WALCHAND COLLEGE OF ENGINEERING, SANGLI

(Government Aided Autonomous Institute)

WALCHAND LINUX USERS' GROUP

LINUXDIARY 6.0

EXCITING PRIZES

LIMITED SEATS

16 AUG — WARGAMES — 17 AUG

01 BORN TO BOOT

02 COMMAND QUEST

03 FILE FORGE

04 NET NAVIGATORS

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I /C Director
Walchand College of Engineering

Let's get started!

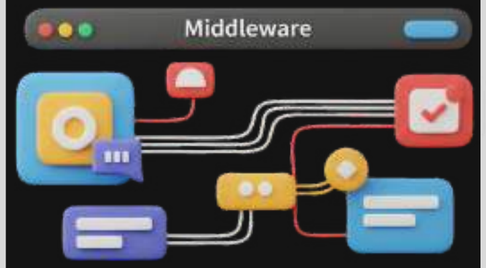
Contents of the session

- Open Source Software
- Operating System
- Kernel
- System Calls

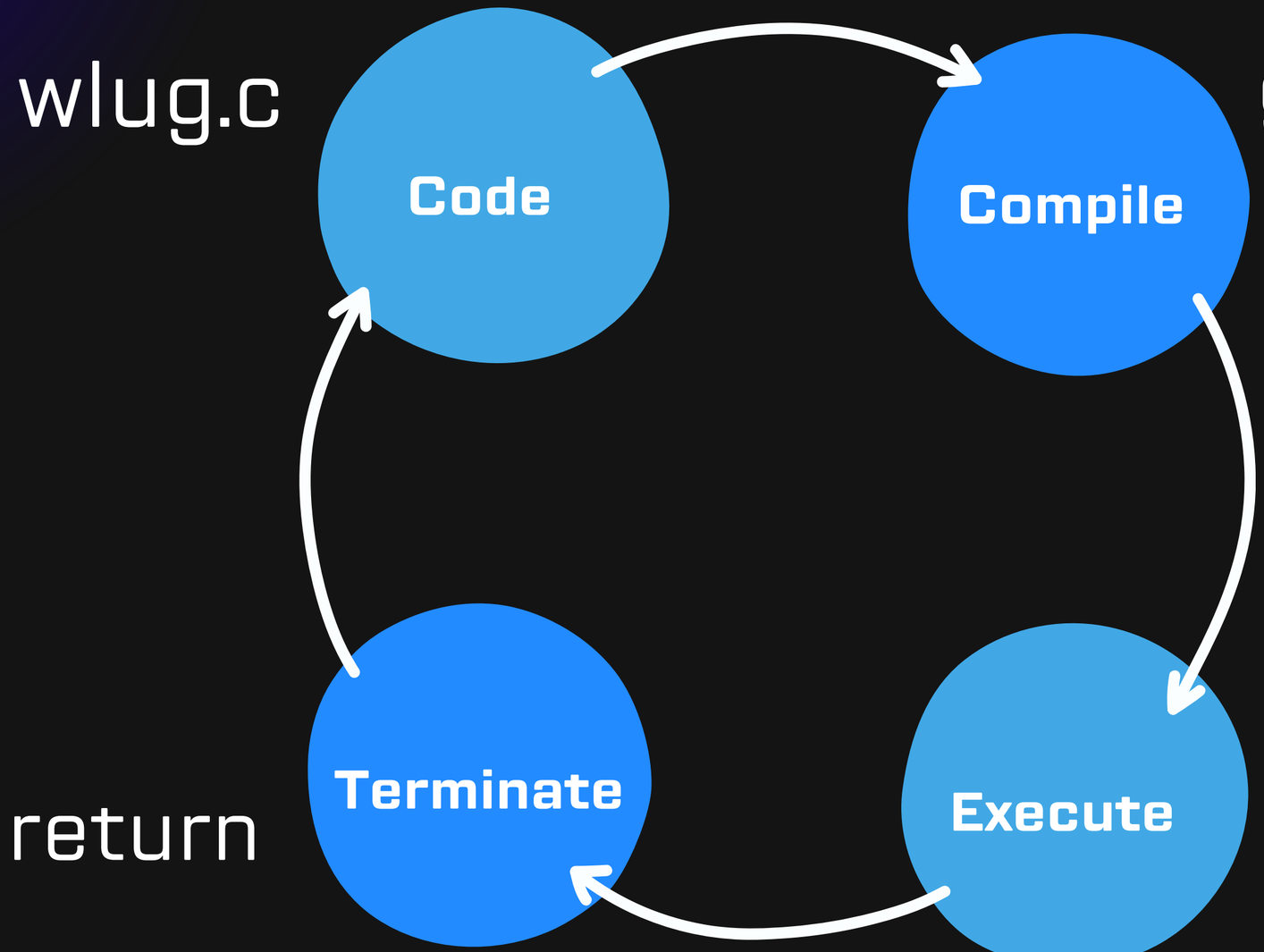
What is Software?

- Bundle of Code, Dependencies, Data, etc
- Built using programming languages
- Defines how the system behaves

Types of Software

System Software	Application Software	Middleware	Utility Software
			

Software Lifecycle



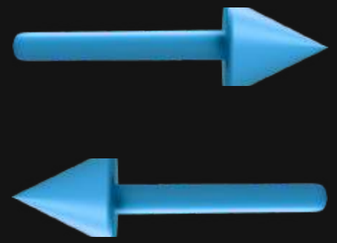
Program

- Set of instructions written in programming languages
- Stored in memory
- Static until executed

Process

- Running instance of a program
- Has its own memory and state
- Created and managed by OS


RECIPE
INGREDIENTS
DIRECTIONS



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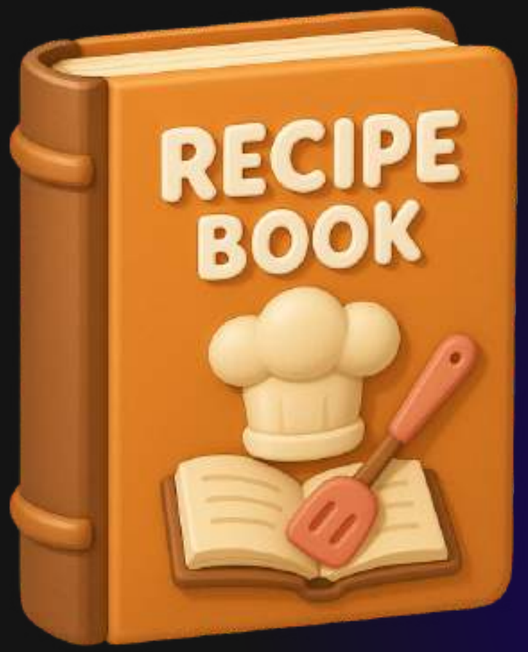
So what's the difference between program and software?

=

Program

Software

=



Source Code

- Source code is original set of instruction written in programming language
- Written by developers
- Human-readable form of software
- Needs to be compiled / interpreted

```
#ifdef TOP_BUILDDIR
    setenv ("VLC_PLUGIN_PATH", TOP_BUILDDIR"/modules", 1);
    setenv ("VLC_DATA_PATH", TOP_SRCDIR"/share", 1);
    setenv ("VLC_LIB_PATH", TOP_BUILDDIR"/modules", 1);
#endif

    /* Clear the X.Org startup notification ID. Otherwise the UI might try to
     * change the environment while the process is multi-threaded. That could
     * crash. Screw you X.Org. Next time write a thread-safe specification. */
    unsetenv ("DESKTOP_STARTUP_ID");

#ifndef ALLOW_RUN_AS_ROOT
    if (geteuid () == 0)
    {
        fprintf (stderr, "VLC is not supposed to be run as root. Sorry.\n"
        "If you need to use real-time priorities and/or privileged TCP ports\n"
        "you can use %s-wrapper (make sure it is Set-UID root and\n"
        "cannot be run by non-trusted users first).\n", argv[0]);
        return 1;
    }
#endif
```

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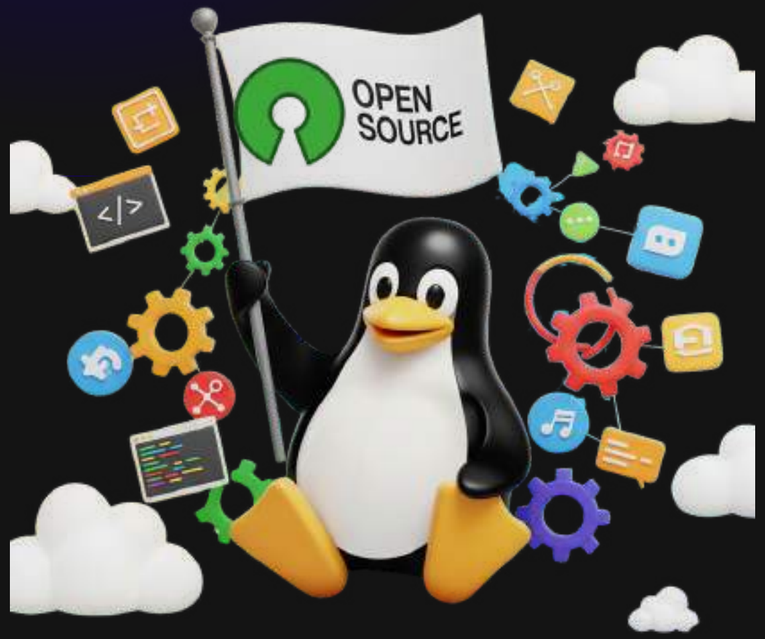
Open Source Software

Open Source Software



- Source code is public with open access
- Free to use, modify and distribute
- Built by a global community
- Ex. GIT, LINUX, etc

Features

- Transparency
- Customizability
- Community - collaboration
- No vendor lock-in

Closed Source Software

- Source code is private
- Owned and Managed by companies
- No modifications are allowed

Advantages of Open Source Software

- Security
- Community Support
- Flexibility
- Cost Efficient

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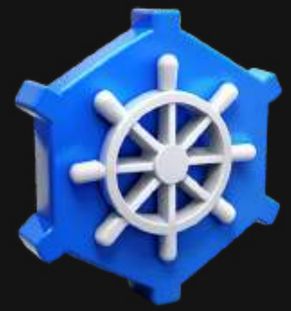
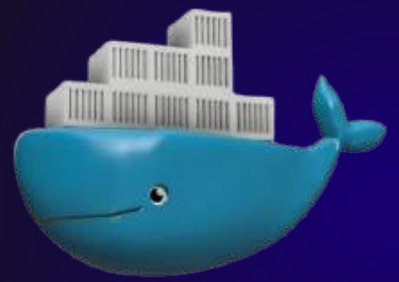
OSS in Modern Development

- Large Language Models - GenAI Applications
- Powers startups and enterprises
- Ex. Kubernetes, PyTorch, Docker





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Operating System

Operating System

- Interface between user and hardware
- Manages Resources and Programs
- Provides GUI and CLI
- Ensures Security and Access Control

Functions of OS

- Memory Management
- Process Management
- File handling
- Device Control

What is a shell?

