

# [StuCo 98008] GNU/Linux for Beginners

## **Session 2**

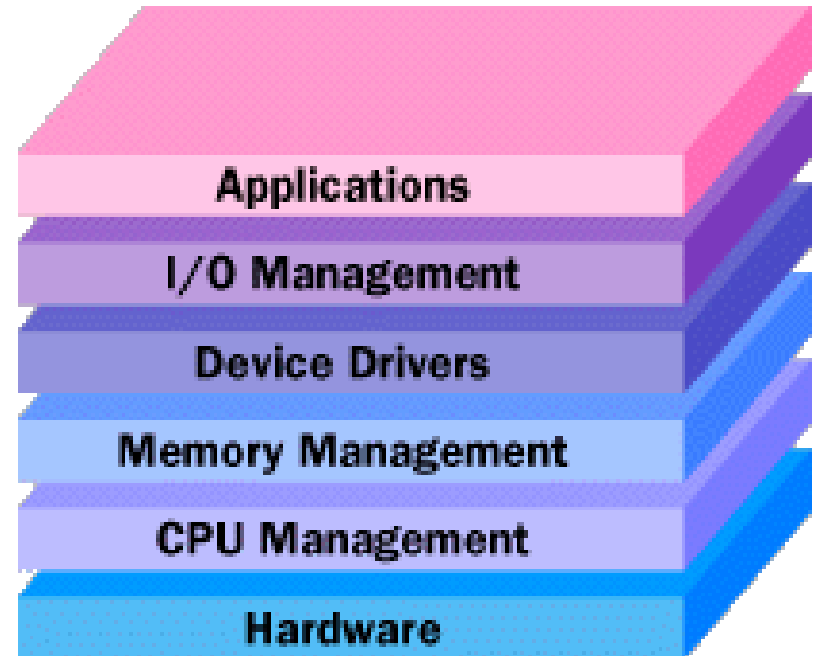
Operating Systems Fundamentals  
Definitions of Important Terms  
The GNU/Linux filesystem

# By the end of this lecture you will know

- What an operating system is
- The main components of an OS
- The history of GNU/Linux
- What **GNU**, **Linux**, **distribution** all mean.
- The filesystem structure of GNU/Linux
- How to explore the filesystem

