

# Linux? Linus? Lunix? UNIX?

## Modern Computational Methods in Physics 2.

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# Content

## Main Questions

- What is Linux? What even are operating systems anyway?
- What are Linux distros?  
How is Linux structured?
- Why is it so often mentioned and used in the world of science and IT?
- When should I use it instead of another operating system?

# Content

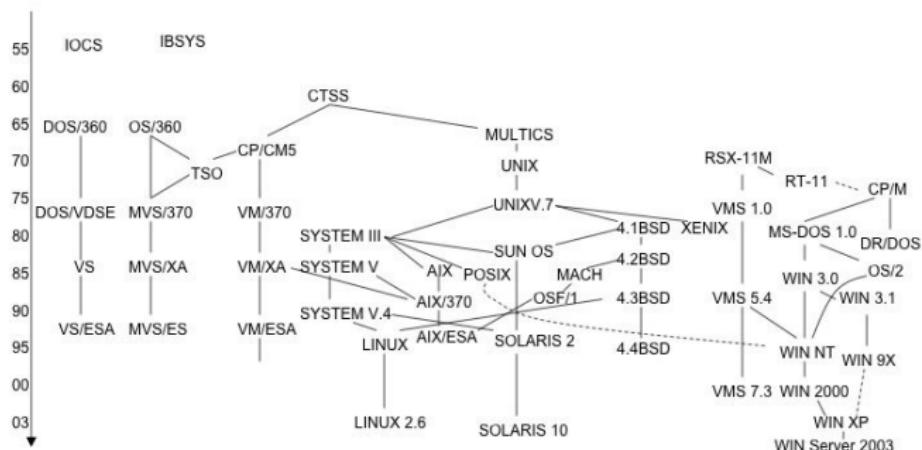
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- What is Linux? What even are operating systems anyway?
- What are Linux distros? How is Linux structured?
- Why is it so often mentioned and used in the world of science and IT?
- When should I use it instead of another operating system?
- What does it even mean that „I use arch btw”?



# Linux? Unix? GNU? OS???

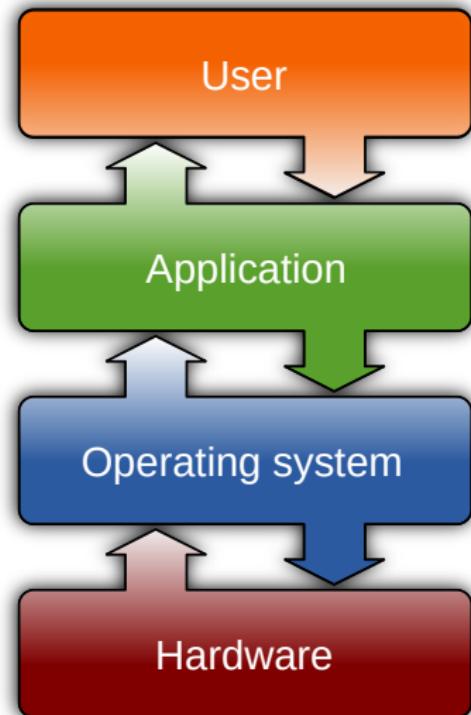
## Operating Systems Evolution



# Linux? Unix? GNU? OS???

## OS

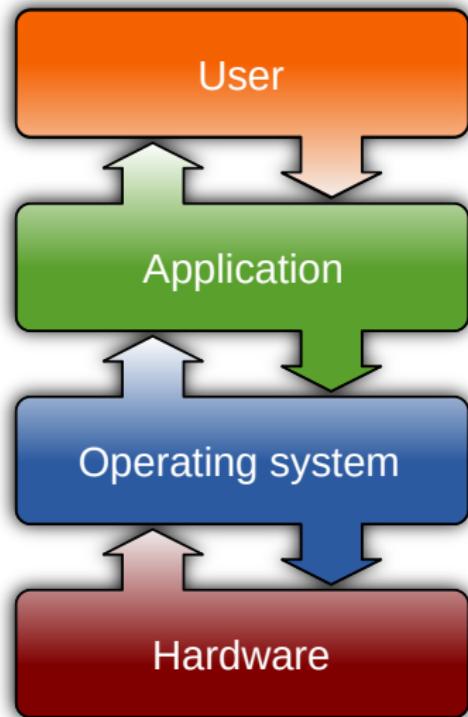
- Program that directly manages hardware and provides a unified environment for applications



