start	Cancel

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.



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

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.
Host Drive 'D:' 🔹 🔀
Start Cancel



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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



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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
 -





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Popular Linux distributions

- Debian, community based ubuntu debian
 - 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





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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)
- 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..."



e) Remember the above location!

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

PC 32bit Standard image disc

* 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

🔋 Oracle	e VI	M Virt	ualBox Manager						
File M	lack	nine	Help						
5mz	6) Myl	LubuntuVM - Set	tings		?	X		
New S			General	Storage				shots 2, itty.exe	
22			System	Storage Tree	Attributes			E A	
			Display	Controller: IDE	Optical Drive:	IDE Secondary Master			
1			0	Empty		Live CD/DVD		Choose Virtual Optical Disk File 2	
		2	storage	😤 Controller: SATA	Information			Hox Brite 'Br'	
			Audio	MyLubuntuVM.vdi	Size:	-		lubuntu-14.04.1-desktop-i386.iso	
		P	Network		Location:			ubuntu-14.04.1-desktop-i386.iso	
			C		Attached to:	-		Remove Disk from Virtual Drive	
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		Ø	USB						
			Shared Folders						
		:	User Interface						
				6 🖬 🕹 🕹					
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		-					_		
				Host Driver: Windows DirectSound Controller: ICH AC97					
				P Network				•	

Ex. 7: Install Lubuntu in MyLubuntuVM7.2 Select the ISO file downloaded



Ex. 7: Install Lubuntu in MyLubuntuVM7.2 Select the ISO file downloaded

😳 Myl	L <mark>ubuntuVM -</mark> Set	tings		? ×
	General	Storage		
	System	Storage Tree	Attributes	
	Display	Controller: IDE	Optical <u>D</u> rive:	IDE Secondary Master 🔻 🧿
	Storage	Controller: SATA	Information —	Live CD/DVD
	Audio	MyLubuntuVM.vdi	Type:	Image
₽	Network		Location:	C:\VirtualBox\ubuntu-14.04.3-de
	Serial Ports		Attached to:	-
Ø	USB			
	Shared Folders			
	User Interface			
		🗟 🗖 😓		
			4 ок	Cancel <u>H</u> elp

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

7.3 Select and Start the virtual machine.



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

🚰 LubuntuVM [Running] - Oracle VM VirtualBox			. 😰	LubuntuVM [Runnin	g] - Oracle VM Virt	tualBox			
Machine View Devices Help	P	Machine View Dev	rices Help						
Lar	nguage					Keym	ар	-	
Аларіс Français Arabic Gaeilge Asturianu Galego Беларуская Gujarati Български Лייוש Bengali Hindi Tibetan Hrvatski Bosanski Magyar Català Bahasa Indonesia Čeština Íslenska Dansk Italiano Deutsch 日本語 Dzongkha Jანდული Eλληνικά English Esperanto Español 한국어 Eesti Kurdî Euskara Lao Jurus Lietuviškai Suomi Latviski	nguage Maкедонски Malayalam Marathi Burmese Nepali Nederlands Norsk bokmål Norsk nynorsk Punjabi (Gurmukhi) Polski Português do Brasil Português Română Pycckий Sámegillii జားစစာ Slovenčina Slovenščina Shqip Српски Svenska F5 Accessibility F6 O	Tamil ヴ ² シンXン Thai Tagalog Türkçe Uyghur Українська Tiếng Việt 中文(简体) 中文(簡体) 中文(繁體)		Afghani Albanian Amharic Arabic Armenian Asturian Austria Azerbaijani Bambara Belarusian Belgian Bengali Bosnia Brazil Bulgarian Burmese Cameroon Canada Catalan Chinese Congo F1 Help F2 Lang	Croatian Czech Danish Dhivehi Dutch Dvorak Dzongkha Esperanto Estonian Faroes Filipino Finnish French Georgian German Ghana Greek Guinea Gujarati Gurmukhi Het rew uage F3 Keyr	Hungarian Icelandic Indian Iraqi Irish Italian Japanese Kannada Kazakh Kenya Khmer Korean Kurdish Kyrgyz Lao Latin Amer. Latvian Lithuanian Macedonian Malayalam Malese nap [4 Modes	Maori Mongolian Montenegrin Morocco Nepali Nigeria Norwegian Pakistan Persian Polish Portuguese Romanian Russian Saami (Fin.) Saami (Nor.) Saami (Swe.) Serbian Sinhala Slovak Slovenian South Africa F5 Accessibili	Spanish Swedish Swiss Free Swiss Ger Syria Taiwanese Tajik Tanil Tanzania Telugu Thai Tswana Turkish Turkish Turkish Turkish Turkish K USA USA USA USA Intl. Ukrainian Uzbek Vietnam	Holof

