

Topic 1

Introduction to GNU/Linux

Dr Diarmuid Ó Briain

20 May 2022



License



This work is licensed under a Creative Commons
Attribution-ShareAlike 4.0 International License.
Full License: <http://creativecommons.org/licenses/by-sa/4.0>

Learning objectives

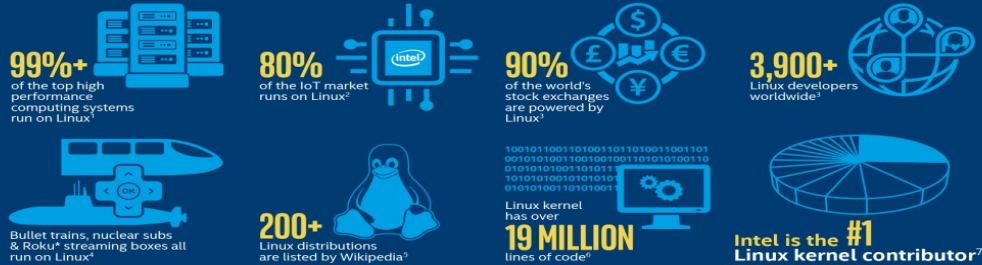
- GNU/Linux General Background
- Server vs Desktop
- Debian vs Ubuntu
- The Linux Foundation

GNU/Linux General Background



What runs on linux

LINUX* BY THE NUMBERS



Free Software (a.k.a. Open Source)

- guarantees these four freedoms to the user:
 - **use** for any purpose.
 - **study** and **adapt** to personal needs*.
 - **copy** and **share** with your neighbour.
 - **distribute** modified copies*.

(*) access to the source code is a precondition for this.

INSPIRING FUTURES

setu.ie | 6

Richard Stallman

"I discovered that a company that had supplied a new printer for the laboratory where I was working did not want to give me the driver source code. All I wanted was to modify it so that the printer would automatically alert me when the paper was jammed. The company refused to provide the source code."



Richard Stallman

setu.ie | 7

INSPIRING FUTURES

What is FSF?

- Companies began to restrict access to source code in 1970s.



- Richard Stallman founded the Free Software Foundation (FSF) in October 1985 to support the free software movement, which promotes the universal freedom to create, distribute and modify computer software.

INSPIRING FUTURES

setu.ie | 8

- **Freedom 0**
 - The freedom to be able to use the program for any purpose.
- **Freedom 1**
 - The freedom to study how the program works and adapt it.
 - Access to the source code is a pre-requisite for guaranteeing this freedom.
- **Freedom 2**
 - The freedom to freely distribute copies of the software.
- **Freedom 3**
 - The freedom to improve the program and to make improvements public, for the benefit of the entire community.
 - Access to the source code is also a pre-requisite for guaranteeing this freedom.

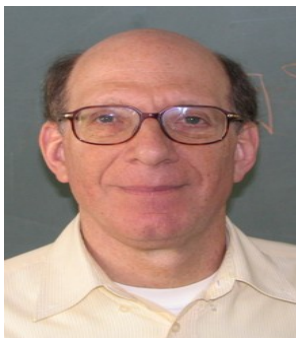
What is GNU?

- GNU recursive acronym for "GNU's Not Unix!".
- Unix-like, but differs from Unix by being free software and containing no Unix code.
- Based on the **GNU Hurd Kernel**.
- GNU General Public License (GPL)
 - Gives users freedom to share and change free software.
- GNU Lesser General Public License (LGPL)
 - Written for the GNU C Library to allow it to be linked with proprietary software.
- GNU Free Documentation License (FDL)
 - GPL for documentation.



What is MINIX?

- Unix-like computer operating system based on a microkernel architecture, a small modular part of an operating system kernel which implements its basic features.
- Created by **Andrew S. Tanenbaum** at Vrije Universiteit Amsterdam for educational purposes.
- First released in 1987, with its complete source code made available to universities for study in courses and research.
- It has been free and open-source software since it was re-licensed under the BSD license in April 2000.