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## OS

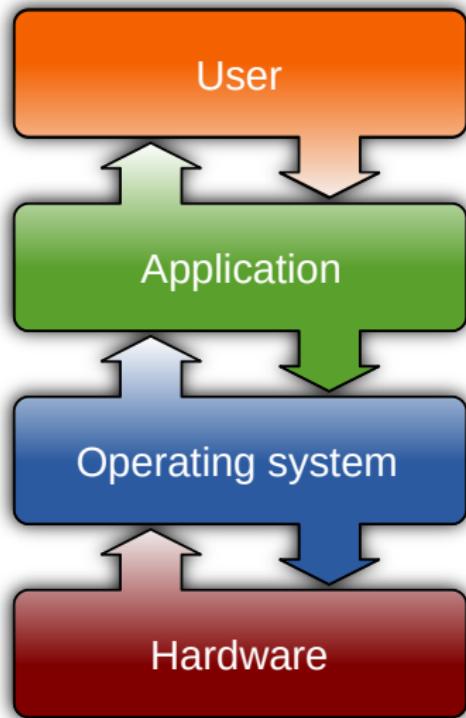
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## OS

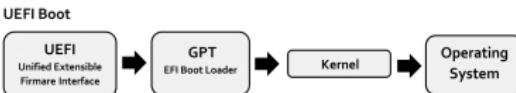
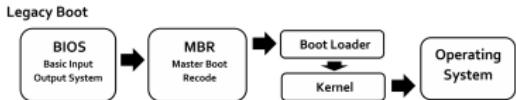
- Program that directly manages hardware and provides a unified environment for applications
- First OS were simply I/O systems, but nowadays they are much more intricate
- Three main components:
  - ① kernel (the heart of the OS)
  - ② shell (the interface between the user and the kernel)
  - ③ basic software and libraries



# Linux? Unix? GNU? OS???

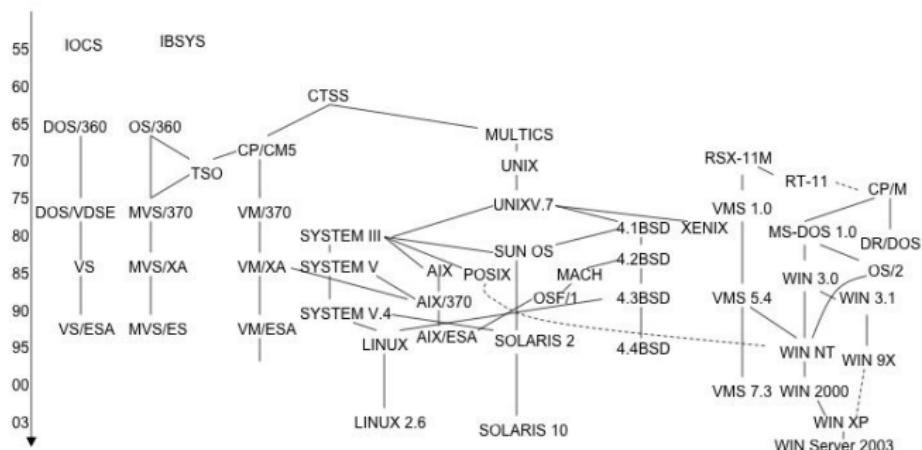
## Booting

- Nowadays there are more layers between the kernel and the hardware too
- UEFI has replaced BIOS-based boot since ~ 2012
- It's complicated business (POST → boot loader → kernel → OS)