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- 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)

7.5 Select Install Lubuntu and press enter.



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7.6 Click on continue twice

🚰 LubuntuVM [Running] - Oracle VM VirtualBox			P LubuntuVM [Running] - Oracle VM VirtualBox
Machine View Devices Help			Machine View Devices Help
™ Welcome	install		Preparing to install Lubuntu
Čeština Cymraeg Dansk Deutsch Eesti English Español Esparanto Euskara Français Gaeilge	the <u>release notes</u> .	F	For best results, please ensure that this computer: has at least 4.5 GB available drive space is plugged in to a power source is connected to the Internet Download updates while installing Lubuntu uses third-party software to play Flash, MP3 and other media, and to work with some graphics and wi-fi hardware. Some of this software is proprietary. The software is subject to license terms included with its documentation. Install this third-party software Fluendo MP3 plugin includes MPEG Layer-3 audio decoding technology licensed from Fraunhofer IIS and Technicolor SA.
a	• • • • • • •	Quit Bac Continue	Continue
	III.	👂 📀 🖉 🗐 📾 🔟 🛛 🚱 🖲 HÖGER CRTL	<

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



LubuntuVM [Running] - Oracle VM VirtualBox

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

	Install	
Who are yo	ou?	
	Your name: courseuser Your computer's name: Lubuntu-VirtualBox The name it uses when it talks to other computers. Pick a username: courseuser Choose a password:	_
	Confirm your password: Log in automatically Require my password to log in Encrypt my home folder	
	Back	Continue
	"" 🔯 😪 🌽 🖶 🚍 🖷	🔟 🚫 💽 HÖGER
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Ex. 7: Install Lubuntu in MyLubuntuVM 7.11 Let's wait for installation to complete!



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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

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!



Programming Course

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

sf_LubuntuVM shared			
	GDebi Package Installer		
II' Accessories	Lubuntu Software Center		
Graphics	Network		
Internet	C Printers		
Office	Software Updater		
A Programming	 Startup Disk Creator 		
际 Sound & Video	Synaptic Package Manager		
🖵 System Tools	System Profiler and Benchmark	install, remove and upgrade sortware packages	
Preferences	, Task Manager		
Run	Ime and Date		
	Users and Groups		
Logout	2 UXTerm		
🔊 🗈 🚰 🎦 🗂	🗂 📔 🐸 XTerm		()) 53 💈 🏥 🕇

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Programming Course

Tutorial 1a

Ex. 8.1: Installing software from repositories

Adding software requires superuser privileges

Authentication - + ×	
Authentication is required to run the Synaptic Package Manager Identity: courseuser ‡	
Password:	
X Cancel VOK	

F	Synaptic Package Manager	
File Edit Package Settings	Help	
C 🔊	des Apply Properties	
All	S Package Search for packages	Latest
Amateur Radio (universe)	Oad Oad	0.0.15+0
Communication	🗌 0ad-data	0.0.15-1
Communication (multivorce	Oad-data-common	0.0.15-1
Sections	Oad-dbg	0.0.15+0
Status	No package is selected.	
Origin		
Custom Filters		
Search Results		
Architecture		
45085 packages listed, 1158 in	stalled, 0 broken. 0 to install/upgrade, 0 to remove	
	🔚 Synaptic Package 🜒 🗵 💈 🏥 🔃	11:30 ()

