# Operating Systems

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# Lecture 2: Resources and operations over them. Case study: Linux CLI, working with files.

# Resources of computer

- Processors
- Memory
- Devices
- Information

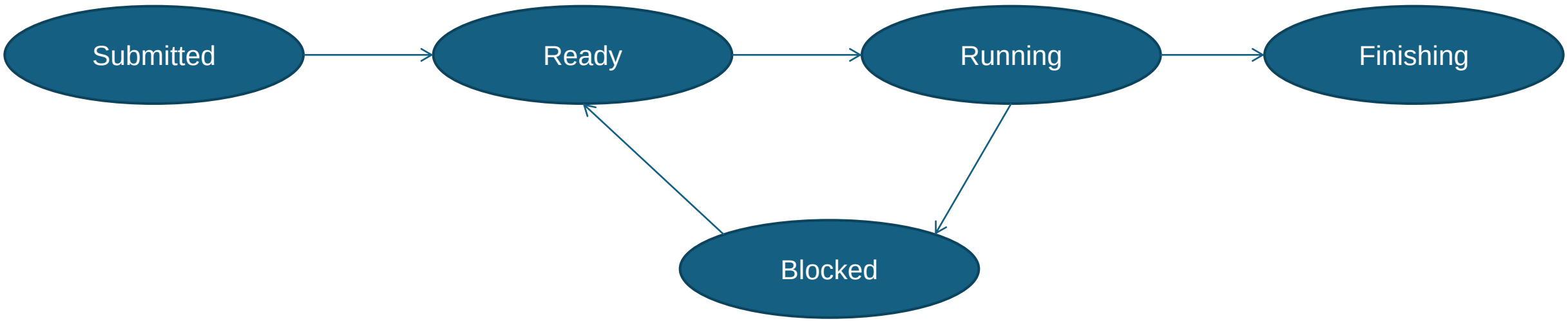
# Operations over resources

- Allocate
- Deallocate (free)
- Track (supervise)
- Schedule (plan)