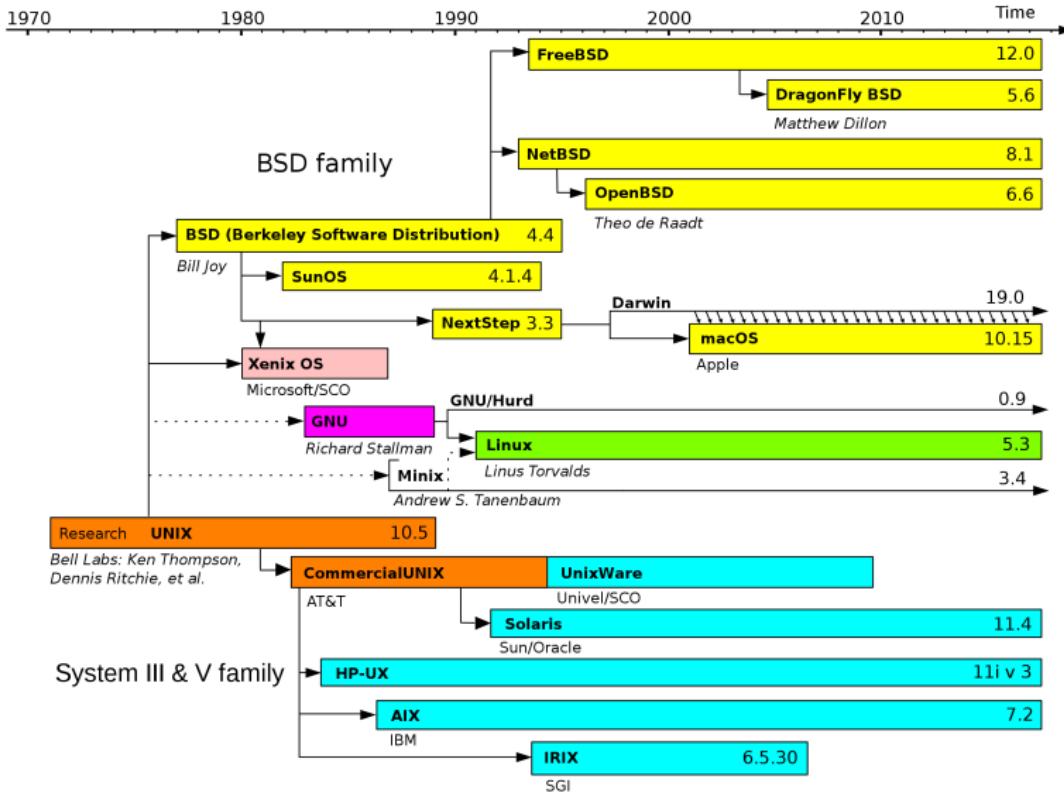


# Linux? Unix? GNU? OS???

## Operating Systems Evolution



# GNU+Linux



# GNU+Linux

15



Linus Benedict Torvalds

to

...

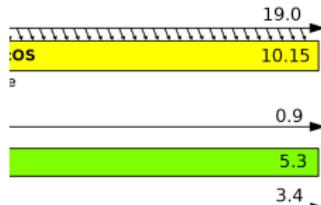
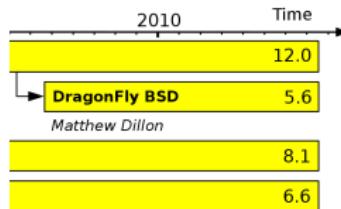
Hello everybody out there using minix -

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).

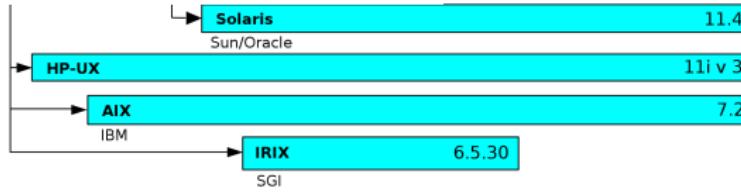
I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)

Linus ([tor...@kruuna.helsinki.fi](mailto:tor...@kruuna.helsinki.fi))

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



System III & V family



# GNU+Linux

15



Linus Benedict Torvalds

to

...

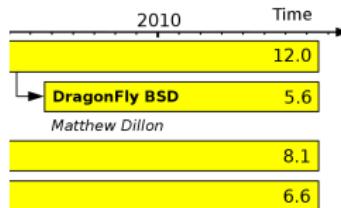
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Jyrki Kuoppala

to

In article <[1991Aug25...@klaava.Helsinki.FI](http://1991Aug25...@klaava.Helsinki.FI)>, [torvalds@klaava](mailto:torvalds@klaava) (Linus Benedict Torvalds) writes:  
>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  
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Tell us more! Does it need a MMU?

