# Linux Introduction

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## Before this talk

- Browse this slide for 15 minutes first.
- Write down the section(s) you don't know yet.
- Be attention on those sections.
- Ask questions on sli.do/fcmeqjza.
- Download this slide at Here,
  this full source code (tar archive) at Here.
- These source files are (CC BY-SA 4.0)

## Outline

## What is OS?

## What is OS?

Time: 00:02:29 $\rightarrow$ 00:03:09 in "Revolution OS"
https://youtu.be/vWwvh3036Fw?t=149
(The next page is the text version of this segment.)

## What is OS?

Linus Torvalds:

> *The thing about an operating system is that you are never ever supposed to serve. Because nobody really uses an operating system. People use programs on their computers and the only mission in the life of an operating system is to help those programs run. So an operating system never does anything on its' own. It's only waiting for the programs to ask for certain resources, ask for certain files on the disk or ask for the programs to connect them to the outside world. And then the operating system comes steps in and tries to make it easy for people to write programs.*

## User-space programs in execution

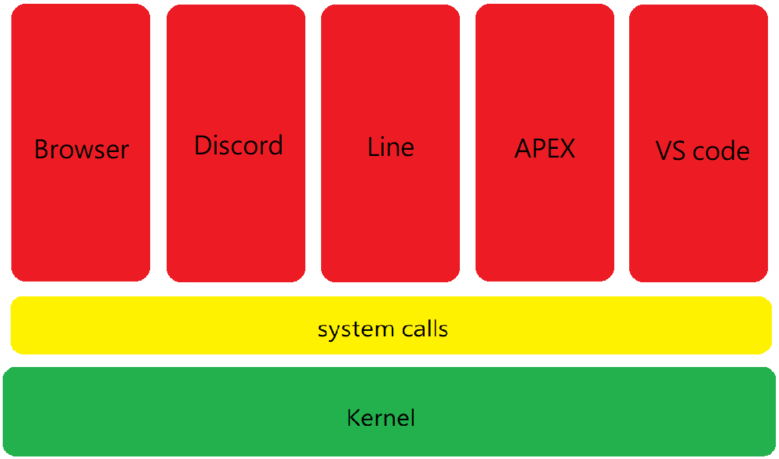
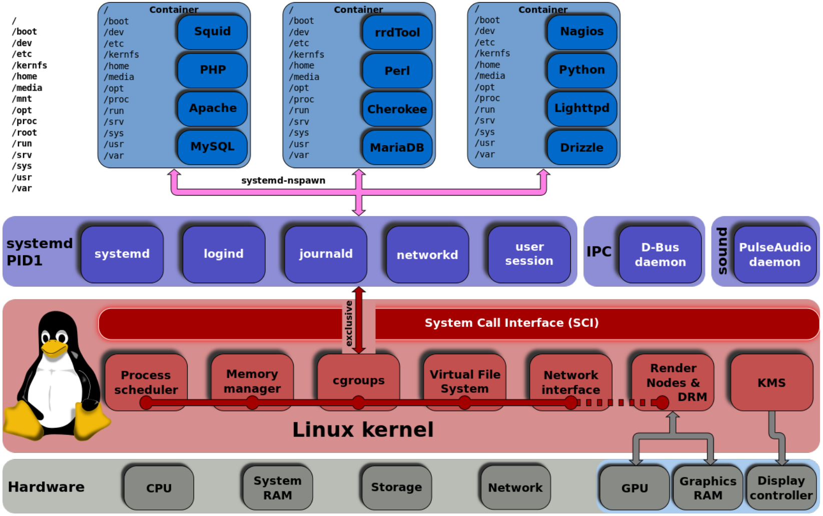