E	Synaptic Package Manager	
File Edit Package Settings I	Help	
C 💽 Reload Mark All Upgrad	les Apply Properties	Q Search
All	S Package	Installed Version Latest
Amateur Radio (universe)	🔚 Find ·	- + × 0.0.15+c
Communication	Search: uistualbay	0.0.15-1
Communication (multivorse	Search: Vircuatox	0.0.15-1
Sections	Look in: Description and Nam	e ▼ 0.0.15+c
Status	X Cancel S	earch
Origin		2
Custom Filters		
Search Results		
Architecture		
45085 packages listed, 1158 ins	stalled, 0 broken. 0 to install/upgra	de, 0 to remove
🔊 🗈 🚰 🗖 🗖 🕻	Synaptic Package	(1) 🖬 🔋 🎰 📬 11:31 🕛

	Synaptic Package Manager	
File Edit Package Settings	Help	
C 🔊	des Apply Properties	Q Search
All	S Package I	nstalled Version Latest
virtualbox	virtualbox-guest-additions-isc	4.3.10-1
	virtualbox-guest-dkms	4.3.10-d
	virtualbox-guest-source	4.3.10-d
Sections	virtualbox-guest-utils	4.3.10-d
	virtualbox-guest-x11	4.3.10-d
Status	virtualbox-qt	4.3.10-d
Origin	virtualbox-source	4 3 10-d
Custom Filters	x86 virtualization solution - gu for dkms	est addition module so
Search Results	Get Screenshot Get Changelog	Visit Homepage
Architecture	VirtualBox is a free x86 virtualizatio	n solution allowing a wide
25 packages listed, 1162 insta	lled, 0 broken. 0 to install/upgrade, 0 to	o remove
Á 🗈 🚰 💳 🚺	🔚 Synaptic Package 🜒	53 🕴 🎰 👣 17:36 🕛

	Synaptic Package Manager	
File Edit Package Settings	Help	
C 🖸 Reload Mark All Upgrad	des Apply Properties	Search
All	S Package Insta	lled Version Latest
virtualbox	virtualbox-guest-additions-isc	4.3.10-1
	virtualbox-quest-dkms	4.3.10-d
	C Unmark	4.3.10-d
Sections	Mark for Installation	4.3.10-d
	Mark for Reinstallation	4.3.10-d
Status	Mark for Upgrade	4.3.10-d
Origin	Mark for Removal	4 3 10-d
	Mark for Complete Removal	lition module so
Custom Filters	Properties	
Search Results	Mark Recommended for Installation	mepage
Architecture	Mark Suggested for Installation	
25 packages listed, 1162 instal	led, 0 broken. 0 to install/upgrade, 0 to ren	nove
	🔚 Synaptic Package 📢) 📧	الله 17:36 🖞

E	Synaptic Package Manager	
File Edit Package	synaptic - + ×	
Reload Marl	Mark additional required changes? The chosen action also affects other packages. The	
All	following changes are required in order to proceed.	Latest
VIECOBLOOX	▼ To be installed	4.3.10-1
	binutils	4.3.10-d
	dkms	4.3.10-d
Sections	fakeroot	4.3.10-d
Status	gcc gcc-4.8	4.3.10-d 4.3.10-d
Origin	libasan0	4.3.10-d
Custom Filt	libatomic1	dule so
Search Rest	🗙 Cancel 🗸 Mark	
Architectu	K	a wide
25 packages listed, 1162 ins	stalled, 0 broken. 0 to install/upgrade, 0 to remove	
	Synaptic Package 🜒 🛐 🚊 🏥 📬	17:37 ()