# An Operating System...

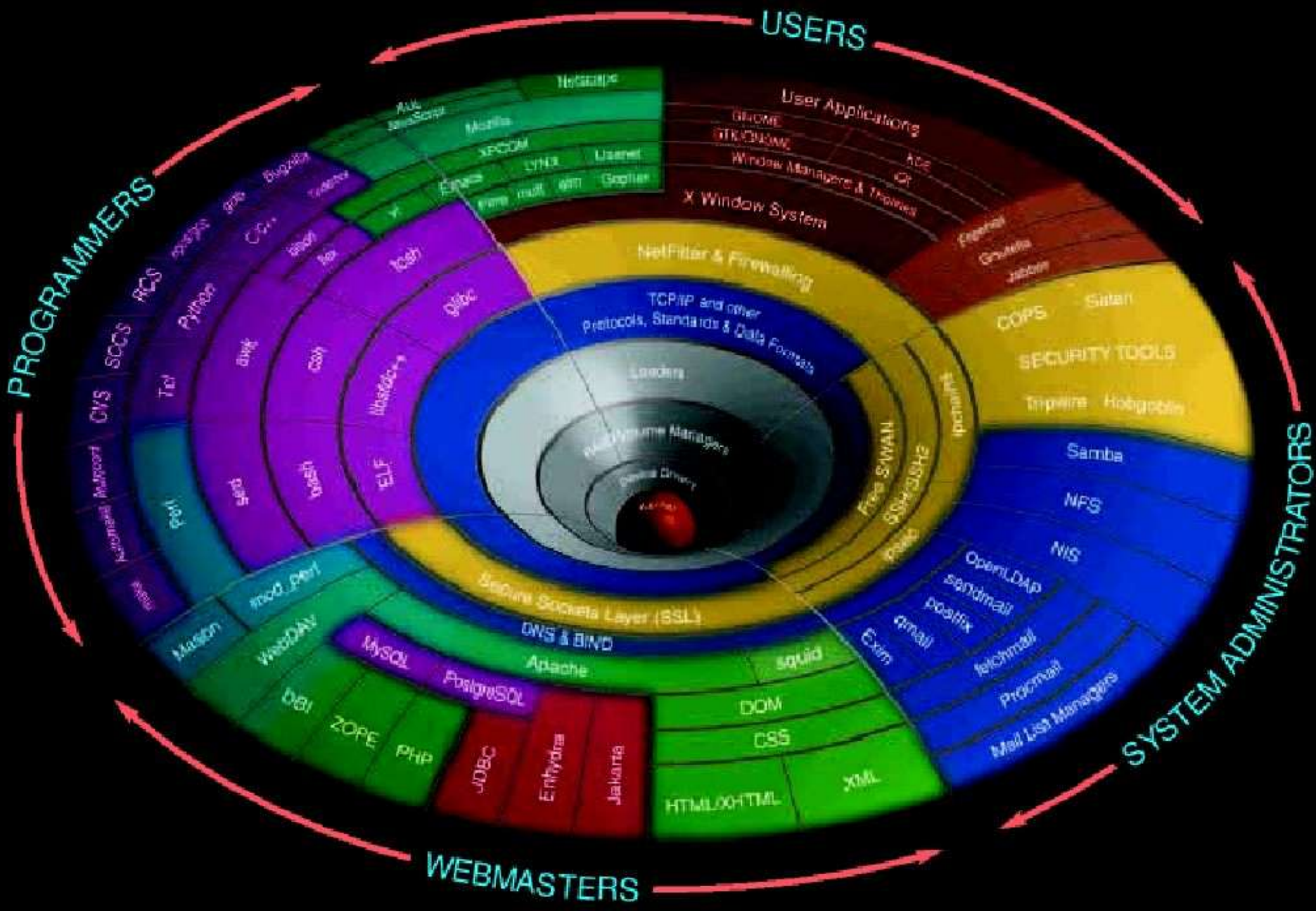
- Provides communication between machines and humans by:
  - Knowing how devices work (drivers)
  - Managing memory and CPU (to emulate multi-tasking)
  - Accepting commands from humans (through a UI - user interface)
  - Interpreting and passing commands to hardware.



# Main Components of Operating Systems

- **Kernel** – provides hardware management
- **User Interface**
  - Command Line Interface (CLI)
    - Bourne Again Shell a.k.a. bash
    - DOS command line
  - Graphical User Interface (GUI)
    - XFree86
    - Mac OSX Quartz
- **userland** n. Anywhere outside the kernel\*

\* (The Jargon File - <http://www.jargon.org>)



Source: [ftp://ftp.oreilly.com/pub/poster/oreilly\\_linux\\_poster.pdf](ftp://ftp.oreilly.com/pub/poster/oreilly_linux_poster.pdf)

# The Linux kernel

- Started as a fun project by Linus Torvalds in 1991
- Linux 2.4.20: 17750 files, 3,100,000 lines of code