Photo credits: Koul

# Components



https://zh.wikipedia.org/wiki/Cgroups

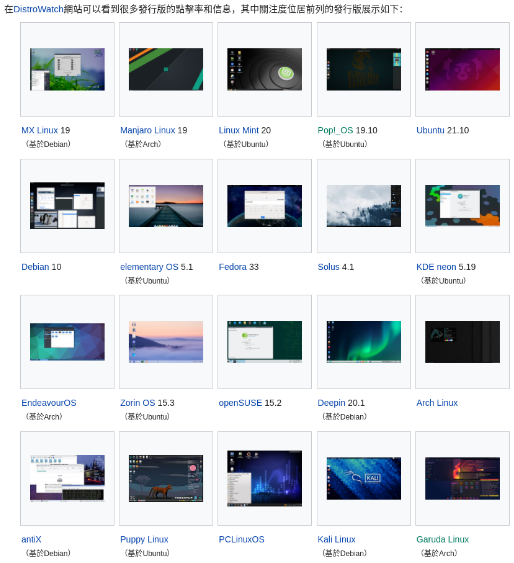
## Why you should learn Linux?

1. Understand how computers work (customize)
2. Open source[1] and ubiquitous
3. Programmer, security researcher, *big/LITTLE*[2] architectures
4. You can Google it!

[1] https://www.gnu.org/home.zh-tw.html

[2] https://zh.wikipedia.org/wiki/Big.LITTLE

## Distros.



在DistroWatch網站可以看到很多發行版的點擊率和信息，其中關注度位居前列的發行版展示如下：

| | | | | |
|---|---|---|---|---|
| MX Linux 19 （基於Debian） | Manjaro Linux 19 （基於Arch） | Linux Mint 20 （基於Ubuntu） | Pop!_OS 19.10 （基於Ubuntu） | Ubuntu 21.10 |
| Debian 10 | elementary OS 5.1 （基於Ubuntu） | Fedora 33 | Solus 4.1 | KDE neon 5.19 （基於Ubuntu） |
| EndeavourOS （基於Arch） | Zorin OS 15.3 （基於Ubuntu） | openSUSE 15.2 | Deepin 20.1 （基於Debian） | Arch Linux |
| antiX （基於Debian） | Puppy Linux （基於Ubuntu） | PCLinuxOS | Kali Linux （基於Debian） | Garuda Linux （基於Arch） |

https://zh.wikipedia.org/wiki/Linux%E5%8F%91%E8%A1%8C%E7%89%88

## Linux distribution

Traverse it: Wiki
and `https://distrowatch.com/`

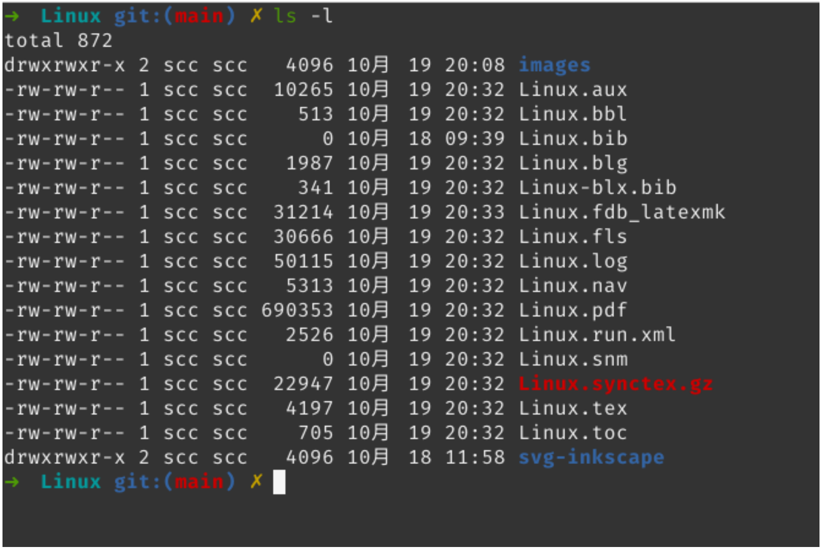
## Booting and history

Traverse it: IBM boot
Netscape history: Wiki
Revolution OS: YouTube
Traverse it: Hurd
Read parts of initrd.

