INTRODUCTION TO LINUX

Course: SNA
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What is Linux. Timeline of development

- Linux is a free and open source operating system.
- At it's core, the Linux operating system is derived from the Unix OS.
  - Unix was created in the 1960s by Dennis Ritchie and Ken Thompson
  - both of them also invented the C programming language (Unix was rewritten in C in 1973)

AT&T Bell Laboratories

What is Linux. Timeline of development (cont.)

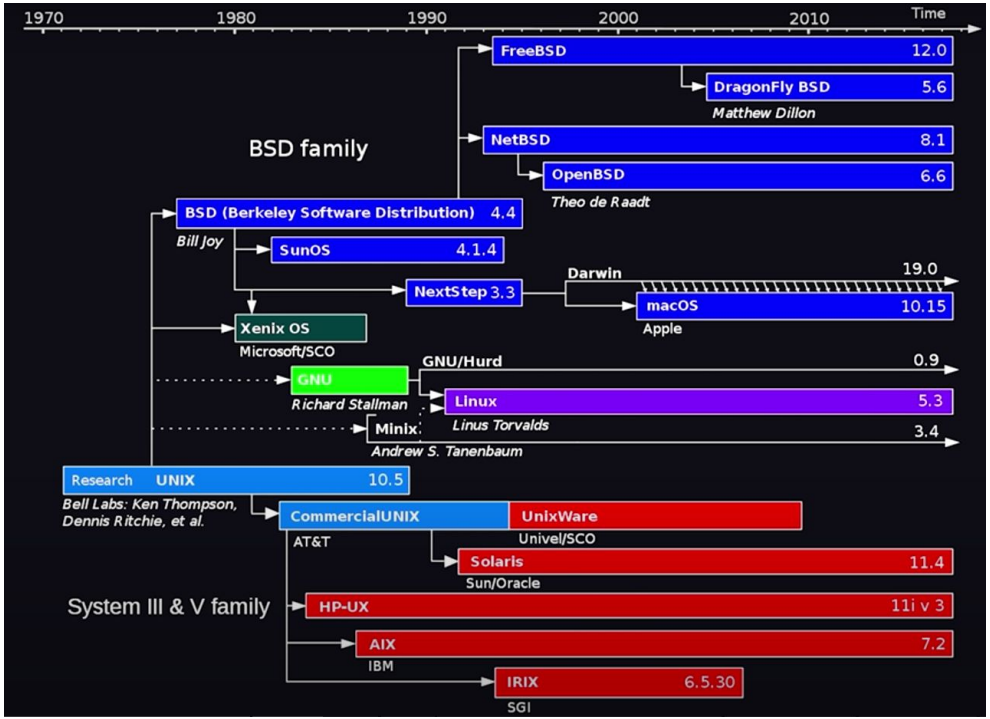
Some Basics of Unix philosophy:

1. Modularity: Write simple parts connected by clean interfaces
2. Clarity: Clarity is better than cleverness
3. Composition: Design programs to be connected with other programs
4. Simplicity: Design for simplicity; add complexity only when you must
5. Transparency: Design for visibility to make inspection and debugging easier
6. Robustness: Is the child of simplicity and transparency
7. Diversity: Distrust all claims for "one true way"
8. Extensibility: Design for the future, because it will be here sooner than you think

What is Linux. Timeline of development (cont.)

- Licensed by AT&T to Berkeley University in 1977
- Improved drivers and services
- Later it was used as base to create Internet stacks, TCP/IP

The original BSD daemon appeared first in 1983 on the cover of the 4.2BSD manuals published by the Usenix Association



What is Linux. Timeline of development (cont.)

Berkeley is dragged into a lawsuit by AT&T due source code release as public

1983 Richard Stallman, after a struggle to get a Xerox printer to work properly, get a glimpse about freedom and free software.

He writes the GNU MANIFESTO.

GNU MANIFESTO

FREE UNIX!

Richard Stallman

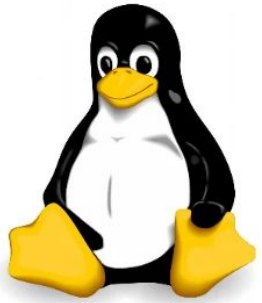
What is Linux. Timeline of development (cont.)