## Programming languages used in the Linux kernel \*

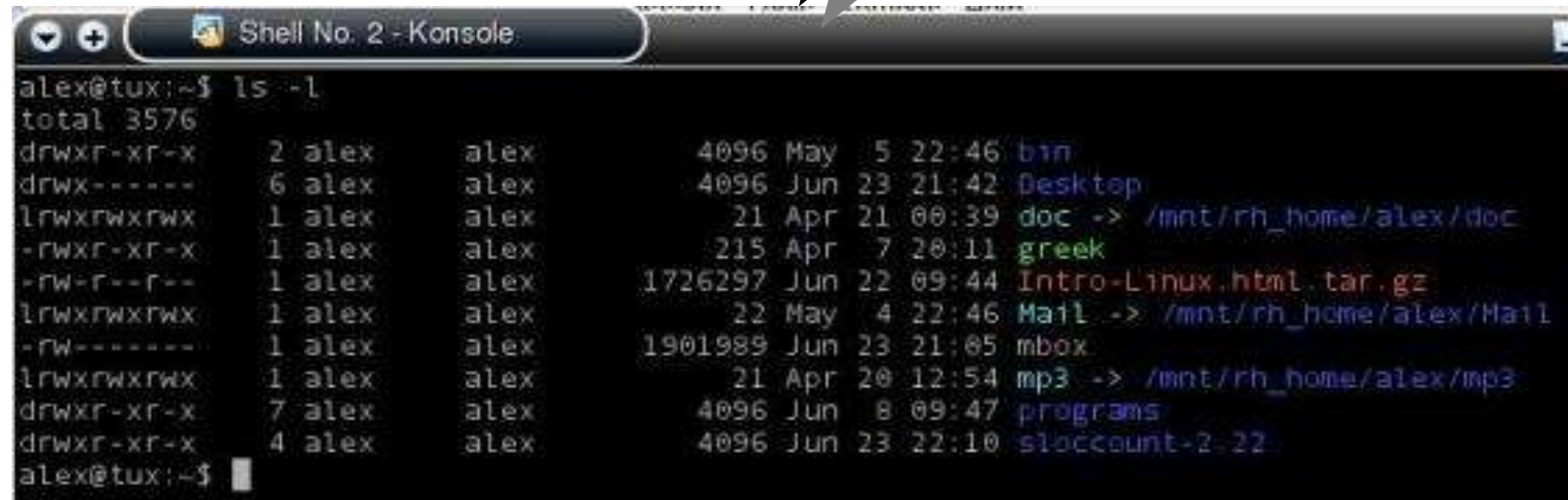
ansic:	2920896 (94.36%)
asm:	164848 (5.33%)
sh:	3267 (0.11%)
perl:	2273 (0.07%)
yacc:	1575 (0.05%)
cpp:	794 (0.03%)
lex:	748 (0.02%)
tcl:	577 (0.02%)
awk:	251 (0.01%)
lisp:	218 (0.01%)
sed:	79 (0.00%)

\*Calculated using David A. Wheeler's 'SLOCCount'



# User Interface

Graphical  
Interface



shell

# Command Line Interface

- *The basic input/output mechanism of any UNIX system.*
- **Shell** – the command interpreter (“command prompt” in other OSs) – bash, tcsh, csh etc.
- **Terminal** – a local or remote mechanism that facilitates some kind of shell.
- **Console** – the terminal that is provided to the user that has physical access (e.g. Ctrl-Alt-F1)



# Graphical User Interface

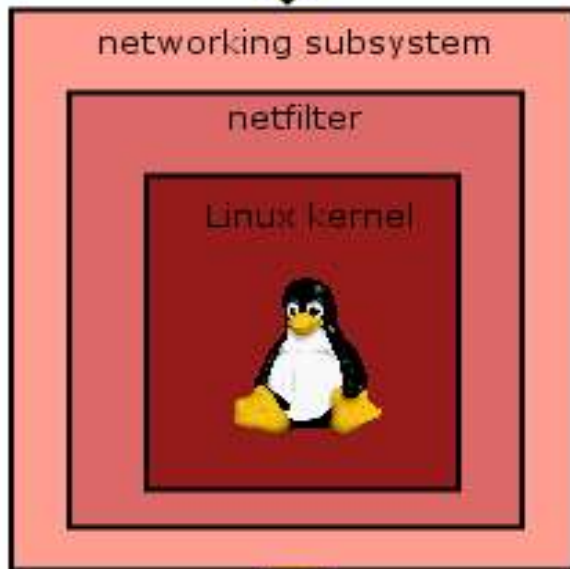
- One layer above the CLI.
- GUI can only do what CLI can do, while the reverse is not necessarily true.
- GUI is based on a “windowing” system, called **X**.
- X draws basic shapes and handles fonts and colors *only*.
- The rest is provided by a **window manager**, like KDE, GNOME, WindowMaker, BusyBox etc.