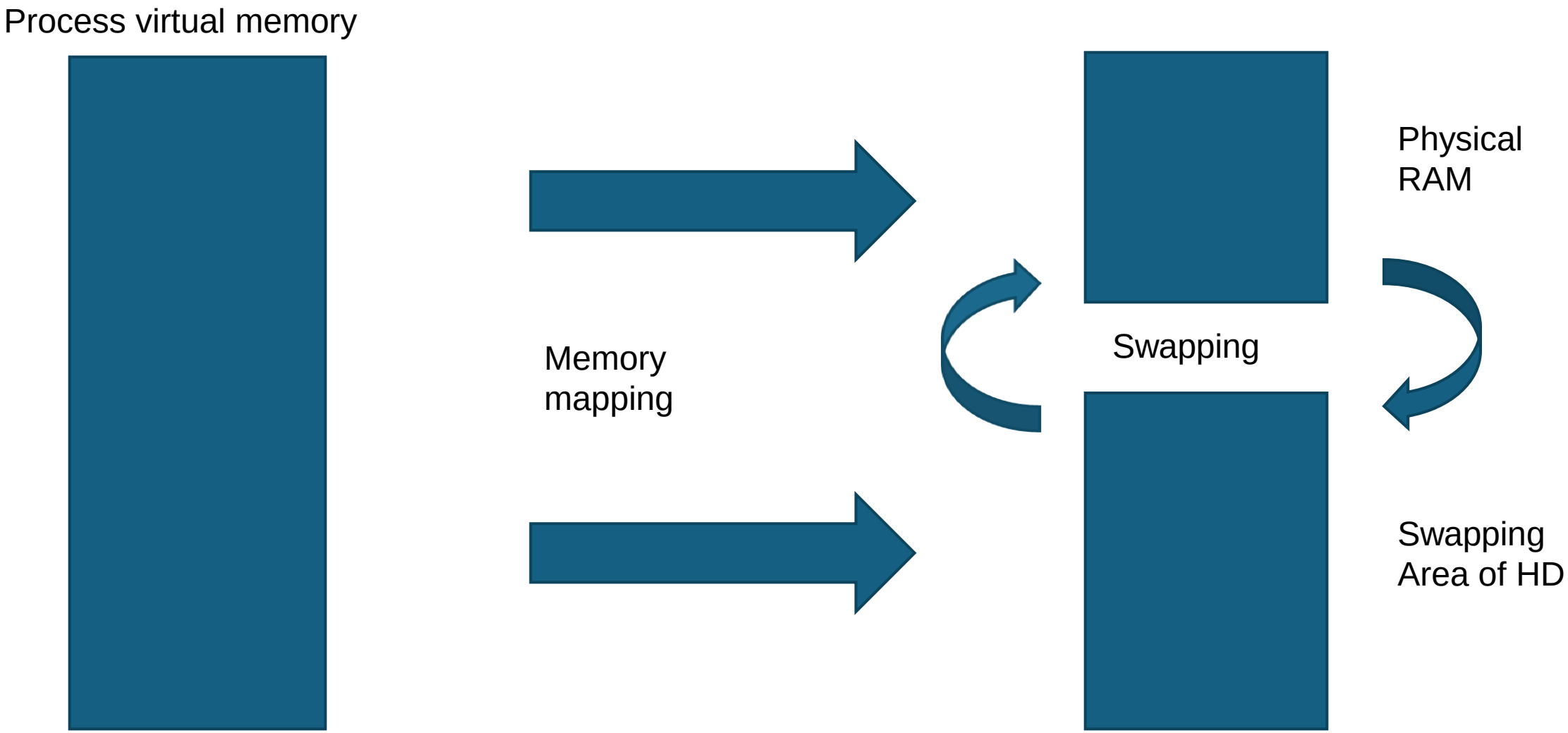
# Formula of OS: 4x4

| | Processors | Memory | Devices | Information |
|---|---|---|---|---|
| Allocate | PA | MA | DA | IA |
| Free | FP | FM | FD | FI |
| Track | TP | TM | TD | TI |
| Schedule | SP | SM | SD | SI |

# Process scheduling – switching process states



# Virtual Memory Concept



# Drivers of Devices

- Byte devices
- Block devices
- Graphical devices
- Controllers and Channels
- Asynchronous IO
- Interrupts of Devices
- Driver Interfaces

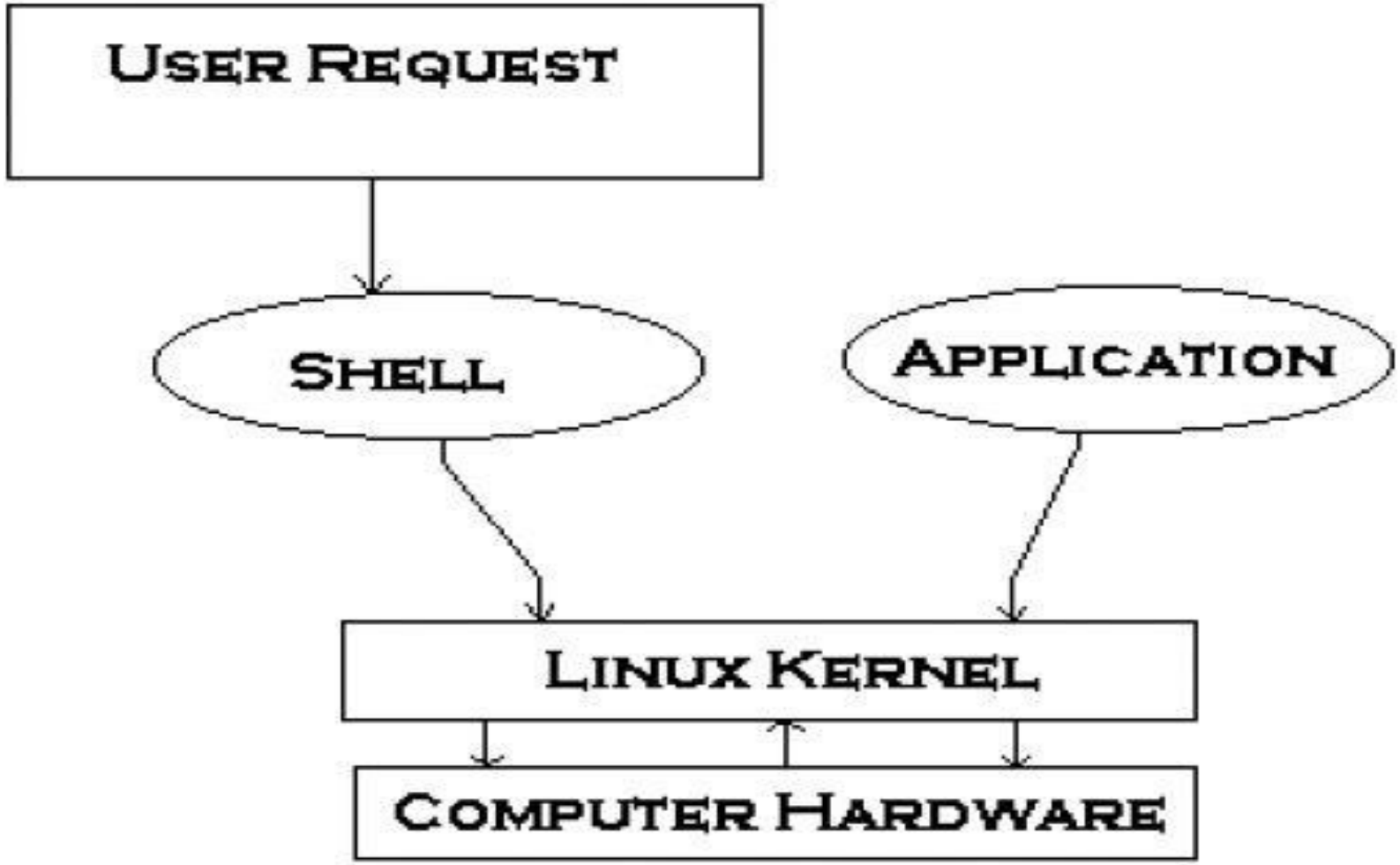
# File System

- Volume, Directory, and File
- File Structure of HD
- Allocation of device space
- Mapping of files
- File Descriptor
- Basic operations: read, write, seek
- Buffering