## Permissions

## File Permissions

$ ls -l



```
→  Linux git:(main) ✗ ls -l
total 872
drwxrwxr-x 2 scc scc   4096 10月  19 20:08 images
-rw-rw-r-- 1 scc scc  10265 10月  19 20:32 Linux.aux
-rw-rw-r-- 1 scc scc    513 10月  19 20:32 Linux.bbl
-rw-rw-r-- 1 scc scc      0 10月  18 09:39 Linux.bib
-rw-rw-r-- 1 scc scc   1987 10月  19 20:32 Linux.blg
-rw-rw-r-- 1 scc scc    341 10月  19 20:32 Linux-blx.bib
-rw-rw-r-- 1 scc scc  31214 10月  19 20:33 Linux.fdb_latexmk
-rw-rw-r-- 1 scc scc  30666 10月  19 20:32 Linux.fls
-rw-rw-r-- 1 scc scc  50115 10月  19 20:32 Linux.log
-rw-rw-r-- 1 scc scc   5313 10月  19 20:32 Linux.nav
-rw-rw-r-- 1 scc scc 690353 10月  19 20:32 Linux.pdf
-rw-rw-r-- 1 scc scc   2526 10月  19 20:32 Linux.run.xml
-rw-rw-r-- 1 scc scc      0 10月  19 20:32 Linux.snm
-rw-rw-r-- 1 scc scc  22947 10月  19 20:32 Linux.synctex.gz
-rw-rw-r-- 1 scc scc   4197 10月  19 20:32 Linux.tex
-rw-rw-r-- 1 scc scc    705 10月  19 20:32 Linux.toc
drwxrwxr-x 2 scc scc   4096 10月  18 11:58 svg-inkscape
→  Linux git:(main) ✗
```

stat: https://linux.die.net/man/1/stat

## File Permissions

Traverse it:
https://linuxjourney.com/lesson/file-permissions

## Don't 777

ALL[3]
Think about what it means!

[3] https://serverfault.com/questions/364677/why-is-chmod-r-777-destructive

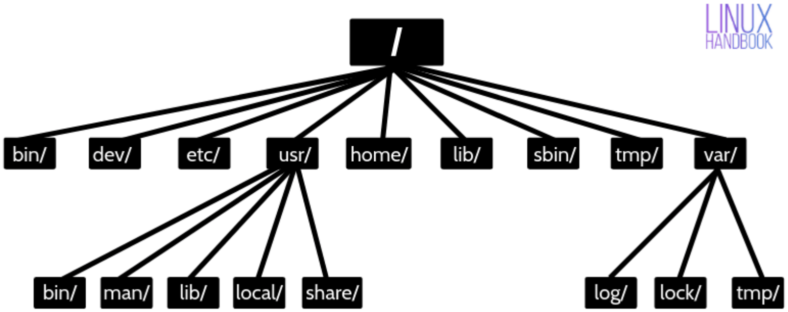
## Process permissions (capabilities)

Process is a program in execution.

File permission extending: access control and capabilities
Linux Capabilities intro, (zh_cn)
capabilities since Linux 2.2 (1999/1/25)[4]:
Man capabilities
Search the 2.2.0

[4] https://zh.wikipedia.org/wiki/Linux%E5%86%85%E6%A0%B8

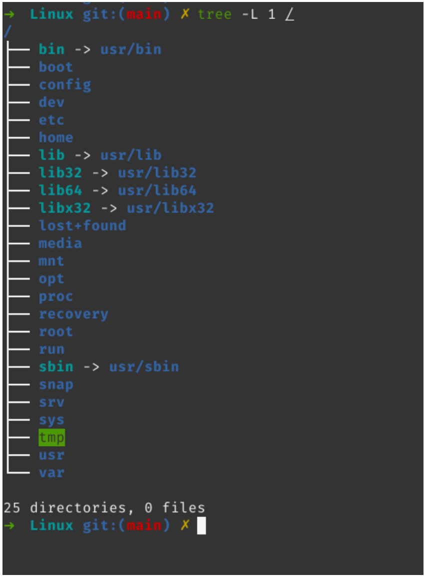
## File systems



src: https://linuxhandbook.com/linux-directory-structure/

## Tree

$ tree -L 1 /; # You can man it!