## GUI (Knetfilter)



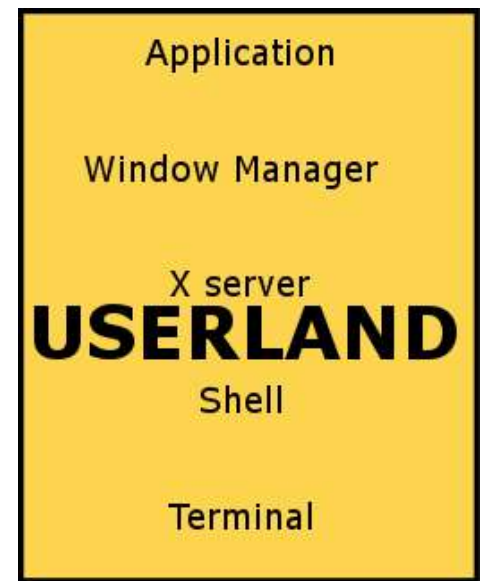
CLI (bash)

```
[root@tux]# iptables -P INPUT DROP
```



# A graphical depiction

- How a mouse click is received by the system...
- Translated to a shell command...
- Received by the kernel...
- Executed by the network card



# (Very brief) History of GNU/Linux

**UNIX**

**1970:**  
UNIX born in  
AT&T Labs



**1984:**  
GNU Project  
started



**1991:**  
Linux kernel  
created

**2003:**  
GNU/Linux  
maturity



# Protecting Freedom – the GNU GPL

- Project commencement 1984 – Richard Stallman
- Free Software Foundation founded 1985
- GNU General Public License (GPL)
  - Uses copyright law against itself
  - Grants complete freedom to users, with two restrictions:
    - This software may not be released with a different license.
    - This software may not be incorporated in non-free software.