- Interface between User and OS
- Command Interpreter
- Commands to the OS
- Ex. Bash, ZSH


NYPD
SHELL
TERMINAL

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Shell

- Command-line interpreter
- Executes user commands
- Runs inside the terminal
- Ex. Bash, Zsh, Fish

VS

Terminal

- Interface to access the shell
- Displays and manages shell session
- Hosts the shell
- Ex. GNOME Terminal, Konsole, xTerm

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The User

Terminal

Shell

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KERNEL

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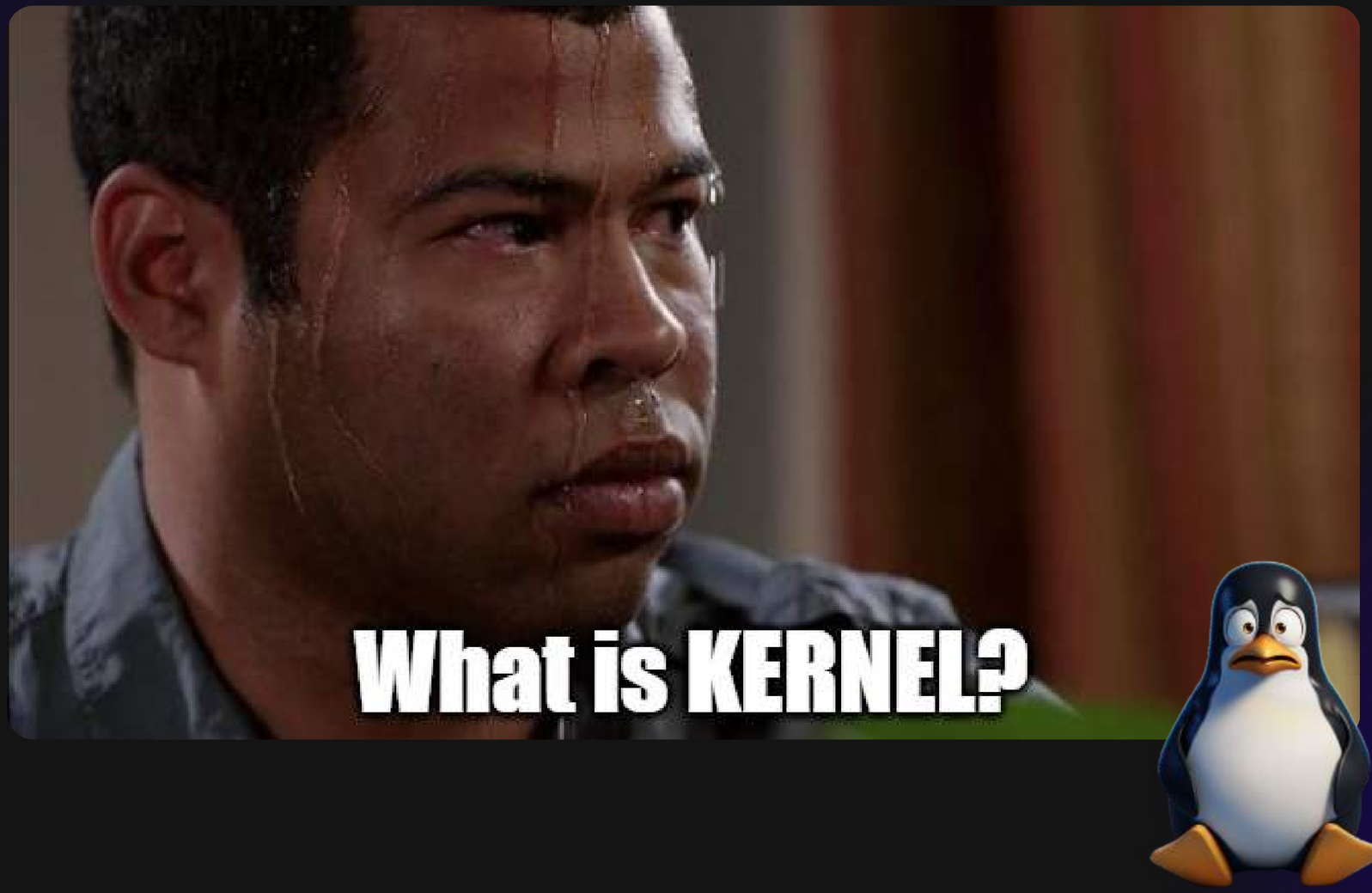
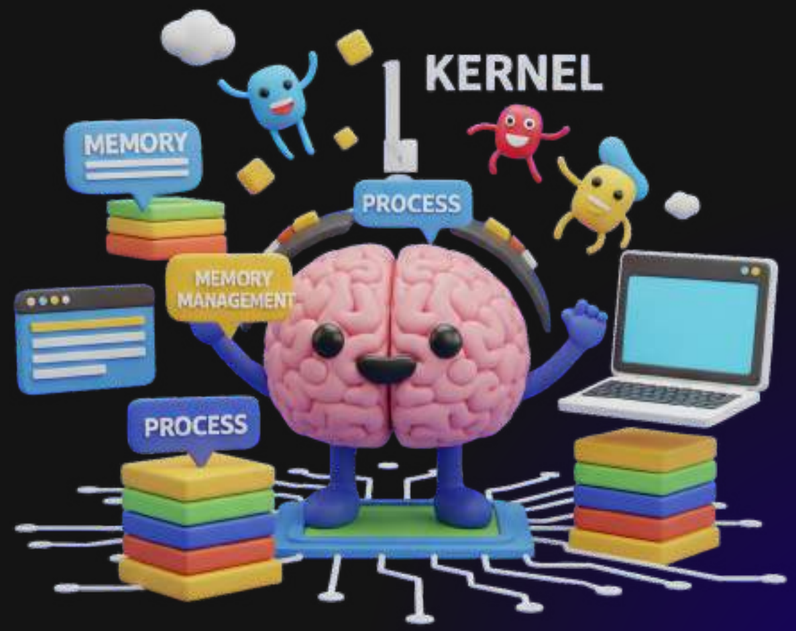


What is Kernel?

- Core of the OS
- Directly communicates with hardware
- Stays in memory always

Kernel Functions

- Process scheduling
- Memory management
- File system control
- Device handling



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Kernel Space

- Full access to system resources
- No need of system calls
- Executes core OS functionalities

User Space

- Limited access to system resources
- Must use system calls
- Runs applications and user programs

Kernel Modules

- Extend kernel functionality
- Load/unload at runtime
- Used for drivers (USB, Wi-Fi, etc.)
- No need to reboot or recompile kernel

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Types of Kernels

- Monolithic
- Microkernel
- Hybrid

Monolithic Kernel

- All core functions in a single codebase
- Direct access to hardware
- High performance
- Example: Linux

Microkernel

- Only essential services in kernel space
- Others in user space (like drivers)
- Lower performance due to context switching
- Example: MINIX

Hybrid

- Mix of monolithic and microkernel
- Some services in kernel space, some outside
- Balanced performance and stability
- Example: MacOS

Quick comparison of all three types

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Feature	Monolithic Kernel	Microkernel	Hybrid Kernel
Main Idea	All OS services run in kernel space	Minimal services in kernel, rest in user space	Mix of monolithic and microkernel
Performance	Fast	Slower	Balanced
Security	Lower	Higher	Moderate to high
Modularity	Low	High	Moderate
Use Case	General-purpose OS	Real-time, critical systems	Desktop, enterprise

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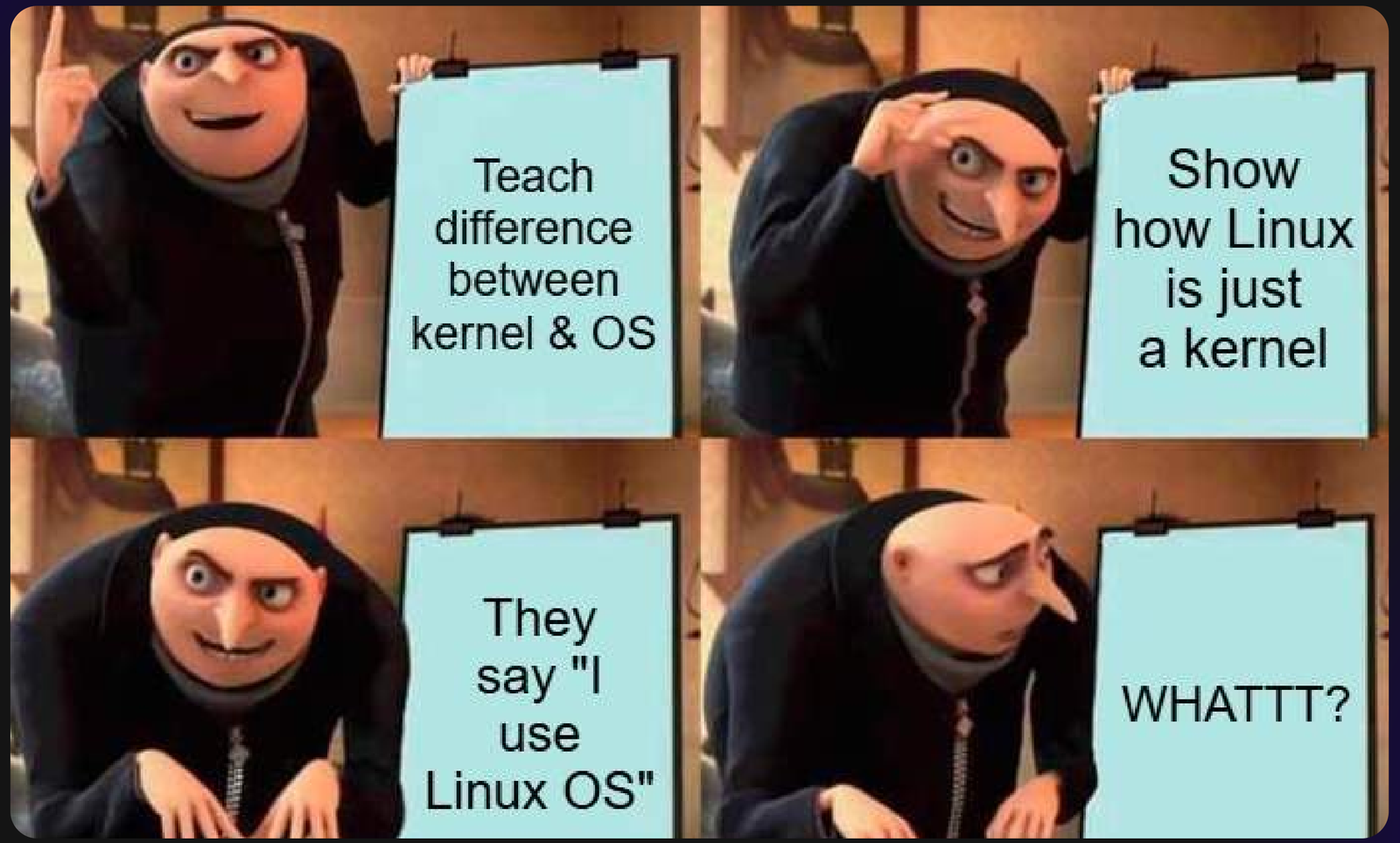
OS

Kernel


Teach difference between kernel & OS
Show how Linux is just a kernel
They say "I use Linux OS"
WHATTT?

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Kernel

- Kernel
  is the core of OS
- Manages hardware and system resources
- Kernel does the work
- Ex. Linux , XNU

VS

OS

- System software that manages the computer
- Provides interface between user and hardware
- OS gives the work to kernel
- Ex. Ubuntu , Windows

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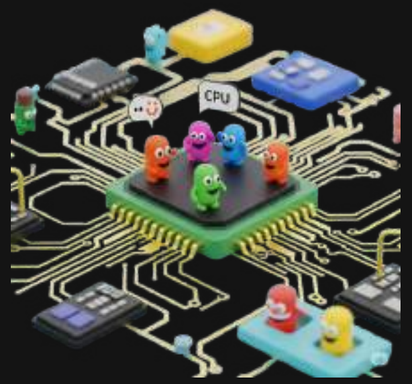
System Calls

Shell

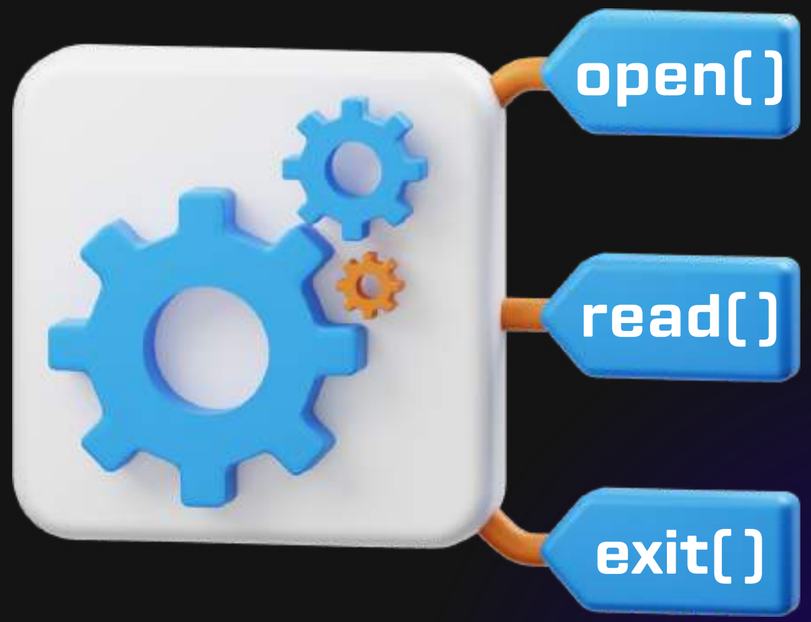


System Call
Gateway

Kernel

What are system calls?