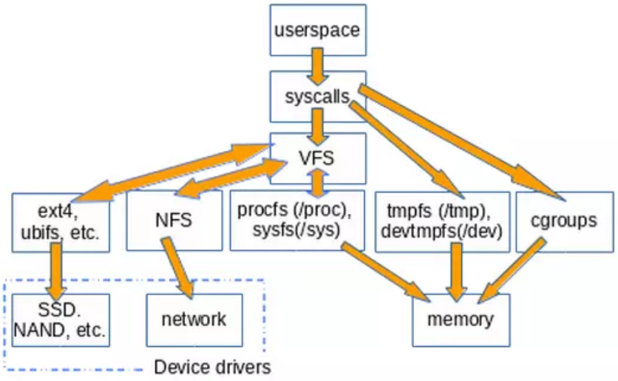
```
➜ Linux git:(main) ✗ tree -L 1 /
/
├── bin -> usr/bin
├── boot
├── config
├── dev
├── etc
├── home
├── lib -> usr/lib
├── lib32 -> usr/lib32
├── lib64 -> usr/lib64
├── libx32 -> usr/libx32
├── lost+found
├── media
├── mnt
├── opt
├── proc
├── recovery
├── root
├── run
├── sbin -> usr/sbin
├── snap
├── srv
├── sys
├── tmp
├── usr
└── var

25 directories, 0 files
➜ Linux git:(main) ✗
```

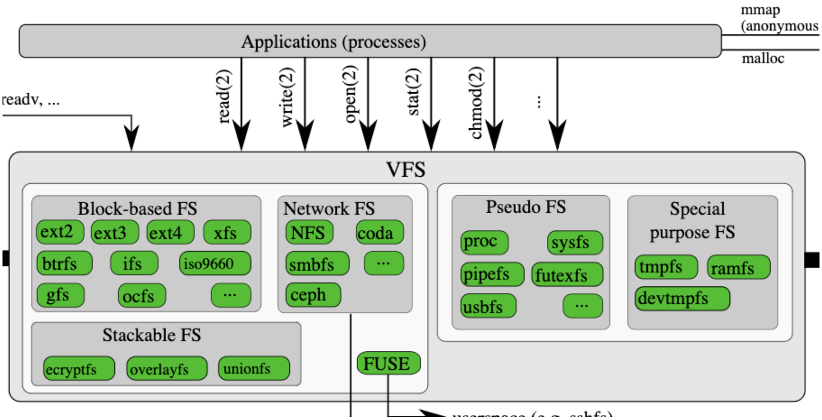
## Mount devices

The mount must mount ‘device’ on the directory.
Traverse it: Mount tutorial

# VFS in kernel



# VFS in kernel



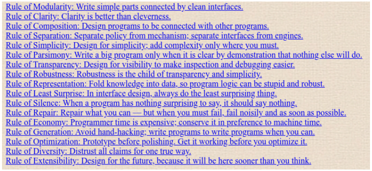
## Everything is a file descriptor

Read parts of Universal-IO

> *Rather than have a variety of device emulation mechanisms (for network, block, and other drivers) , virtio provides a common front end for these device emulations to standardize the interface and increase the reuse of code across the platforms.*