Source: <http://www.gnu.org/copyleft/gpl.html>  
The GNU General Public License

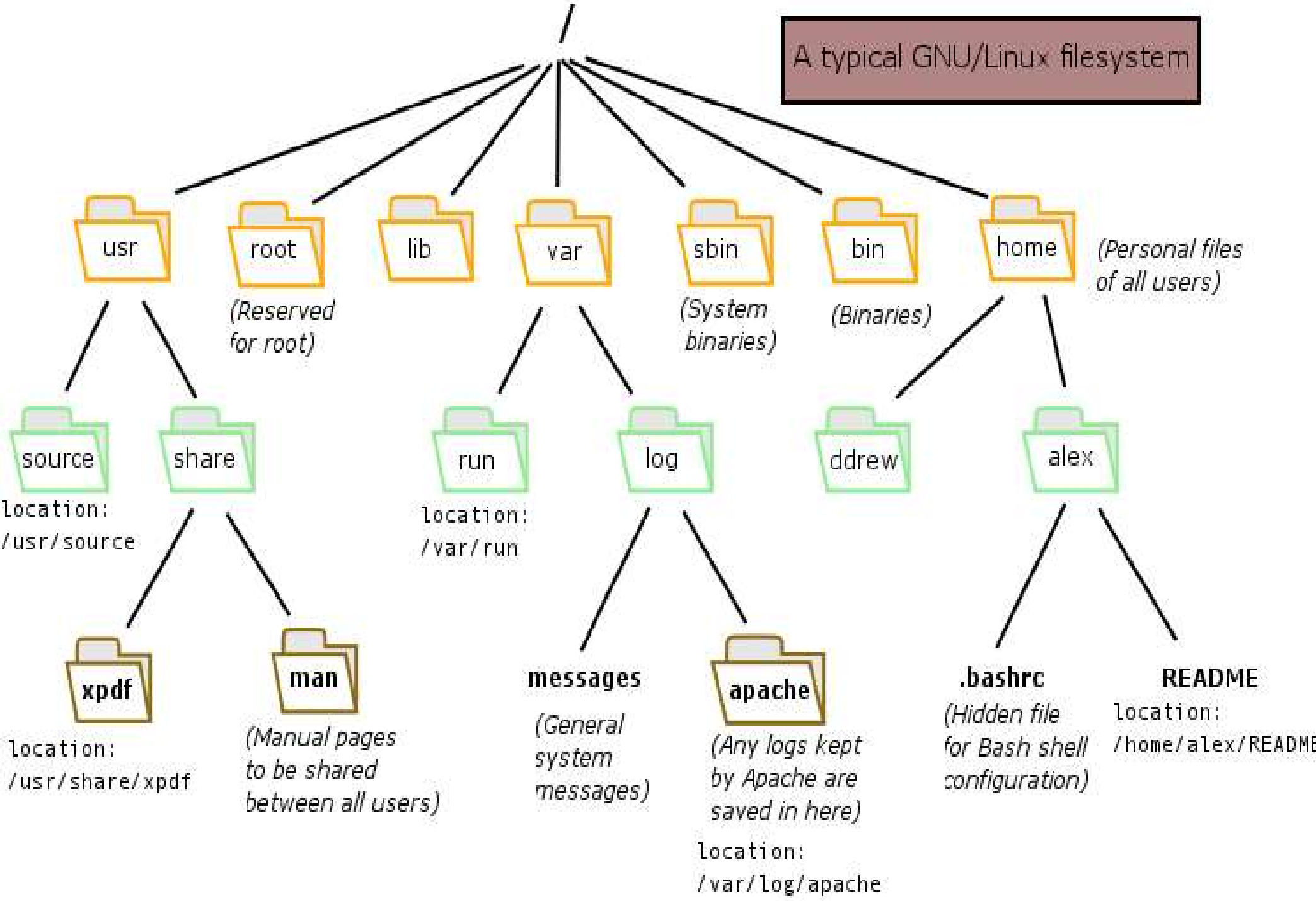
# Free as in **speech**, not free as in **beer**.

- Free to **use** the program
- Free to **study** how the program works, and **adapt** it to your needs
- Free to **redistribute** copies to anyone
- Free to improve the program and **release** the improvements to the community

# Important Terms

- **GNU:** The free OS built as an alternative to UNIX
- **Linux:** The kernel most commonly used with GNU
- **Distribution:** A pre-packaged collection of software (e.g. Red Hat Linux, Debian GNU/Linux)
- **Kernel space:** The memory space used by the kernel (inaccessible to user applications)
- **Userland (or user space):** The memory space used by user applications
- **Filesystem:** A system to organize the files of an Operating System

