Unix? GNU? Linux? POSIX? GNU/Linux? What are they?

A short history of POSIX (Unix-like) operating systems



image from gnu.org

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Mohammad Akhlaghi

Centro de Estudios de Física del Cosmos de Aragón (CEFCA), Teruel, Spain (founder of GNU Astronomy Utilities)



Most recent slides available in link below (this PDF is built from Git commit d658621-dirty): http://akhlaghi.org/pdf/posix-family.pdf



Understanding the relation between the POSIX/Unix family can be confusing

Image from shutterstock.com

In the beginning there was ...

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In the beginning there was ...

The big bang!



Fast forward to 20th century...

Early computer hardware came with its custom OS (shown here: PDP-7, announced in 1964)



Fast forward to the 20th century... ($\sim 1970 s)$

- AT&T had a Monopoly on USA telecommunications.
- So, it had a lot of money for *exciting research*!
 - Laser
 - CCD
 - The Transistor
 - Radio astronomy (Janskey@Bell Labs)
 - Cosmic Microwave Background (Penzias@Bell Labs)
 - etc...
- One of them was the Unix operating system:
 - Designed to run on different hardware.
 - C programming language was designed for writing Unix.
- To keep the monopoly, AT&T wasn't allowed to profit from its other research products...
 - ... so it gave out Unix for free (including source).





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Unix was designed to be modular, image from an AT&T promotional video in 1982



https://www.youtube.com/watch?v=tc4ROCJYbm0

User interface was only on the command-line (image from late 80s).



Image from stevenrosenberg.net.

Many organizations started to use Unix, free of charge...

BSD (Berkeley System Distribution):

- Written at University of California at Berkeley.
- A modification and addition to Unix's source (including its kernel).
- BSD was first released on 1974.
- ► BSD is the ancestor of Apple's macOS.



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GNU (GNU is Not Unix)

- Richard Stallman (RMS, from MIT) announced it in 1983.
- GNU behaves like Unix, but written from scratch to be fully free.
- Arguing in favor of the culture of free software (as in "free speech").
- RMS quit MIT and devoted himself to the full re-write of Unix.
- ▶ In the 80s, GNU wrote a free C library, C compiler and shell tools.





By the 1990s, GNU had built most necessary OS components...

GNU's own Kernel (GNU Hurd) was not yet fully developed.

Following the Unix philosophy, GNU wanted it be fully modular, but that was taking too much time.

Linux kernel

- Linus Torvalds (University of Helsinki, Finland) announced it in 1991.
- Linux is a monolithic kernel (complex and highly intertwined).
- Linux only builds with GNU tools (C compiler, C library and etc).
- It was the subject of his MSc thesis.

GNU/Linux operating system

- ► GNU's lower-level and higher-level tools were mature & modular.
- Linux kernel was simple, easy to run and add extensions.
- People ran GNU tools over the Linux kernel and a free OS was born.





GNU/Linux operating systems: GNU Shell and GNU Utilities use the Linux kernel (which can only be built with GNU tools)



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Please call this operating system GNU/Linux, not Linux...

... the kernel is a small fraction of the operating system. ... you don't use the kernel directly.

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Richard Stallman:

"saying 'running Linux' is like saying you are 'driving your carburetor' or 'driving your transmission'."

With GNU/Linux all OS components were free to play with, so diversity/creativity thrived...

- GNU/Linux includes many modular/separate components.
- To simplify the installation for different needs, people Packaged the components into different Distributions.
- Below you can see a few of them, there are MANY MORE!



Image from shutterstock.com



Image from kkslinuxinfo.wordpress.com

Lineage of some GNU/Linux distributions (zoomed on Debian; see full in Wikipedia).





What distinguishes the different distributions is their Package managers

The most prominent difference between the distributions is how they "package" the software.

Debian-based (Debian, Ubuntu, Linux Mint, etc)apt-get

Arch-based (ArchLinux, Hyperbola, Frugalware, Deli Linux) pacman

many more ...

Portable Operating System Interface (POSIX): standards to unify this complex history/lineage

1970

All originated from Unix, but they were slowly starting to diverge.

- IEEE started the POSIX specifications in 1988, enabling inter-operability between the operating systems.
- It has evolved since then (most ► recent specifications in 2017).
- All POSIX OSs have unique features beyond POSIX. but share the POSIX part.

POSIX and "Unix-like" are sometimes used interchangeably.



 $GNU/Linux \ GUIs: \ Graphic \ User \ Interfaces \ (GUIs \ are \ just \ another, \ program, \ which \ you \ can \ change)$

GNU/Linux graphic environments: Xfce



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GNU/Linux graphic environments: KDE



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GNU/Linux graphic environments: Unity (mostly used by Ubuntu)



GNU/Linux graphic environments: GNOME (GNU Network Object Model Environment)



Where does Microsoft (and its Windows) stand in all of this?

- Microsoft started by licensing Unix into its own "Xenix OS", in 1980 and selling it to Intel, IBM and etc.
- For single-user systems, it purchased 86-DOS (calling it MS-DOS). Further work on MS-DOS defined its future growth.
- ▶ In 1985 they released Windows 1.0.
- Microsoft mostly continued with Windows after mid-1990s.
- Some versions of MS-DOS became free software (MIT License) in 2018.





Logo of MS-DOS



Screenshot from Windows 1.0

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Summary

- ▶ (1970s) Unix was created at Bell Labs to be a modular, hardware-independent OS.
- ► (1980s) GNU was a full re-write (to be free) of Unix, with same interface.
- ▶ (1980s) POSIX is an IEEE standard between all OSs originating from Unix.
- (1990s) The Linux kernel was built with GNU tools to be their interface with the hardware.
- (1990s today) MANY GNU/Linux distributions are created for different purposes.
 Each is just a different (in version & configuration) packaging/collection of the same core software.
- These slides are available at http://akhlaghi.org/pdf/posix-family.pdf.

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