	Synaptic Package Manager	
File Edit Package Settings	Help	
C 📀 Reload Mark All Upgra	des Apply Apply Properties	Q Search
All A	pply all marked changes	Installed Version Latest
virtualbox	virtualbox-guest-additions-isc	4.3.10-1
	✓ virtualbox-guest-dkms	4.3.10-d
	virtualbox-guest-source	4.3.10-d
Sections	virtualbox-guest-utils	4.3.10-d
	virtualbox-guest-x11	4.3.10-d
Status	virtualbox-qt	4.3.10-d
Origin	virtualbox-source	4 3 10-d
Custom Filters	x86 virtualization solution - g for dkms	uest addition module so
Search Results	Get Screenshot Get Changelog	Visit Homepage
Architecture	VirtualBox is a free x86 virtualizati	on solution allowing a wide
25 packages listed, 1162 insta	lled, 0 broken. 19 to install/upgrade, 0	to remove; 59,3 MB will be
	🔚 Synaptic Package 📢) 🛐 🗿 💼 📬 17:37 🕛

	Synaptic Package M	lanager
	Summary	- + ×
2	Apply the following changes?	
f	This is your last opportunity to look through th they are applied.	e list of marked changes before
	▶ To be installed	
	Summary 19 new packages will be installed	Show Details
	59,3 MB of extra space will be used 15,1 MB have to be downloaded	
	Download package files only	Apply all marked changes
		× Cancel × Apply

Ex. 9: Logout dialog: Reboot

9.1 Reboot the machine.

a			courseuser	
File Edit View Bookmarks Go Tools	Help			-
「+ < ▼ > ∧ 📓 /home/courseus	er			
Directory Tree	•			
t III Videos				
* m /	.cache	.config	Cubanca	s Desktor
• 🖬 bin				
• 🛅 boot		N.		
🔸 🛅 cdrom	Public	Templates	Logout Lubuntu 14.04 session ?	.dmrc
🕑 🛅 dev			() Shutdown	
• 🛅 etc			O Shucdown	
• home		a	※ Reboot	
• 🔂 courseuser	vhoxclient	Vauthorit		1 2014-08-1
	seamless.pid	.Xadenone	G Suspend	5x 60302_13
			W Liberate	664_scrot
			* nibernace	Jan 1997
il Accessories			😫 Switch User	
i Graphics				
Internet			Lock Screen	J
			(D) anoth	
			Logout	k.
System Tools			× Cancel	
• Preferences				,
Run				
🖹 Logout				
	ourseuser@Lub	courseuse	r and a second	

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Programming Course

Ex. 10: Software update



Ex 10: Software update

	Software Updater	- + ×
Checking for u	pdates	
	0	Θstop
Finished	\odot	



9

Software Updater

- + ×

Updated software is available for this computer. Do you want to install it now?

▼ Details of updates

Install	Download
Security updates	65,8 MB
🕨 🗹 🔯 Pidgin Internet Messenger	3,3 MB
🗹 🐻 Linux Kernel Headers for developme	ent 799 kB
🕨 🗹 🔕 Lubuntu base	61,7 MB
Other updates	2,3 MB
🕨 🗹 🞑 Software & Updates	1,2 MB
🕨 🗹 🚫 Lubuntu base	1,1 MB

68,2 MB will be downloaded.

Settings...

Remind Me Later

Ex. 11: Customizing the desktop

Customization of the desktop: application shortcuts



Click on "Application Launch Bar" settings

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Programming Course

Ex. 11: Customizing the desktop

Customization of the desktop: application shortcuts



Add LXTerminal to Launchbar

F	lori	do	Pag	ane	lli

Tutorial 1a

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.