- **GNU** - is a Unix-like operating system. The development of GNU, started in January 1984, is known as the GNU Project. That means it is a collection of many programs: applications, libraries, developer tools, even games. Originally they were developed for UNIX kernel
- **GNU free software** - means users of a program have the four essential freedoms:
  - The freedom to run the program as you wish, for any purpose
  - The freedom to study how the program works, and change it so it does your computing as you wish . Access to the source code is a precondition for this.
  - The freedom to redistribute copies so you can help others.
  - The freedom to distribute copies of your modified versions to others. By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this
- GNU General Public License

What is Linux. Timeline of development (cont.)

- In 1991 Linus Torvalds developed a Unix-like kernel a student at the University of Helsinki.

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:
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 :-(.

Linus Torvalds

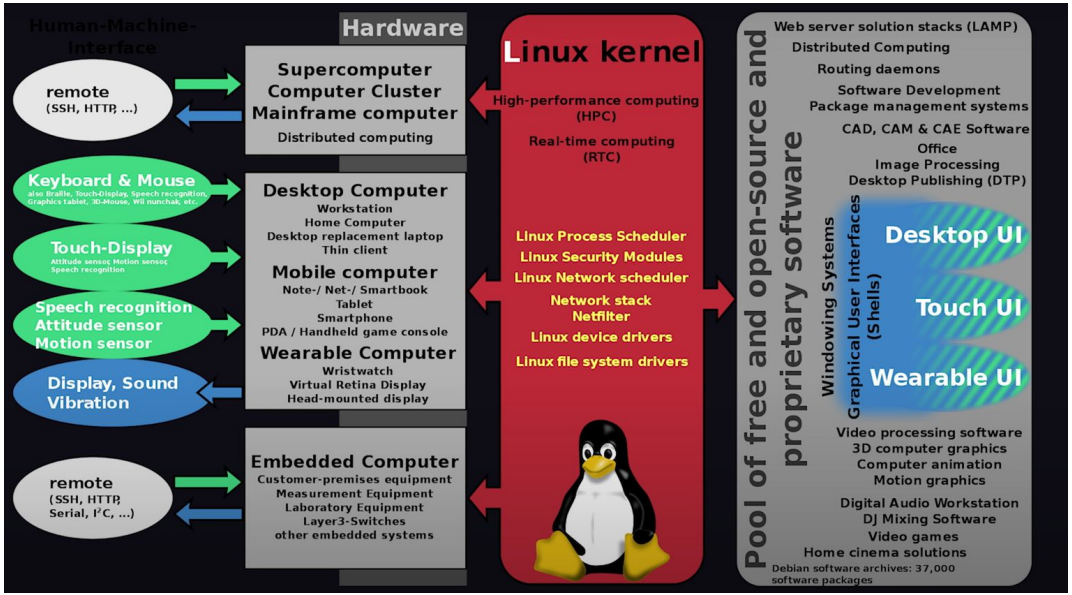
What is Linux. Timeline of development (cont.)

- In 1992 Linux kernel was released under GNU GPL license. Linux and GNU developers started to work on integration GNU components with Linux to make a fully functional and free operating system
- People started calling the GNU/Linux
- Once released, companies and enthusiasts around the globe started to develop their own solutions and versions of Linux

What is Linux. Timeline of development (cont.)

So, what is Linux?

1. Linux kernel
2. Packages (GNU)
3. Package manager
4. Desktop UI

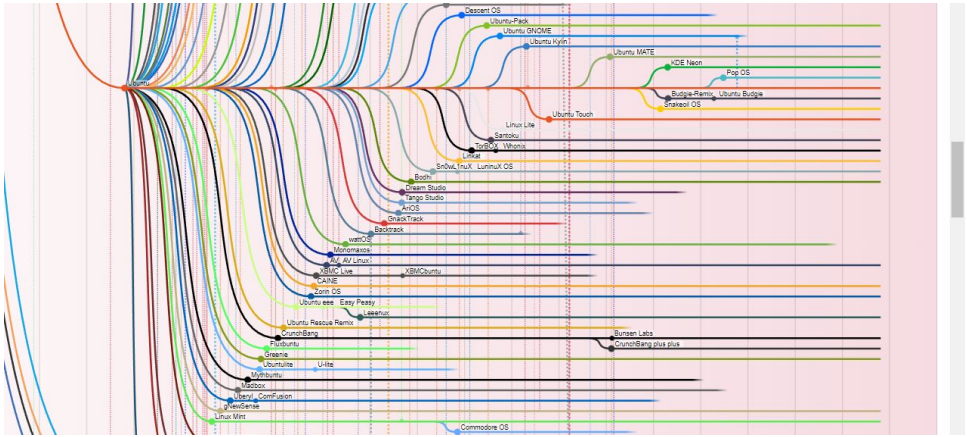


Distribution of Linux:

- Linux OS has multiple distributions (called distros) that are derived from it's initial deployment.
- Most of the are FREE and offer full functionality:
- Examples:
  - Debian
  - Ubuntu
  - CentOS
  - OpenSUSE
  - Mint
  - Gentoo
  - Slackware.
- Source for the list of distros

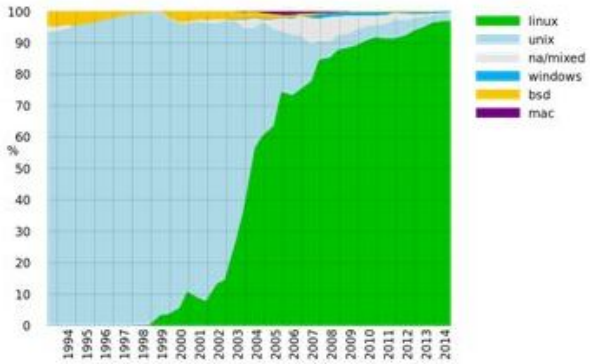
Distribution of Linux:

- Some examples of non-free (enterprise) Linux distros are:
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - Oracle Linux
  - Scientific Linux
  - Turbo Linux
  - Linux Mandriva
- Timeline of different Linux distributions creation



Why should I care about Linux?

- In September 2008 Steve Ballmer (Microsoft CEO) claimed 60% of servers run Linux and 40% run Windows Server. According to IDC's report covering Q2 2013, Linux was up to 23.2% of worldwide server revenue.
- Linux is used as:
  - Server (HTTP, FTP, DNS, file server, etc)
  - Desktop (it's a free alternative to Microsoft's Windows family)
  - Supercomputer operating system:
    - According to Wikipedia & top500.org, over 95% of Supercomputers use Linux as their host OS.



Graph showing the market share of Linux in the SuperComputer area

Why should I care about Linux?

- You can also find Linux distros in:
  - Routers, firewalls, switches
  - Smartphones (Android)
  - Gaming consoles (Sony PlayStation, Valve SteamBox)
  - Smart home devices, IoT devices

Simplified architecture of Linux

- Kernel:
  - The kernel is the heart of the operating system.
  - It interacts with hardware and most of the tasks like memory management, task scheduling and file management.

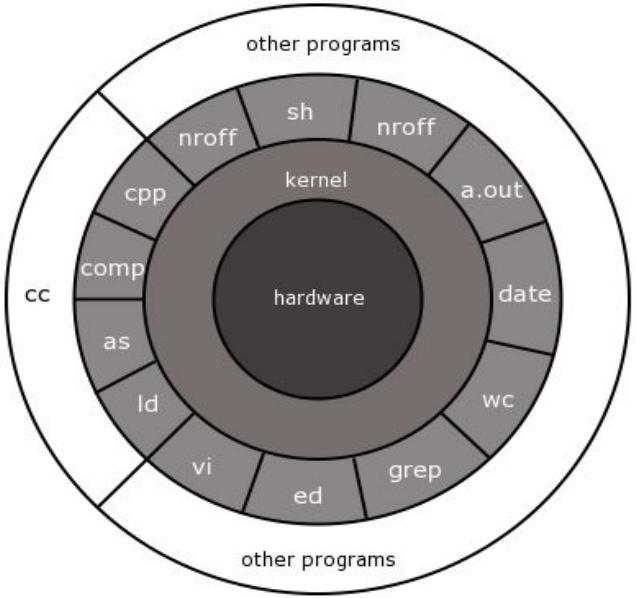
- Shell:
  - The shell is the utility that processes your requests.
  - When you type in a command at your terminal, the shell interprets the command and calls the program that you want.
  - The shell uses standard syntax for all commands.
  - C Shell, Bourne Shell and Korn Shell are most famous shells which are available with most of the Unix variants.

Simplified architecture of Linux

- Commands and Utilities:
  - There are various commands and utilities which you would use in your day to day activities.
  - *ls, cd, cp, mv, cat* are few examples of commands and utilities.
  - There are over 250 standard commands plus numerous others provided through 3rd party software.
  - All the commands come along with various options

- Files and Directories:
  - All data in Linux is organized into files. All files are organized into directories.
  - These directories are organized into a tree-like structure called the filesystem.