- Bridge between user space and kernel space
- Used by programs to request services
- Executes in kernel mode only



Why system calls?

- Security → No direct hardware access
- Controlled Access → Only kernel allows permitted actions
- Safe Execution → Prevents crashes and unsafe memory use

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Kitchen

Customer

Hotel Reception

Room Services

Electricity

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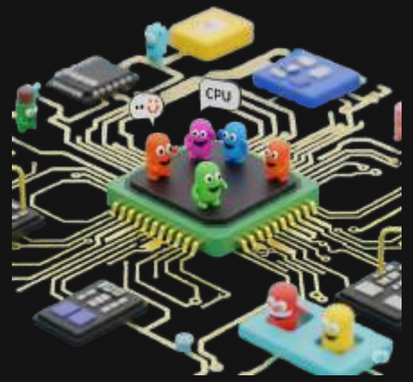
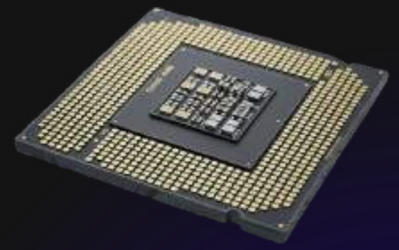
User Program



System Call
Gateway

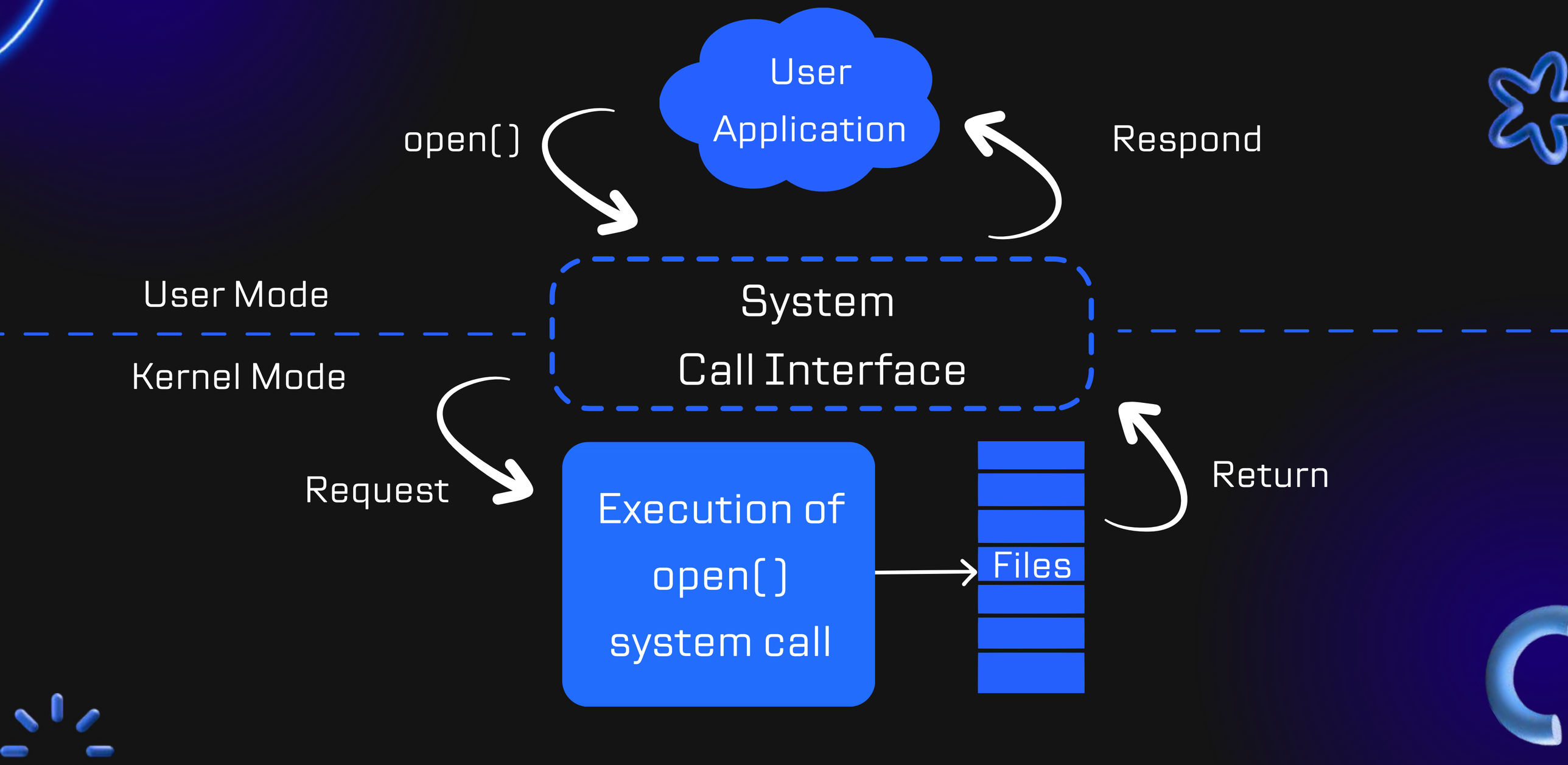
ROM



CPU

GPU

Working Example



Few System Calls

- open( ) – Open a file
- read( ) – Read from a file
- exec( ) – Replace process image
- exit( ) – Terminate a process

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USE OTH
PRETEND EVE
SIMPL

LINUX.
RN THE
UTH!

"THE CHOICE IS YOURS.."

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What is Linux?

CONTENT

- What is Linux
- How Linux was Developed
- Applications of Linux
- Linux Distributions
- Desktop Environments
- Package Management

WHAT IS LINUX?

- Open Source Kernel
- Customisable & flexible
- Secure & stable

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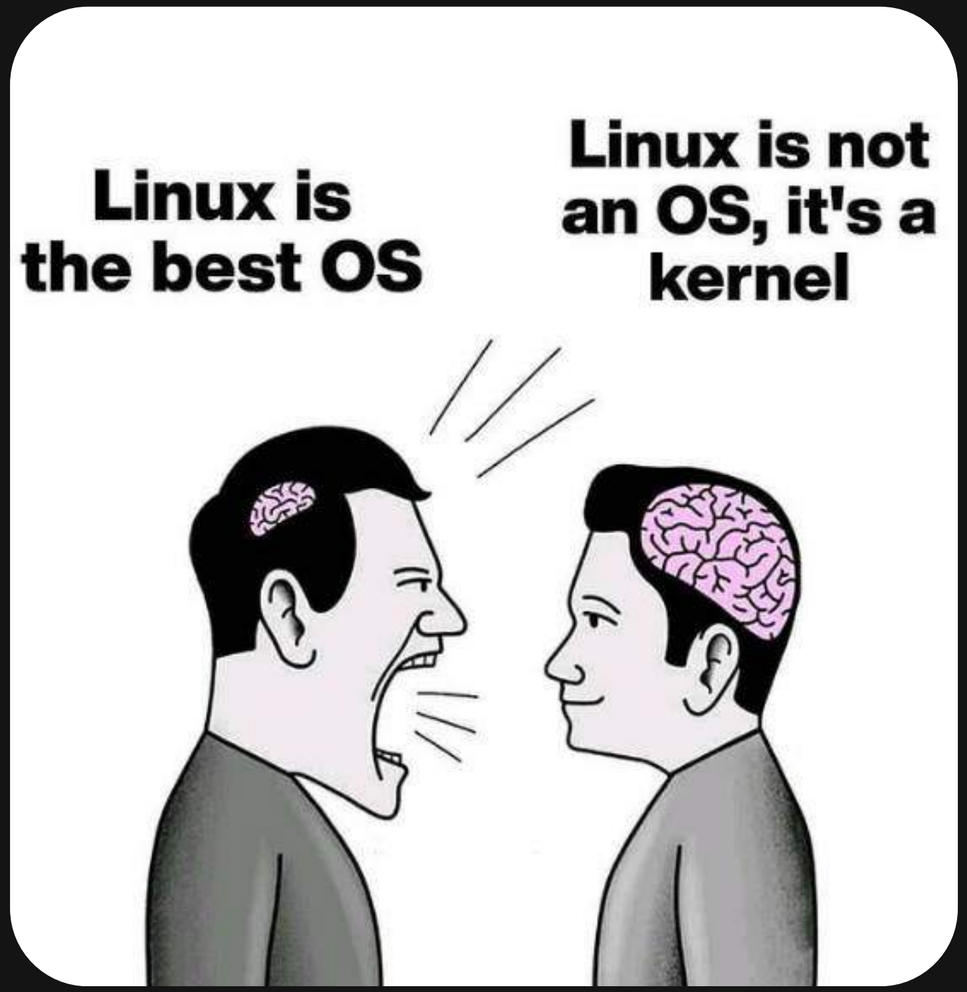

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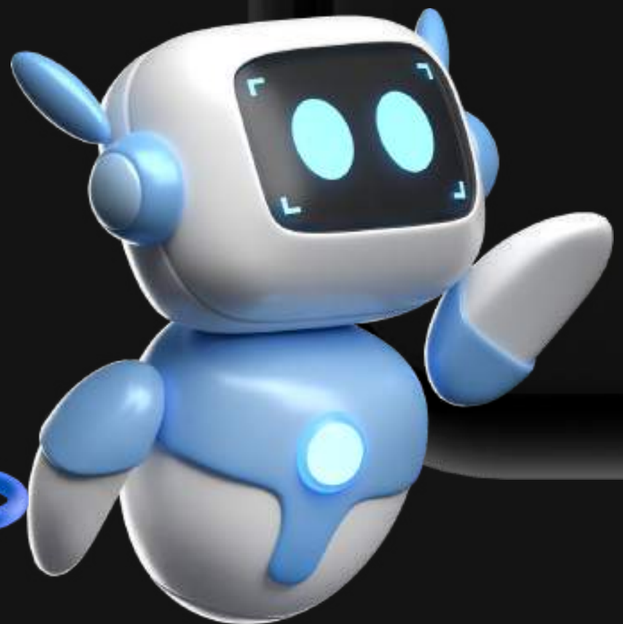
What is Unix?



UNIX

- Developed in the 1969 at Bell Labs
- Efficient and powerful command line tools
- Supports multitasking and multiusers
- Most versions are commercial

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Development of Linux

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1969
UNIX DEVELOPED AT BELL LABS.

1980
GNU PROJECT LAUNCHED

1991
LINUX WAS DEVELOPED

1993
FIRST LINUX DISTRO WAS DEVELOPED(SLS)

2017
ALL TOP 500 SUPERCOMPUTERS

2025
STILL WORKING EFFECTIVELY

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Linux Distributions

LINUX DISTRIBUTIONS

- A Linux distribution is a full OS based on the Linux kernel
- It includes system tools, and a desktop interface
- Examples: Ubuntu, Fedora, Debian, Arch

LINUX DISTRIBUTIONS

Kernel Softwares Interface

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GUI VS CLI

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GUI

VS

CLI

- Easy to use with icons and menus
- Slower because of graphics
- Needs more system resources
- GUI: Visual-based interface.