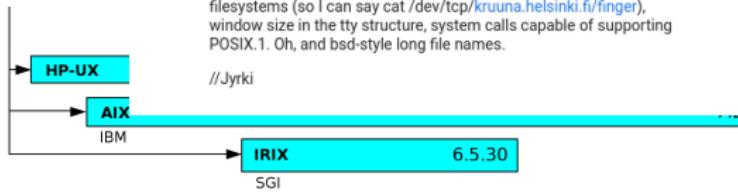
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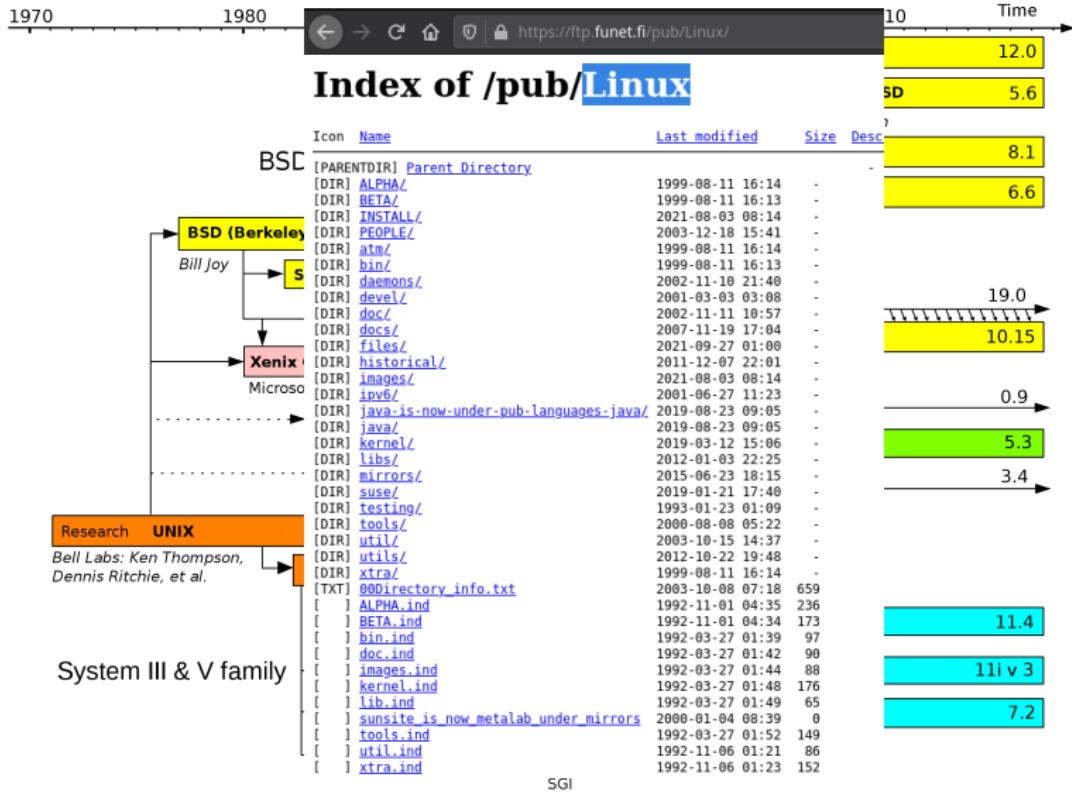
How much of it is in C? What difficulties will there be in porting?  
Nobody will believe you about non-portability ;-), and I for one would  
like to port it to my Amiga (Mach needs a MMU and Minix is not free).

As for the features; well, pseudo ttys, BSD sockets, user-mode  
filesystems (so I can say cat /dev/tcp/[kruuna.helsinki.fi/finger](http://kruuna.helsinki.fi/finger)),  
window size in the tty structure, system calls capable of supporting  
POSIX.1. Oh, and bsd-style long file names.

