



WALCHAND COLLEGE OF ENGINEERING, SANGLI  
WALCHAND LINUX USERS' GROUP



LIMITED  
SEATS

# LINUXDIARY 5.0

EXPLORE THE LINUX REALM

Session 01:  
**FOSS  
KICKOFF**

10  
AUG

Session 02:  
**ROUTE TO  
ROOT**

WARGAMES

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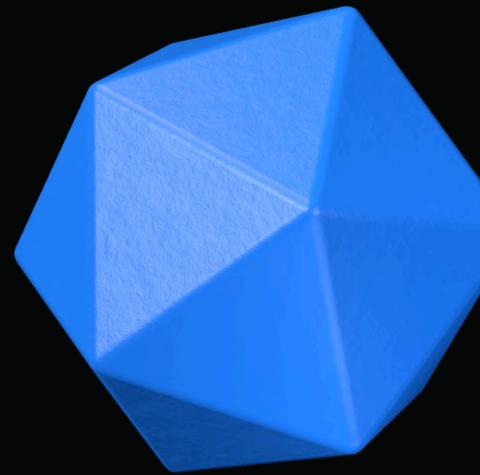
Dr. U. A. Dabade  
I/C Director  
Walchand College of Engineering

# Let's get started

**Me after attending  
the Linux workshop**



**Me before attending  
the Linux workshop**



# Contents

- ◆ Open Source Softwares
- ◆ Understanding Kernel
- ◆ System Calls
- ◆ Linux Distros and Desktop Environments
- ◆ Package Managers
- ◆ Applications



# Open Source Softwares

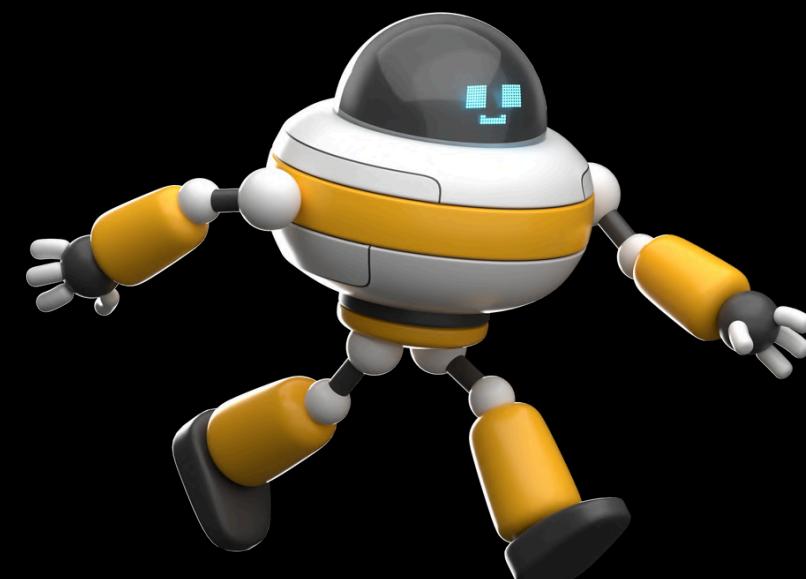
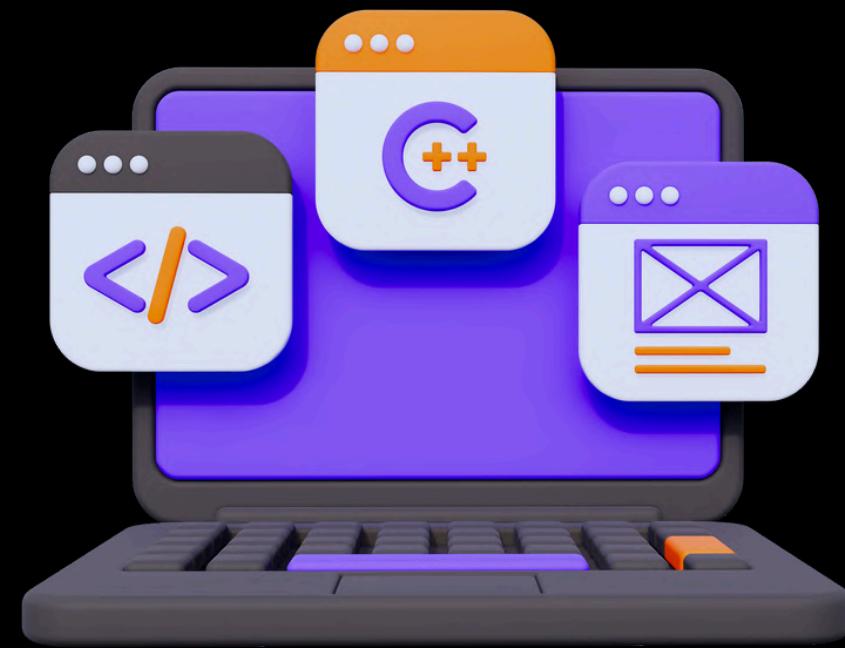
# Software

- ◆ Set of instructions for computer
- ◆ Comprises various programs, data and documentation
- ◆ Designed with a specific intent
- ◆ Ex. Chrome



## ◆ Program

Set of instructions written in a particular language

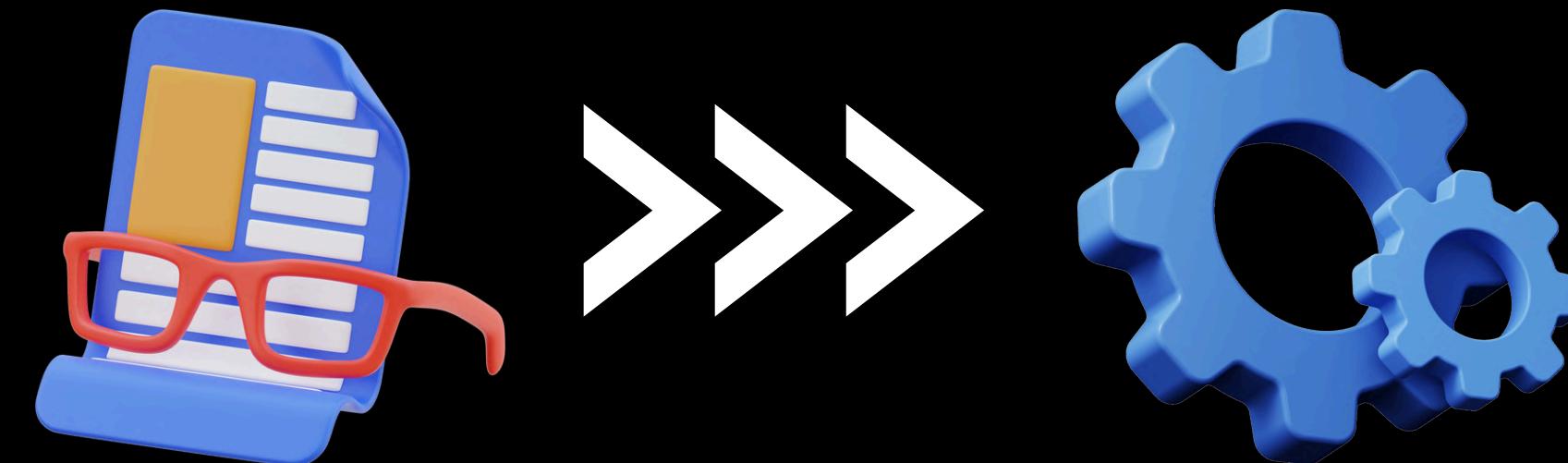


## ◆ Process

Running instance of a program

# Source of a Software

- ◆ Built from programming languages
- ◆ Compiled to machine executable code



# Open Source Softwares

- ◆ The source code is available publicly
- ◆ Anyone can inspect and edit according to their needs
- ◆ Ex. VLC, Blender, VS Code



# Closed Source Software

- ◆ The source code is not available openly
- ◆ Proprietary organizations have the control over the source
- ◆ Ex. Microsoft Office, Zoom, Skype



# Application Software

- ◆ Installed by user
- ◆ Not needed by system



# System Software



- ◆ Generally pre-installed
- ◆ Controls internal functions of computer

# Advantages of OSS

- ◆ Security
- ◆ Community
- ◆ Cost effective
- ◆ Flexibility



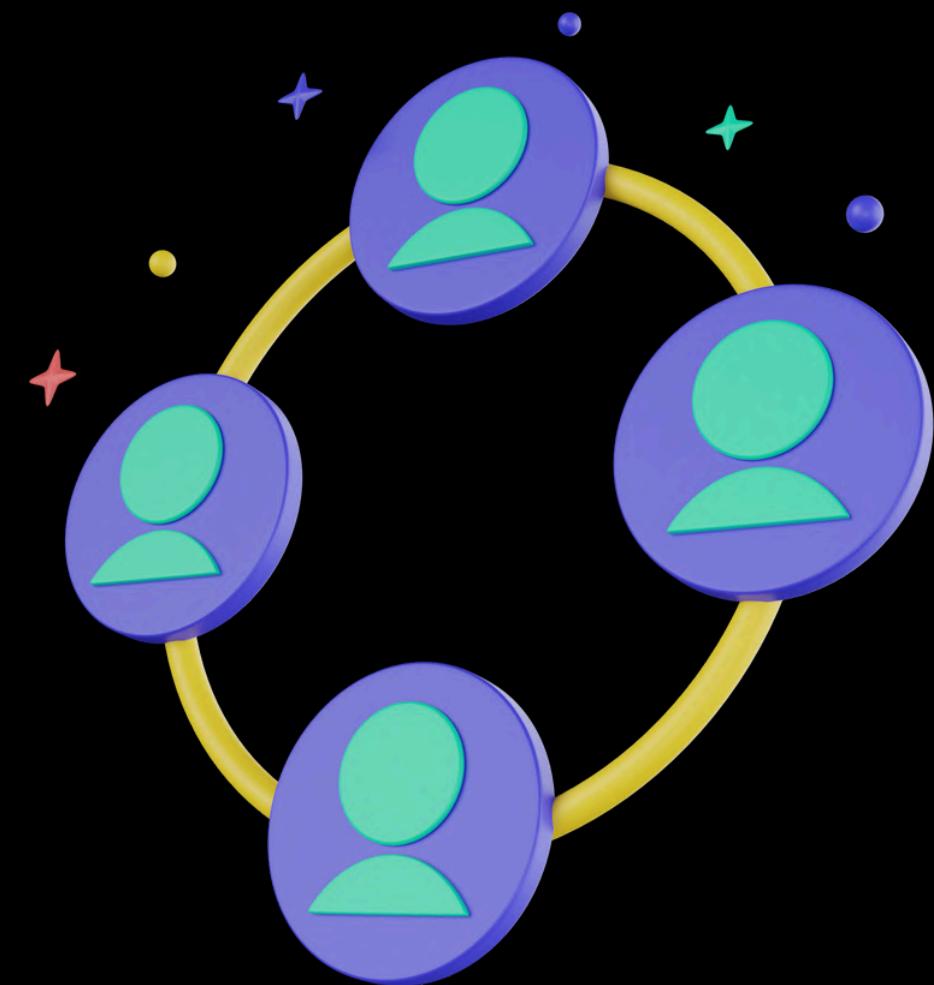
# Security

- ◆ Code reviews by experts
- ◆ Moderated by the maintainers
- ◆ Many eyes principle



# Community

- ◆ People come together for a project
- ◆ Support for the project by various means
- ◆ Helps with troubleshooting



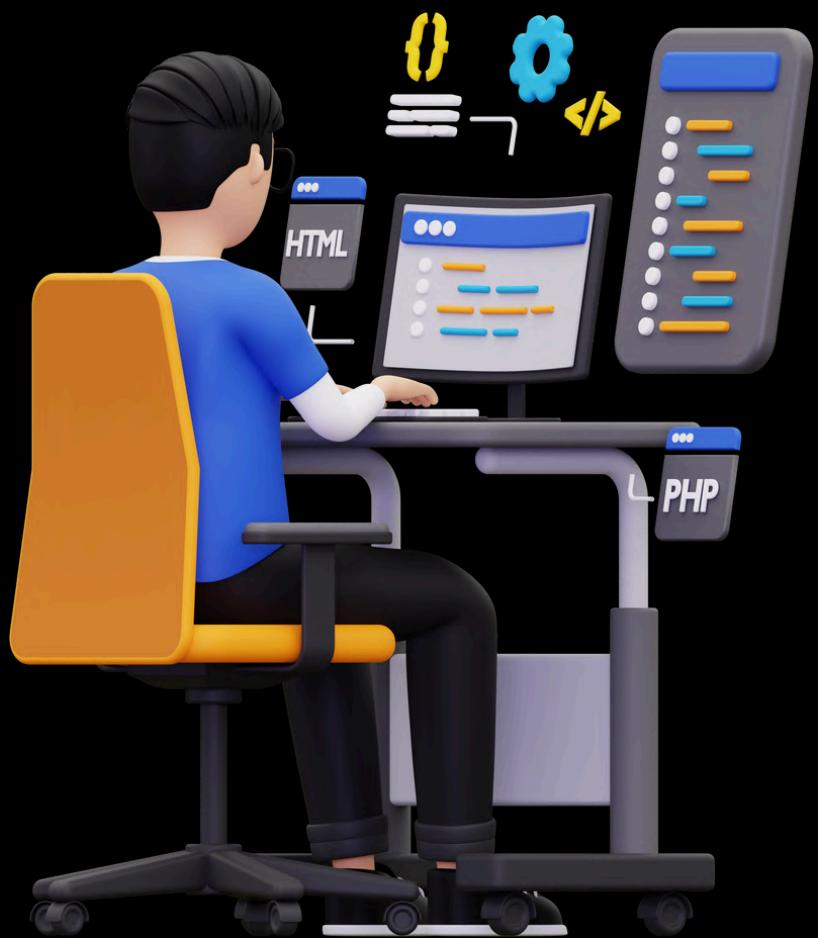
# Cost Effective

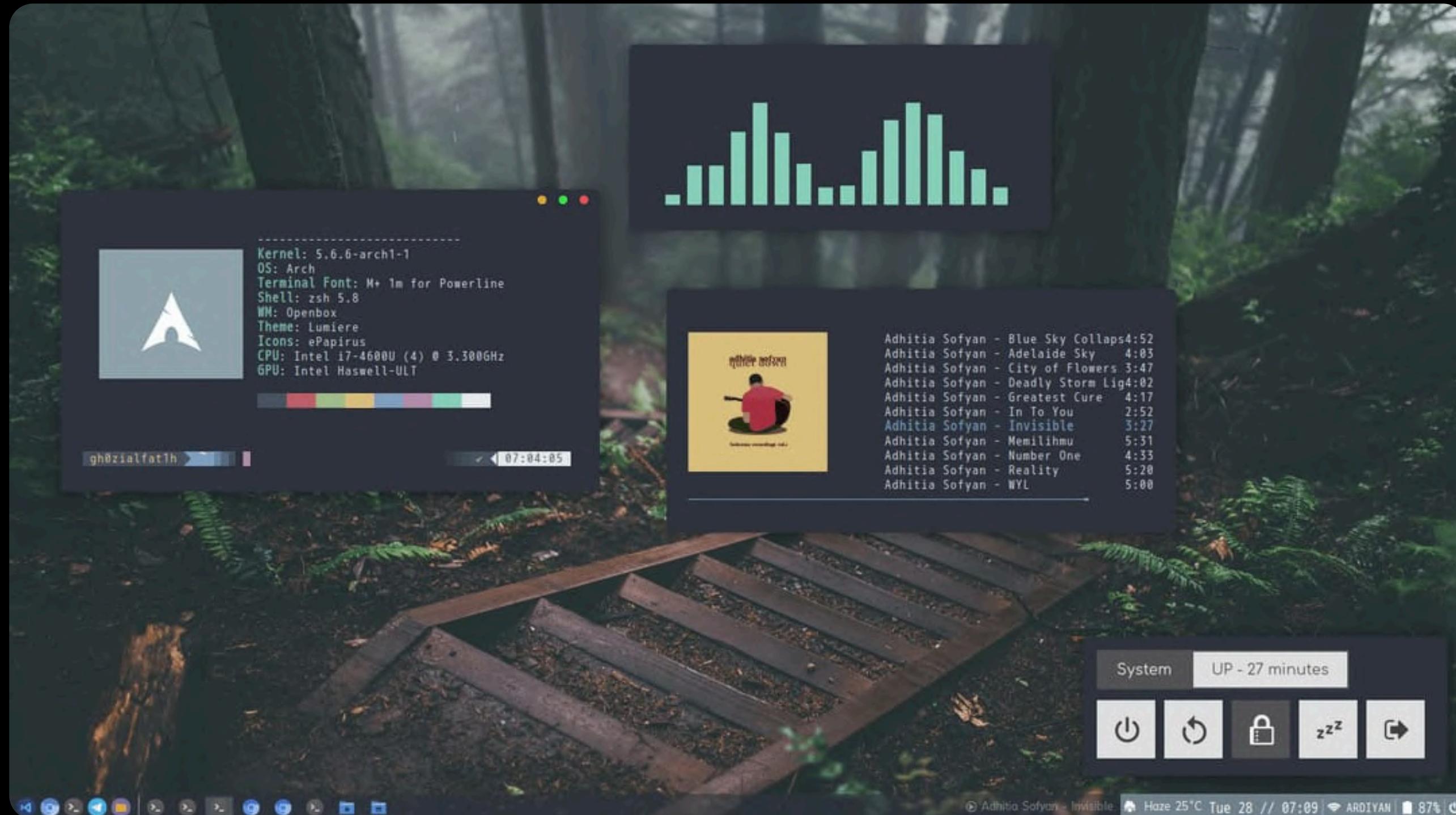
- ◆ Often free to use
- ◆ Community-Driven Assistance
- ◆ Lower hardware requirements



# Flexibility

- ◆ Modify the software according to need
- ◆ Avoids vendor lock-in
- ◆ Offers high degree of customisation





# Operating System

- ◆ Control program
- ◆ Gives a GUI and CLI
- ◆ Environment for program execution
- ◆ Bundled with services and various utilities

User



OS



Hardware

# Shell

- ◆ Command-line interpreter for users
- ◆ Commands to the operating system
- ◆ Communication between user and operating system
- ◆ Ex. Bash, Zsh