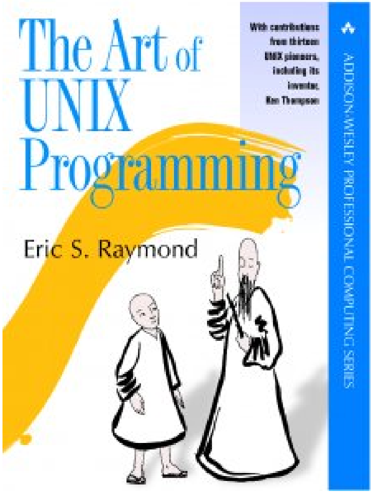
## Small is beautiful

# The Art of UNIX Programming



Rule of Modularity: Write simple parts connected by clean interfaces.
Rule of Clarity: Clarity is better than cleverness.
Rule of Composition: Design programs to be connected with other programs.
Rule of Separation: Separate policy from mechanism; separate interfaces from engines.
Rule of Simplicity: Design for simplicity; add complexity only where you must.
Rule of Parsimony: Write a big program only when it is clear by demonstration that nothing else will do.
Rule of Transparency: Design for visibility to make inspection and debugging easier.
Rule of Robustness: Robustness is the child of transparency and simplicity.
Rule of Representation: Fold knowledge into data, so program logic can be stupid and robust.
Rule of Least Surprise: In interface design, always do the least surprising thing.
Rule of Silence: When a program has nothing surprising to say, it should say nothing.
Rule of Repair: Repair what you can — but when you must fail, fail noisily and as soon as possible.
Rule of Economy: Programmer time is expensive; conserve it in preference to machine time.
Rule of Generation: Avoid hand-hacking; write programs to write programs when you can.
Rule of Optimization: Prototype before polishing. Get it working before you optimize it.
Rule of Diversity: Distrust all claims for one true way.
Rule of Extensibility: Design for the future, because it will be here sooner than you think.

`http://www.catb.org/~esr/writings/taoup/html/`


The Art of UNIX Programming
Eric S. Raymond
With contributions from thirteen UNIX pioneers, including its inventor, Ken Thompson
ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES

## The 17 Rules of Eric Raymond

- Build modular programs
- Write readable programs
- Use composition
- Separate mechanisms from policy
- Write simple programs
- Write small programs
- Write transparent programs
- Write robust programs
- Make data complicated when required, not the program
- Build on potential users' expected knowledge
- Avoid unnecessary output
- Write programs which fail in a way that is easy to diagnose
- Value developer time over machine time
- Write abstract programs that generate code instead of writing code by hand
- Prototype software before polishing it
- Write flexible and open programs
- Make the program and protocols extensible.

## Less is more than more

man page of less
Master Foo and the Ten Thousand Lines

## Review the modular from the first section

Go!

## Package manager

Best Linux Package Managers

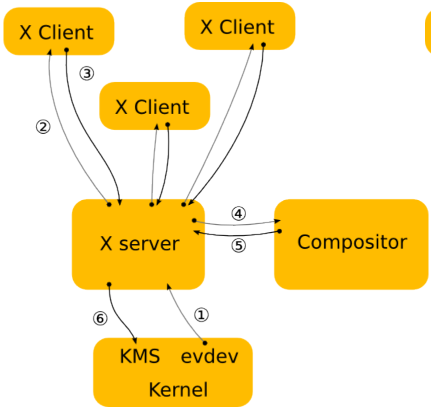
- DPKG
- RPM
- Pacman (AUR)

Use Docker image to demo.