Andrew S. Tanenbaum

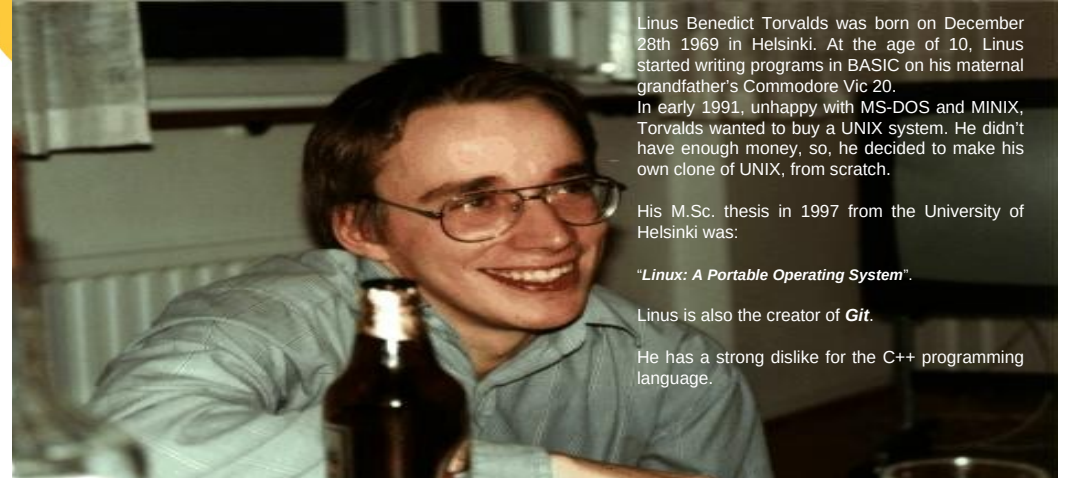
What is a Microkernel?

- A operating system that only manages the: Central Processing Unit (CPU), memory, and Inter-Process Communication (IPC).
 - Everything else is handled in user mode.
- | | |
|---|--|
| <ul style="list-style-type: none"> • Pros <ul style="list-style-type: none"> – Portability – Small install footprint – Small memory footprint – Security | <ul style="list-style-type: none"> • Cons <ul style="list-style-type: none"> – More HW abstraction – HW slower as the drivers are in user mode – Processes have to wait in a queue for information – No IPC without waiting |
|---|--|

What is a Monolithic kernel?

- An operating system that manages the: CPU, memory, IPC plus device drivers, file system management and system server calls.
- **Pros**
 - More direct access to HW
 - IPC
 - Devices that work do not require additional SW
 - Faster process reaction as no waiting
- **Cons**
 - Large install footprint
 - Large memory footprint
 - Less secure as everything runs in kernel mode

Linus Torvalds



Linus Benedict Torvalds was born on December 28th 1969 in Helsinki. At the age of 10, Linus started writing programs in BASIC on his maternal grandfather's Commodore Vic 20. In early 1991, unhappy with MS-DOS and MINIX, Torvalds wanted to buy a UNIX system. He didn't have enough money, so, he decided to make his own clone of UNIX, from scratch.

His M.Sc. thesis in 1997 from the University of Helsinki was:

"Linux: A Portable Operating System".

Linus is also the creator of **Git**.

He has a strong dislike for the C++ programming language.

Ref: https://www.cs.helsinki.fi/u/kutvonen/index_files/linus.pdf

Origin of Linux?

From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)
Newsgroups: comp.os.minix
Subject: What would you like to see most in minix?
Date: 25 Aug 91 20:57:08 GMT

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 :-).

Tanenbaum-Torvalds

- Tanenbaum criticised Linux when he argued that microkernels are superior to monolithic kernels in a post on **comp.os.minix**, in 1992, and therefore Linux was obsolete.
- Torvalds responded by arguing that MINIX has inherent design flaws such as the lack of multithreading.
- The debate continued over and back until about 2004.
- The debate has sometimes been considered a flame war.

GNU/Linux monolithic kernel

- GNU/Linux kernel is monolithic, with the largest footprint and the most complexity over the other types of kernels.
- Linux developers addressed monolithic kernel flaws through kernel **modules** that could be loaded and unloaded at runtime.
- Features can be added or removed at any time.
- This can even go as far as allowing the entire kernel to be replaced without the need to reboot the computer.