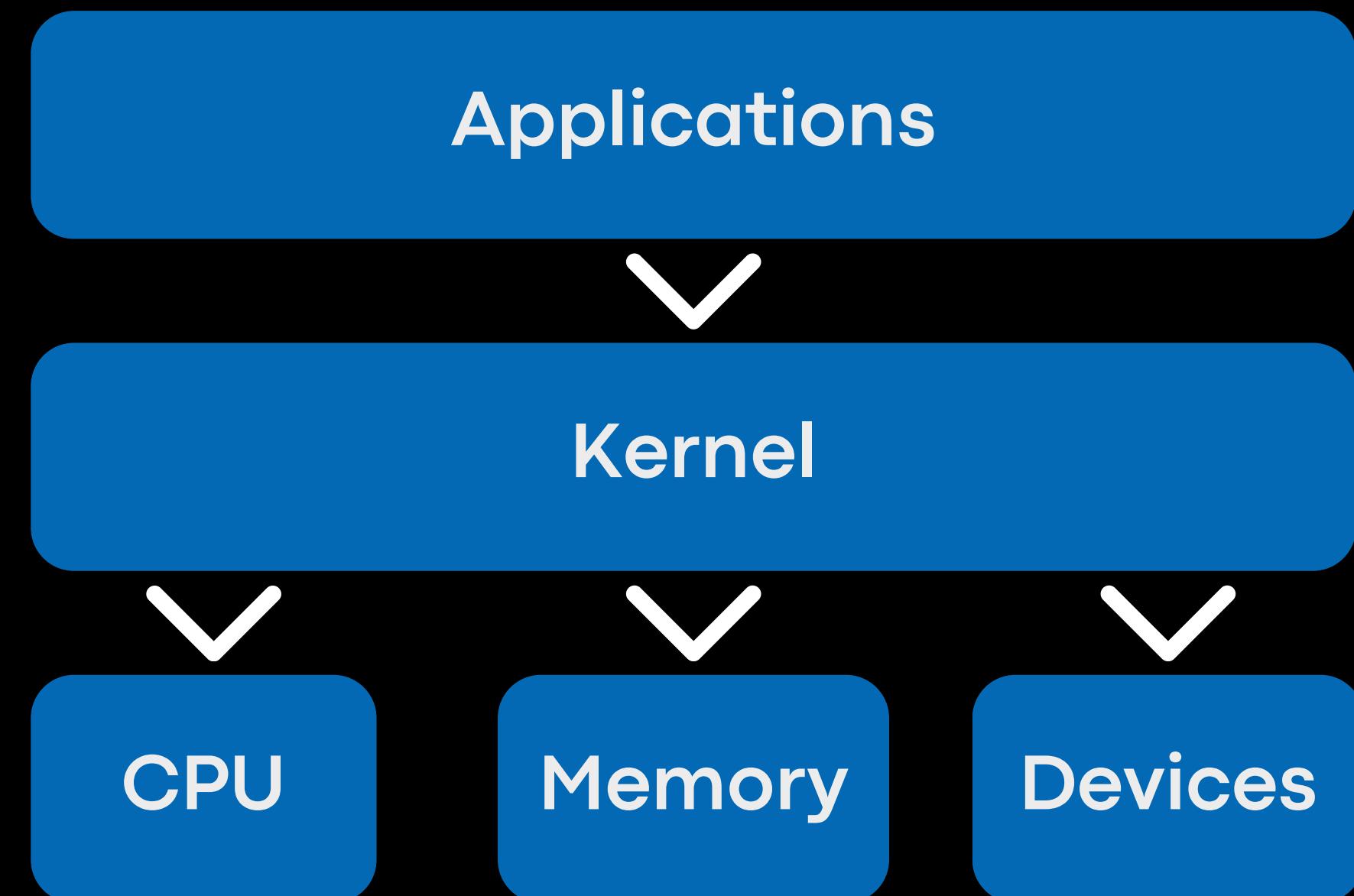


# Kernel

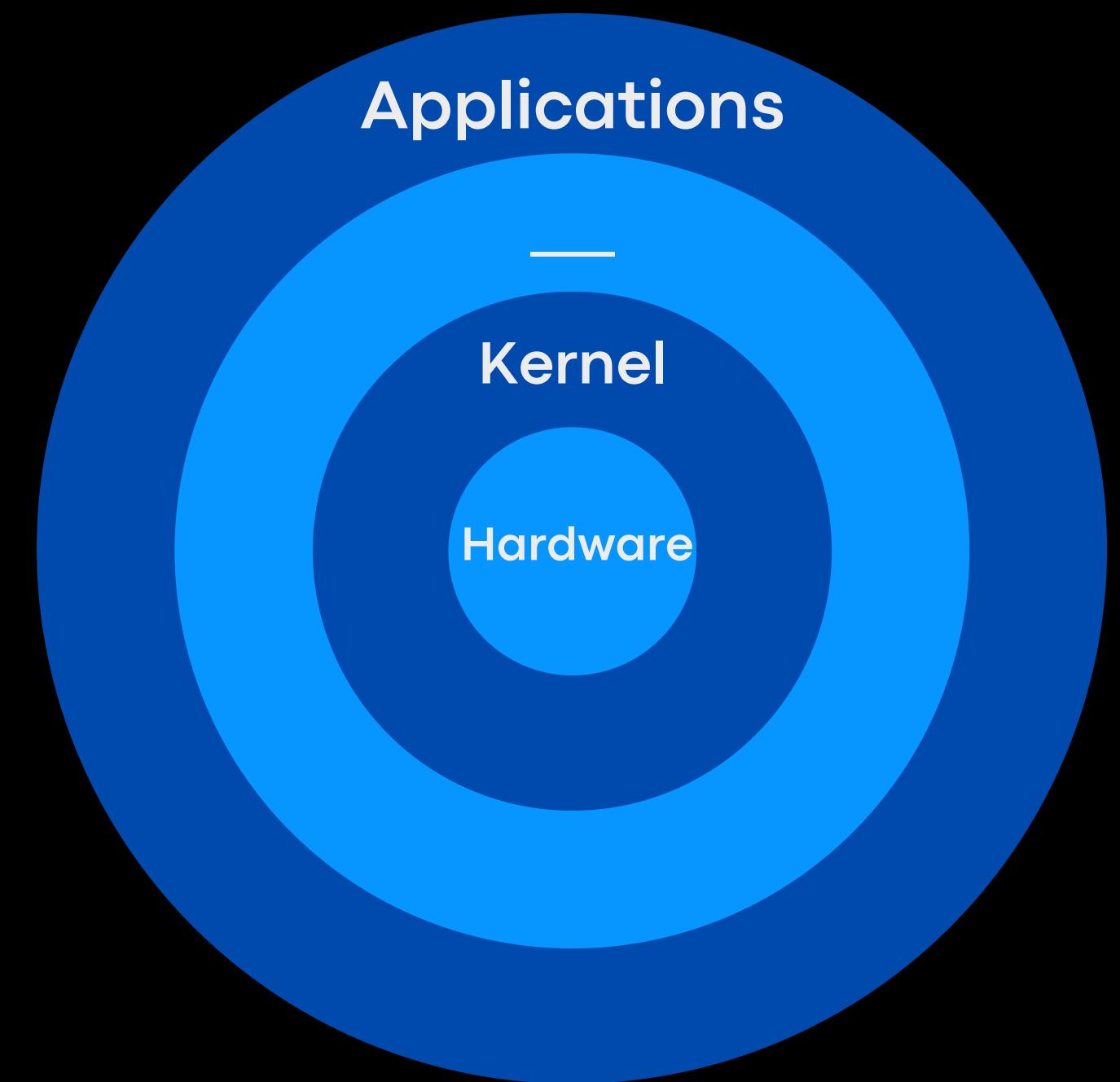
- ◆ Controls access to hardware
- ◆ Manages life-cycle of process
- ◆ Communication between hardware and software



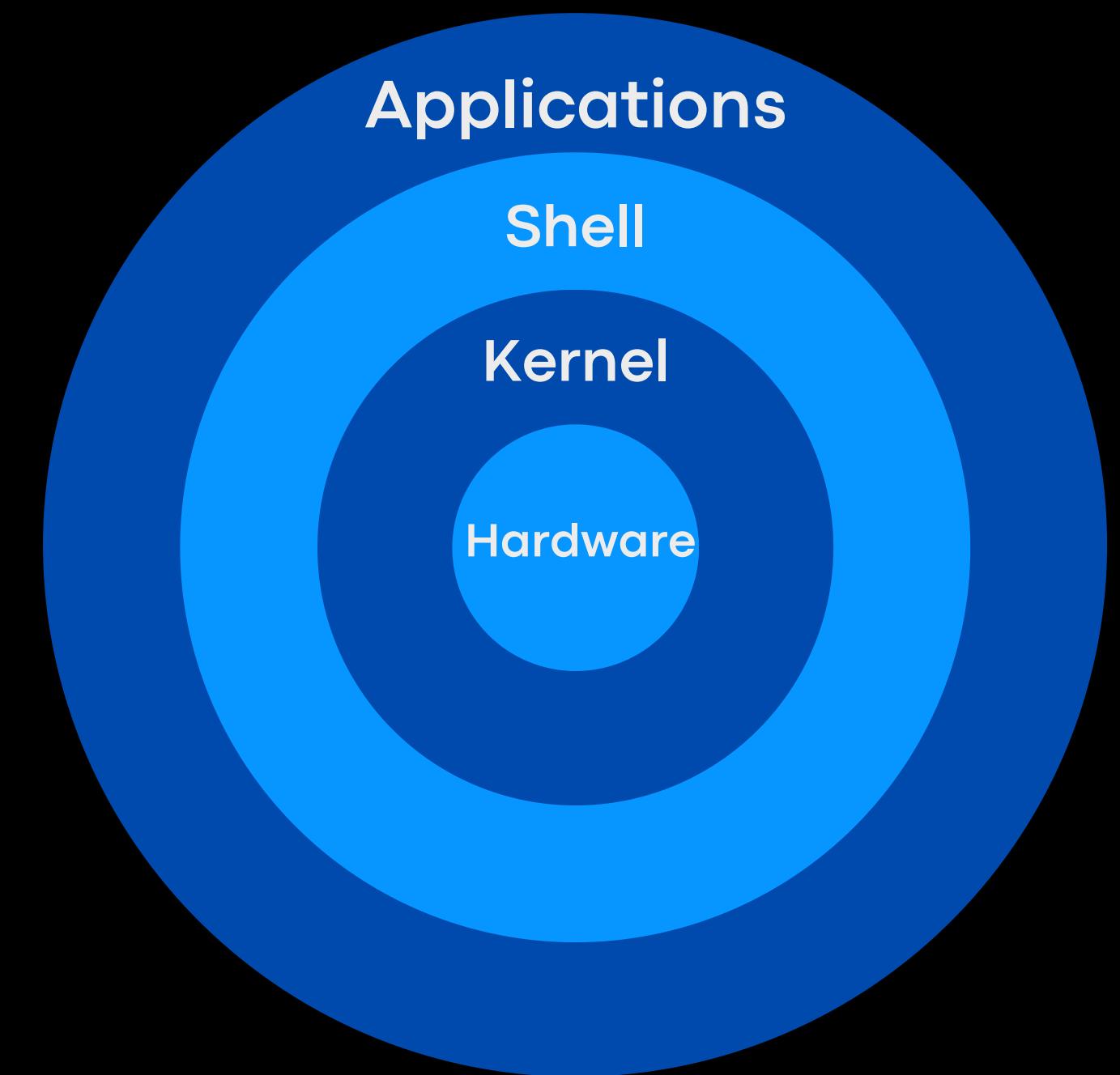
# Kernel Architecture



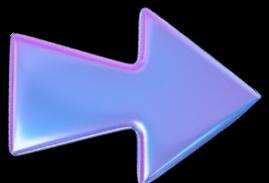
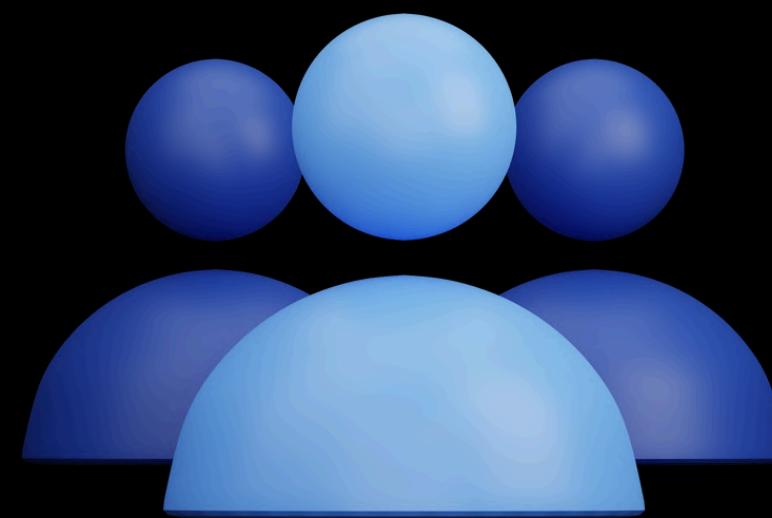
# Kernel Architecture



# Kernel Architecture



# Kernel vs OS



# Kernel *VS* OS

Kernel is a part of OS

Core of the OS

Interface between  
software and hardware

Ex. Linux, XNU

OS is a system software

Kernel + system utilities

Interface between  
user and hardware

Ex. Ubuntu, MacOS

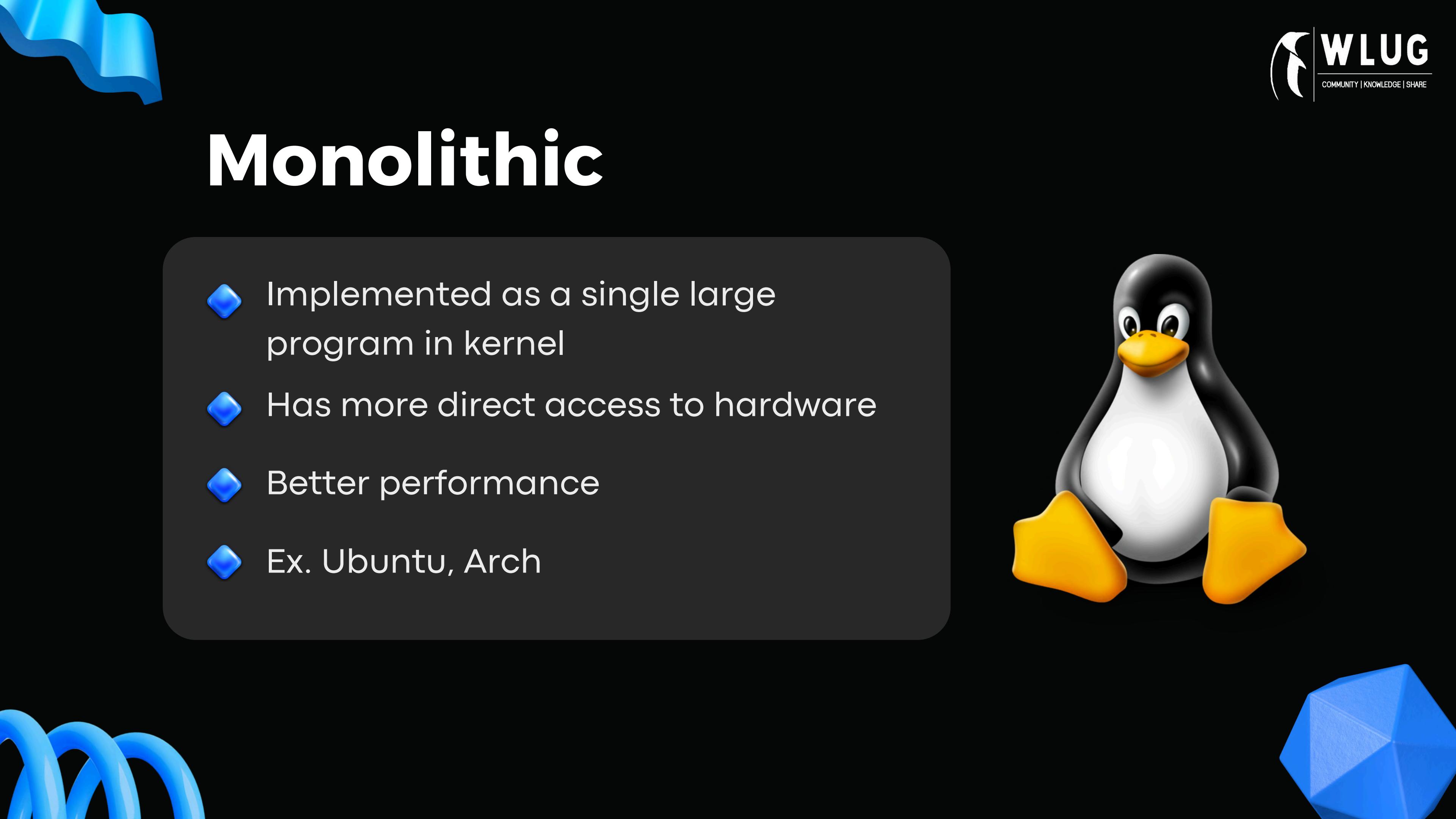
# Types of Kernel

- ◆ Monolithic
- ◆ Microkernel
- ◆ Hybrid



# Monolithic

- ◆ Implemented as a single large program in kernel
- ◆ Has more direct access to hardware
- ◆ Better performance
- ◆ Ex. Ubuntu, Arch



# Microkernel

- ◆ Essential services implemented in kernel space
- ◆ Other services and utilities implemented in user space
- ◆ More stability
- ◆ Ex. Minix



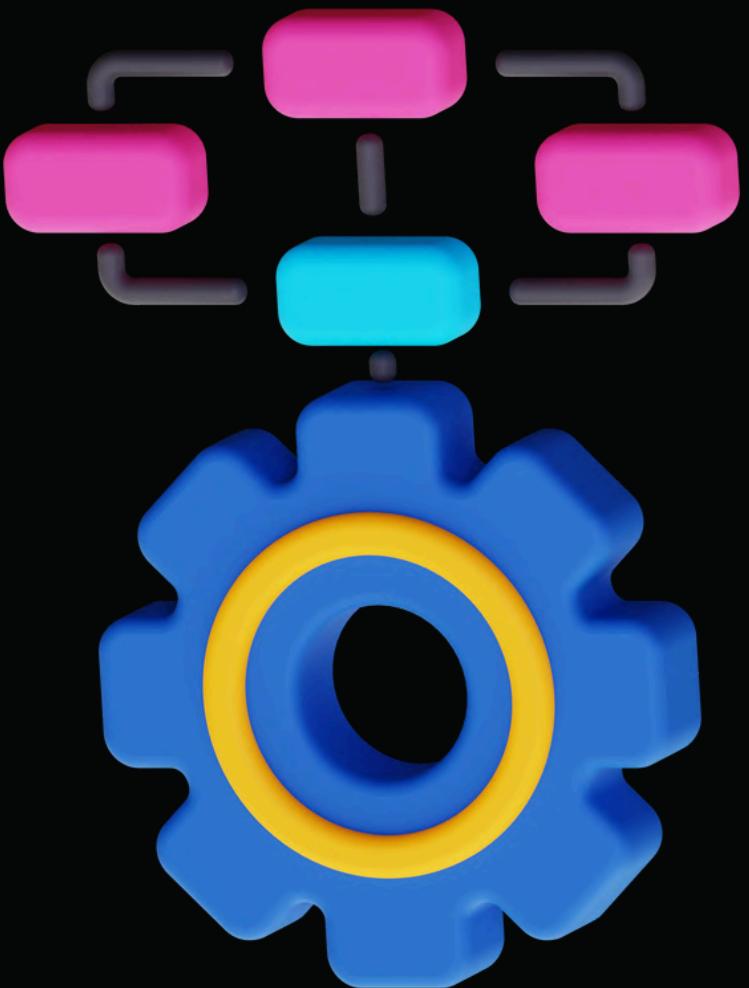
# Hybrid

- ◆ Combination of Monolithic and Microkernel
- ◆ Isolation of services as well as access to hardware
- ◆ Balanced performance and stability
- ◆ Ex. MacOS