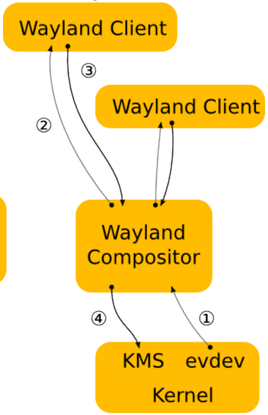
# GUI Concepts and DE

Take WSL as an example

The X



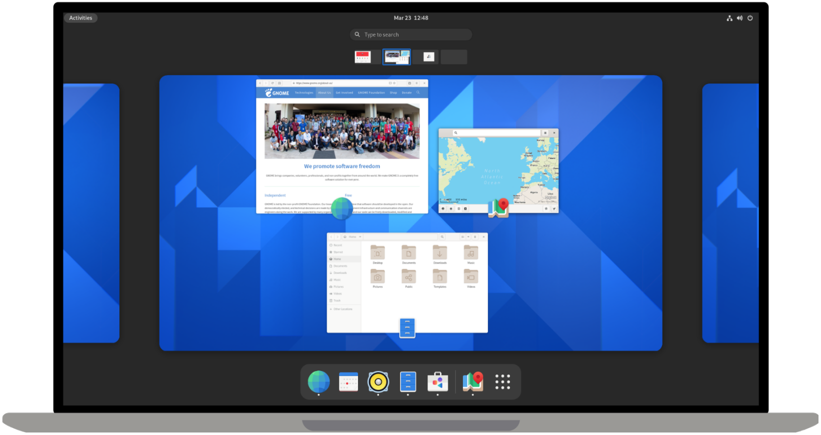
The wayland



Wiki

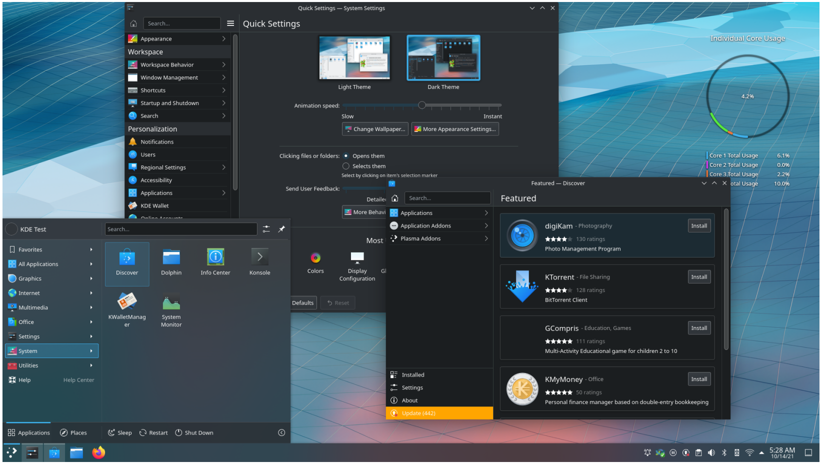
## GNOME

YouTube: Plugins
Youtube: GNOME 40



# KDE

YouTube


Quick Settings — System Settings

Animation speed: Slow — Instant

Clicking files or folders: [✓ Opens them] Selects them

Select by clicking on item's selection marker

Send User Feedback:

Featured — Discover

digiKam - Photography ★★★★ 130 ratings Photo Management Program

KTorrent - File Sharing ★★★★ 128 ratings BitTorrent Client

GCompris - Education, Games ★★★★★ 111 ratings Multi-Activity Educational game for children 2 to 10

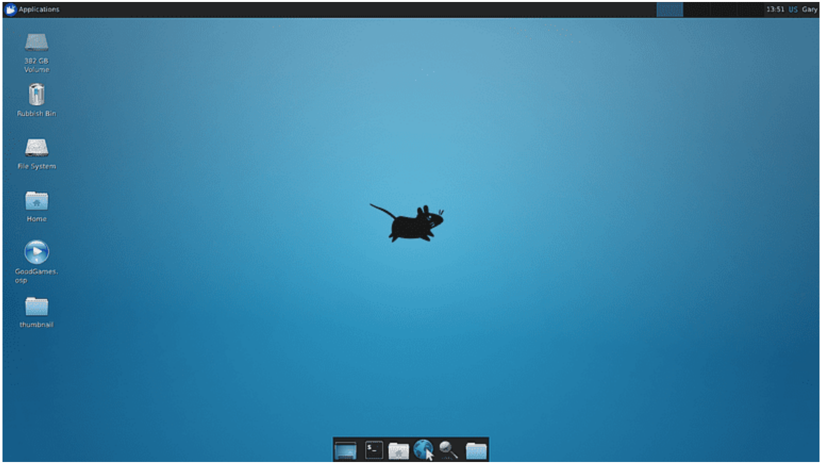
KMyMoney - Office ★★★★★ 50 ratings Personal finance manager based on double-entry bookkeeping

Individual Core Usage

| | |
|---|---|
| Core 1 Total Usage | 6.1% |
| Core 2 Total Usage | 0.0% |
| Core 3 Total Usage | 2.2% |
| Total Usage | 10.0% |