GNU/Linux Distributions

Linux Kernel and GNU



Linux
Kernel



GNU
Tools

Linux Primary Distributions



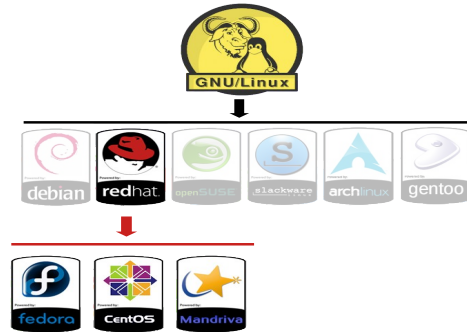
Linux
Kernel



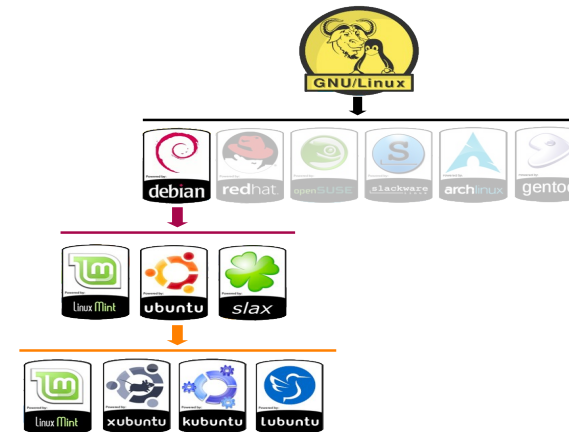
GNU
Tools



Redhat Linux derivatives



Debian Linux derivatives



Server vs Desktop Debian vs Ubuntu



Server vs Desktop

- **Server – Headless mode**
 - No Desktop Environment
 - Applications focused on providing daemons (applications).
- **Desktop**
 - Application focused on the host machine
 - Desktop Environment
 - Office productivity suite
 - Multimedia software
 - Web browser and applications.

Debian vs Ubuntu

- Debian is a **lightweight stable** Linux distribution upon which Ubuntu is based.
- The desktop version of Ubuntu is much easier to install and use, particularly for beginners.

- Ubuntu, by default, choices are pre-made and simply works:



- “expert mode” lets the installer edit and configure as required



- By default, both Ubuntu and Debian Desktop versions install the GNU Network Object Model Environment version 3 (**GNOME3**) desktop environment
- Other optional Desktop environments are available.

Debian Server vs Ubuntu Server

- Choose the correct distribution for the requirements
 - **Enterprise** environment, **Debian** is more stable and more secure
 - If the **latest releases of all software** is a necessity, use Ubuntu.



Debian Versions



Version	Code name	Release	Status	End of Life
Debian 13	Trixie	Future		
Debian 12	Bookworm	Future		
Debian 11	Bullseye	14 Aug 2021	Current 'Stable'	30 Jun 2026
Debian 10	Buster	06 Jul 2019	LTS	30 Jun 2024
Debian 9	Stretch	17 Jun 2017	LTS	30 Jun 2022
Debian 8	Jessie	26 Apr 2015	Extended LTS	30 Jun 2022