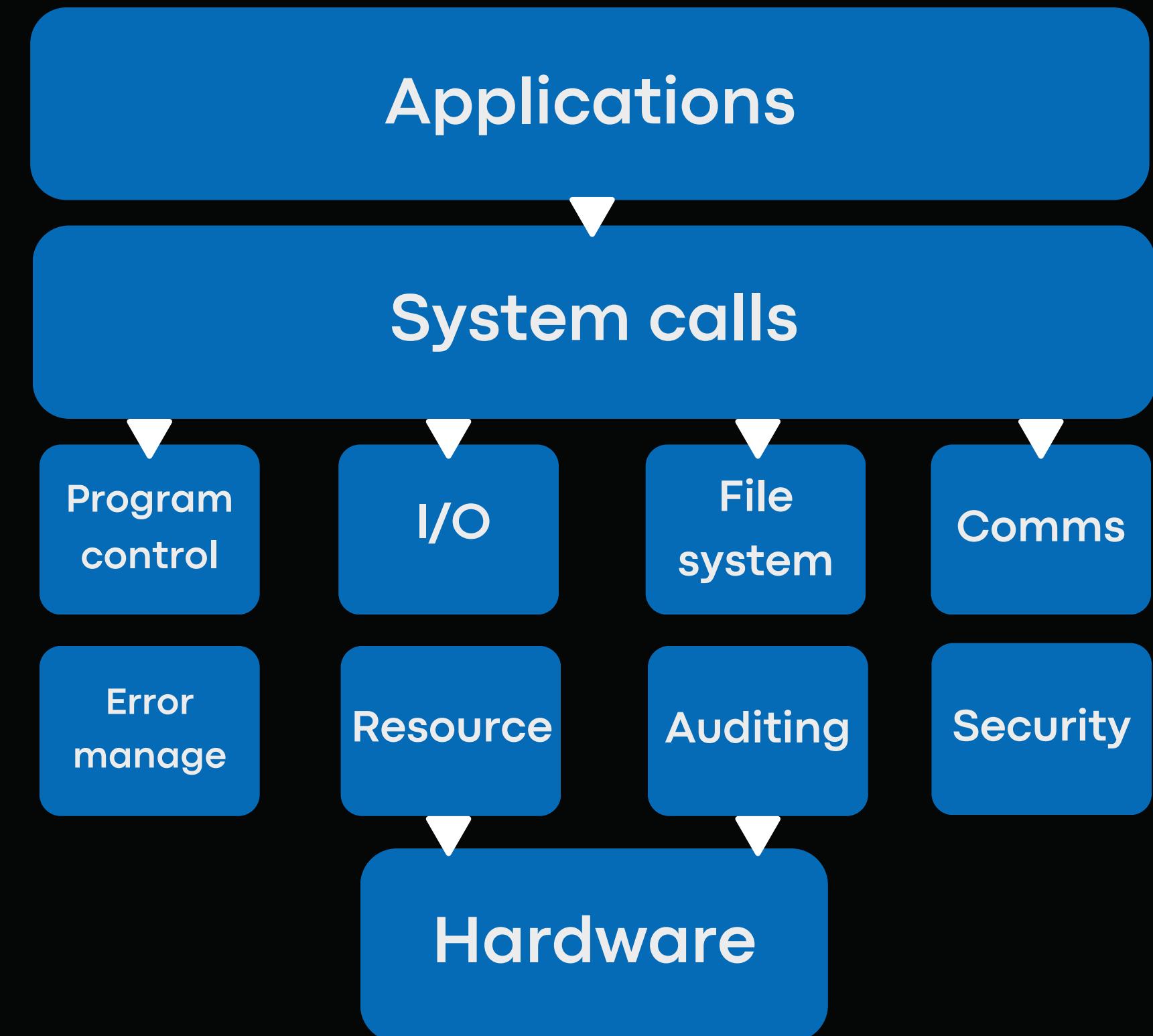


# System Calls

- ◆ Only way for programs to interact with kernel
- ◆ Set of commands to request privileged actions or services
- ◆ Each OS has its own set of system calls

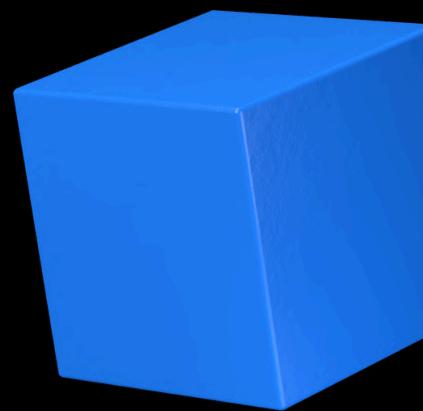
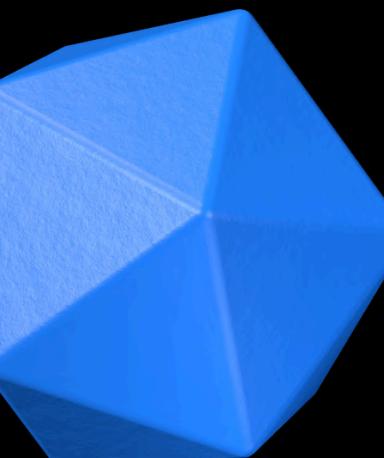
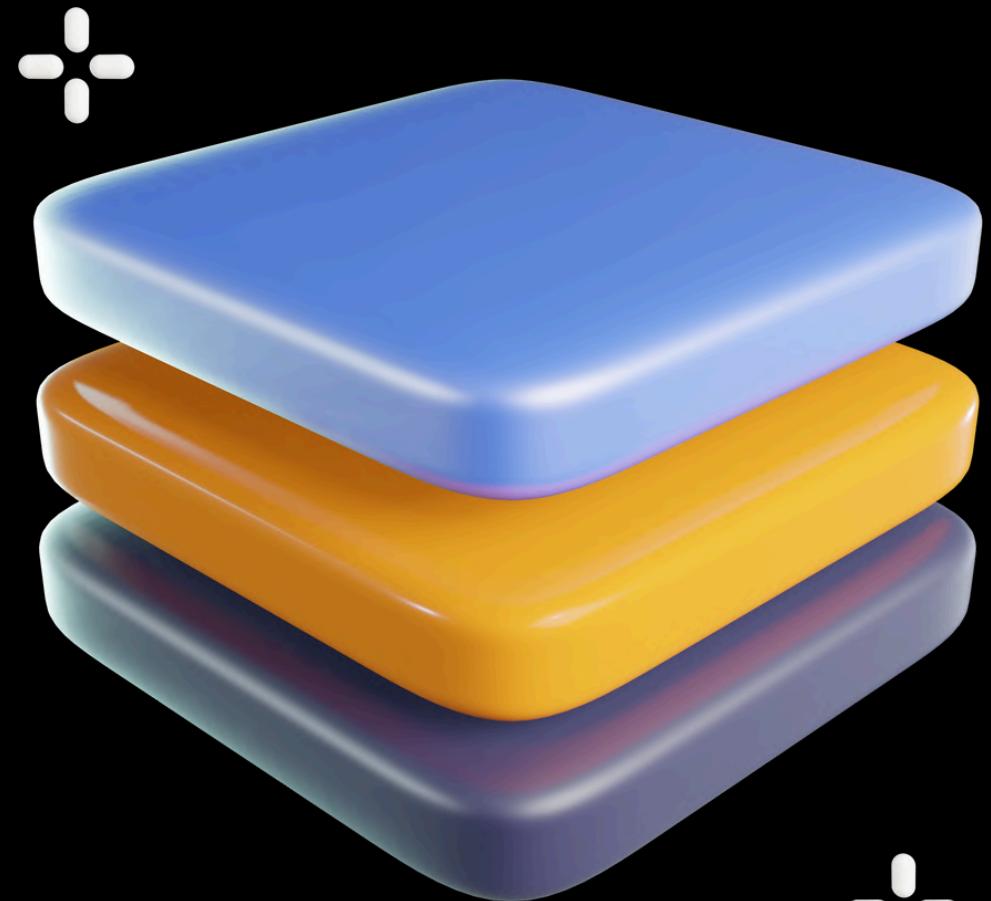


# Architecture

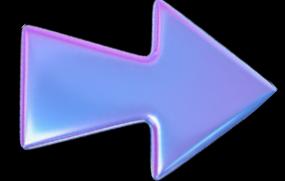
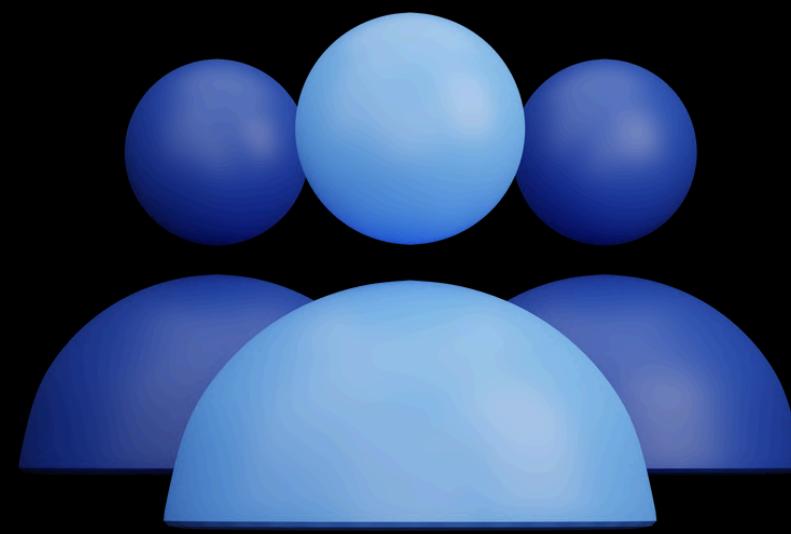


# Why System Calls?

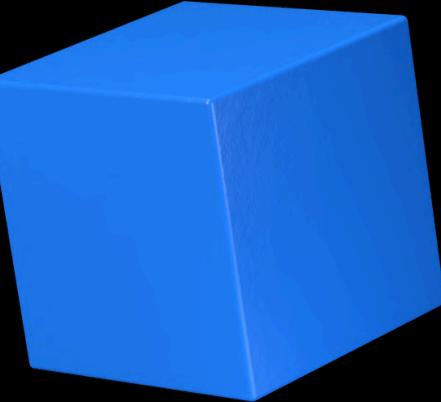
- ◆ Provides a layer of abstraction, giving simple interfaces
- ◆ Enhances security by controlling access to hardware
- ◆ Manages resources efficiently



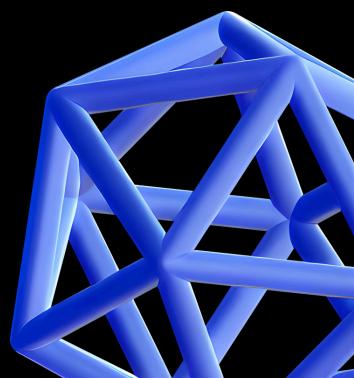
# Kernel vs OS



# Few System Calls



- ◆ open(): Opens a file, for reading or writing data
- ◆ read(): Reads data from the file
- ◆ write(): Writes data to the file
- ◆ close(): Closes the file, cannot read or write
- ◆ fork(): Creates a copy of a current process
- ◆ exit(): Terminates the process



# WHAT IS LINUX?

UNIX OR  
UNIX  
LIKE?

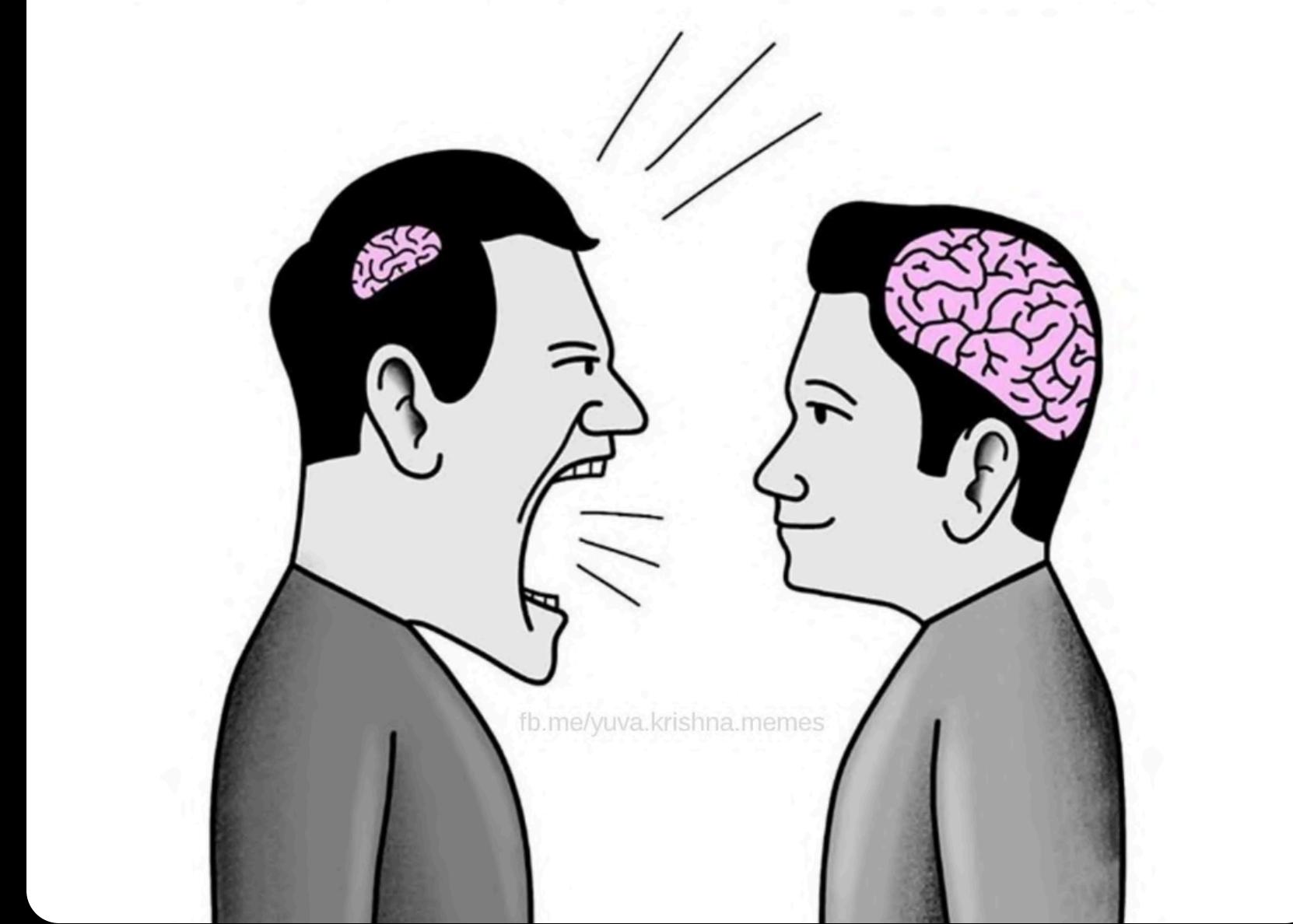
OPEN  
SOURCE  
DISTRO?

OPERATING  
SYSTEM?

KERNEL?

**Linux is  
the best OS**

**Linux is not  
an OS, it's a  
kernel**



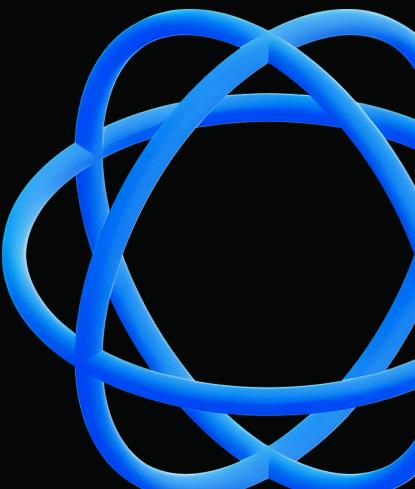
# Linux

- ◆ Core component of the OS
- ◆ Created by Linus Torvalds in 1991
- ◆ GNU/LINUX = GNU + LINUX

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# WHAT IS UNIX?

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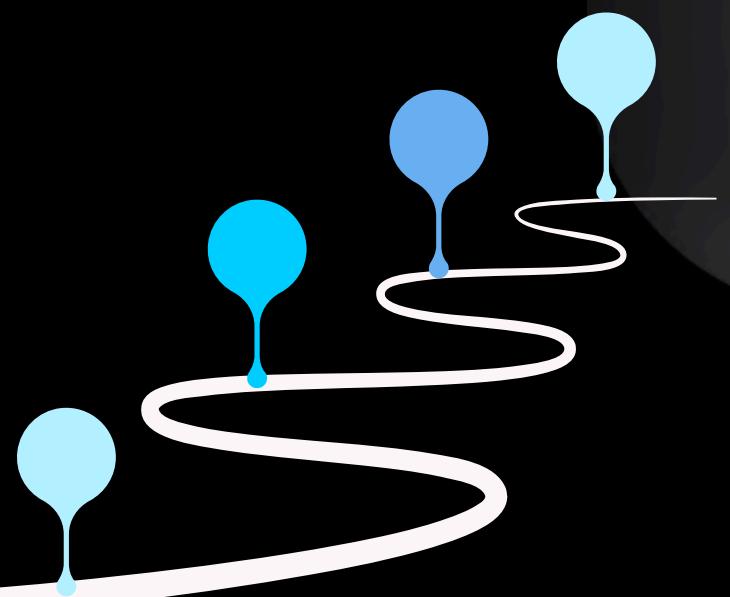
# Unix

- ❖ Family of multitasking, multiuser computer OS
- ❖ Written in C and assembly languages
- ❖ Provides easy communication

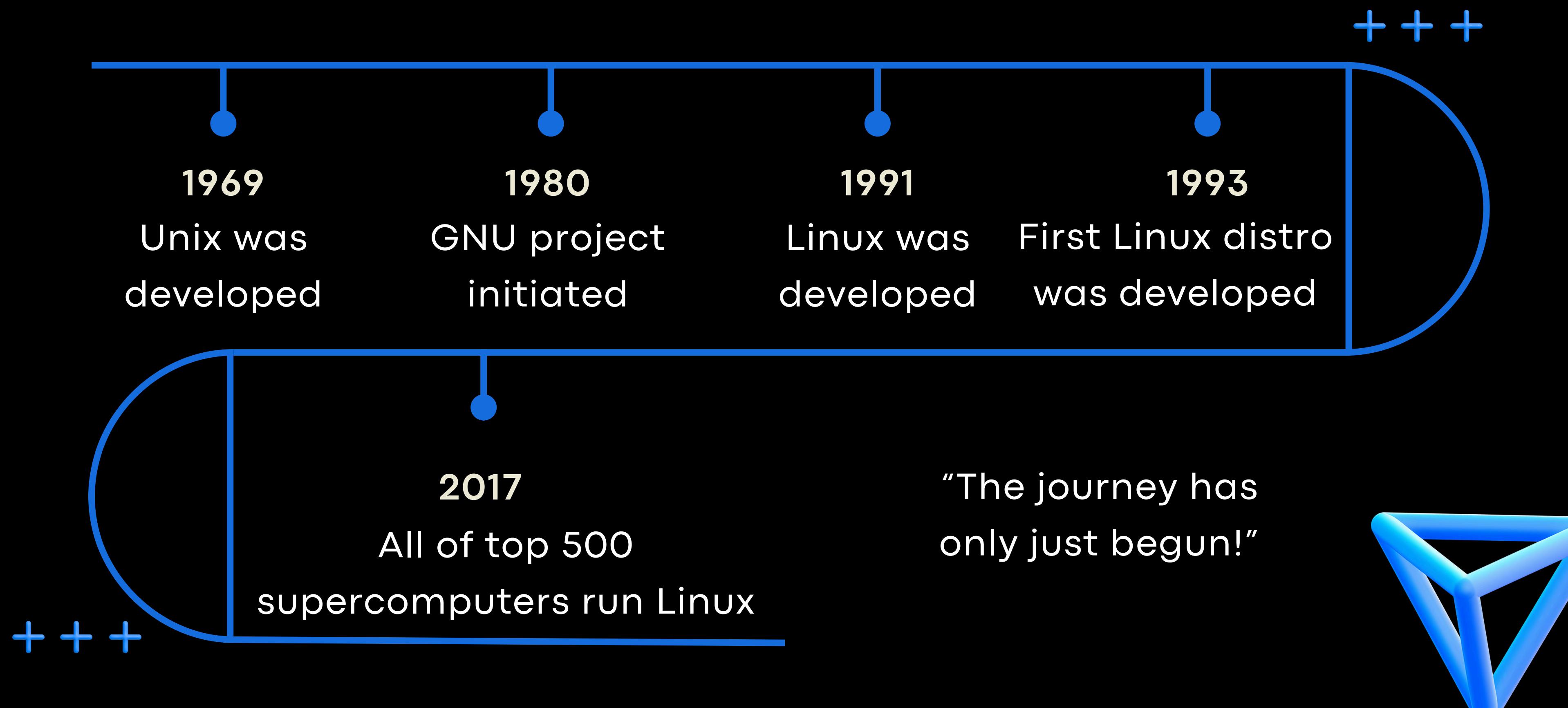
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# HOW WAS LINUX DEVELOPED?

