

ICTP DP Linux Basic Course - UNIX/Linux

ESP Students - First Semester

Graziano Giuliani
ggiulian@ictp.it

The Abdus Salam International Centre for Theoretical Physics

ICTP Diploma Program
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Course Outline ¹

Daily program

- **UNIX/Linux**

- ① The Computer and Programming
 - ② The Operating System
 - ③ Installing Linux OS
- Basic CLI in Linux
- Programming on Linux
- Text file manipulation
- Basic BASH and Python

Slides:

<http://tinyurl.com/2jsvfbd6>

or the \LaTeX source on GitHub:

<https://github.com/graziano-giuliani/LinuxBasics>

¹Course created in 2019 with Adriano Angelone, now LPTMC-FR

The computer is a machine.

Who is doing the work?

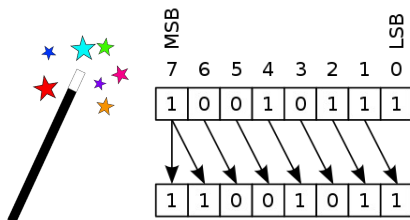
- A machine is a physical system using power to apply forces and control movement to perform an action.
- A digital bit is the minimal amount of information representing a logical state of a system with two possible values [0-1]
- A computer is an electronic digital machine carrying out logical operations on binary bits of information
- Switching a bit is an action and work must be done on the system to change it



Computer Programming

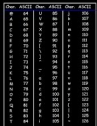
System status and bits

- The status of the computer system is a string of *bits*.
- A computer program is a sequence of instructions modifying the status. The initial status is called the *input*, the final state is the *output* of the program.
- The instructions are bit patterns themselves, following conventions defined by the producer of the *Processor*, which translates operation codes into action on bits.
- All the information is registered in the computer using *bits*.



Information Coding

From letters to bit patterns

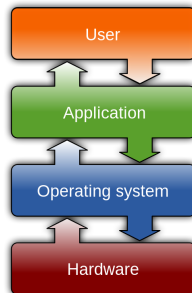
ASCII Code			
			
B	→	1000010	
L	→	1101100	
V	→	1110101	
e	→	1100101	

- The information is CODED : a → 01100001
- There are codes for
 - Characters
 - Exact Integer numbers
 - Approximate representation of Real numbers
- Special units in the processor can perform
 - Character string manipulation
 - Arithmetic operation
 - Mathematical complex evaluation

The operating System

The origin of UNIX

- Hardware
 - CPU, GPU, Motherboard, Cabling, Power
- User
 - Keyboard, Mouse, Monitor, etc
- Software
 - Application, Operating system



- 1969 - Multi-Tasking Multi-User Unix AT&T
- 1991 - Free Unix OS for Intel X86 (Linux)

By Peter Hamer: Ken Thompson (sitting) and Dennis Ritchie
at PDP-11 Magnus Manske, CC BY-SA 2.0

The UNIX Philosophy

Why UNIX is such a good idea

- 1 Make each program do one thing well.
- 2 Expect the output of every program to become the input to another.
- 3 Purpose of computation is data transformation

... at its heart is the idea that the power of a system comes more from the relationships among programs than from the programs themselves. Many UNIX programs do quite trivial things in isolation, but, combined with other programs, become general and useful tools. ...

The UNIX Programming Environment, Brian Kernighan and Rob Pike, 1984

The Linux Revolution

Why a free OS is a good idea

```
From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)
Newsgroups: comp.os.minix
Subject: What would you like to see most in minix?
Summary: small poll for my new operating system
Message-ID: <1991Aug25.205708.9541@klaava.Helsinki.FI>
Date: 25 Aug 91 20:57:08 GMT
Organization: University of Helsinki
```

Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat (same physical layout of the file-system (due to practical reasons) among other things).

I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)

Linus (torvalds@kruuna.helsinki.fi)

PS. Yes - it's free of any minix code, and it has a multi-threaded fs. It is NOT protable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-).

The Free Software Movement

Free Software as in Freedom

The Freedom to

- run the program as you wish, for any purpose
- study how the program works, and change it as you wish
- redistribute copies so you can help others
- distribute copies of your modified versions to others



Linux architecture

Linux is the kernel and we do not hate it!



- The Linux kernel is a program that loads all the other programs and supervise the resources allocated to each one of them, providing locking and I/O services.
- The system services (*daemons*) are programs running on the system and providing facilities that allow or enhance access to system resources.
- User programs are controlled interactively or through batch job submission system by physical users concurrently accessing system resources through a multi tasking sharing of the CPU(s).

Install Linux OS

A Linux Distribution

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Server

IoT

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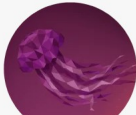
The open-source desktop operating system that powers millions of PCs and laptops around the world. Find out more about Ubuntu's features and how we support developers and organisations below.

[Ubuntu Desktop homepage](#) [Visit the Ubuntu Desktop blog](#)

Ubuntu 22.04.2 LTS

The latest LTS version of Ubuntu, for desktop PCs and laptops. LTS stands for long-term support — which means five years of free security and maintenance updates, guaranteed until April 2027.

[Ubuntu 22.04 LTS release notes](#)



Install Free Software on MacOS

HomeBrew



Homebrew

The Missing Package Manager for macOS (or Linux)

English

Follow me on GitHub

Install Homebrew

```
$ /bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"
```

Paste that in a macOS Terminal or Linux shell prompt.

The script explains what it will do and then pauses before it does it. Read about other [installation options](#).

What Does Homebrew Do?

Homebrew installs **the stuff you need** that Apple (or your Linux system) didn't.

```
$ brew install wget
```

Install Free Software on Windows

WSL - Windows Subsystem for Linux

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Install Linux on Windows with WSL

Article • 01/12/2023 • 8 contributors

Feedback

Developers can access the power of both Windows and Linux at the same time on a Windows machine. The Windows Subsystem for Linux (WSL) lets developers install a Linux distribution (such as Ubuntu, OpenSUSE, Kali, Debian, Arch Linux, etc) and use Linux applications, utilities, and Bash command-line tools directly on Windows, unmodified, without the overhead of a traditional virtual machine or dualboot setup.

Prerequisites

You must be running Windows 10 version 2004 and higher (Build 19041 and higher) or Windows 11 to use the commands below. If you are on earlier versions please see [the manual install page](#).

Install WSL command

You can now install everything you need to run WSL with a single command. Open PowerShell or Windows Command Prompt in **administrator** mode by right-clicking and selecting "Run as administrator", enter the `wsl --install` command, then restart your machine.

PowerShell

Copy

```
wsl --install
```

In this article

Prerequisites

Install WSL command

Change the default Linux distribution installed

Set up your Linux user info

Show more ▾

Install Linux

Let's try install