- Requires typing , knowing commands
- Faster, once commands are familiar
- Uses very little system resources
- CLI: Text-based interface

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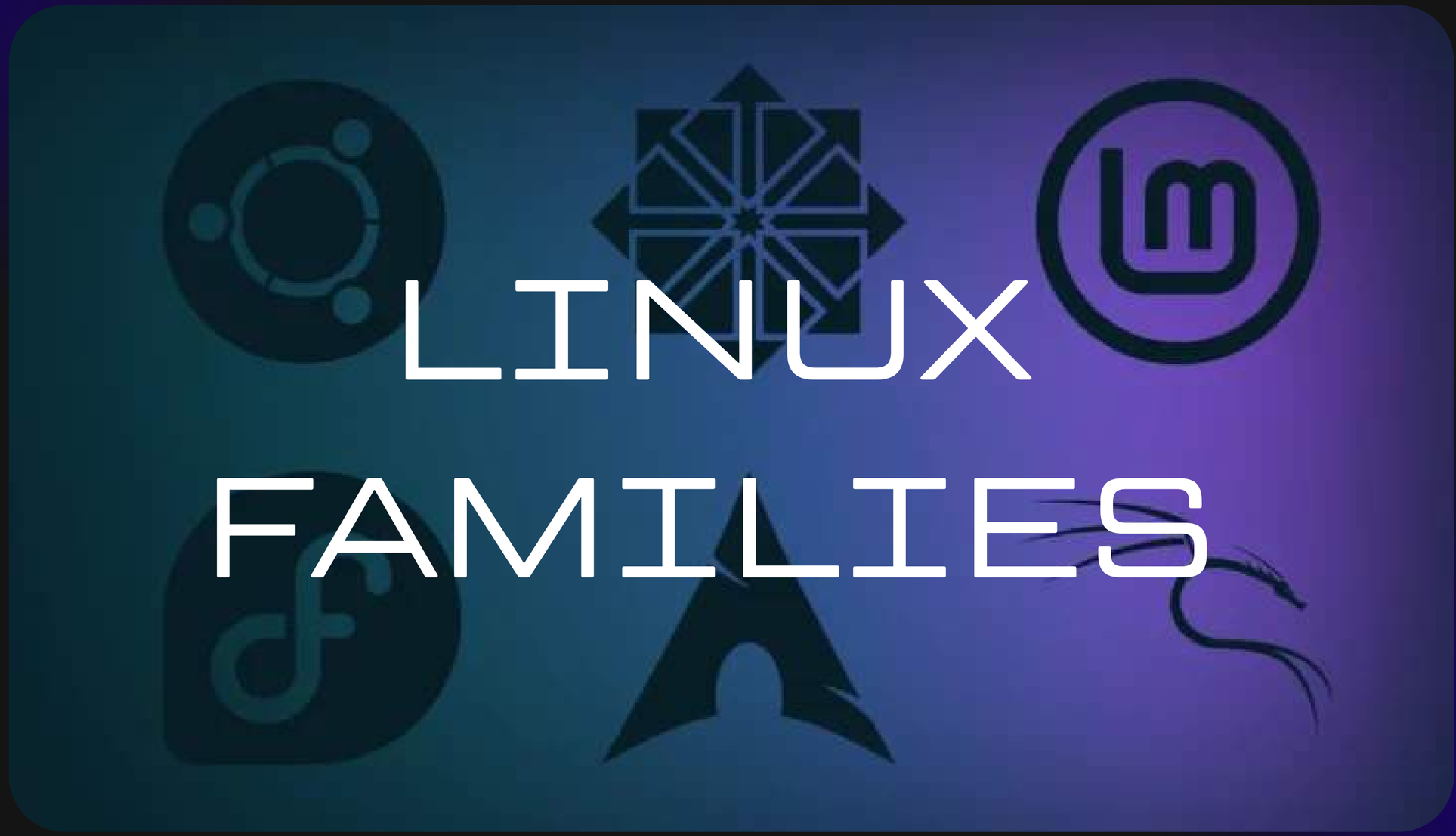
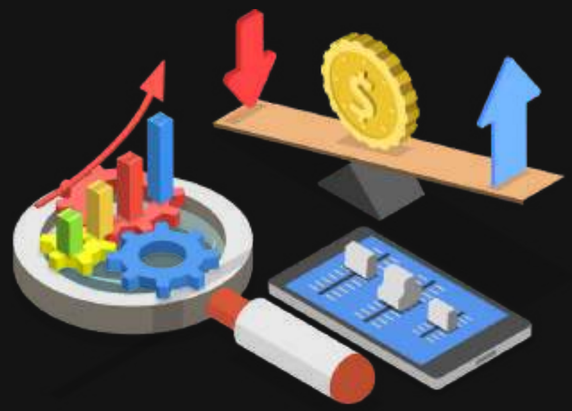


LINUX FAMILIES

COMMON FEATURES

- Open Source
- Linux Kernel
- Multiuser & Multitasking
- Command-Line Support



WHAT ARE THE LINUX FAMILIES ?

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The Linux family includes operating systems based on the Linux kernel and UNIX-like principles.

Linux users fighting over
which distro is best
Me:

DEBIAN FAMILY

- Based on Debian Linux
- Easy to use and stable
- Popular among beginners and desktop users
- Examples: Ubuntu, Linux Mint

ARCH FAMILY

- Known for being lightweight and flexible.
- Designed for advanced users.
- Users can build their system from scratch.
- Examples: Garuda, EndeavourOS.


Tell me your best merits and I will choose the next king
I'm Brave
I'm strong
I use Arch

SUSE FAMILY

- Designed for both desktop and enterprise use.
- Known for strong system tools and admin support.
- Focuses on stability and performance.
- Examples: openSUSE, SUSE Linux Enterprise.

RED HAT FAMILY

- Developed from Red Hat Linux.
- Trusted in companies and server environments.
- Focuses on security and performance.
- Examples: Fedora, CentOS.

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Red Hat

Suse

Debian

Arch

FAMILY TREE

- Debian
  - 
  - 
- Arch
  - 
  - 
- SUSE
  - 
  - 
- Red hat
  - 
  - 

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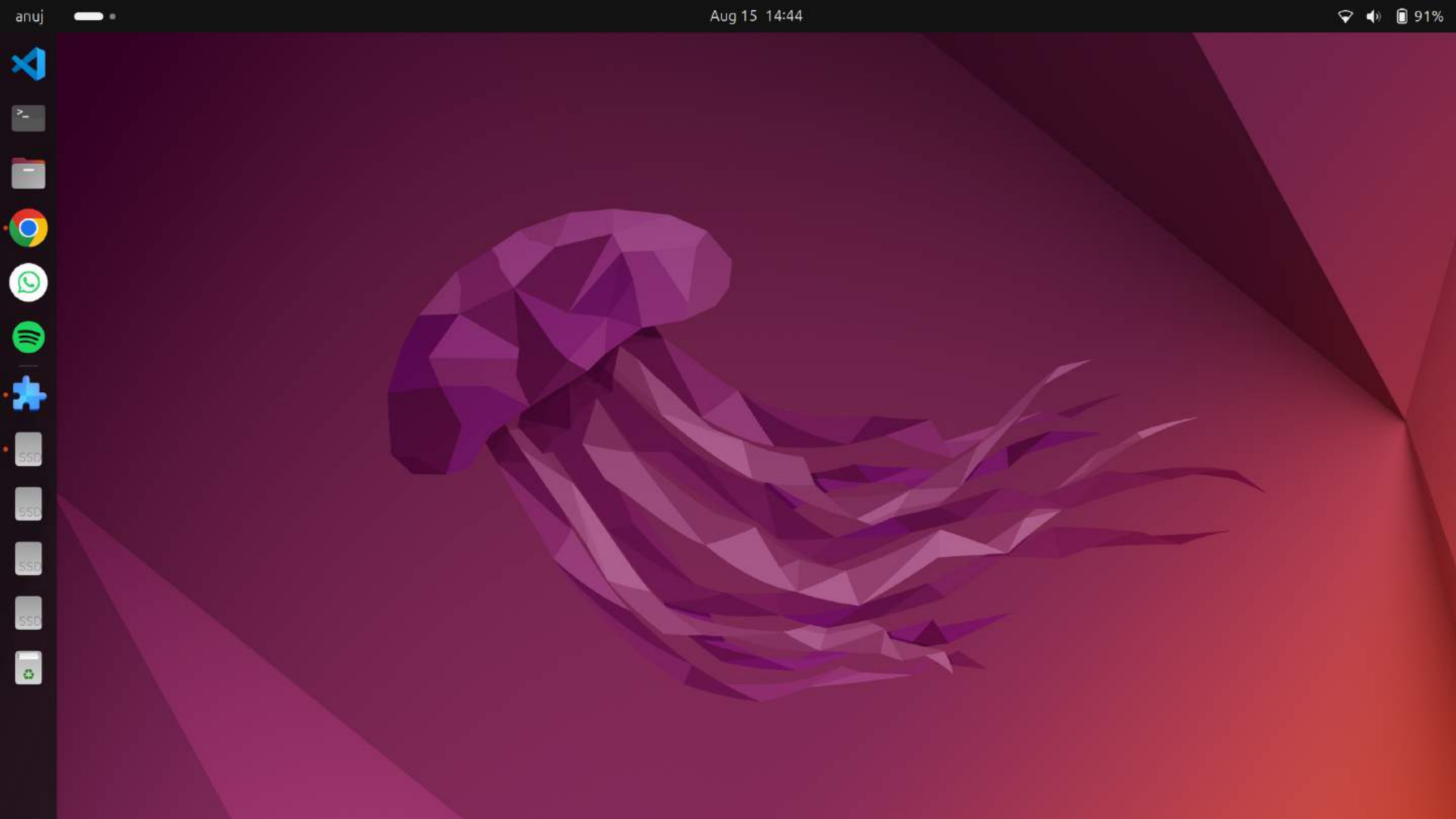
UBUNTU