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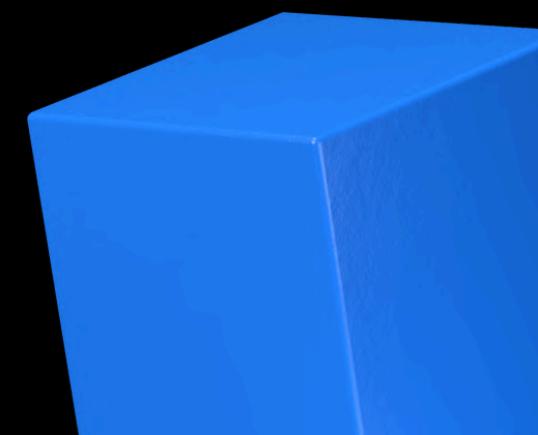
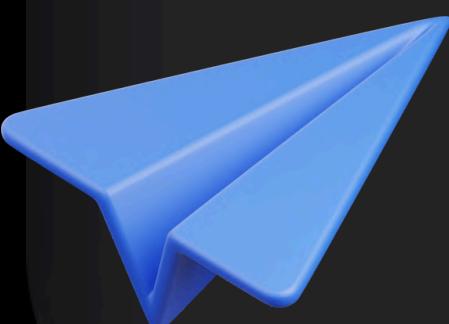
# Linux Development



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# LINUX DISTRIBUTIONS

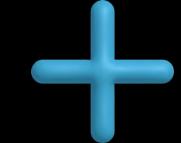
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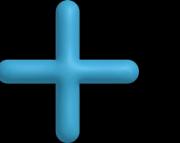
# LINUX DISTRIBUTIONS



Kernel



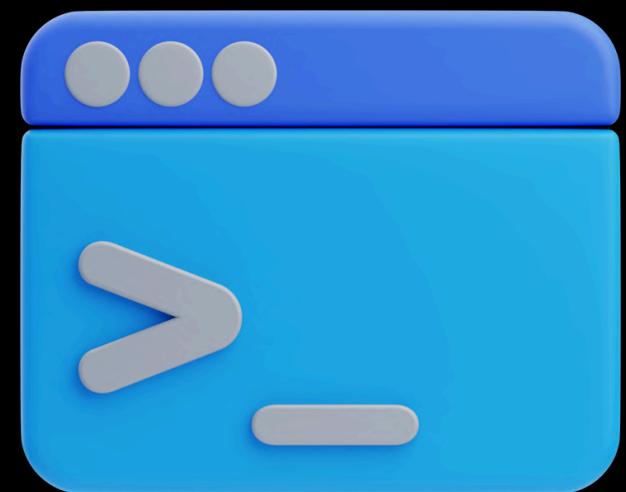
Softwares



Interface



# CLI



# /vs



# GUI

# CLI *VS* GUI

Operates through  
text commands

More efficient

Consumes fewer  
system resources

Steeper learning  
curve

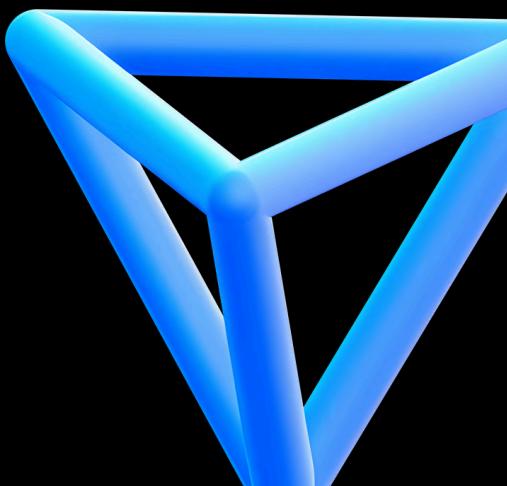
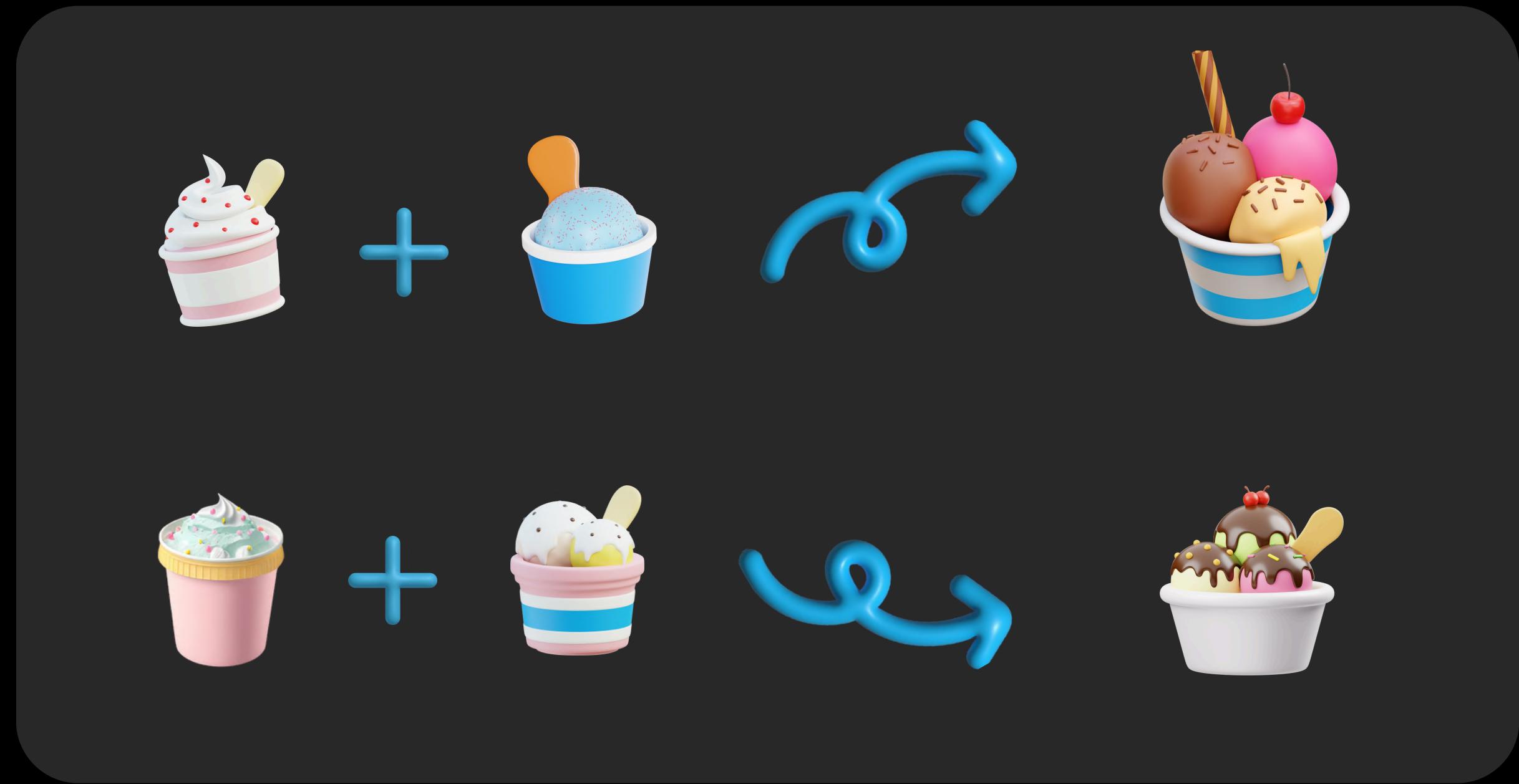
Relies on icons,  
menus and windows

Less efficient

Consumes more  
system resources

Shallow learning  
curve

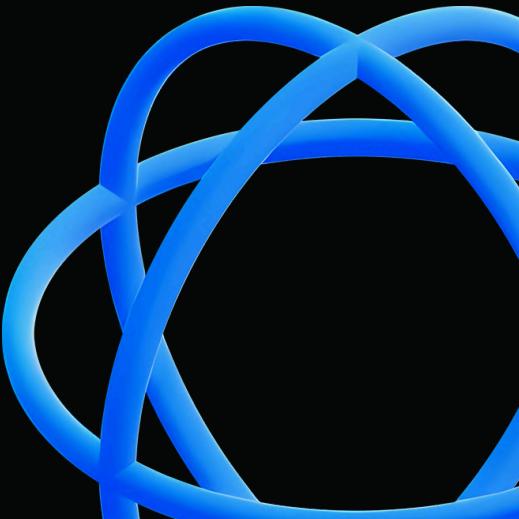
# Flavours of Linux



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# LINUX FAMILIES

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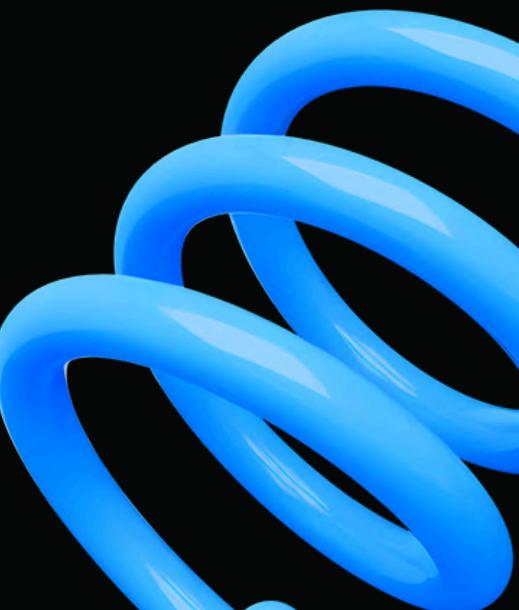


# Common Features

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- ◆ Wide hardware compatibility
- ◆ Extensive community support
- ◆ Extensive customisation

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# Debian

- ◆ Popular amongst general users
- ◆ Known for stability, security and extensive repository
- ◆ Ideal for servers

# Arch

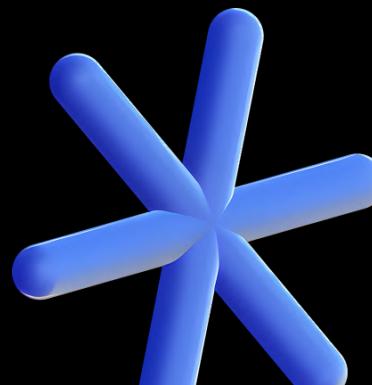
- ❖ Popular among developers
- ❖ Known for vast repositories i.e AUR
- ❖ Provides latest softwares and high degree of customisation



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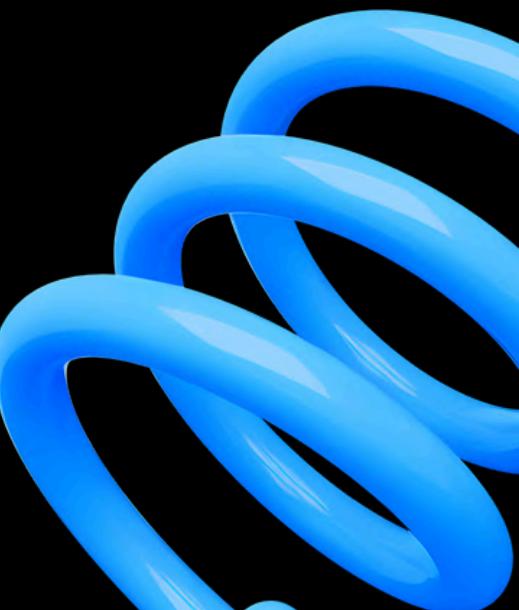


# Red Hat Enterprise Linux

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- ◆ Popular among enterprises
- ◆ Designed specifically for commercial and enterprise environments
- ◆ Provides management tools like red hat satellite

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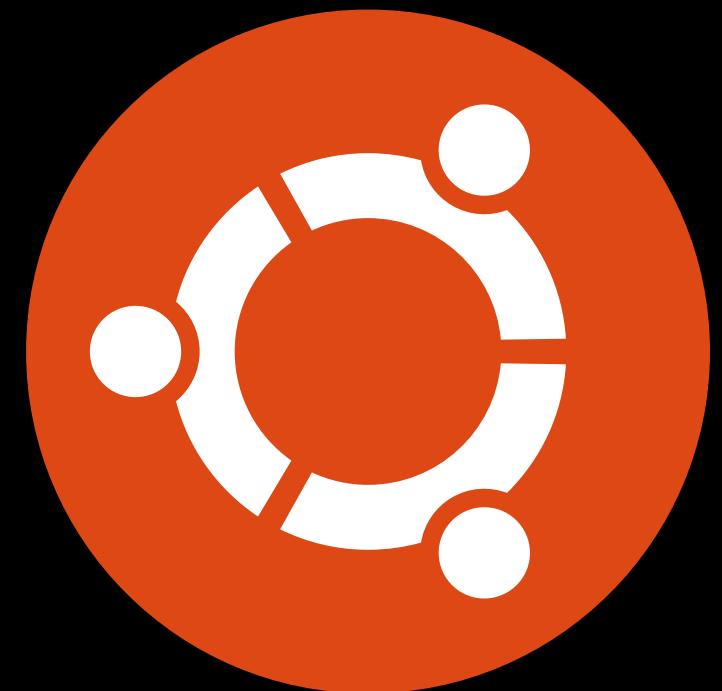




**UBUNTU**

# Ubuntu

- ◆ Base: Debian
- ◆ User-friendly interface and stable
- ◆ Lots of pre-installed apps





Applications Places Activities

Sun Jul 7 13:53:52

Overcast Clouds, 24 °C

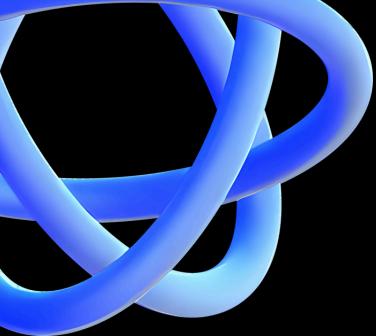


80%



Home

# GARUDA



# Garuda

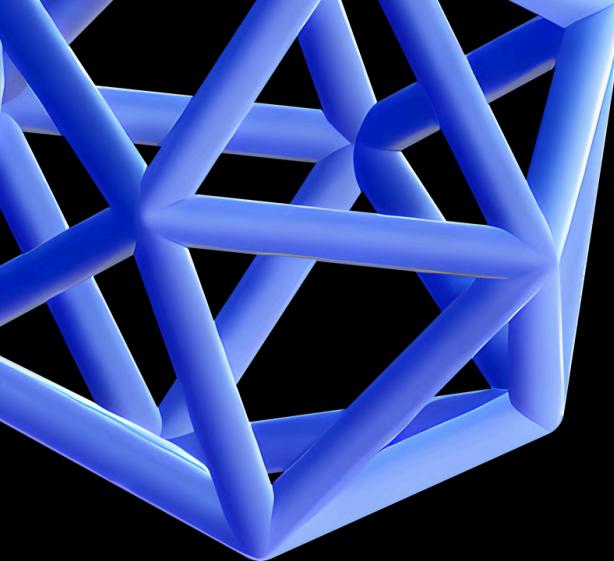
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- ◆ Base: Arch
- ◆ Simple and elegant interface
- ◆ Pre-installed softwares for gaming
- ◆ Snapshot feature



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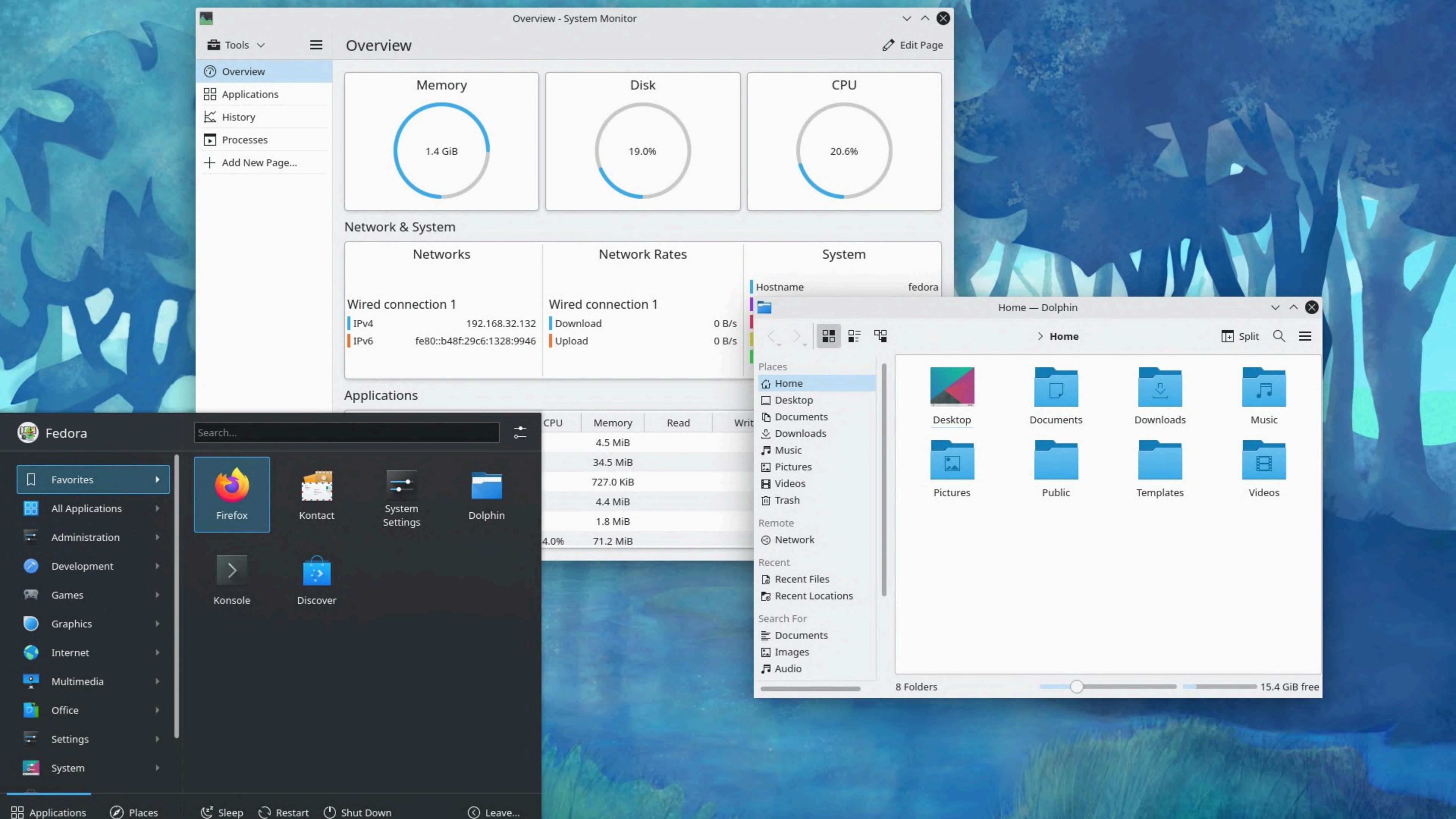