What were repositories? Click here for the slide about repositories

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Programming Course

Tutorial 1a

	Software & Updates	- + ×
Ubuntu Software	Other Software Updates Authentication Addition	ional Drivers
Downloadable fro	m the Internet	
Canonical-sup	ported free and open-source software (main)	
Community-m	aintained free and open-source software (universe)	
🛛 Proprietary dr	ivers for devices (restricted)	
Software rest	ricted by copyright or legal issues (multiverse)	
Source code		
Download from:	Server for Sweden	▼
Installable from C	D-ROM/DVD	
To install from a	CD-ROM or DVD, insert the medium into the drive.	
	Revert	× Close
uara 9 Hadatas		



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

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	Software & Updates - + ×	
	Ubuntu Software Other Software Updates Authentication Additional Drivers	
	Canonical Partners Software packaged by Canonical for their partners	
	 The information about available software is out-of-date To install software and updates from newly added or changed sources, you have to reload the information about available software. You need a working internet connection to continue. 	
	C Reload X Close	
	Add Edit – Remove Add Volume Revert X Close	
Software & Updates		 (1)) 53 🖗 🏥 14:46



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§ion=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-linuxalongside.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.**

Programming Course

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/InstallingLub untu
- Lubuntu official documentation / How Tos https://help.ubuntu.com/community/Lubuntu/Documentati on
- 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
- ۲

Backup slides

Ex. 13: Other installation methods Normal user: Lubuntu Software Center

	🔚 GDebi Package Insta	aller
	🔡 Lubuntu Software C	enter
ii Accessories	Network	Lets you choose from thousand
L Graphics	Printers	of applications available for
Internet	› 🛄 Software Updater	
Office	🔸 🖄 Startup Disk Creato	r and a second
時 Sound & Video	🔸 🔚 Synaptic Package M	anager
System Tools	, 🖃 System Profiler and	Benchmark
Preferences	开 🏧 Task Manager	
	📰 Time and Date	
RUN	晶 Users and Groups	
Logout	UXTerm	
🔊 🗈 🖬 🖬 🗖	🛾 🎦 XTerm	

Ex. 13: Other installation methodsInstalling Geany editor

1	Lubuntu Software Center		- +	×
<	Get Software Installed Software Apps Basket	Q, IDE	∞	₽
🔊 s	Searching in All	5	Show at least 20 results	•
	Code::blocks ide Configurable and extensible IDE			
	Drracket IDE for Racket			
	Ecere ide Ecere IDE			
	Eric python ide Full featured Python IDE			
	Faustworks IDE for Faust dsp programming language			
60	Geany A fast and lightweight IDE using GTK2			
Ian	Lazarus (1.0.10) Lazarus IDE (1.0.10)			
ъ Р	Mcu 8051 ide Graphical IDE for MCS-51 based microcontrollers			
Selec	elected package 'geany'	i Information	Add to the Apps Basi	ket
2	💫 💼 🚰 🚞 🔚 🧊 Lubuntu Softwar 🕌 [Software Updater]	4) 59 🛛 🛄 13:34	0

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Ex. 13: Other installation methodsInstalling Geany editor

2			Lubuntu Software Center			+ ×
< ✓ Get Software	ftware 2A	pps Basket	(1)	Q IDE	\otimes	₽
? Apps Basket						
Package	To Download	To Install	Version			
Geany	1 070 k	2 603 k	1.23.1+dfsg-1			
geany-common (requested by geany)	2 709 k	7 202 k	1.23.1+dfsg-1			



Programming Course

Ex. 13: Other installation methodsInstalling Geany editor

8			Lubuntu Software Center	- +	×
 ✓ Get Software O Installed Software 	tware ?A	pps Basket	1) Q IDE		¢
? Apps Basket					
Package	To Download	To Install	Version		
Geany geany-common (requested by geany) 2	1 070 k 2 709 k	2 603 k 7 202 k	1.23.1+dfsg-1 1.23.1+dfsg-1		
			Authentication - + × To install or remove software, you need to authenticate. Identity: courseuser Password: COURSepassword		
			X Cancel		
1 package marked 2 770 k to download	0.00E k to incl	tall		Discased Install Daskage	



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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.



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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