- Base: Debian
- User-friendly interface and stable
- Uses APT package manager


anuj
Aug 15 14:44
91%

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GARUDA

GARUDA

- Base: Arch
- Gaming and performance focused
- Comes with snapshots


Favorites
All Applications
Development
Graphics
Internet
Multimedia
Office
Settings
System
Utilities
FileDragon
System Settings
Dolphin
Discover
Applications
Places
Leave
mori@morivm
OS: Garuda Linux x86_64
Host: VMware7,1
Kernel: 6.12.1-zen1-1-zen
Uptime: 2 mins
Packages: 1264 (pacman)[stable]
Shell: fish 3.7.1
Resolution: 1920×1080
DE: KDE Plasma 6.2.4
WM: KWin (X11)
WM Theme: Sweet-Dark
Theme: Dr460nized (Sweet) [Qt], Sweet-Dark [GTK2/3/4]
Icons: BeautyLine [Qt], BeautyLine [GTK2/3/4]
Terminal: konsole 24.8.3
Terminal Font: FiraCode Nerd Font Mono 12
CPU: Intel(R) Core(TM) i5-7200U (2) @ 2.71 GHz
GPU: VMware SVGA II Adapter
Memory: 1533 MiB / 3874 MiB
mori@morivm in ~
About this System — System Settings
About this System
More System Information
Copy Details
General Behavior
Search
Security & Privacy
Screen Locking
Recent Files
User Feedback
Language & Time
Region & Language
Spell Check
Date & Time
System
About this System
Power Management
Software Update
Users
Autostart
Session
Garuda Linux
Software
KDE Plasma Version: 6.2.4
KDE Frameworks Version: 6.8.0
Qt Version: 6.8.1
Kernel Version: 6.12.1-zen1-1-zen (64-bit)
Graphics Platform: X11
Hardware
Processors: 2 × Intel® Core™ i5-7200U CPU @ 2.50GHz
Memory: 3.8 GiB of RAM
Graphics Processor: SVGA3D; build: RELEASE; LLVM;
Manufacturer: VMware, Inc.
Product Name: VMware7,1
System Version: None
Serial Number:
Show
Garuda Welcome
Garuda Linux Bird of Prey
A rolling release, fast, friendly and performance focused OS.
Garuda is loaded with amazing tools and supported by a great community.
Garuda
Garuda Assistant
Garuda Gamer
Garuda Settings Manager
Garuda Network Assistant
Garuda Boot Options
BTRFS Assistant
Partition Manager
Garuda Services
Website
Wiki
Donate
FAQ
GitLab
Chaotic-AUR
Setup Assistant
About...
Close
Show this dialog at start up


arch
based linux
easy installation
linux
*garuda linux

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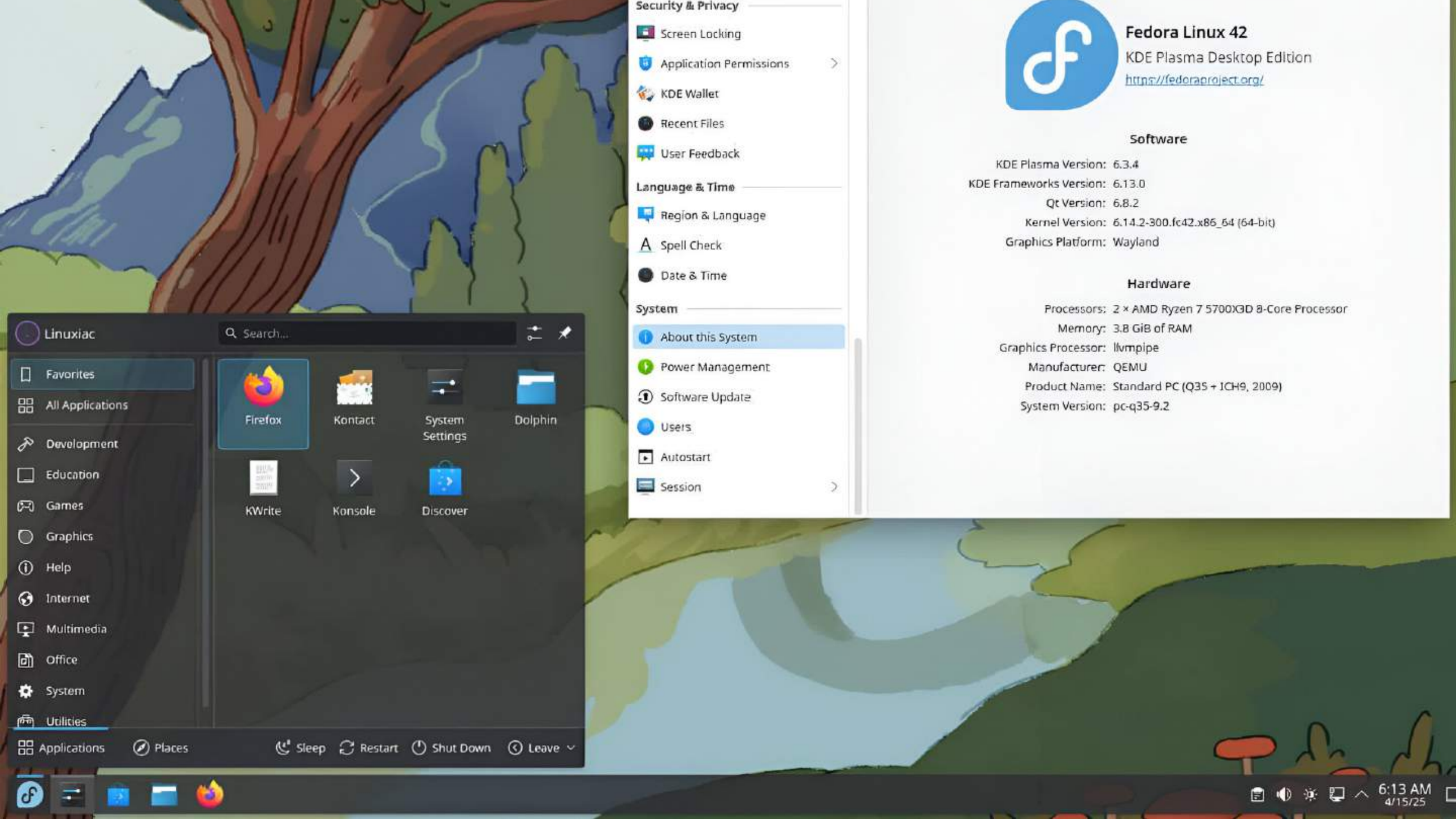
FEDORA

- Base: Red Hat Enterprise Linux
- Focuses on latest software
- Developer tools available


Linuxiac
Search...
Favorites
All Applications
Development
Education
Games
Graphics
Help
Internet
Multimedia
Office
System
Utilities
Firefox
Kontact
System Settings
Dolphin
KWrite
Konsole
Discover
Applications
Places
Sleep
Restart
Shut Down
Leave
Security & Privacy
Screen Locking
Application Permissions
KDE Wallet
Recent Files
User Feedback
Language & Time
Region & Language
Spell Check
Date & Time
System
About this System
Power Management
Software Update
Users
Autostart
Session
Fedora Linux 42
KDE Plasma Desktop Edition
https://fedoraproject.org/
Software
KDE Plasma Version: 6.3.4
KDE Frameworks Version: 6.13.0
Qt Version: 6.8.2
Kernel Version: 6.14.2-300.fc42.x86_64 (64-bit)
Graphics Platform: Wayland
Hardware
Processors: 2 × AMD Ryzen 7 5700X3D 8-Core Processor
Memory: 3.8 GiB of RAM
Graphics Processor: llvmpipe
Manufacturer: QEMU
Product Name: Standard PC (Q35 + ICH9, 2009)
System Version: pc-q35-9.2
6:13 AM
4/15/25

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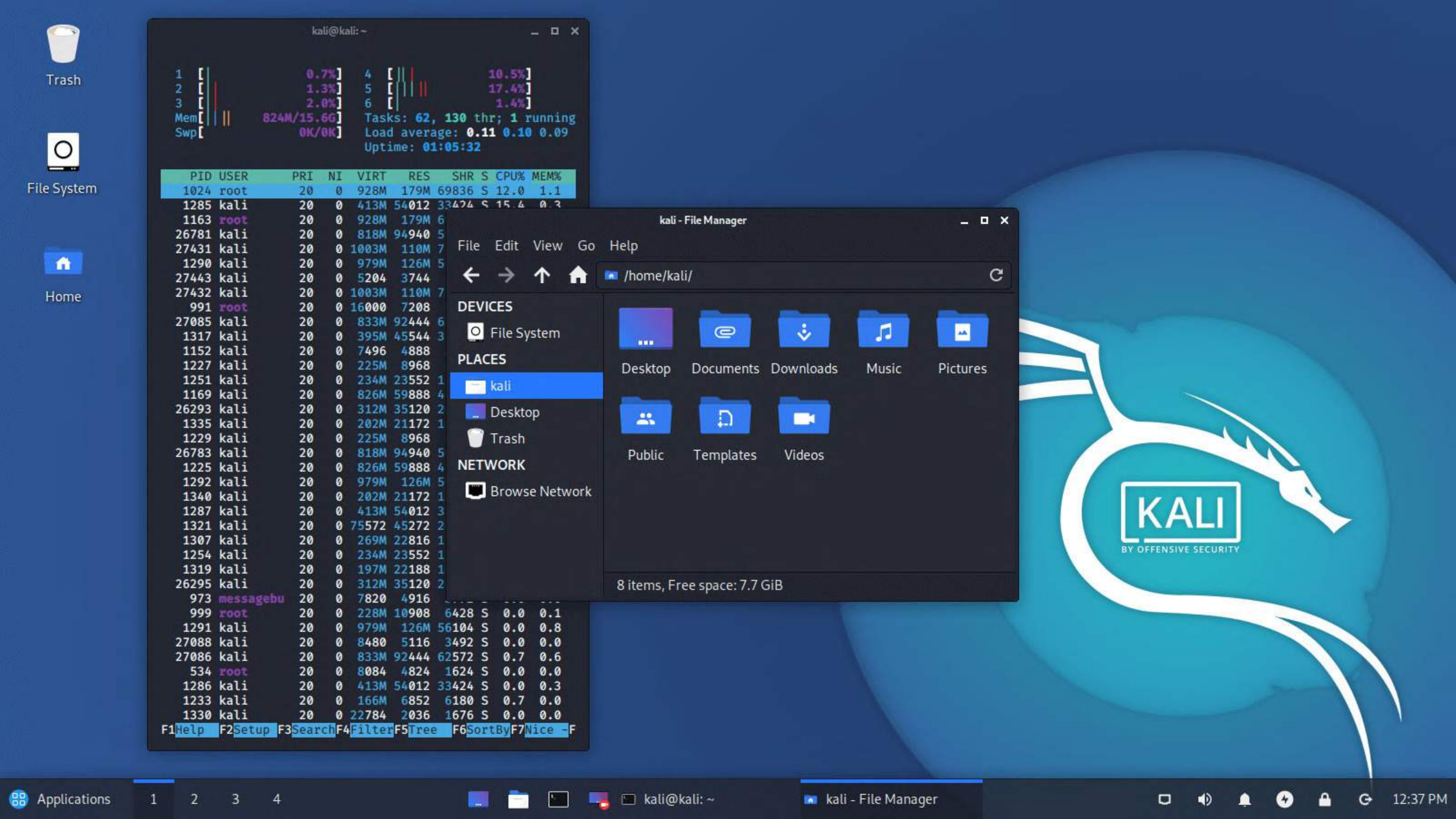
KALI

KALI

- Base: Debian
- Regular updates and security patches
- Pre-installed hacking tools(ex.Nmap)


Trash
File System
Home
kali@kali: ~
1 [0.7%] 4 [10.5%]
2 [1.3%] 5 [17.4%]
3 [2.0%] 6 [1.4%]
Mem[824M/15.6G] Tasks: 62, 130 thr; 1 running
Swp[0K/0K] Load average: 0.11 0.10 0.09
Uptime: 01:05:32
PID USER PRI NI VIRT RES SHR S CPU% MEM%
1024 root 20 0 928M 179M 69836 S 12.0 1.1
1285 kali 20 0 413M 54012 33424 S 15.4 0.3
1163 root 20 0 928M 179M 6
26781 kali 20 0 818M 94940 5
27431 kali 20 0 1003M 110M 7
1290 kali 20 0 979M 126M 5
27443 kali 20 0 5204 3744
27432 kali 20 0 1003M 110M 7
991 root 20 0 16000 7208
27085 kali 20 0 833M 92444 6
1317 kali 20 0 395M 45544 3
1152 kali 20 0 7496 4888
1227 kali 20 0 225M 8968
1251 kali 20 0 234M 23552 1
1169 kali 20 0 826M 59888 4
26293 kali 20 0 312M 35120 2
1335 kali 20 0 202M 21172 1
1229 kali 20 0 225M 8968
26783 kali 20 0 818M 94940 5
1225 kali 20 0 826M 59888 4
1292 kali 20 0 979M 126M 5
1340 kali 20 0 202M 21172 1
1287 kali 20 0 413M 54012 3
1321 kali 20 0 75572 45272 2
1307 kali 20 0 269M 22816 1
1254 kali 20 0 234M 23552 1
1319 kali 20 0 197M 22188 1
26295 kali 20 0 312M 35120 2
973 messagebu 20 0 7820 4916
999 root 20 0 228M 10908 6428 S 0.0 0.1
1291 kali 20 0 979M 126M 56104 S 0.0 0.8
27088 kali 20 0 8480 5116 3492 S 0.0 0.0
27086 kali 20 0 833M 92444 62572 S 0.7 0.6
534 root 20 0 8084 4824 1624 S 0.0 0.0
1286 kali 20 0 413M 54012 33424 S 0.0 0.3
1233 kali 20 0 166M 6852 6180 S 0.7 0.0
1330 kali 20 0 22784 2036 1676 S 0.0 0.0
F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice -F
kali - File Manager
File Edit View Go Help
/home/kali/
DEVICES
File System
PLACES
kali
Desktop
Trash
NETWORK
Browse Network
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
8 items, Free space: 7.7 GiB
KALI
BY OFFENSIVE SECURITY
Applications
1
2
3
4
kali@kali: ~
kali - File Manager
12:37 PM