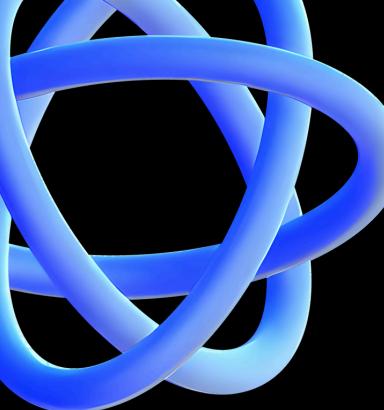


# Fedora

- ◆ Base: Red Hat Enterprise Linux
- ◆ Regular updates
- ◆ Developer tools and softwares readily available



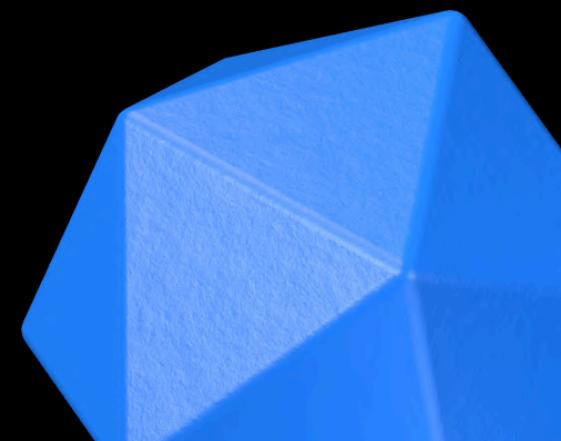




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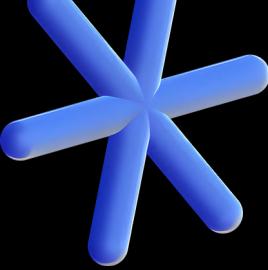


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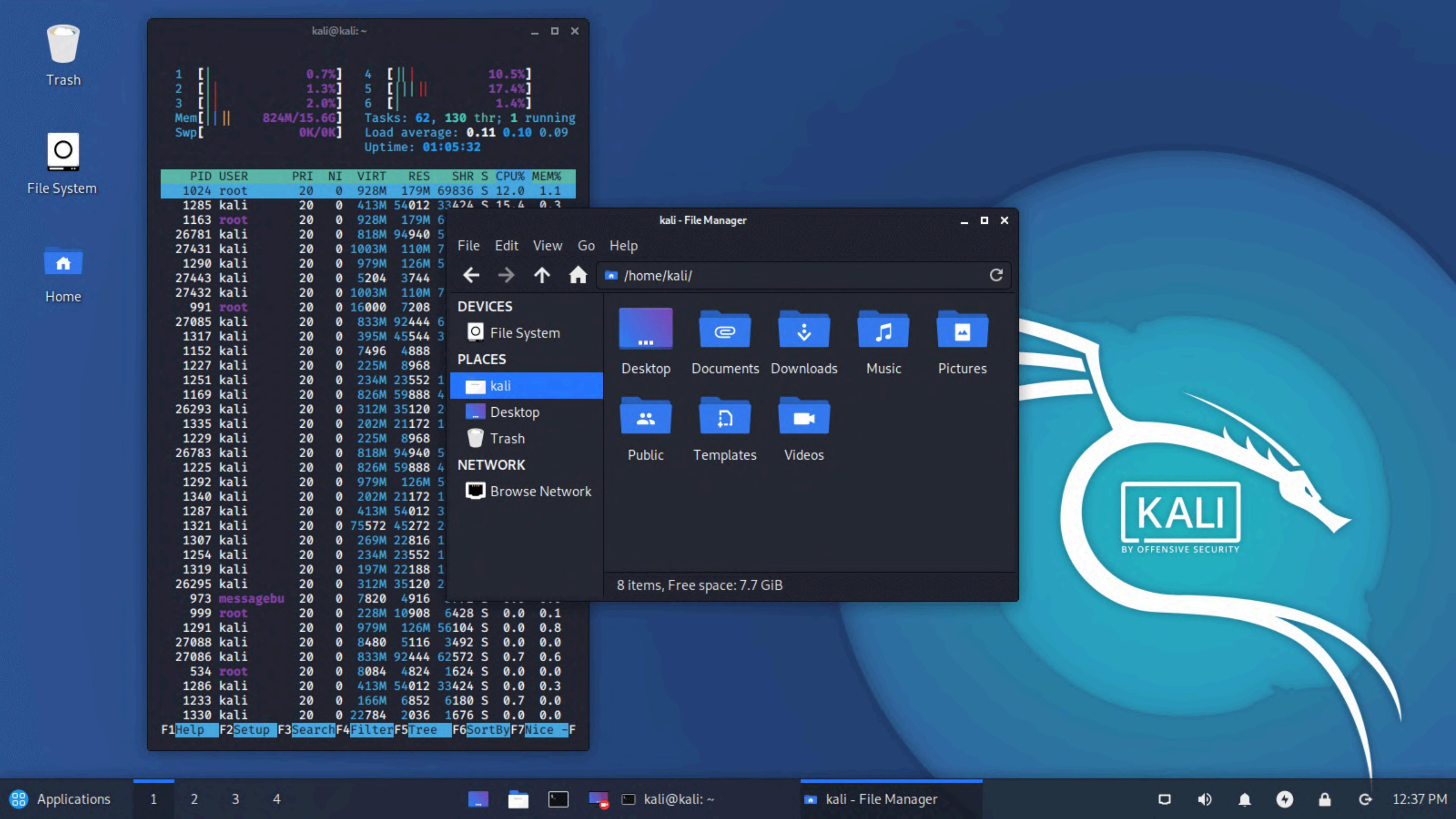
**KALI**



# Kali

- ◆ Base: Debian
- ◆ Pre-installed with numerous security and forensic tools
- ◆ Regular updates and security patches





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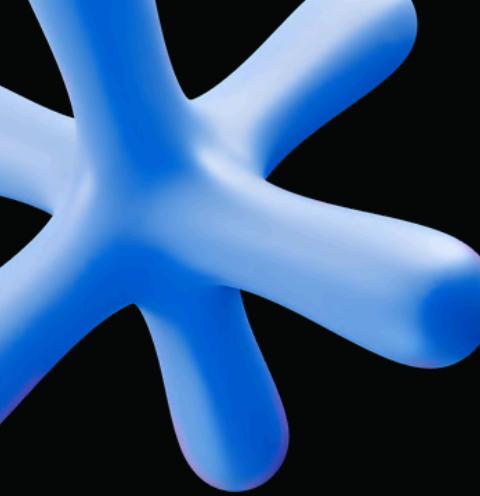
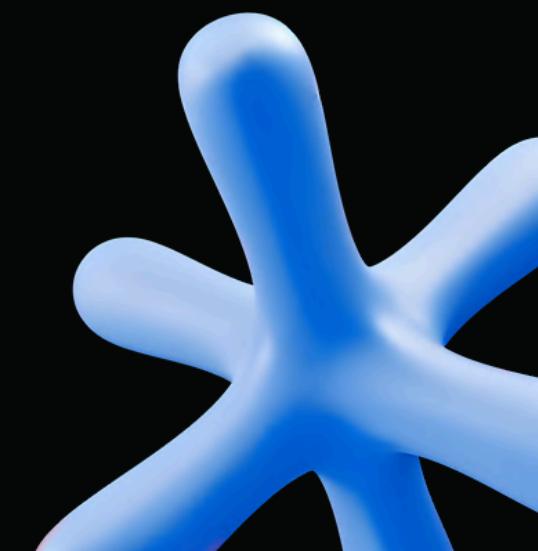
Beginner hackers after installing  
Kali Linux for the first time



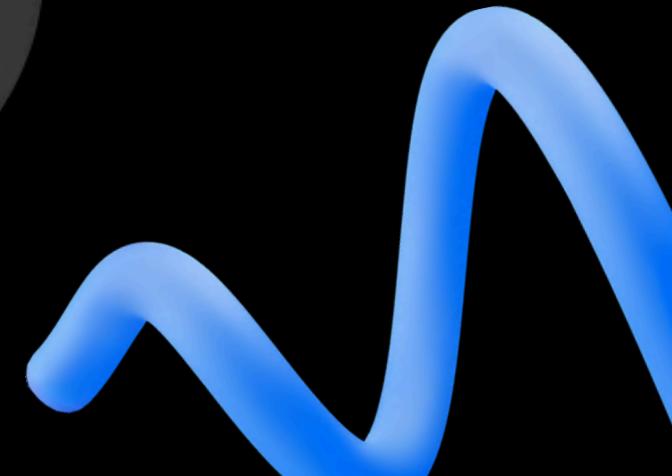
@scorpsec



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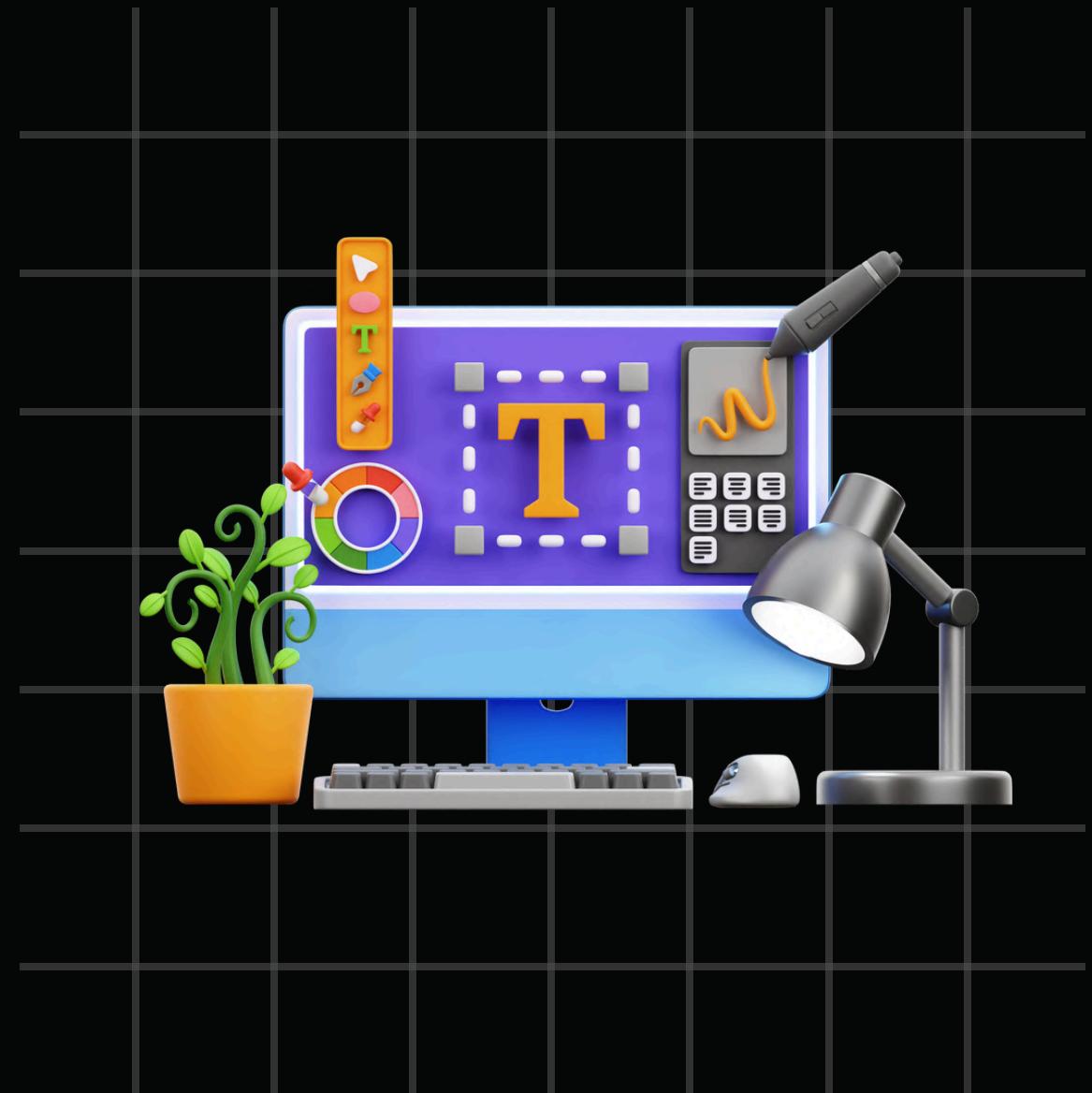


# DESKTOP ENVIRONMENT



# What is a Desktop Environment?

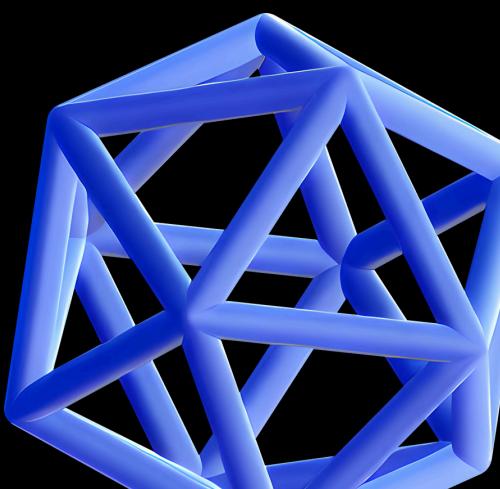
- ◆ A graphical user interface for interacting with OS
- ◆ Ex. MATE, GNOME, XFCE, KDE Plasma & many more



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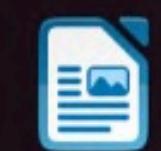
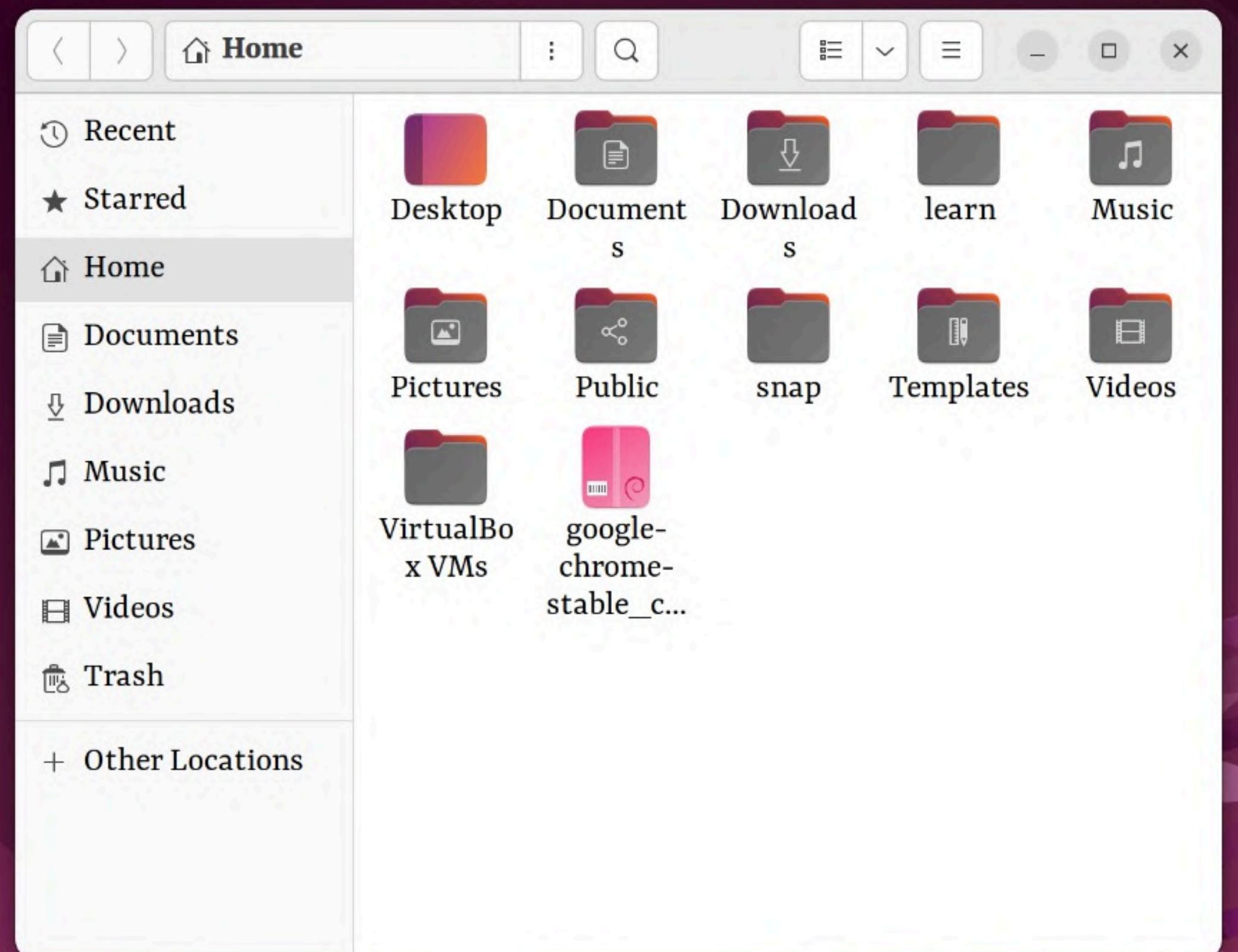
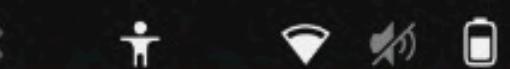
# GNU Network Object Model Environment

- ◆ Modern and trendy
- ◆ Quick access
- ◆ Designed for simplicity
- ◆ Minimalistic
- ◆ Customisation