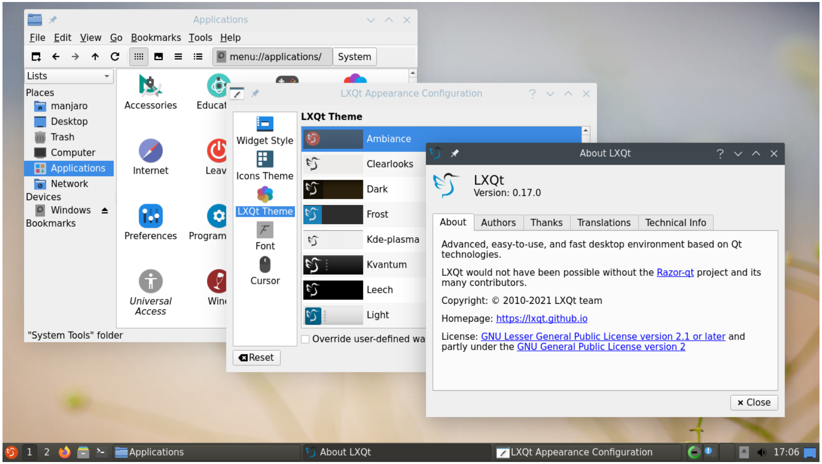
## XFCE

YouTube



# LXDM/LXQT

YouTube



LXQt
Version: 0.17.0

About | Authors | Thanks | Translations | Technical Info

Advanced, easy-to-use, and fast desktop environment based on Qt technologies.

LXQt would not have been possible without the Razor-qt project and its many contributors.

Copyright: © 2010-2021 LXQt team

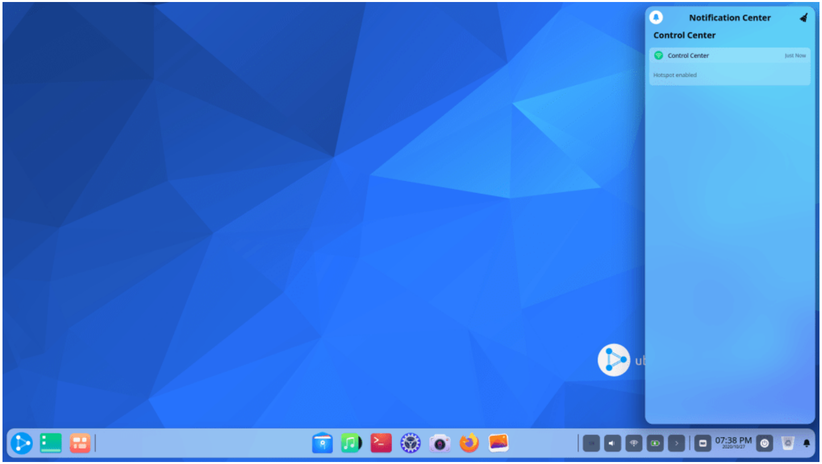
Homepage: https://lxqt.github.io

License: GNU Lesser General Public License version 2.1 or later and partly under the GNU General Public License version 2