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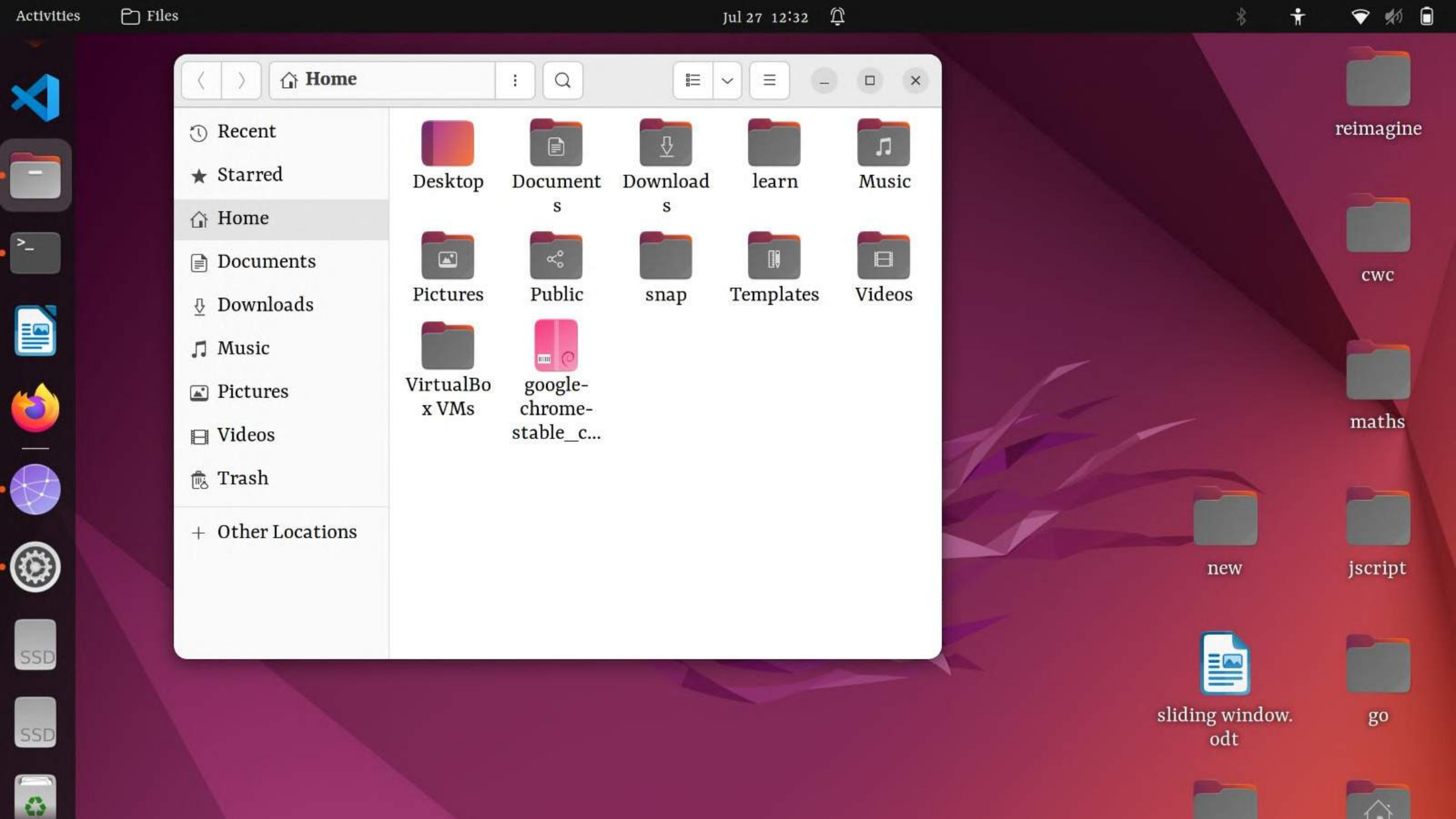
Desktop Environment

DESKTOP ENVIRONMENT

- Provides the graphical user interface.
- It includes icon, panels, and system tools.
- Popular ones are GNOME, KDE Plasma, Xfce.

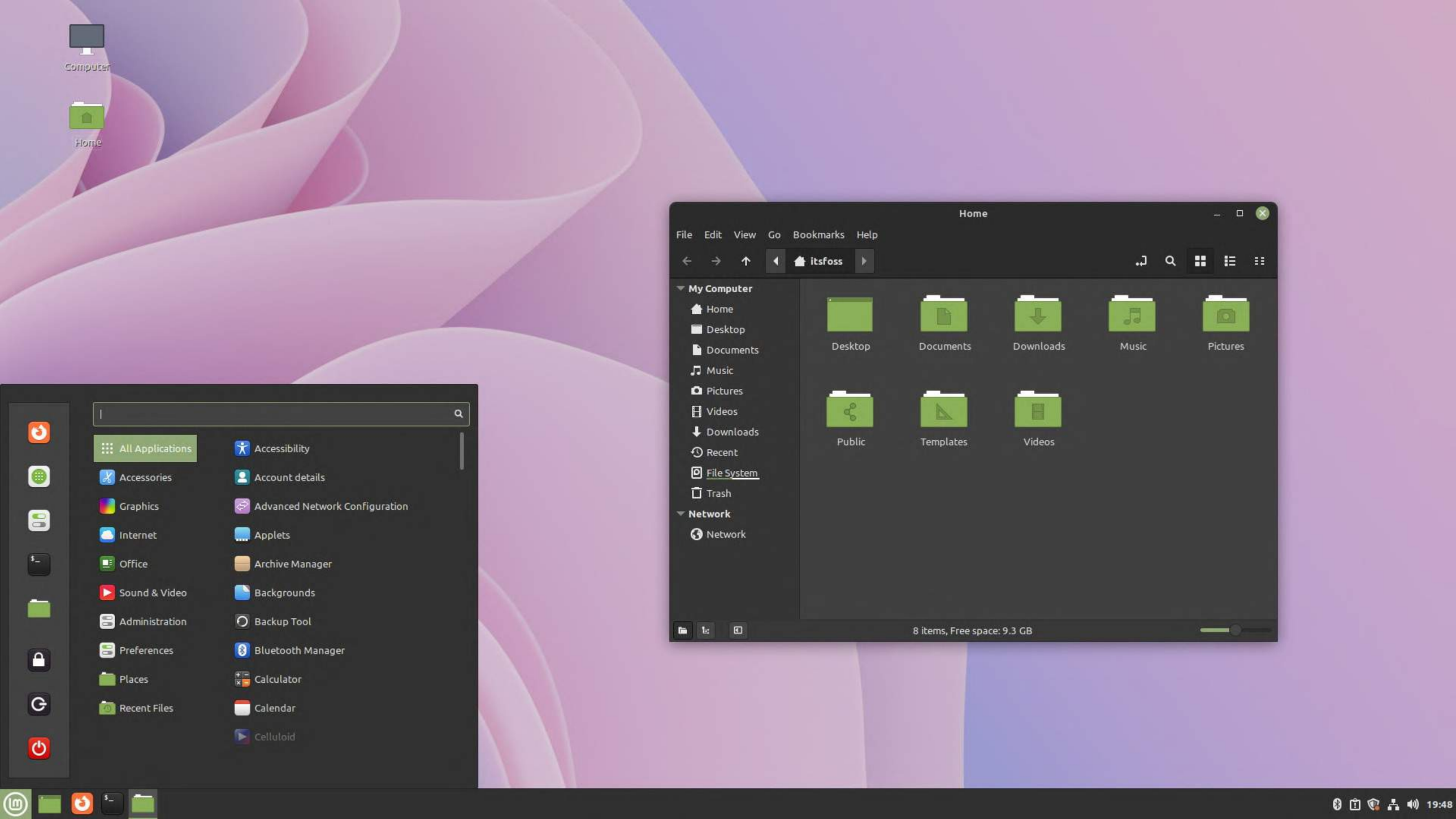
GNU NETWORK OBJECT MODEL ENVIRONMENT (GNOME)

- Uses a clean and modern interface
- Designed for ease of use and productivity
- Uses GNOME Shell to manage the desktop.


Activities
Files
Jul 27 12:32
Home
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
Other Locations
Desktop
Documents
Downloads
learn
Music
Pictures
Public
snap
Templates
Videos
VirtualBox VMs
google-chrome-stable_c...
reimagine
cwc
maths
new
jscript
sliding window.odt
go
SSD
SSD

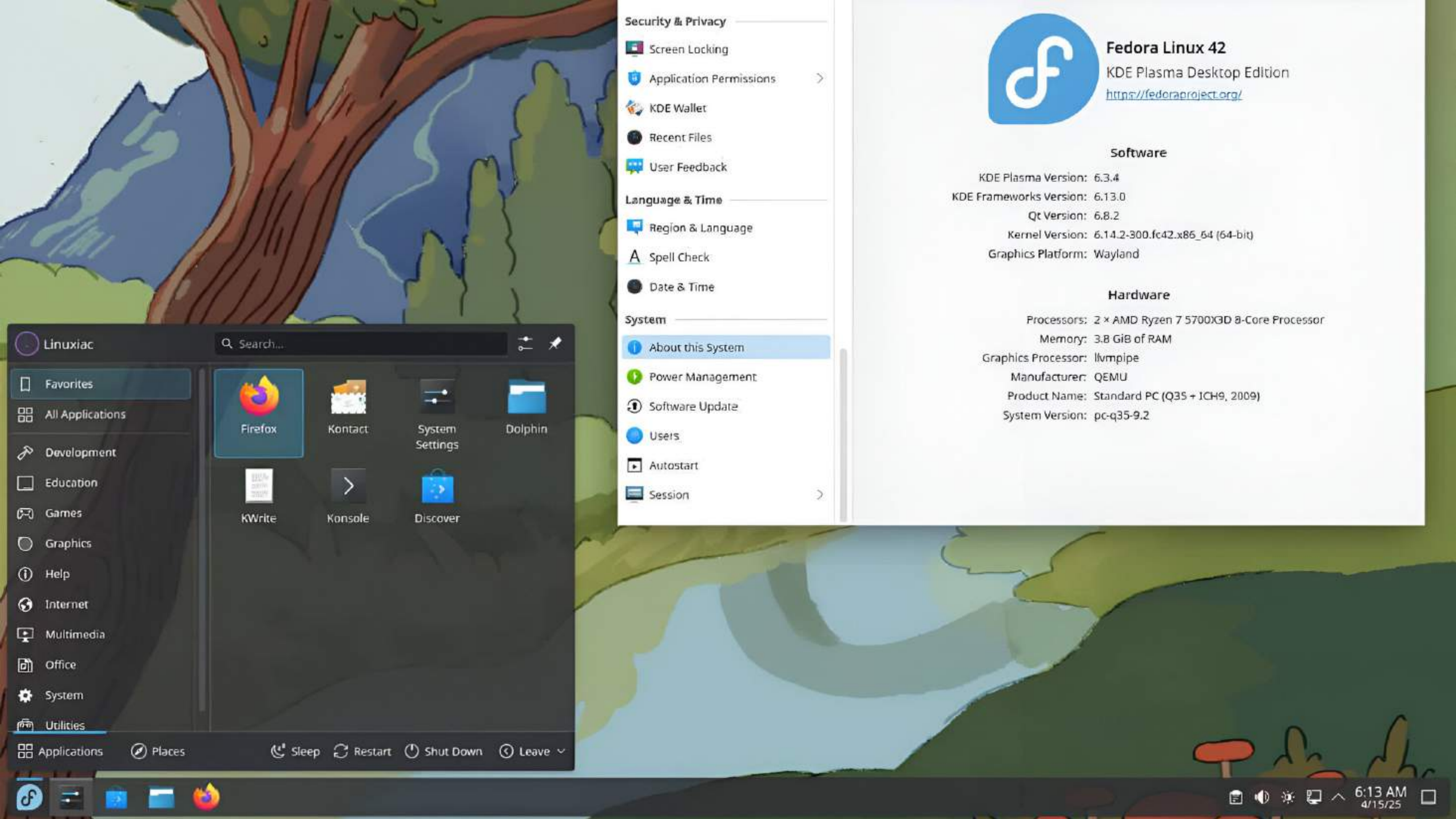
MATE ADVANCED TRADITIONAL ENVIRONMENT(MATE)