Activities

Files

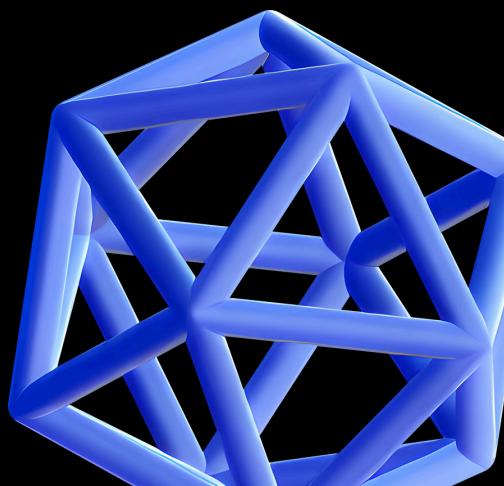
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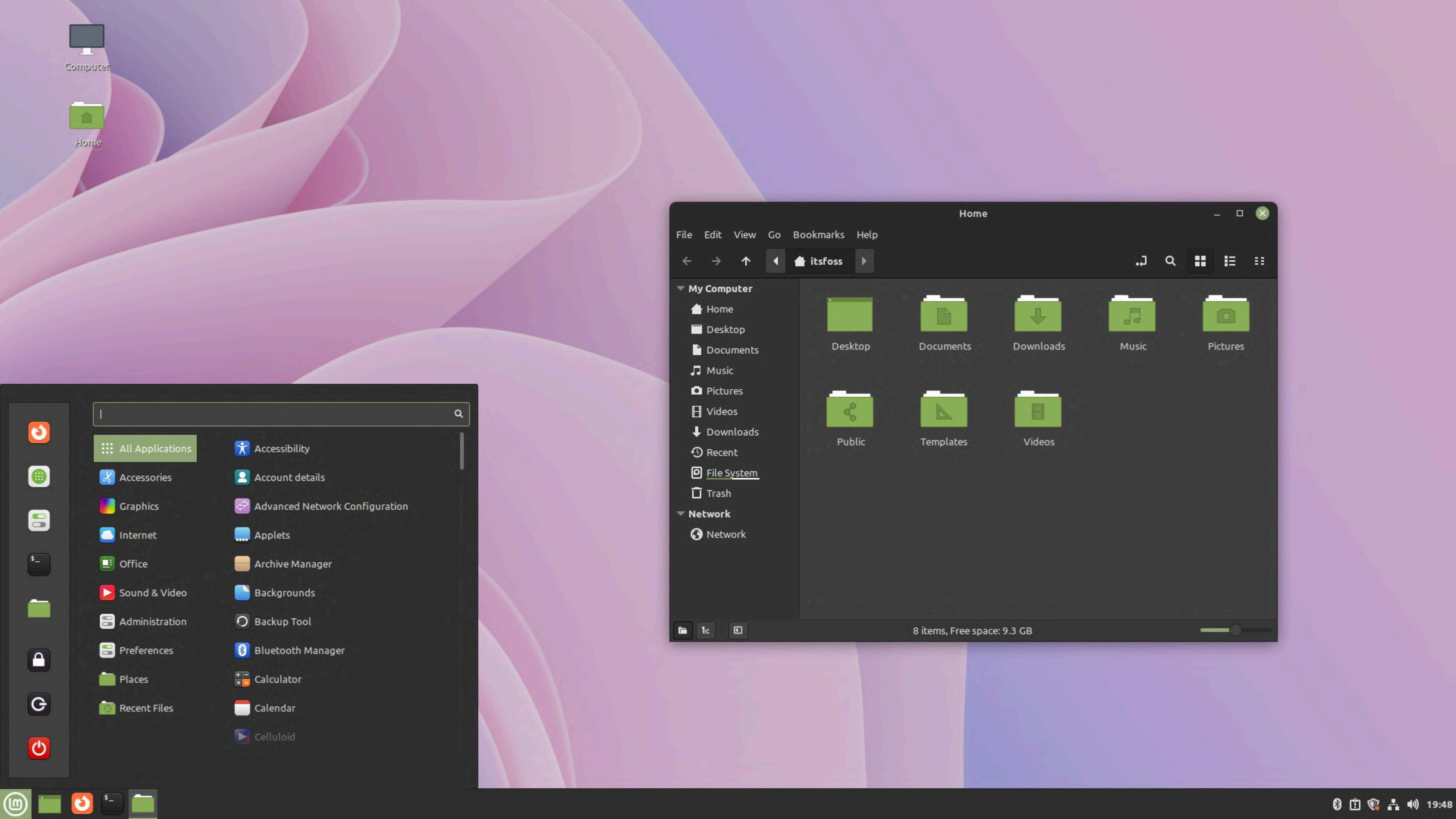


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# MATE Advanced Traditional Environment

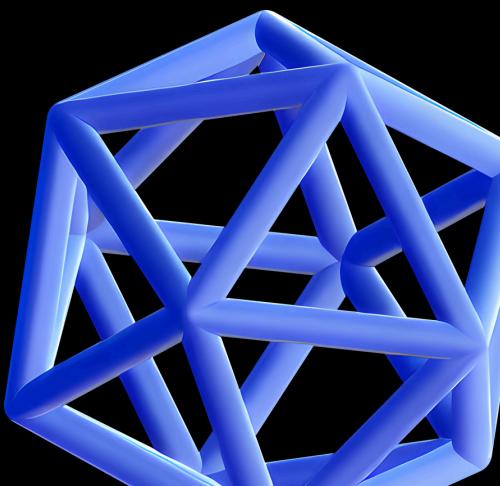
- ◆ Based on GNOME2
- ◆ Traditional layout
- ◆ Caja file manager
- ◆ Lightweight & built in applications
- ◆ Suitable for older hardware



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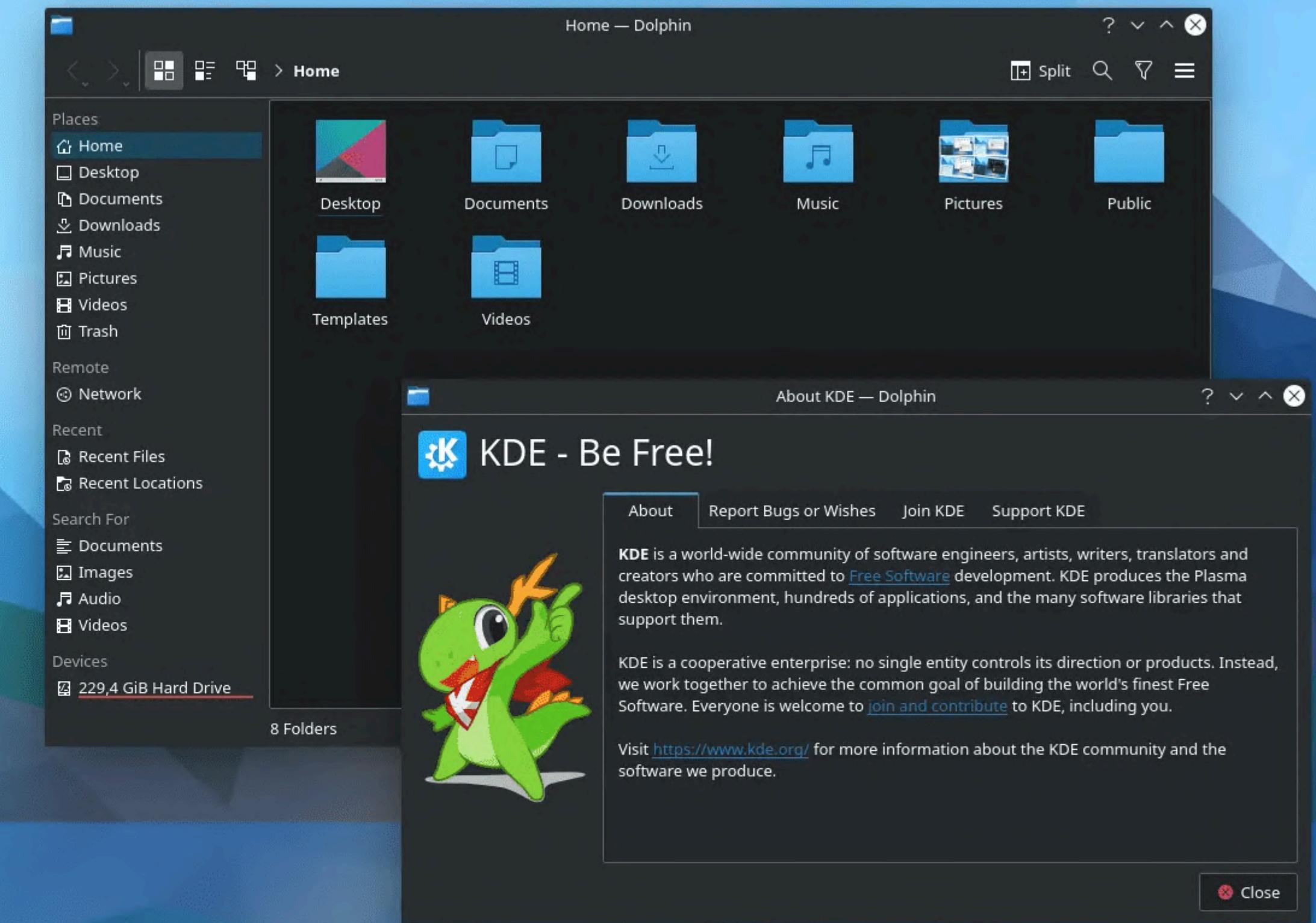
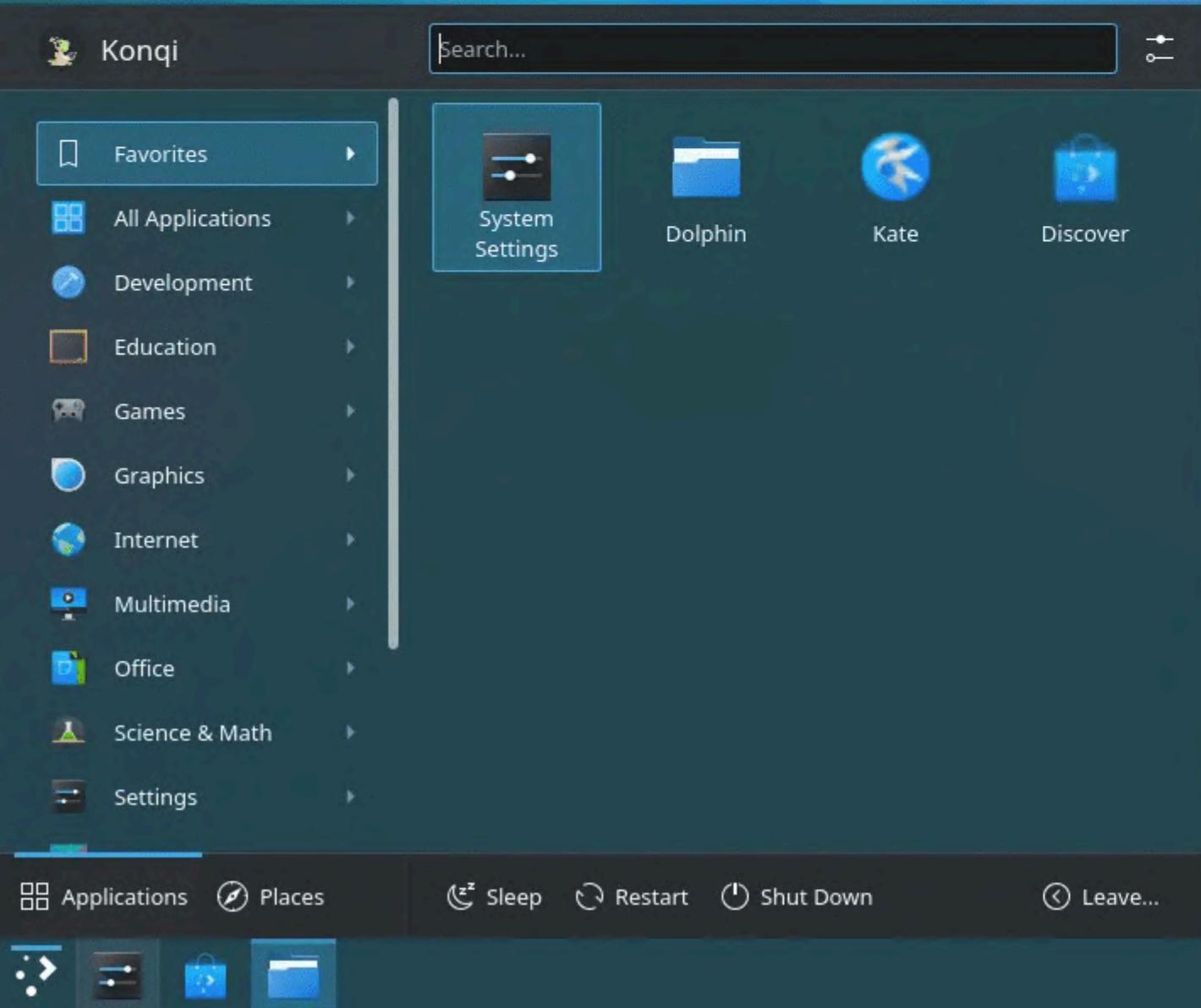


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# K Desktop Environment

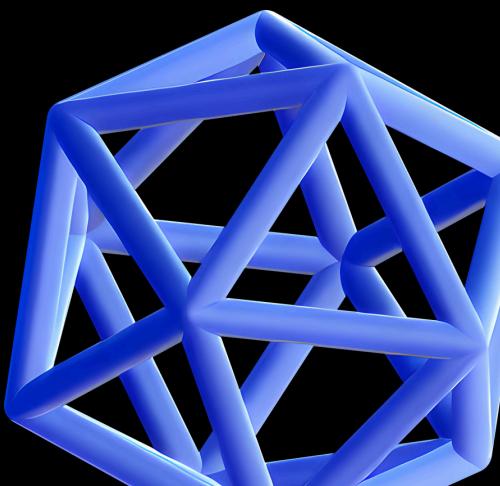
- ❖ Flexibility and modernity
- ❖ Continuos optimization
- ❖ Multiple workspace
- ❖ Highly customisable
- ❖ KRunner terminal, Dolphin file manager



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# XForms Common Environment

- ◆ Lightweight and fast
- ◆ Suitable for older hardware
- ◆ Simple and efficient
- ◆ Thunar file manager

Panel Preferences

Profiles: Backup a

Panel 1

Display Appearance Items

- Applications Menu
- Window Buttons
- Separator
- Workspace Switcher
- Separator
- Status Tray Plugin (external)
- PulseAudio Plugin (external)
- Notification Plugin (external)
- Separator
- Clock
- Separator
- Action Buttons (external)

Help

Status Tray Items

Icons

Adjust size automatically

Fixed icon size (pixels): 22

Behavior

Arrange items in a single row

Hide items by default

Square items

Status Notifiers Systray Icons

Known Items

Item	Hidden
	^
	▼

Features

Menu is primary action

Request symbolic icons

Clear Known Items

Close

+++

xfce



kde



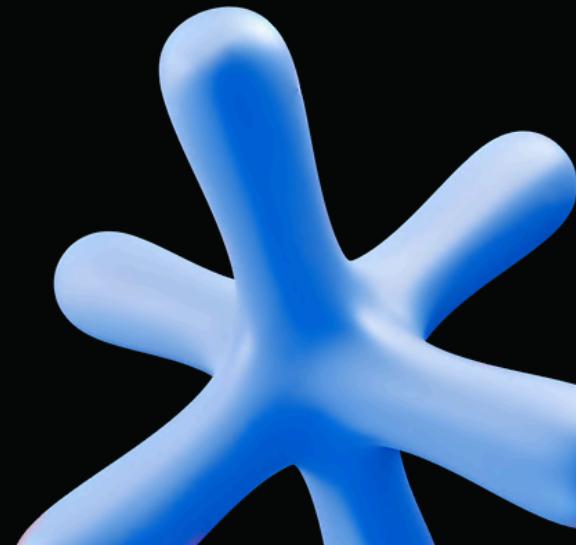
Gnome



Installing all of them  
and switching every  
other week



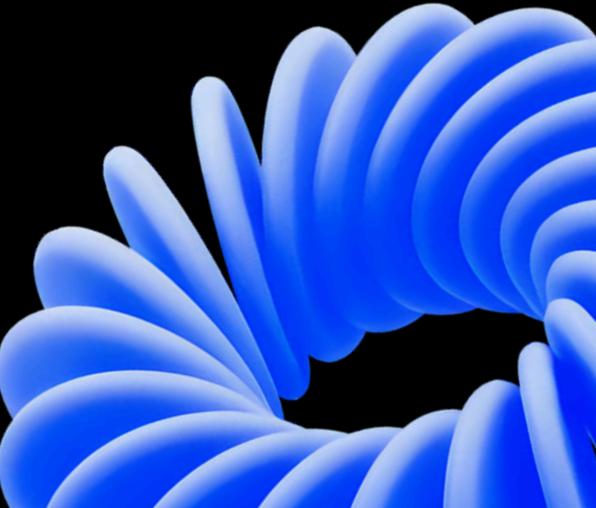
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# PACKAGE MANAGEMENT

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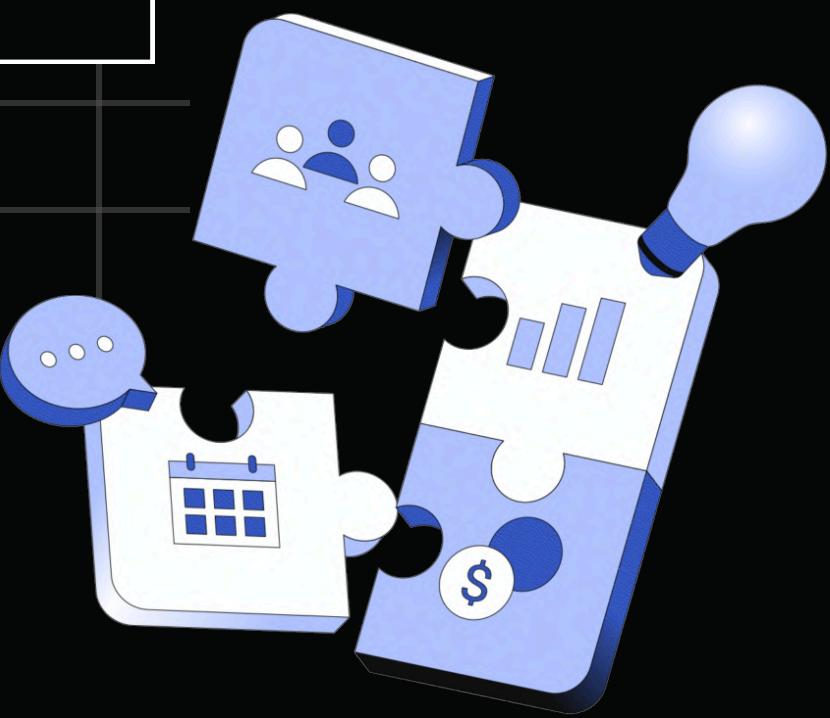
# Packages

Bundles of software that include everything needed to install and run a program on your Linux system