A typical GNU/Linux filesystem



*(Reserved for root)*

*(System binaries)*

*(Binaries)*

*(Personal files of all users)*

location:  
/usr/source

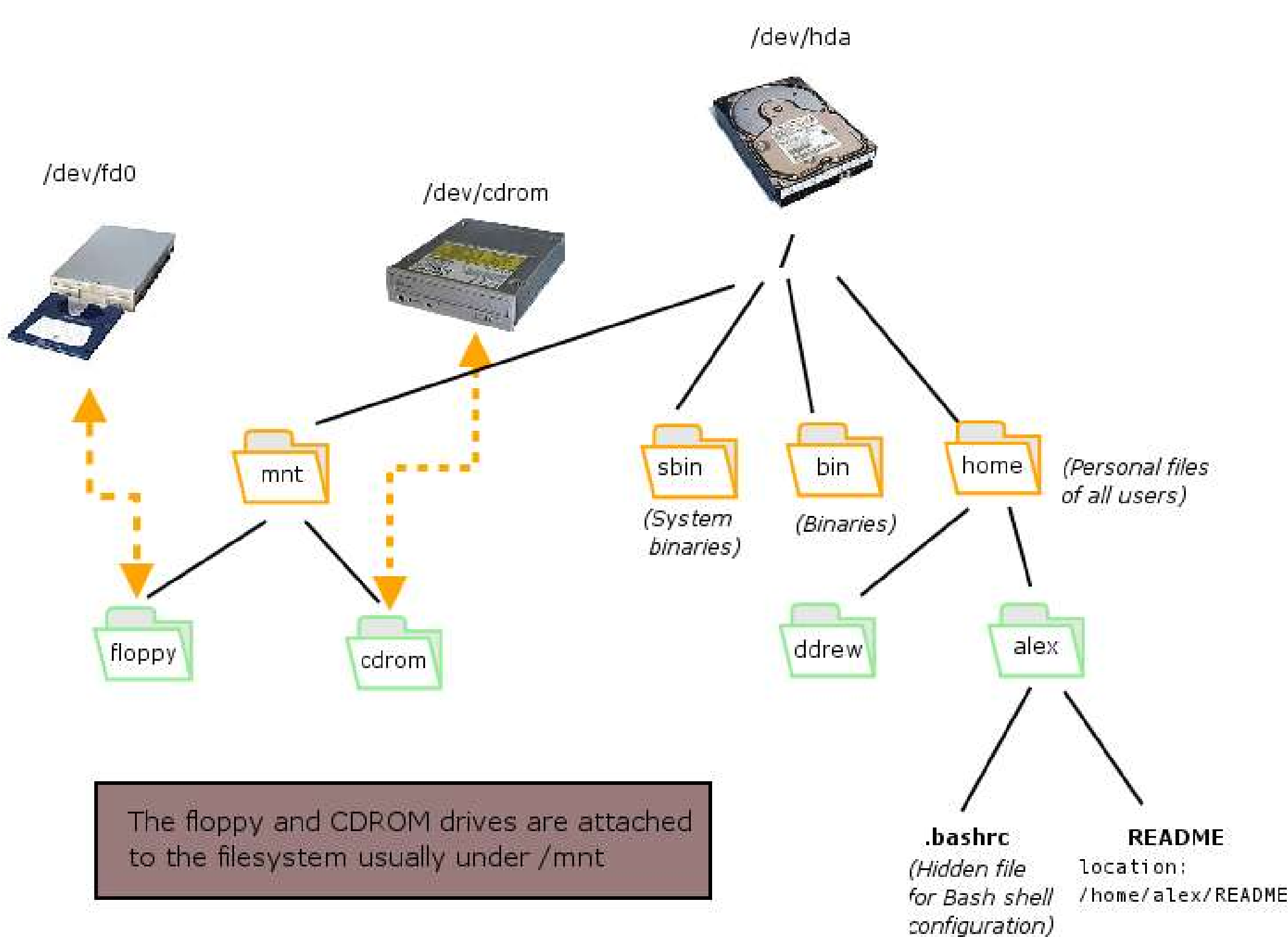
location:  
/var/run

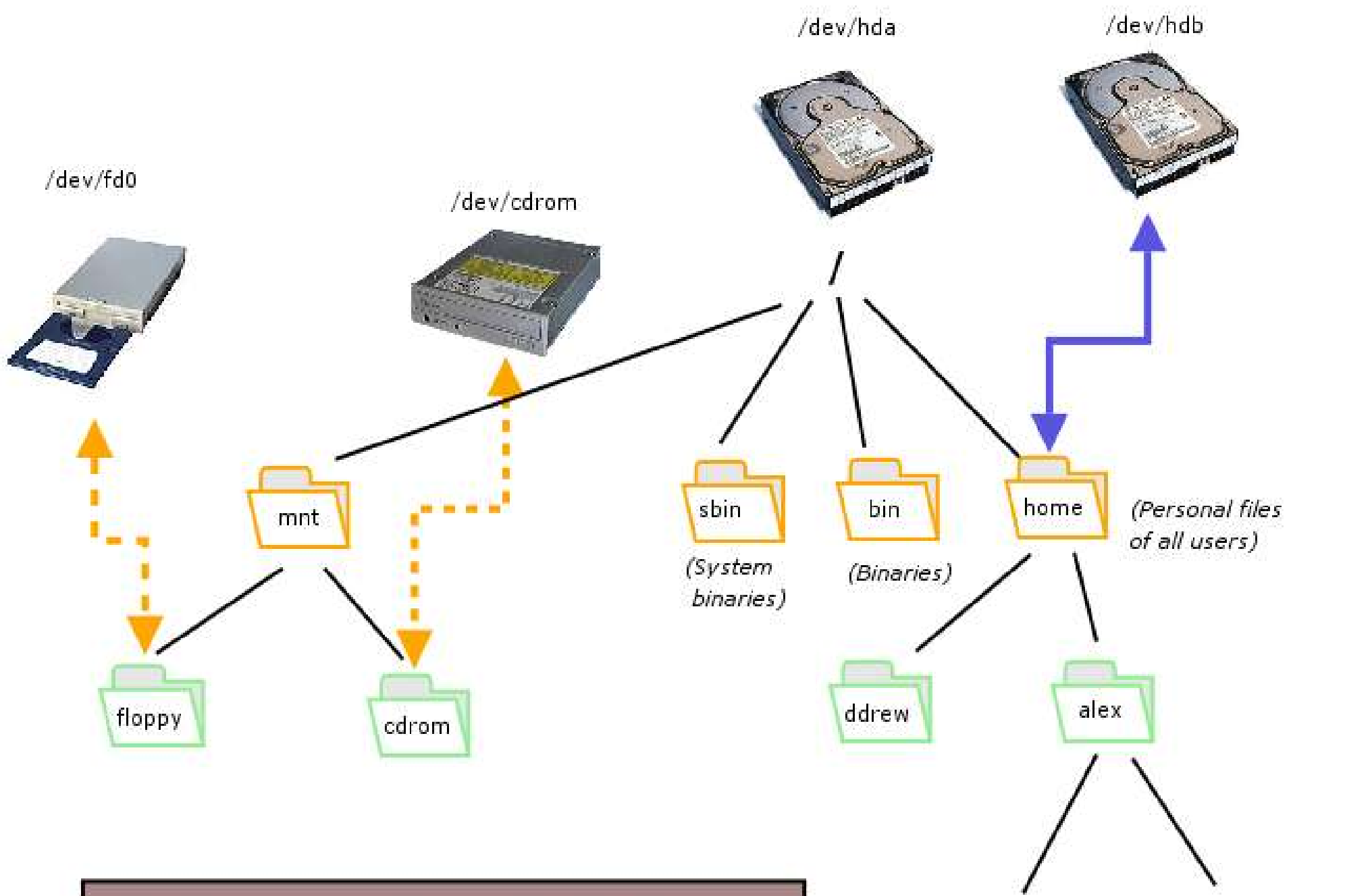
location:  
/usr/share/xpdf

location:  
/var/log/apache

location:  
/home/alex/README







Two hard disks mounted on the same filesystem, plus the usual removable devices under /mnt

**.bashrc**  
*(Hidden file for Bash shell configuration)*

**README**  
 location: /home/alex/README

# Reading for next week

- “Is Open Source synonymous with Free Software?”  
<http://www.gnu.org/philosophy/free-software-for-freedom.html>
- “The Linux Cookbook” - Shell section  
[http://www.tldp.org/LDP/linuxcookbook/html/cookbook\\_5.html#SEC48](http://www.tldp.org/LDP/linuxcookbook/html/cookbook_5.html#SEC48)