- Long Term Support (LTS)
 - At least 5 years from release date



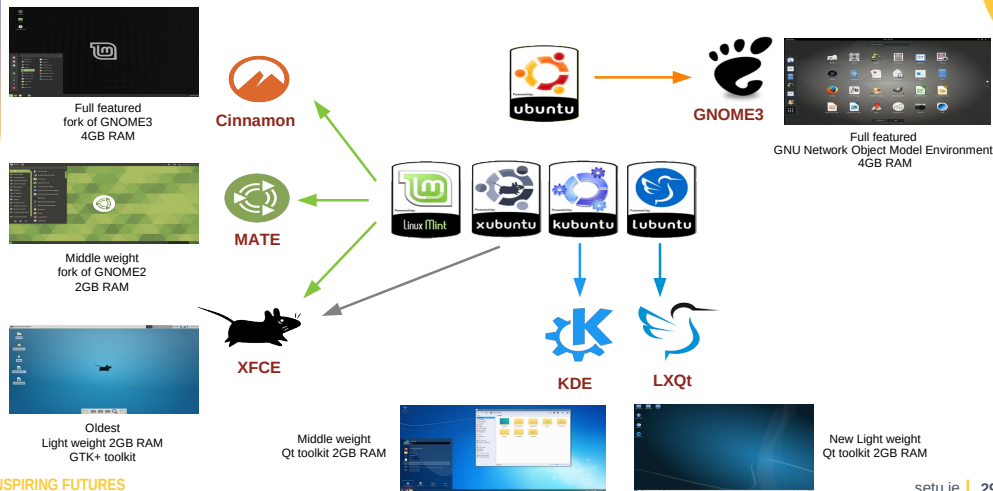
Ubuntu Versions



Version	Code name	Release	End of support	End of Life
Ubuntu 22.10	Kinetic Kudu	20 Oct 2022	TBA	
Ubuntu 22.04 LTS	Jammy Jellyfish	21 Apr 2022	Apr 2027	Apr 2032
Ubuntu 21.10	Impish Indri	14 Oct 2021	TBA	Jul 2022
Ubuntu 21.04	Hirsute Hippo	22 Apr 2021	TBA	Jan 2022
Ubuntu 20.10	Groovy Gorilla	22 Oct 2020	Jul 2021	Jul 2021
Ubuntu 20.04 LTS	Focal Fossa	23 Apr 2020	Apr 2025	Apr 2030
Ubuntu 19.10	Eoan Ermine	17 Oct 2019		Jul 2020
Ubuntu 19.04	Disco Dingo	18 Apr 2019		Jan 2020
Ubuntu 18.10	Cosmic Cuttlefish	18 Oct 2018		Jul 2019
Ubuntu 18.04 LTS	Bionic Beaver	26 Apr 2018	Apr 2023	Apr 2028

- Long Term Support (LTS)
 - Desktop – 3 years
 - Server – 5 years

Ubuntu family – Desktop Environments

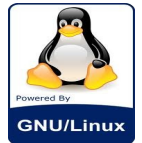


Linux Documentation

- The Linux Documentation Project
 - Manuals, HOWTOs, FAQs etc.
 - <https://www.tldp.org>
- LINUX.COM
 - Repositories of all things Linux
 - <https://www.linux.com>
- **Slashdot**
 - News for nurds, stuff that matters.
 - <https://slashdot.org>



<https://www.linux.org>



setu.ie | 30

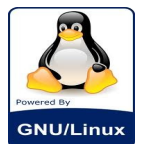
The Linux Foundation



www.linuxfoundation.org



- Non-profit technology consortium founded in 2000.
- A merger between Open Source Development Labs and the Free Standards Group to:
 - Standardise Linux
 - Support its growth
 - Promote its commercial adoption.



setu.ie | 32



Exercise #1: Explore Opensource and GNU/Linux



Exercise #1

- Visit and browse the following websites:
 - <https://www.linuxfoundation.org>
 - <https://www.fsf.org>
 - <https://linux.org>
 - <https://www.linux.org/forums>
 - <https://www.linux.com>
 - <https://slashdot.org>
 - <http://www.tldp.org>
 - <https://ubuntu.com>
- Register to at least one GNU/Linux forum

Learning outcomes

- GNU/Linux General Background ✓
- Server vs Desktop ✓
- Debian vs Ubuntu ✓
- The Linux Foundation ✓

The slide has a blue and green gradient background. In the top right corner is the SETU logo, which consists of a stylized 'U' made of radiating lines, followed by 'SE TU' in large bold letters, and the full name 'Ollscoil Teicneolaíochta an Oirdheiscirt South East Technological University' in smaller text to the right.

In the center is a white business card for Dr. Diarmuid Ó Briain. The card features the SETU logo on the left, a QR code on the right, and the following text: 'EUR ING Dr Diarmuid Ó Briain', 'Innealtóir Cairte agus Léachtóir', 'D +353 59 917 5426 | E diarmuid.obriain@setu.ie | setu.ie', and 'Campas Bhóthar Chill Chainnigh, Ceatharlach, R93 V960, Éire'.

At the bottom of the slide is the 'engcore' logo in a large, lowercase, sans-serif font, with the tagline 'advancing technology' in a smaller font below it. The 'engcore' logo has a blue circle as the dot for the 'o'.

At the bottom left of the slide is the text 'INSPIRING FUTURES' in yellow. At the bottom right is the text 'setu.ie | 38'.