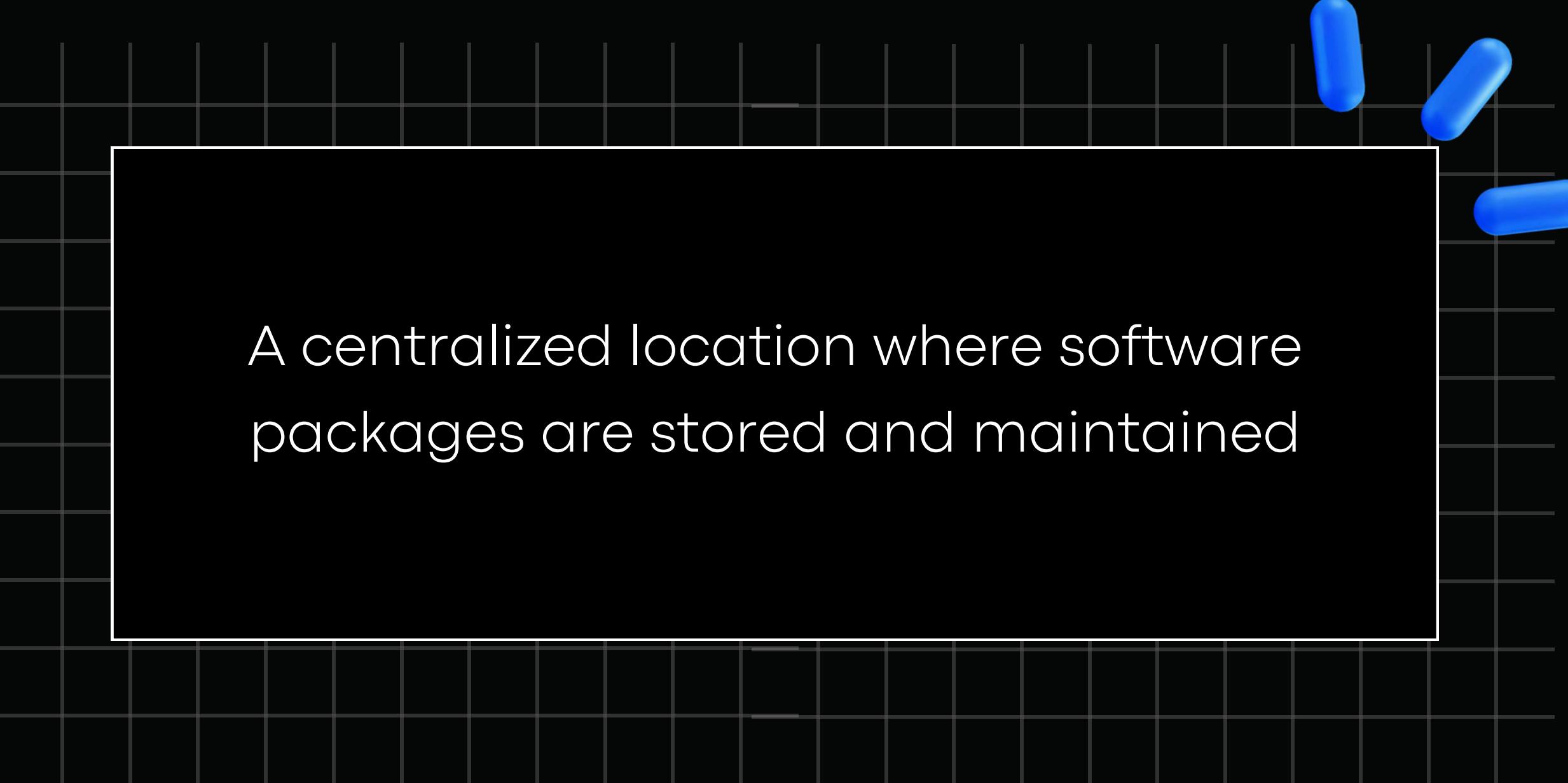


# Metadata

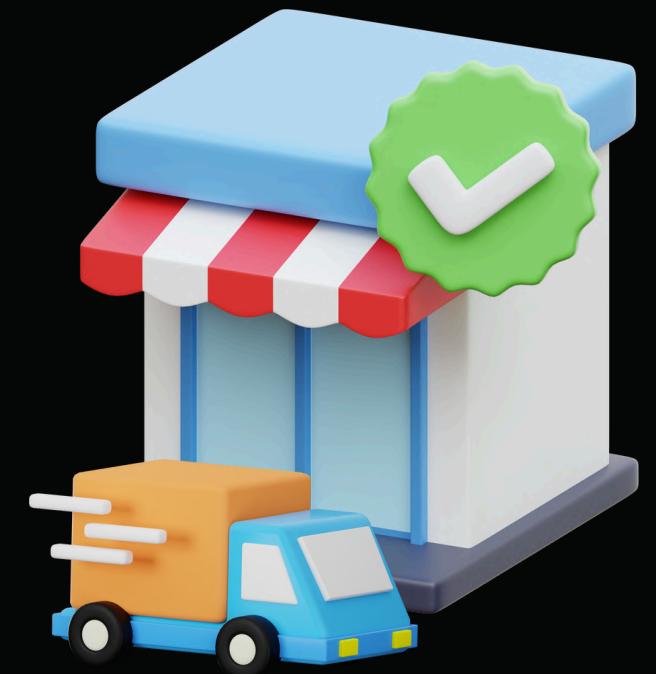
The additional information stored alongside the actual package files



# Repository



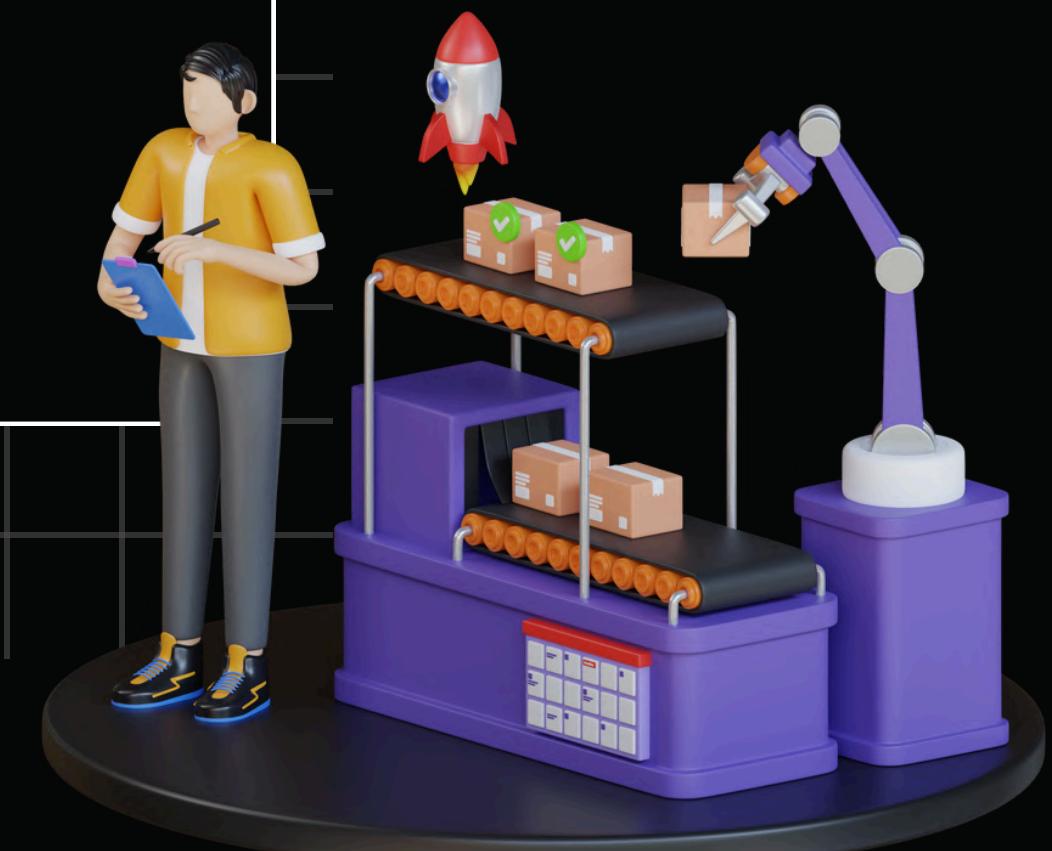
A centralized location where software packages are stored and maintained



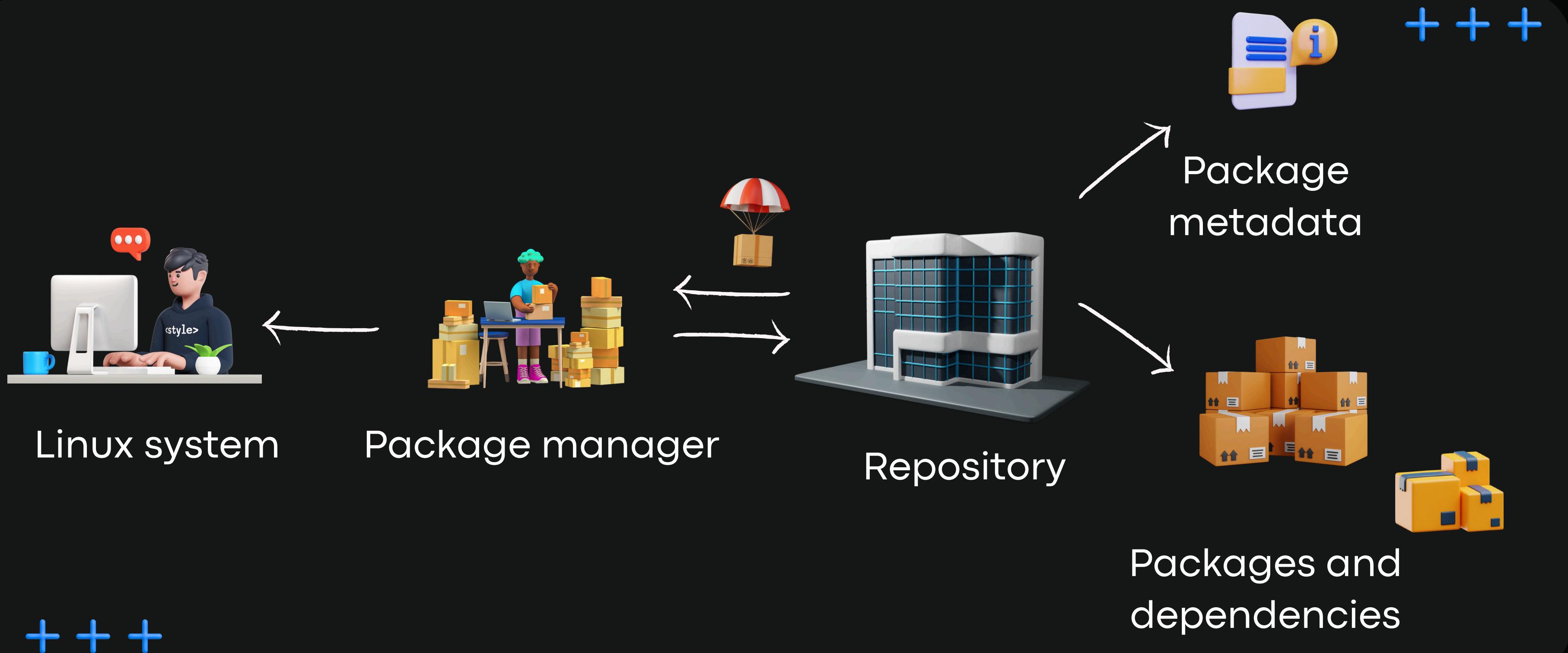
# Package Manager

A tool that automates the process of installing,  
updating, configuring and removing software  
packages

EX: YUM, APT, PACMAN



# Package Management Process



# Package Managers

## PACMAN

Simplicity and speed

Uses AUR  
Signed packages

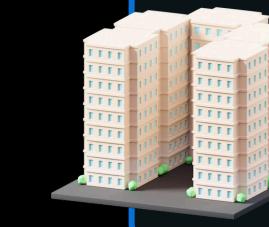


FOR ARCH BASED SYSTEMS

## APT

Vast repository

Easy to use packages  
Ideal for every user



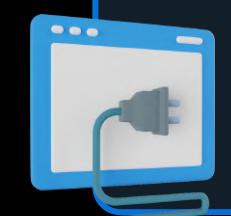
FOR DEBIAN BASED SYSTEMS

## YUM

Enterprise environment

Robust dependency resolution

Plugin support



FOR RHEL BASED SYSTEMS



**HANDS ON  
TIME!**



# Let's Use Package Managers

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Turn on the PCs



Open your terminal



Write the command

Command: To update the system

```
● ● ●  
sudo apt update
```



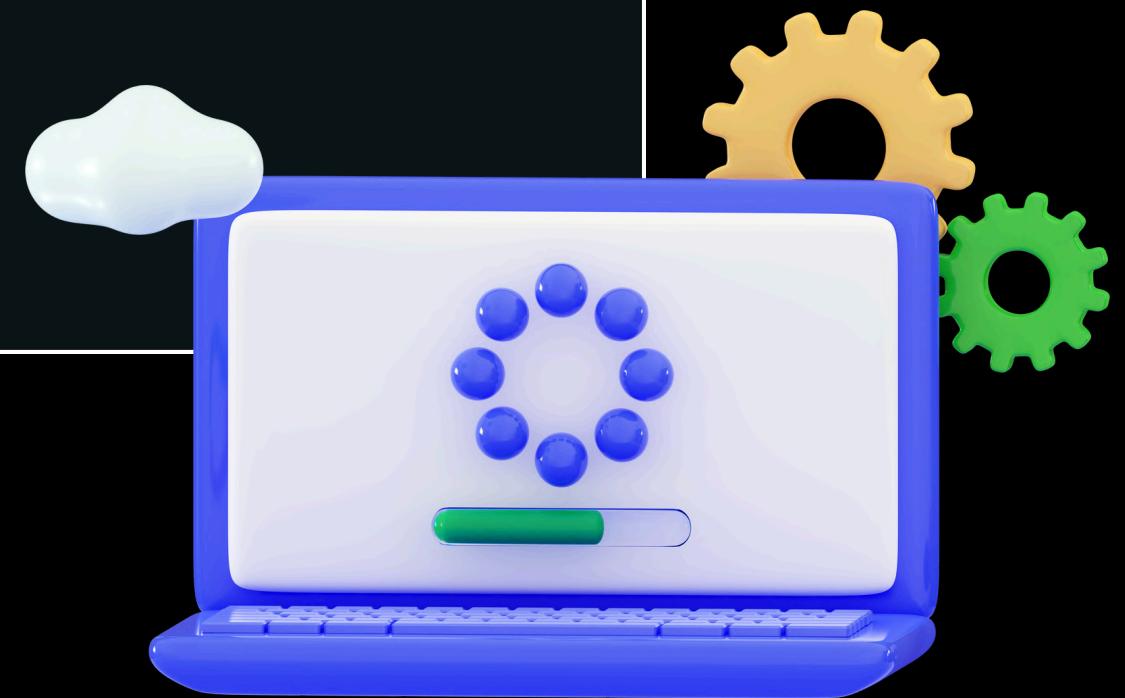
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Command: To upgrade the package



```
sudo apt upgrade
```



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## Command: To install a package



```
sudo apt install cmatrix
```



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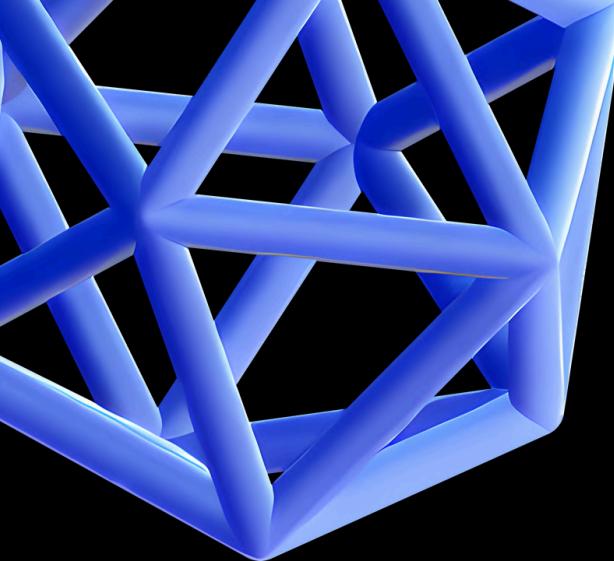
## Command: To remove a package



```
sudo apt remove cmatrix
```

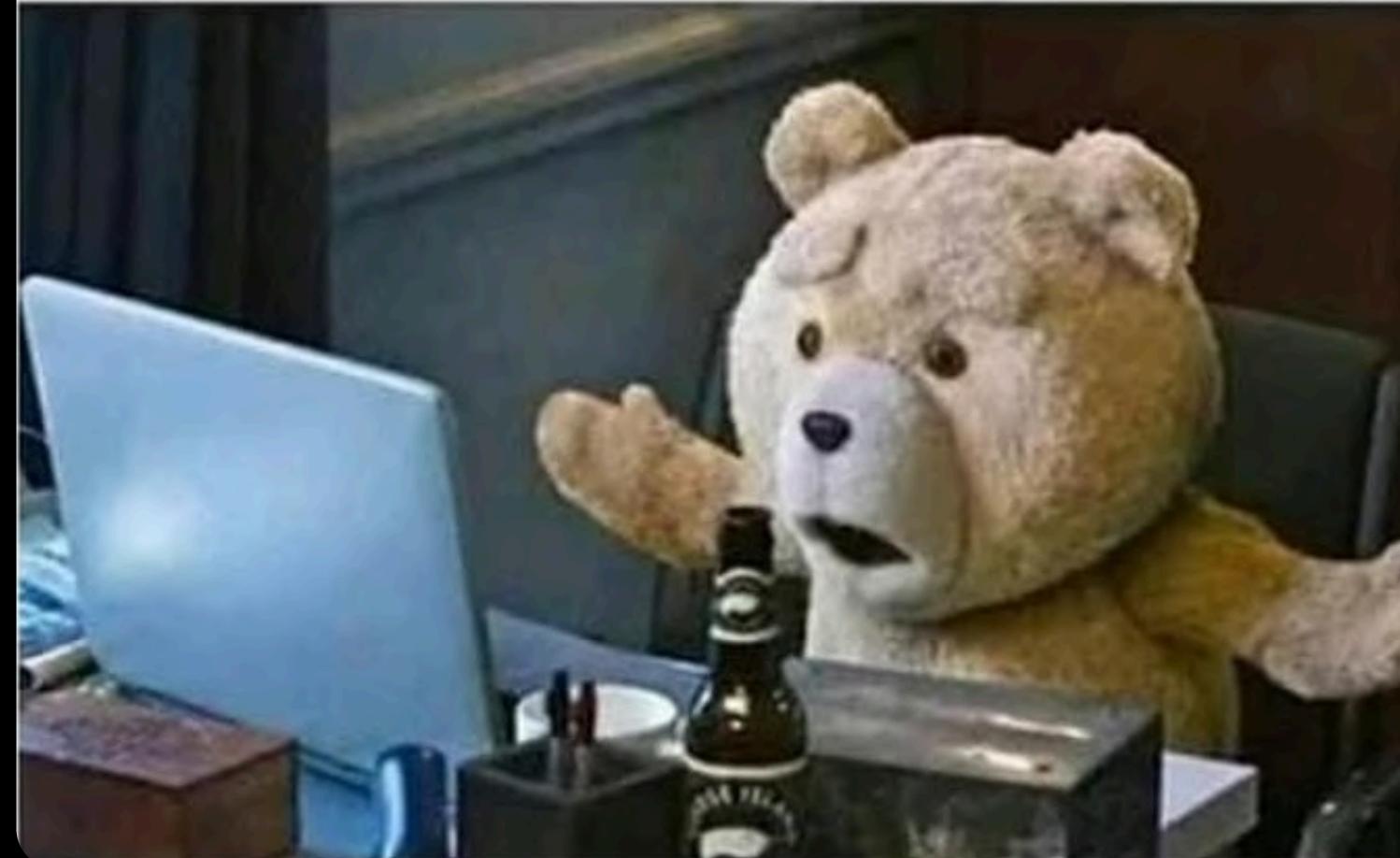


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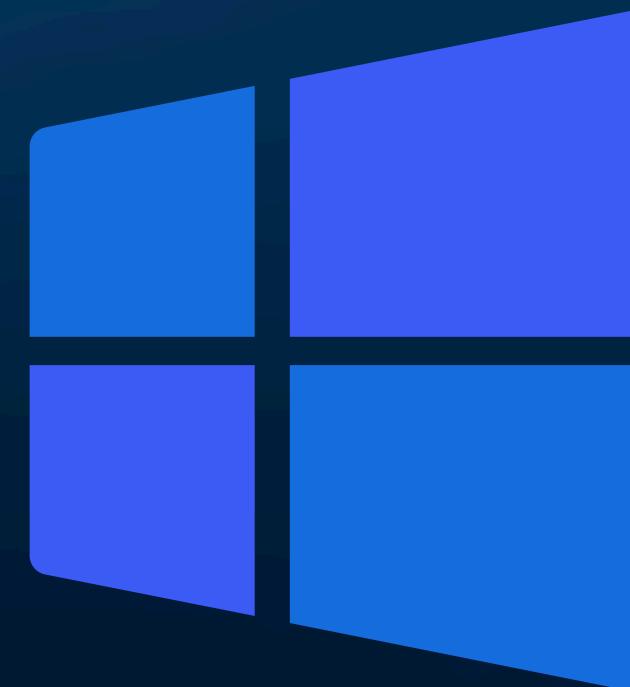
Me trying 'sudo apt update' on  
fedora moving from ubuntu