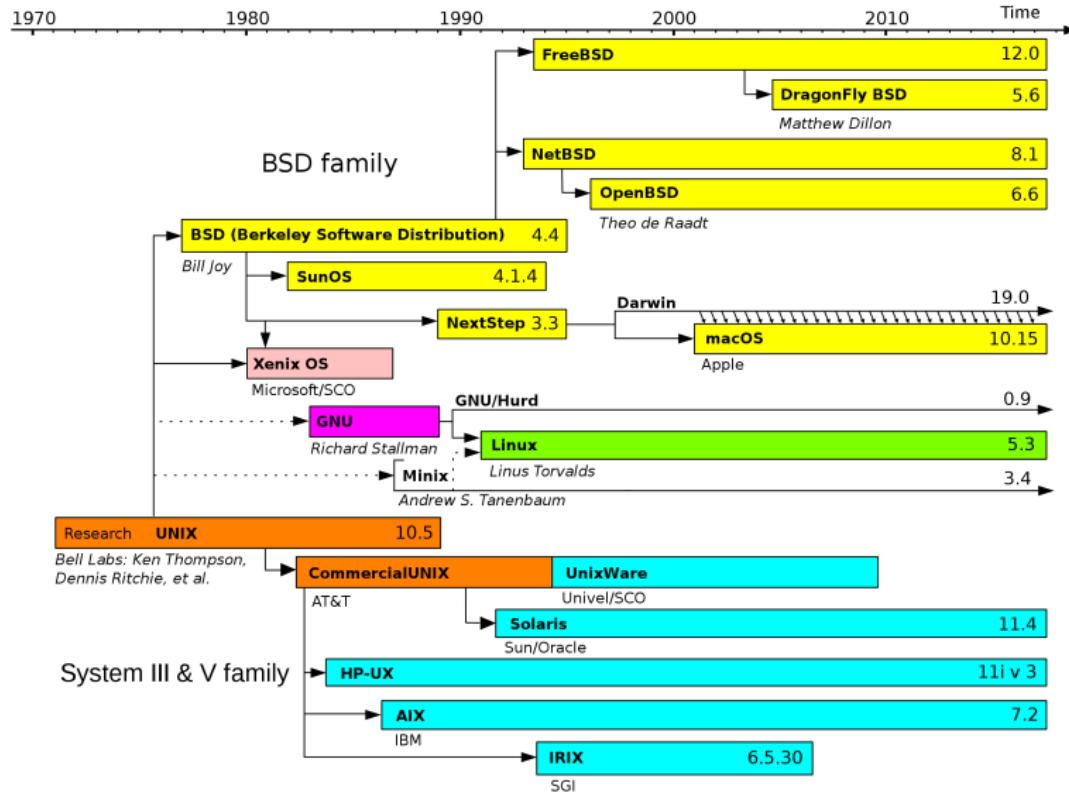
//Jyrki

System III & V family

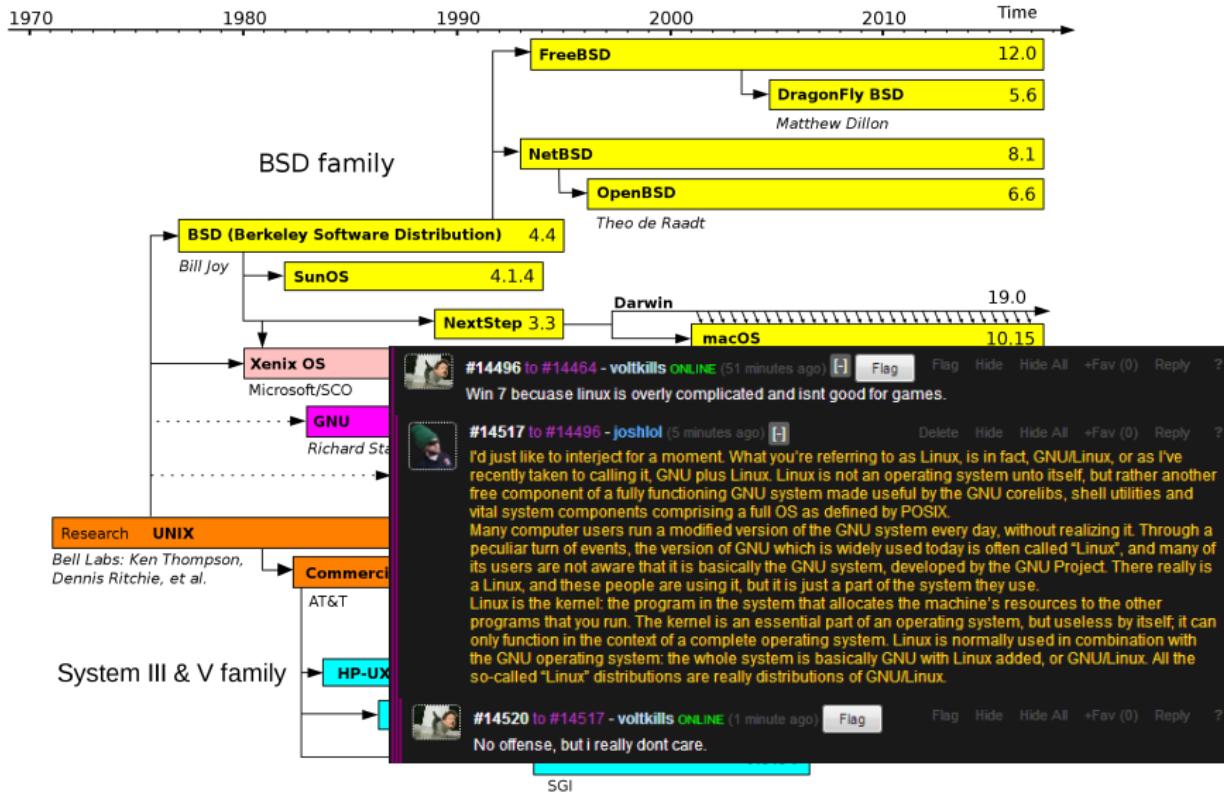




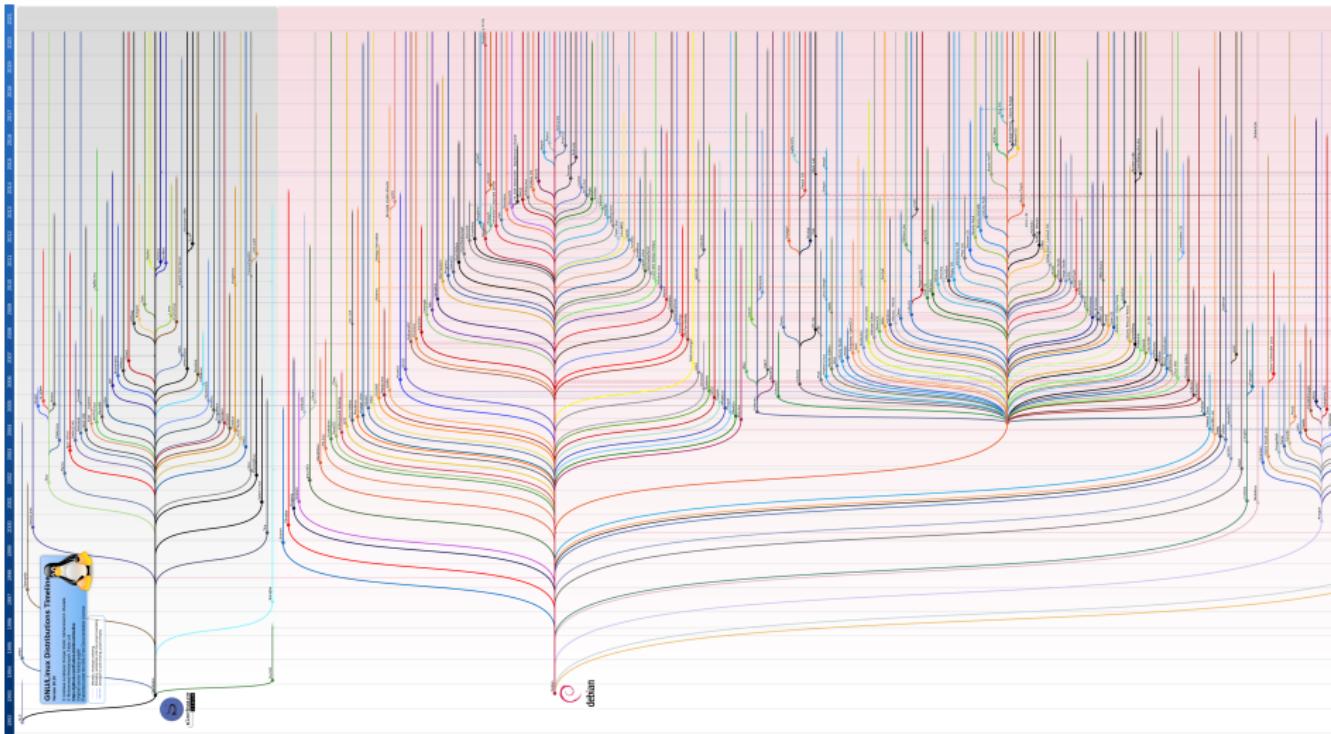
# GNU+Linux



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# Linux distros



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- ...everything above the base Linux kernel.

Differences for real

- Everyone uses their computers differently
- Ready-to-use OSs that aims to meet different needs and tastes
- Of course there are different levels...