- Lightweight and easy to use
- Runs well on older or low-end systems
- Offers a traditional desktop layout


Computer
Home
Home
File Edit View Go Bookmarks Help
itsfoss
My Computer
Home
Desktop
Documents
Music
Pictures
Videos
Downloads
Recent
File System
Trash
Network
Network
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
8 items, Free space: 9.3 GB
All Applications
Accessories
Graphics
Internet
Office
Sound & Video
Administration
Preferences
Places
Recent Files
Accessibility
Account details
Advanced Network Configuration
Applets
Archive Manager
Backgrounds
Backup Tool
Bluetooth Manager
Calculator
Calendar
Celluloid
19:48

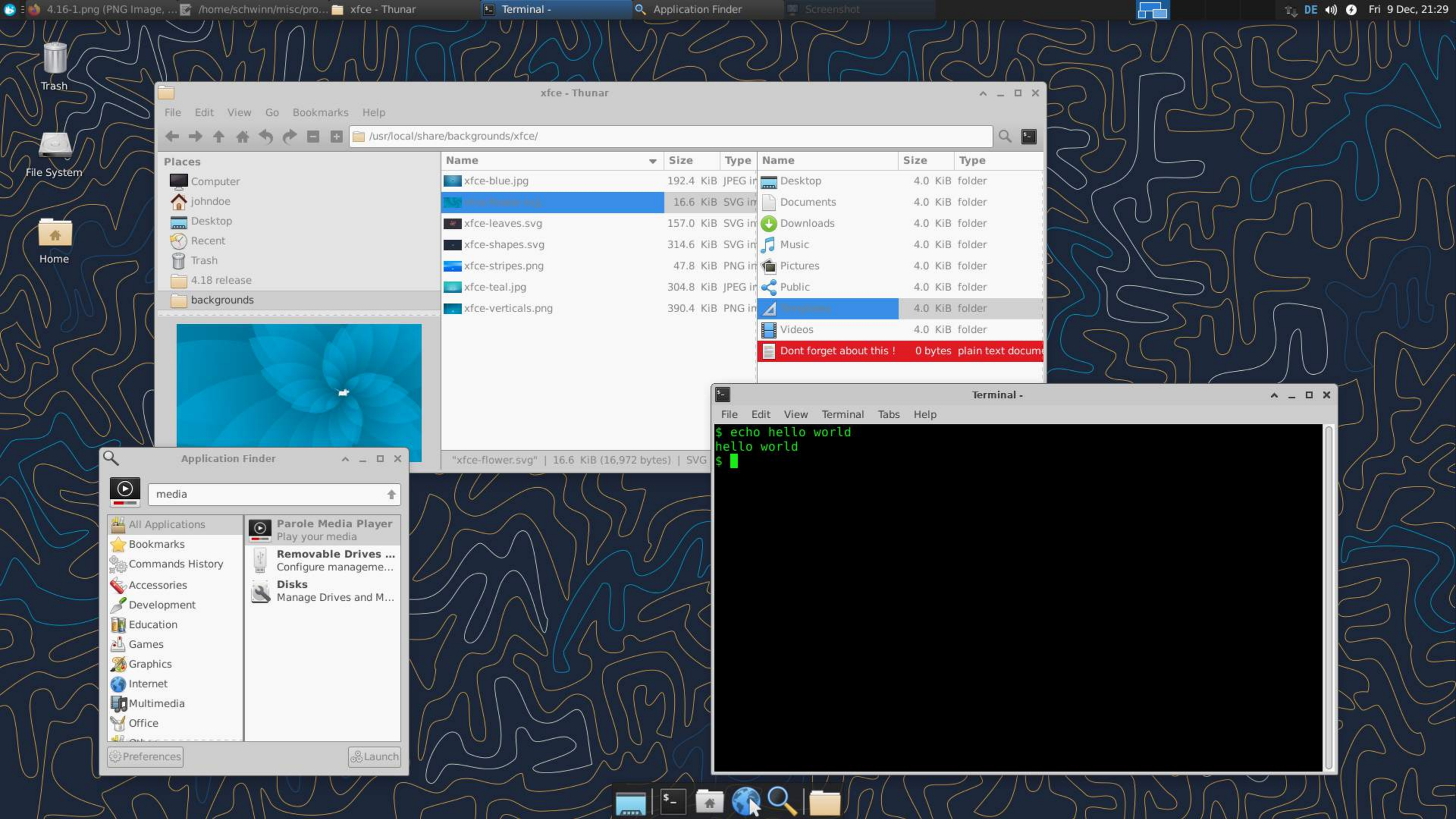
KDE PLASMA

- Built with the Qt toolkit for fast UI
- Uses KWin for window management
- Highly modular and customizable


Security & Privacy
Screen Locking
Application Permissions
KDE Wallet
Recent Files
User Feedback
Language & Time
Region & Language
Spell Check
Date & Time
System
About this System
Power Management
Software Update
Users
Autostart
Session
Fedora Linux 42
KDE Plasma Desktop Edition
https://fedoraproject.org/
Software
KDE Plasma Version: 6.3.4
KDE Frameworks Version: 6.13.0
Qt Version: 6.8.2
Kernel Version: 6.14.2-300.fc42.x86_64 (64-bit)
Graphics Platform: Wayland
Hardware
Processors: 2 × AMD Ryzen 7 5700X3D 8-Core Processor
Memory: 3.8 GiB of RAM
Graphics Processor: llvmpipe
Manufacturer: QEMU
Product Name: Standard PC (Q35 + ICH9, 2009)
System Version: pc-q35-9.2
Linuxiac
Search...
Favorites
All Applications
Development
Education
Games
Graphics
Help
Internet
Multimedia
Office
System
Utilities
Firefox
Kontact
System Settings
Dolphin
KWrite
Konsole
Discover
Applications
Places
Sleep
Restart
Shut Down
Leave
6:13 AM
4/15/25

XFORMS COMMON ENVIRONMENT (XFCE)

- Designed to be lightweight and fast
- Uses low system resources
- Offers a simple and traditional layout


4.16-1.png (PNG Image, ...
/home/schwinn/misc/pro...
xfce - Thunar
Terminal -
Application Finder
Screenshot
DE
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Trash
File System
Home
xfce - Thunar
File Edit View Go Bookmarks Help
/usr/local/share/backgrounds/xfce/
Places
Computer
johndoe
Desktop
Recent
Trash
4.18 release
backgrounds
Name Size Type
xfce-blue.jpg 192.4 KiB JPEG in
xfce-flower.svg 16.6 KiB SVG im
xfce-leaves.svg 157.0 KiB SVG in
xfce-shapes.svg 314.6 KiB SVG in
xfce-stripes.png 47.8 KiB PNG in
xfce-teal.jpg 304.8 KiB JPEG in
xfce-verticals.png 390.4 KiB PNG in
Name Size Type
Desktop 4.0 KiB folder
Documents 4.0 KiB folder
Downloads 4.0 KiB folder
Music 4.0 KiB folder
Pictures 4.0 KiB folder
Public 4.0 KiB folder
Templates 4.0 KiB folder
Videos 4.0 KiB folder
Dont forget about this ! 0 bytes plain text docume
"xfce-flower.svg" | 16.6 KiB (16,972 bytes) | SVG
Application Finder
media
All Applications
Bookmarks
Commands History
Accessories
Development
Education
Games
Graphics
Internet
Multimedia
Office
Parole Media Player
Play your media
Removable Drives ...
Configure manageme...
Disks
Manage Drives and M...
Preferences
Launch
Terminal -
File Edit View Terminal Tabs Help
$ echo hello world
hello world
$

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Package Manager

WHAT IS A PACKAGE ?

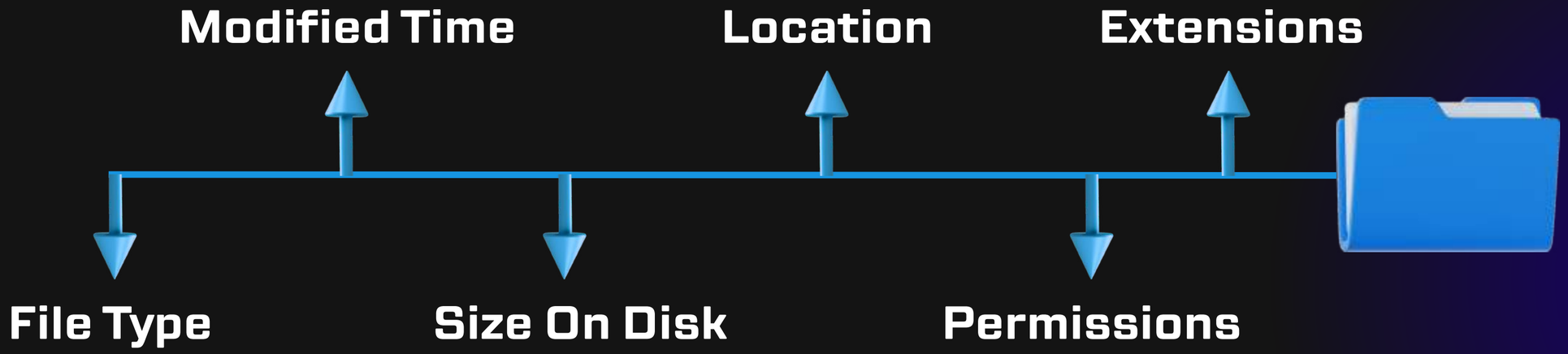
- Bundle of software that includes everything needed to install and run a program on Linux.

WHAT ARE PACKAGE MANAGERS?

- Tools used in Linux to install, update, configure and remove software automatically from the system.

WHAT IS METADATA ?

Metadata is the information about a software package.



WHAT IS A REPOSITORY?

A repository is a storage location where software packages are kept.

PACKAGE MANAGEMENT PROCESS

Linux System

Package manager

Repository

Package metadata

Packages and dependencies

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Hands On!