× Close

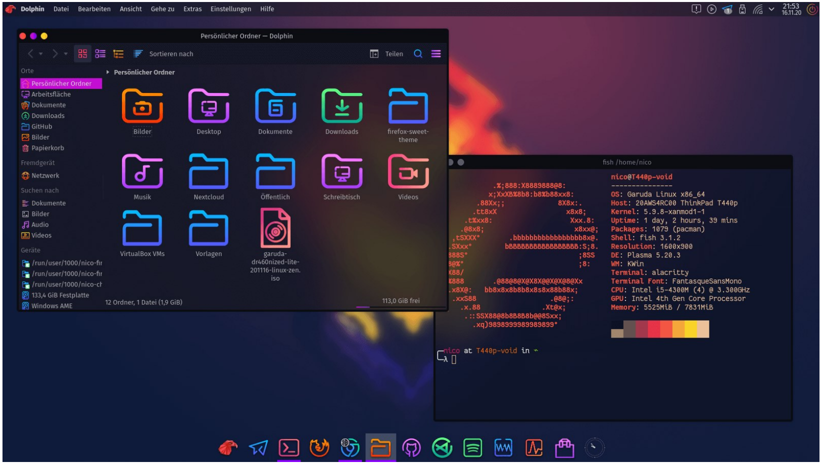
## Deepin: DDE

YouTube



# Garuda KDE Dr460nized

YouTube



```
                                             nico@T440p-void
        .%;888:X8889888@8:                   ---------------
       x;XxXB%8b8:b8%b88xx8:                 OS: Garuda Linux x86_64
    .88Xx;;              8X8x:.              Host: 20AWS4RC00 ThinkPad T440p
   .tt8xX                  x8x8;             Kernel: 5.9.8-xanmod1-1
  .t%xx8:                   Xxx.8:           Uptime: 1 day, 2 hours, 39 mins
 .@8x8;                      x8xx@;          Packages: 1079 (pacman)
,tSXXX°        .bbbbbbbbbbbbbbbbb8x@.        Shell: fish 3.1.2
.SXxx°        bBBBBBBBBBBBBBBBBBB:S;8.       Resolution: 1600x900
888S°                          ;8SS          DE: Plasma 5.20.3
8@%°                           ;8:           WM: KWin
X88/                                         Terminal: alacritty
%888       .@88@8@X@X8X@@X@X@8@Xx            Terminal Font: FantasqueSansMono
.x8X@:   bb8x8x8b8b8x8s8x88b88x;             CPU: Intel i5-4300M (4) @ 3.300GHz
 .xxS88                  .@8@;:              GPU: Intel 4th Gen Core Processor
   .x.88               .Xt@x;                Memory: 5525MiB / 7831MiB
    .::SSX88@8b8B8B8b@@8Sxx;
      .xq)9898999989989899°

nico at T440p-void in ~
λ
```

## Command Line Interface

## Above features are added strength

In my opinion: there are 3 main utilities of CLI

- Scripting (faster)
- Logging
- GUI is not essential

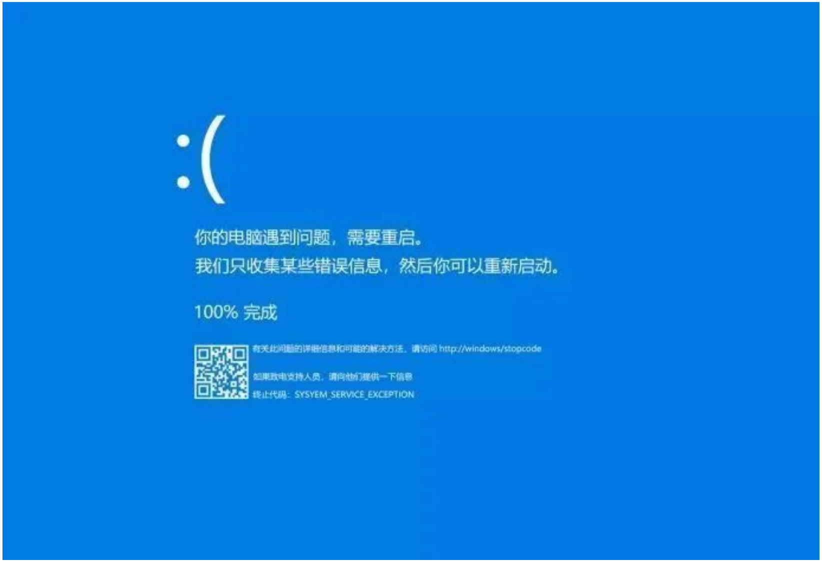
## Scripting

Try:

- Create a folder named 'a' for 100 times recursively.
- Find where are this 'word' in this directory.
- Poke me to make the counter overflow($> 2^{16} - 1$).
  You can win a secret price if you do it! (Show me.)

## Logging

We are developers. We need those information to solve the errors.



:(

你的电脑遇到问题，需要重启。
我们只收集某些错误信息，然后你可以重新启动。

100% 完成

有关此问题的详细信息和可能的解决方法，请访问 http://windows/stopcode

如果致电支持人员，请向他们提供以下信息

终止代码：SYSYEM_SERVICE_EXCEPTION

## GUI is not essential

"A wifi access point does not need a desktop environment."

change my mind.

## How to learn commands?

Click me

## How to learn commands *faster*?

Flash your entire device and install a Linux distro.