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# WINDOWS



# GNU/LINUX



# GNU/LINUX



Open Source

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# WINDOWS



Closed Source

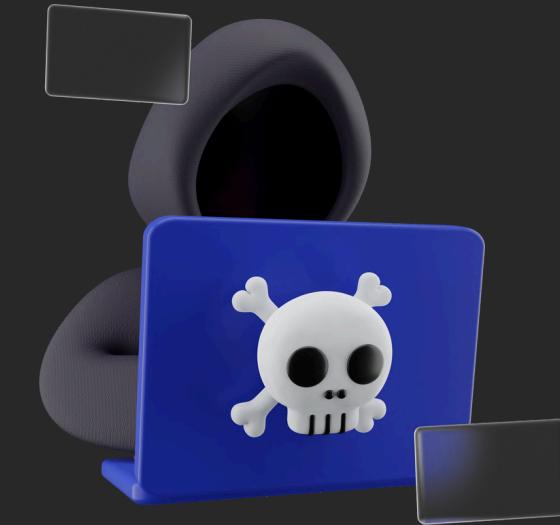
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# GNU/LINUX



More secure

# WINDOWS

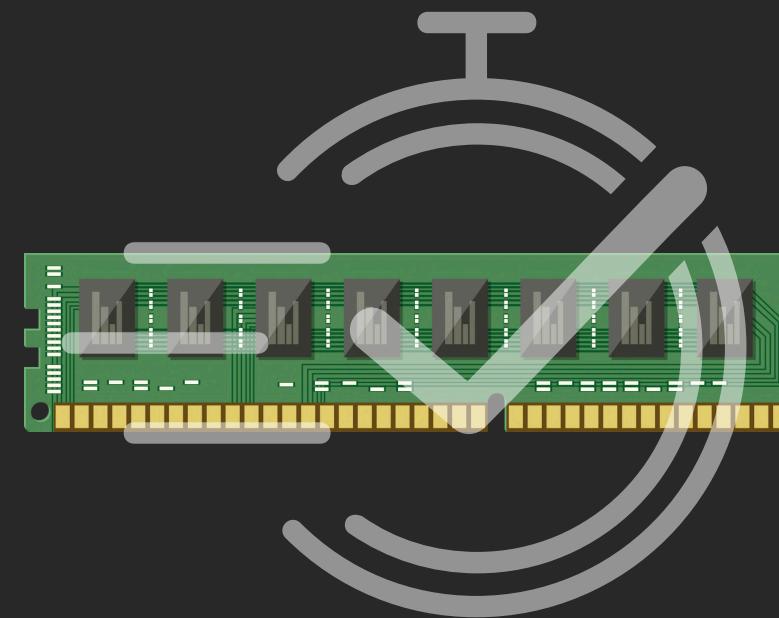


Less secure

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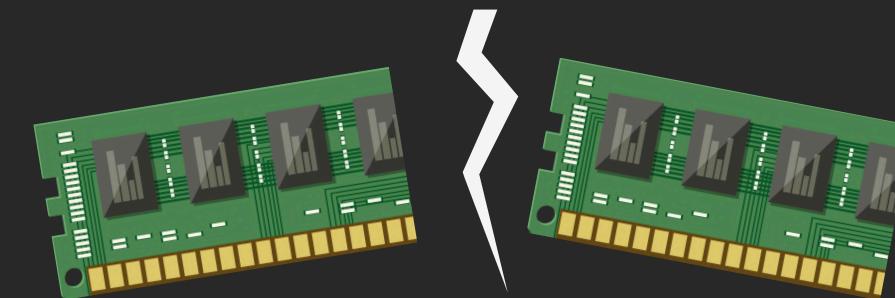
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# GNU/LINUX



Fast and  
lightweight

# WINDOWS

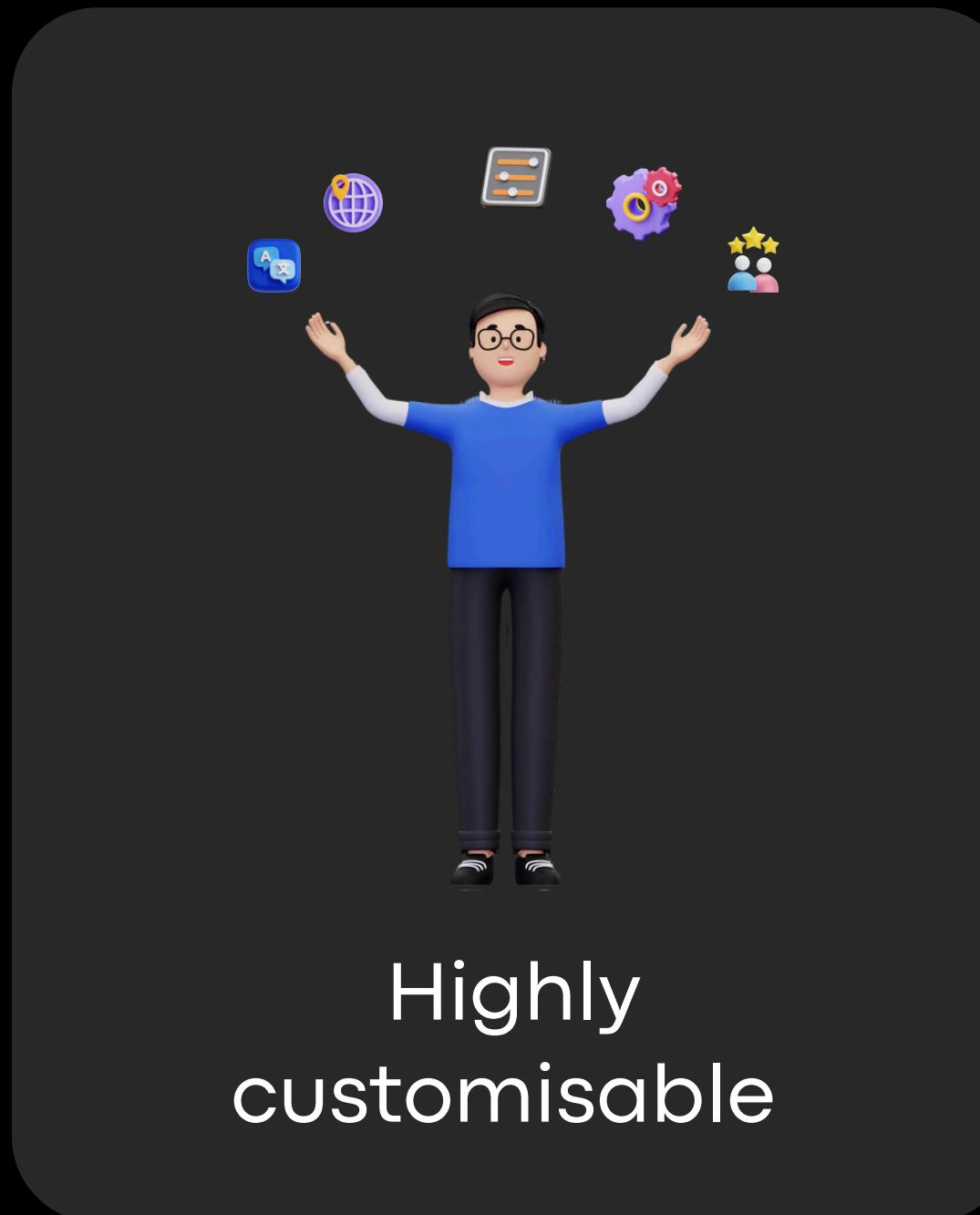


More RAM  
consumption

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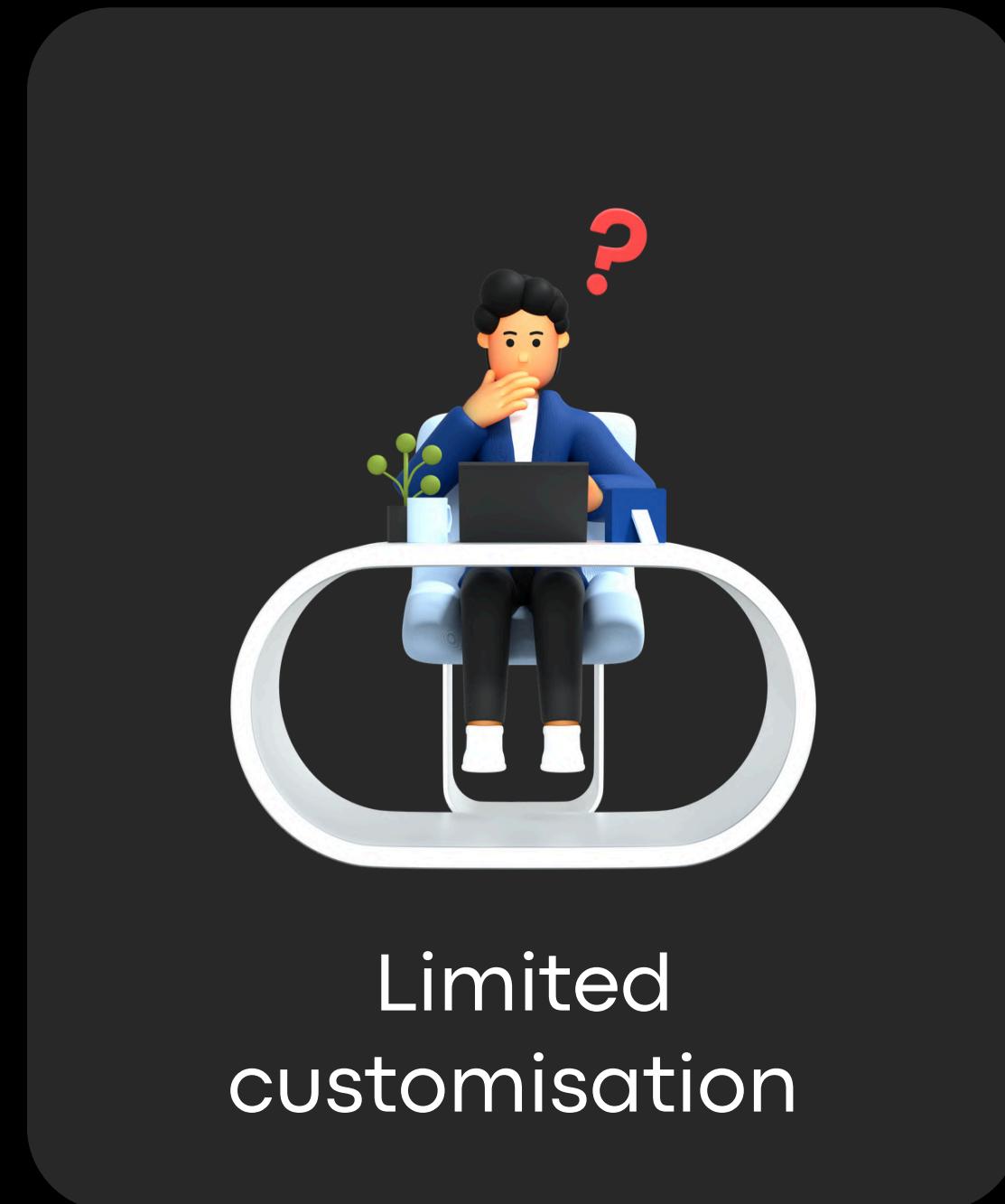
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# GNU/LINUX



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# WINDOWS

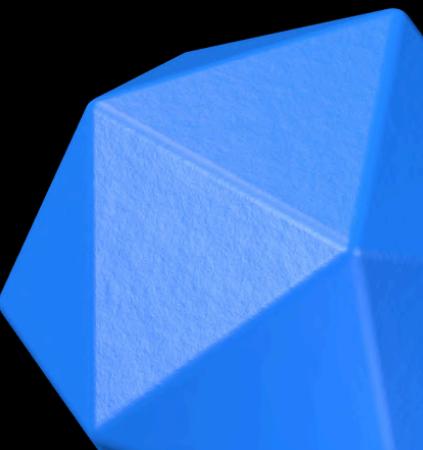


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# APPLICATIONS

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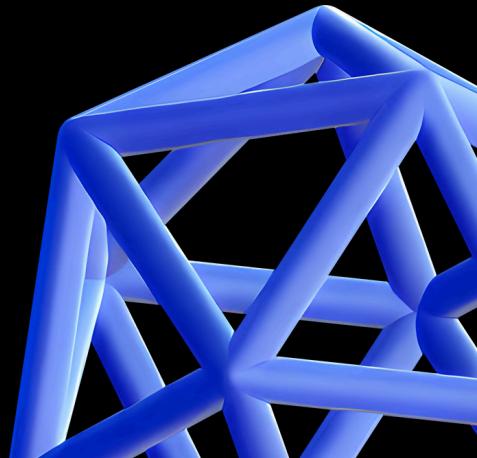
# Development and Programming

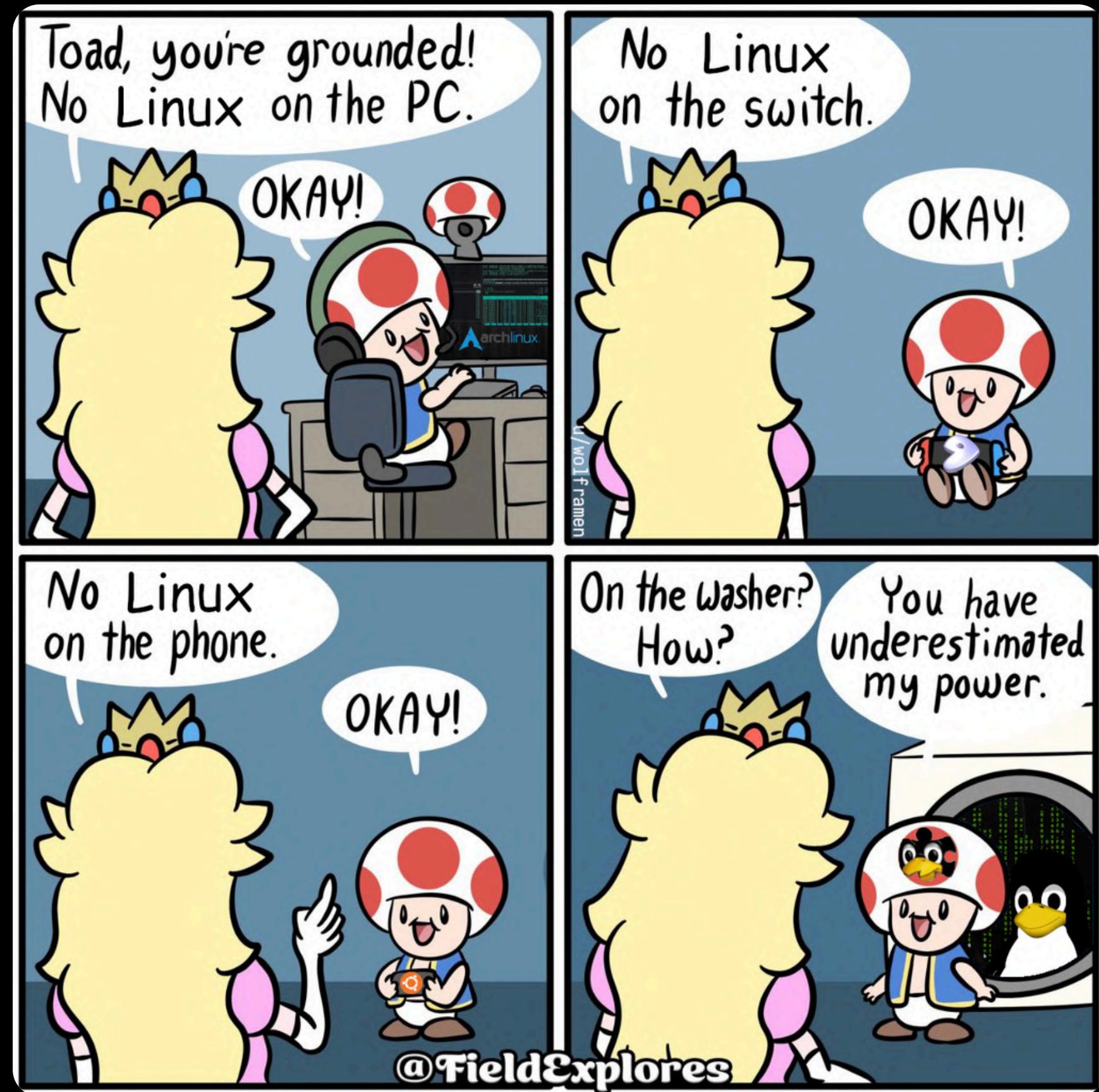
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- ❖ Software development
- ❖ Embedded systems



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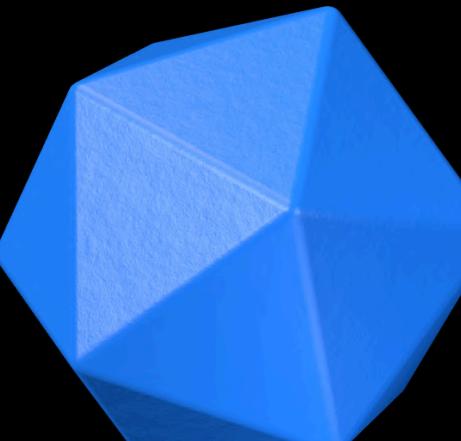




# Servers

- ◆ Web servers
- ◆ Database servers
- ◆ File servers
- ◆ Mail servers

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# Gaming

- ◆ Game development
- ◆ Linux supports various Gaming platforms



# Supercomputers

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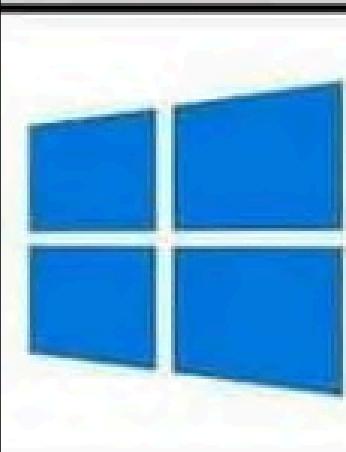
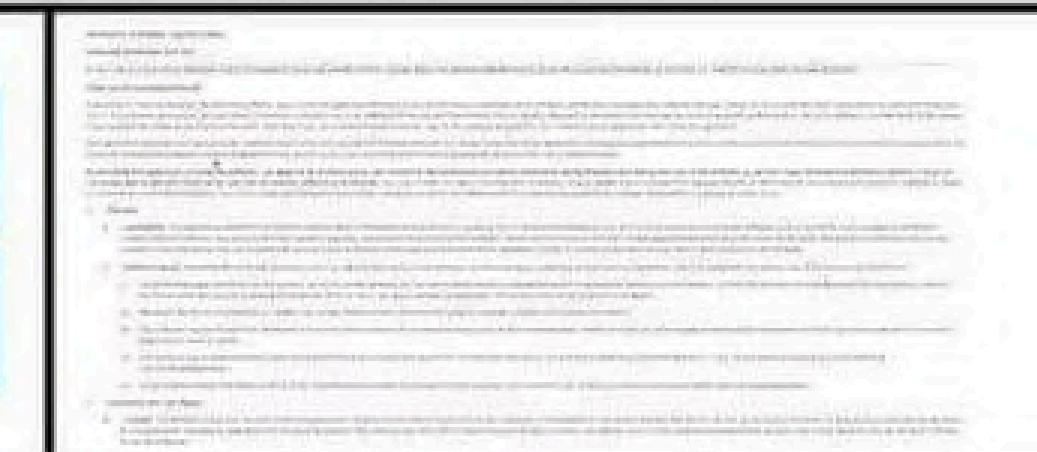
- ◆ A significant majority of the world's supercomputers run on Linux
- ◆ Provide scalability, performance, and flexibility

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# WHY LINUX?

## License agreements of different operating systems

	
	
	<p>Free for all. Share it, use it and adapt it to your own needs and liking.</p> 

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# Advantages

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- ◆ Open Source
- ◆ Security
- ◆ Performance
- ◆ Customisation
- ◆ Community support

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**Break Time!!**

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