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Turn on the PCs → Open your terminal → Write the command

List the packages to upgrade

```
sudo apt update
```

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Upgrades the list of packages

```
sudo apt upgrade
```

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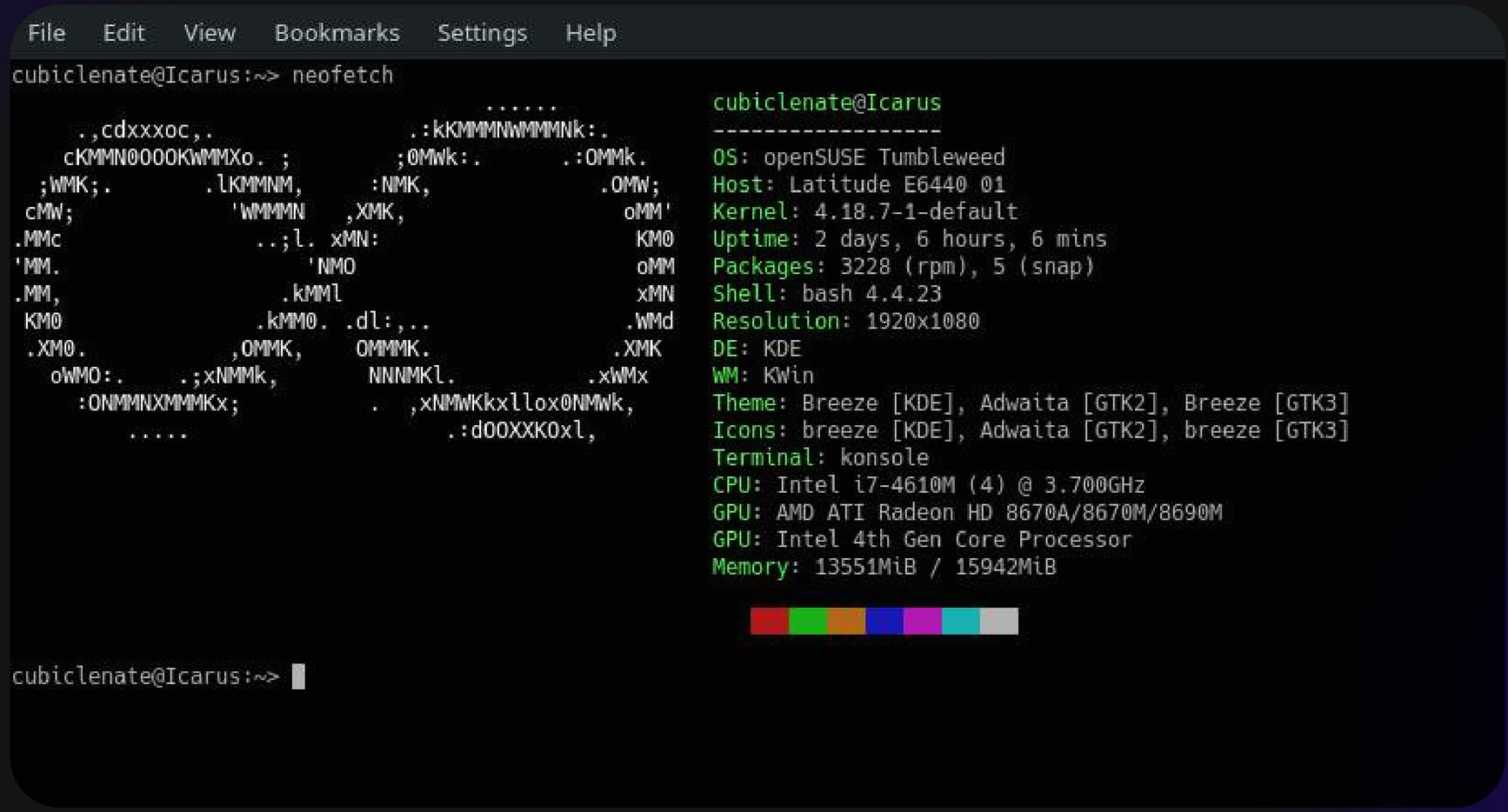
```
sudo apt install cmatrix
```

```
sudo apt remove cmatrix
```

NEOFETCH PACKAGE



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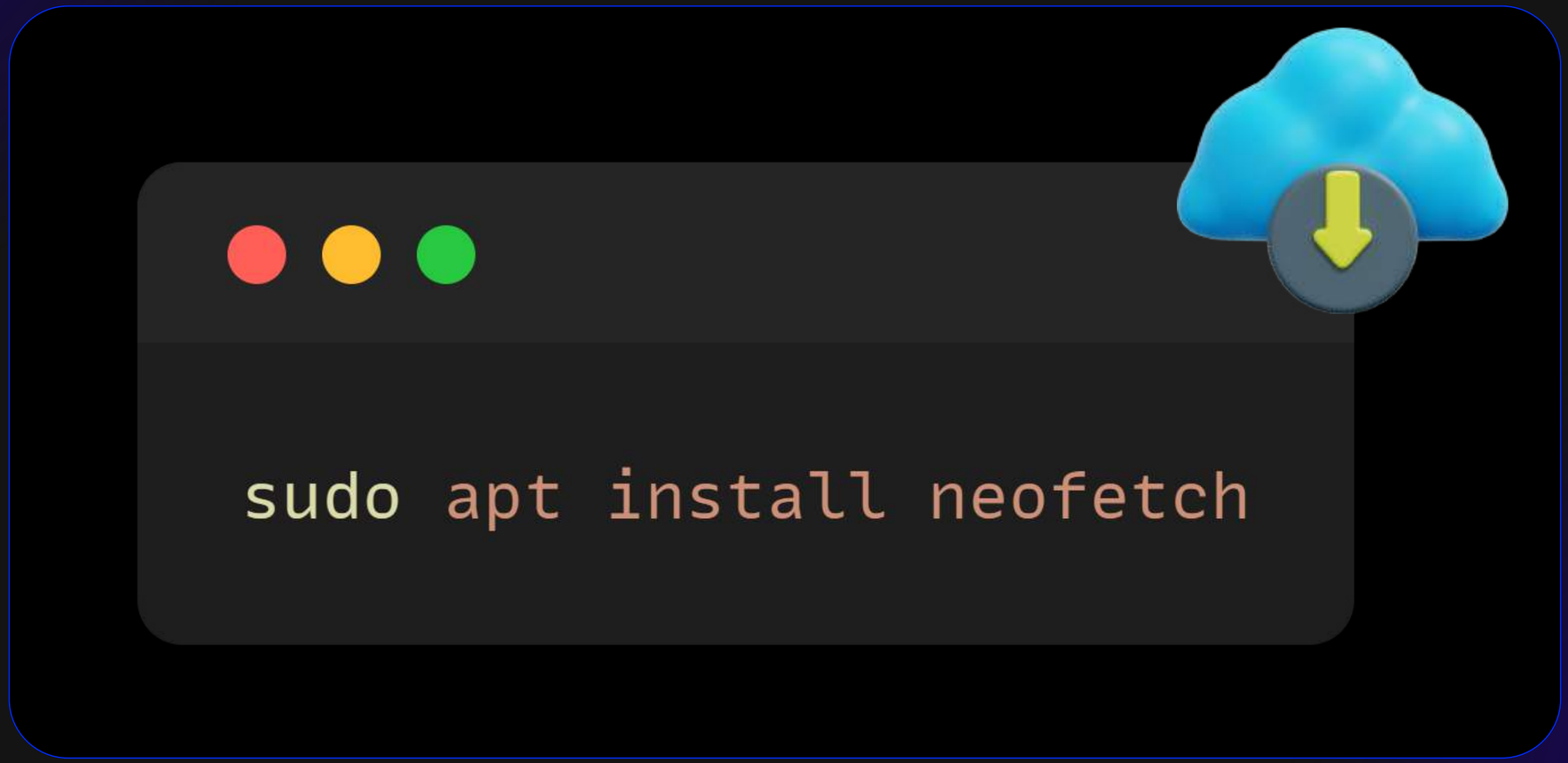

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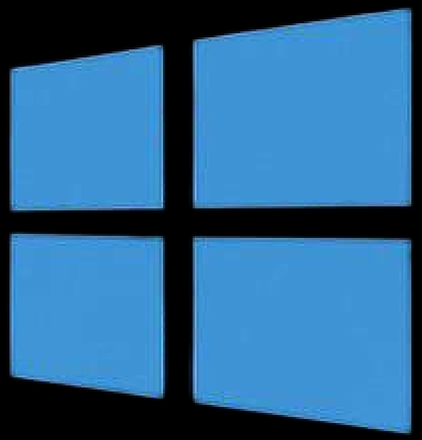
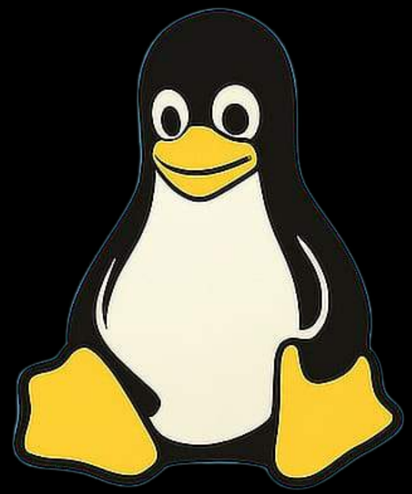


Windows

VS



Linux

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Windows

Closed Source

Linux

Open Source

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Windows

Less secure

Linux

More secure

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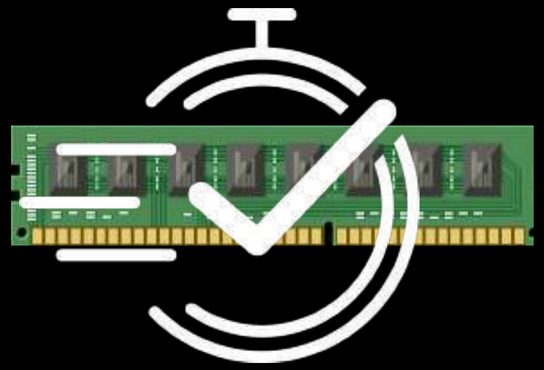
Windows

More RAM

Linux



Fast and lightweight

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Windows

Limited customisation

Linux

High customisation

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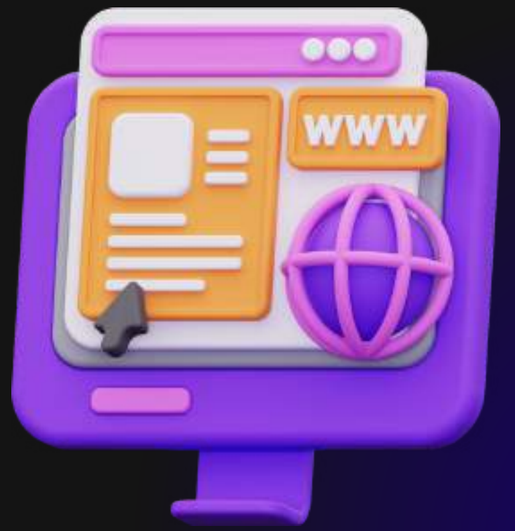
Applications of Linux

WEB SERVER

- Hosting Websites
- Security & Stability
- Ex. Nginx & apache2

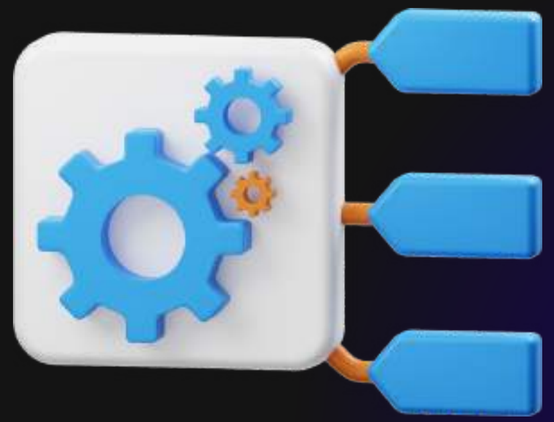


PROGRAMMING AND DEVELOPMENT

- Bash Scripting for automation
- Open Source Tools

EMBEDDED SYSTEMS

- IoT Devices
- Automotive Systems



CYBERSECURITY AND NETWORKING

- Penetration Testing
- Network Management
- Ex .Kali OS

VIRTUAL MACHINE

- Software-based simulation of a physical computer.
- It runs an operating system and applications just like a physical machine.

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THANK YOU!!!