# Using Linux

## Important aspects to consider

- POSIX standard
- Diverse and actively maintained software
- Package manager software (apt, pacman, stb.)
- Enormous, active and (mostly) helpful community

The screenshot shows a Linux desktop environment with several windows open:

- File Manager:** Shows a list of files in the directory `/~/ELTE_Korszam_II_2021_0kt/4-linux/src/images`. The files listed include various screenshots and icons related to Linux distributions and timeline graphics.
- Terminal:** A terminal window titled "ELTE\_Korszam\_II\_2021\_0kt -- Konsole" is open, displaying a command-line session. It includes commands like `inkscape -zELTE_Linux_Distributions_Timeline.svg`, `inkscape -zELTE_Linux_Distributions_Timeline.svg --export-latex`, and `inkscape -zELTE_Linux_Distributions_Timeline.svg --export-pdf=linux-distro.pdf`.
- System Monitor:** A window titled "ELTE\_Korszam\_II\_2021\_0kt -- Konsole" displays system statistics: Tasks (124), CPU usage (0.03), Load average (0.03), and Uptime (66:53:42).
- File Browser:** A window titled "images\_zah -- Konsole" shows a tree view of the `/usr/share/inkscape/fonts` directory.
- Taskbar:** At the bottom, there is a taskbar with icons for Help, F2 (Search), F3 (Switcher), F4 (Terminal), F5 (File Manager), F6 (Konsole), F7 (Kicker), F8 (Kicker), F9 (Kicker), F10 (Kicker), and F11 (Kicker).

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## Closing thoughts

The screenshot shows a Linux desktop environment with several windows open:

- File Manager:** Shows a list of files in the directory `/~/ELTE_Korszam_II_2021_0kt/4-linux/src/images`, including various Linux distributions and boot images.
- Terminal:** A terminal window titled "ELTE\_Korszam\_II\_2021\_0kt -- Konsole" is running multiple commands related to Inkscape and exporting images.
- System Monitor:** A window titled "ELTE\_Korszam\_II\_2021\_0kt -- Konsole" displays system statistics like CPU usage, memory, and tasks.
- Taskbar:** A bottom bar shows icons for Help, F2, Action, F3, Hard, F4, Filter, F5, Free, F6, Police, F7, Kill, F8, Kill, F9, Kill, F10, and Kill.

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- I use arch btw

The screenshot shows a terminal window with several commands run:

- File operations: `-rw-r--r-- 1 masterdesky masterdesky 47K sept 14 20:36 evolution.jpg`, `-rw-r--r-- 1 masterdesky masterdesky 587K sept 14 16:21 'GNU_Linux_Distributions Timeline.svg'`, `-rw-r--r-- 1 masterdesky masterdesky 246 sept 27 21:35 Interjection2.png`, `-rw-r--r-- 1 masterdesky masterdesky 936 sept 27 21:16 Interjection.png`, `-rw-r--r-- 1 masterdesky masterdesky 198K sept 27 14:48 legacy-boot.png`, `-rw-r--r-- 1 masterdesky masterdesky 1K sept 27 14:48 legacy-fstab.png`, `-rw-r--r-- 1 masterdesky masterdesky 916K sept 27 22:28 linux-poly.png`, `-rw-r--r-- 1 masterdesky masterdesky 313K sept 28 00:17 linux-desktop.png`, `-rw-r--r-- 1 masterdesky masterdesky 3.9M sept 27 23:57 linux-distro.png`, `-rw-r--r-- 1 masterdesky masterdesky 79K sept 27 22:57 linux-ftp.png`, `-rw-r--r-- 1 masterdesky masterdesky 183K sept 27 10:18 os-hu.eps`, `-rw-r--r-- 1 masterdesky masterdesky 183K sept 27 10:18 os-hu.eps-converted-to.pdf`, `-rw-r--r-- 1 masterdesky masterdesky 17K sept 27 10:08 os-hu.png`, `-rw-r--r-- 1 masterdesky masterdesky 18K sept 27 10:16 POST.jpg`, `-rw-r--r-- 1 masterdesky masterdesky 17K sept 27 14:47 uefi-boot.png`.
- Inkscape export: `[masterdesky@skydub ~]# inkscape -z ~/ELTE_Korszam_II_2021_0kt/4-linux/src/images/ GNU_Linux_Distributions_Timeline.svg --export-latex`
- System status: `[masterdesky@skydub ~]# org.inkscape.Inkscape:145109: WARNING **: 01:20:10.131: Fonts dir '/usr/share/inkscape/fonts' does not exist and will be ignored.`, `[masterdesky@skydub ~]# http`, `[masterdesky@skydub ~]# ./ELTE_Korszam_II_2021_0kt/4-linux/src/images/ ELTE_Korszam_II_2021_0kt http --Konsolo`.
- System monitoring: `[root@skydub ~]# top` (showing tasks, load average, uptime, memory usage, swap usage, and processes).
- Filesystem usage: `[root@skydub ~]# df -h` (showing disk space usage for /, /home, /tmp, /var, /run, /proc, /sys, and /dev).
- Network traffic: `[root@skydub ~]# netstat -an | grep ESTABLISHED` (showing established network connections).
- Process list: `[root@skydub ~]# ps aux` (showing all running processes).
- System logs: `[root@skydub ~]# journalctl` (showing system logs).