Simplified architecture of Linux



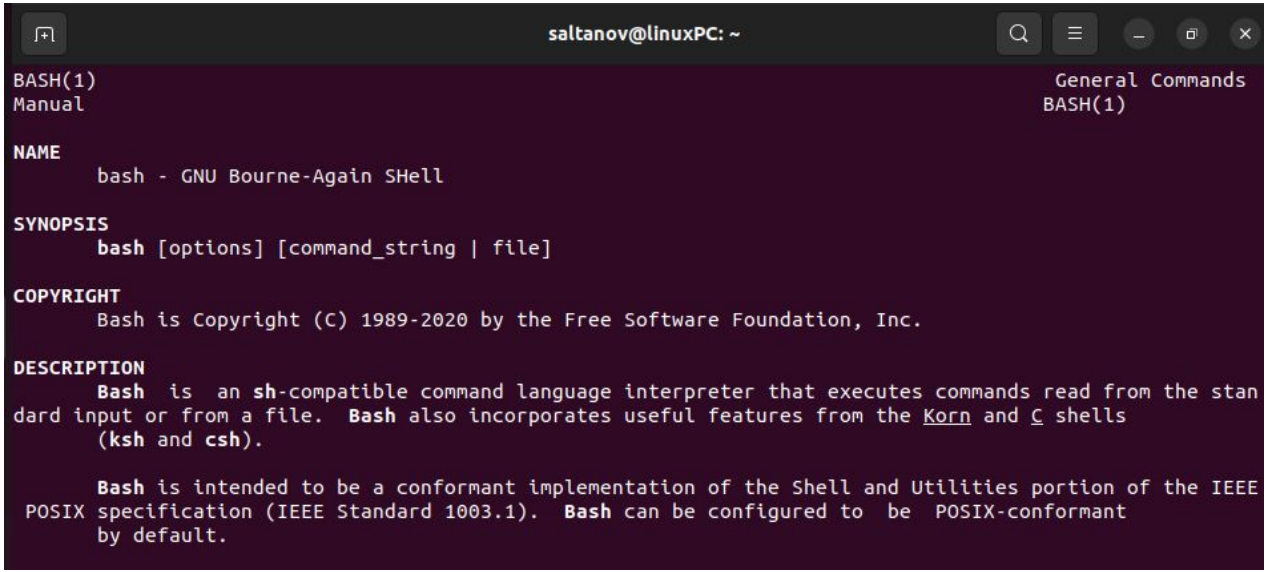
Source: http://www.learnlinux.org.za/courses/build/internals/ch04.html

BASH - Linux shell, programming/scripting language

- **Bash** has been used as the default login shell for most Linux distributions.
- It was one of the first programs Linus Torvalds ported to Linux, alongside GCC. A version is also available for Windows 10/11 via the Windows Subsystem for Linux
- It was developed to replace the Bourne Shell and it offers functional improvements over sh for both programming and interactive use. In addition, most sh scripts can be run by Bash without modification.
- The improvements offered by Bash include:
  - command-line editing,
  - unlimited size command history,
  - job control,
  - shell functions and aliases,
  - indexed arrays of unlimited size,
  - integer arithmetic in any base from two to sixty-four

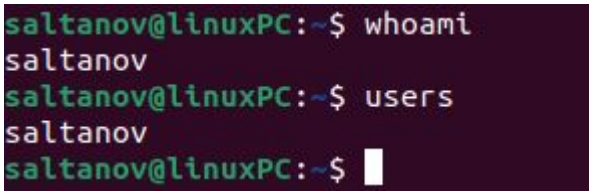
Man - the golden rule when you do not know what a command does:

- man – stands for manual
- man ls
- man cd
- man grep
- etc,



Who am I ? who's logged in ?

- *$whoami* – shows the user you are currently logged in with
- *$users* – displays (all) the users currently logged in



System information

- So you are logged into the terminal, but you have no info about the type of Linux distro or the architecture……
  - *$uname* -a – prints the name, version and other details about the current machine and the operating system running on it.
  - *$lsb_release -a* - prints Distribution information.

```
saltanov@linuxPC:~$ sudo uname -a
[sudo] password for saltanov:
Linux linuxPC 5.15.0-46-generic #49-Ubuntu SMP Thu Aug 4 18:03:25 UTC 2022 x86_64 x86_64 x86_64 GNU/Linux
saltanov@linuxPC:~$ sudo lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 22.04.1 LTS
Release:        22.04
Codename:       jammy
```