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- I use arch btw
- Thanks for your attention :)

The terminal window shows the following sequence of commands:

```
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[masterdesky@skydub ~] ~/ELTE_Korszam_II_2021_0kt/4-linux/src/images
# inkscape -g _GNU_Linux_Distributions_Timeline.svg -o linux-distro.pdf --export-latex

** (org.inkscape.Inkscape:145109): WARNING **: 01:20:10.131: Fonts dir '/usr/share/inkscape/fonts' does not exist and will be ignored.

[masterdesky@skydub ~] ~/ELTE_Korszam_II_2021_0kt/4-linux/src/images
$ http

[masterdesky@skydub ~] ~/ELTE_Korszam_II_2021_0kt/4-linux/src/images
$
```

System monitoring output:

Tasks	Load average	Uptime
124	0.03 0.70 0.62	06:53:42
10	0.03	
11	0.03	
13	0.03	
5.756 (15.66)	0K/57778	

Top command output:

Tasks	CPU(s) %	Command
7644	2.0 0.02801 772R 2048K 5 1.0 4.0 25:47 0.25 /usr/lib/firefox-esr/firefox-esr -contentproc -chil	
7593	2.0 0.356 378W 110P 5 1.0 2.3 11:35.54 /usr/lib/firefox-esr/firefox-esr -contentproc -chil	
7568	2.0 0.80521 279W 84548 5 1.0 1.8 0.09:23 /usr/bin/teamspeak	
119911	2.0 0.859 07866 66372 5 1.0 0.5 0:21:07 /usr/bin/konsole	
3624	2.0 0.305H 28548 2848 5 0.6 0.1 10:31.64 /usr/bin/dbus-daemon --system --address=systemd --nofollow-symlinks --systemd-abstract=systemd --daemonize --xid	
4887	2.0 0.270H 42324 37398 5 0.6 0.3 0:06:29 /usr/bin/konsole	
6269	2.0 0.2960H 310W 86824 5 0.6 2.0 0:03:52 /home/masterdesky/.dropbox-dist/dropbox-in.x86_64-	
5591	2.0 0.418W 562H 231H 5 0.6 3.5 1:16:03 /usr/lib/firefox-esr/firefox-esr	
7724	2.0 0.418W 562H 231H 5 0.6 3.5 1:16:08 /usr/lib/firefox-esr/firefox-esr	
8000	2.0 0.418W 562H 231H 5 0.6 3.5 1:16:10 /usr/lib/firefox-esr/firefox-esr	
9442	2.0 0.1515H 543H 231H 5 0.6 3.4 2:11:16 /usr/lib/firefox-esr/firefox-esr -contentproc -chil	
9458	2.0 0.3151H 543H 231H 5 0.6 3.4 1:33:32 /usr/lib/firefox-esr/firefox-esr -contentproc -chil	
14531	root 2.0 0.1221W 01892 23312 5 0.6 0.5 2:23:16 /usr/sbin/expressvpn --client-version 3.11.0 --cli	
15545	masterdesky 2.0 0.764H 70820 72445 5 0.6 0.2 0:09:06 /usr/bin/expressvpn-agent --daemon	
21593	masterdesky 2.0 0.542H 32956 66472 5 0.6 0.5 1:38:18.00 /usr/lib/firefox-esr/firefox-esr -contentproc -chil	