# CLI

- Unix/Linux – Shell: sh, csh, ksh, bash, etc
- MS-DOS for Windows
- Principles of CLI: command, arguments, and options
- Batch files and scripts
- Advantages of CLI
- Modern script languages: Perl, Ruby, etc

# Linux command line mode




# Basic concepts

- Kernel, Daemons, and Applications
- Username, password, and group
- Terminals and Shells
- XWindow and Desktopts

# Bootup Ubuntu

- BIOS — Boot Sector Loader
- (UEFI — Unified Extensible Firmware Interface)
- MBR —the boot loader
- Bootloader — grub
- Kernel — vmlinuz
- Initial RAM disk image — initrd
- systemd

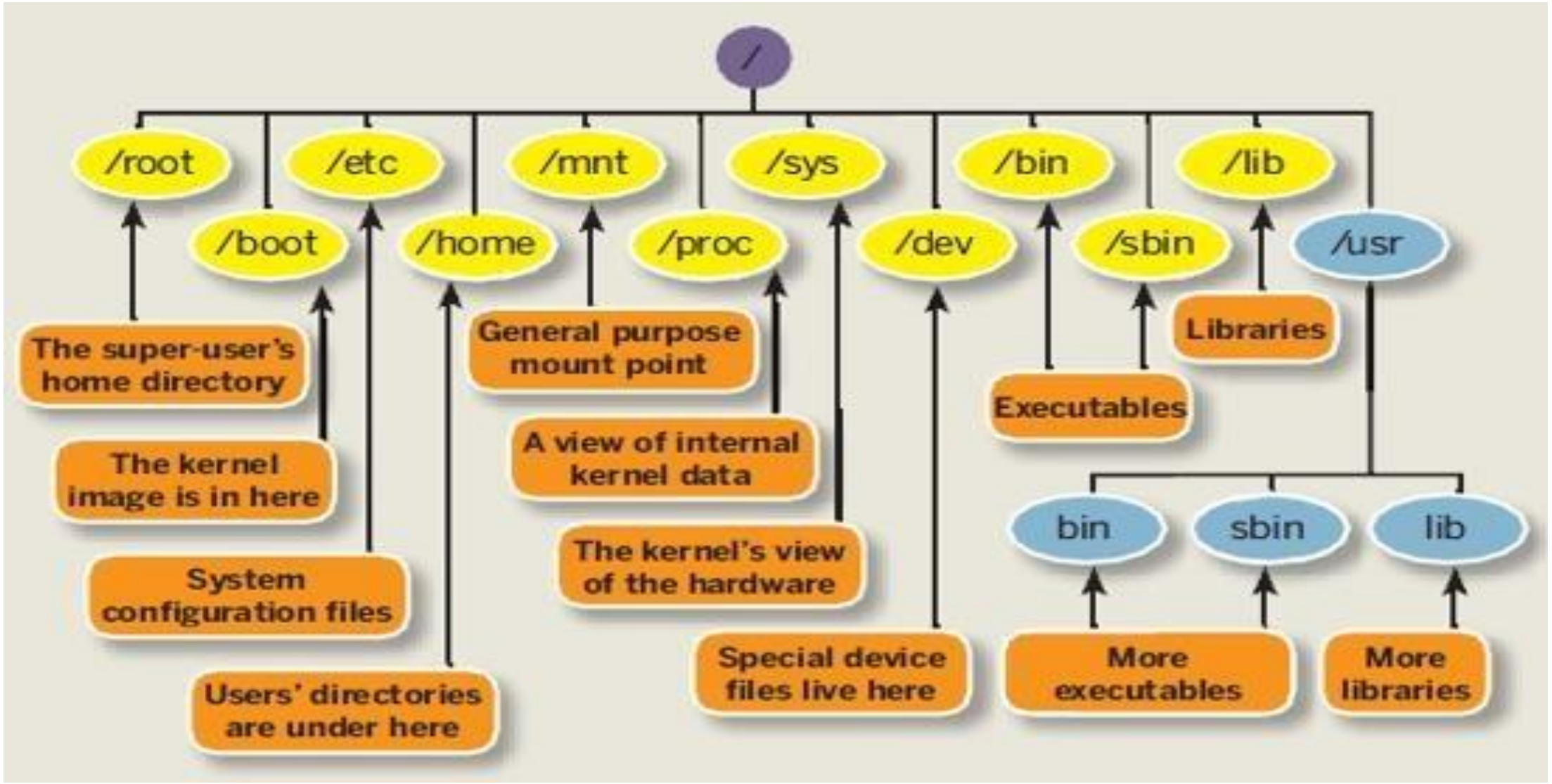
# Start CLI

- Virtual terminal: Ctrl-Alt-Fi
- Terminal window: Ctrl-Alt-t
- Username
- Password
- /etc/passwd: UID and GID, shell, working directory
- Configuration files: .profile, .bashrc, .bash_logout
- First commands: whoami, pwd, ls, ps, who, exit

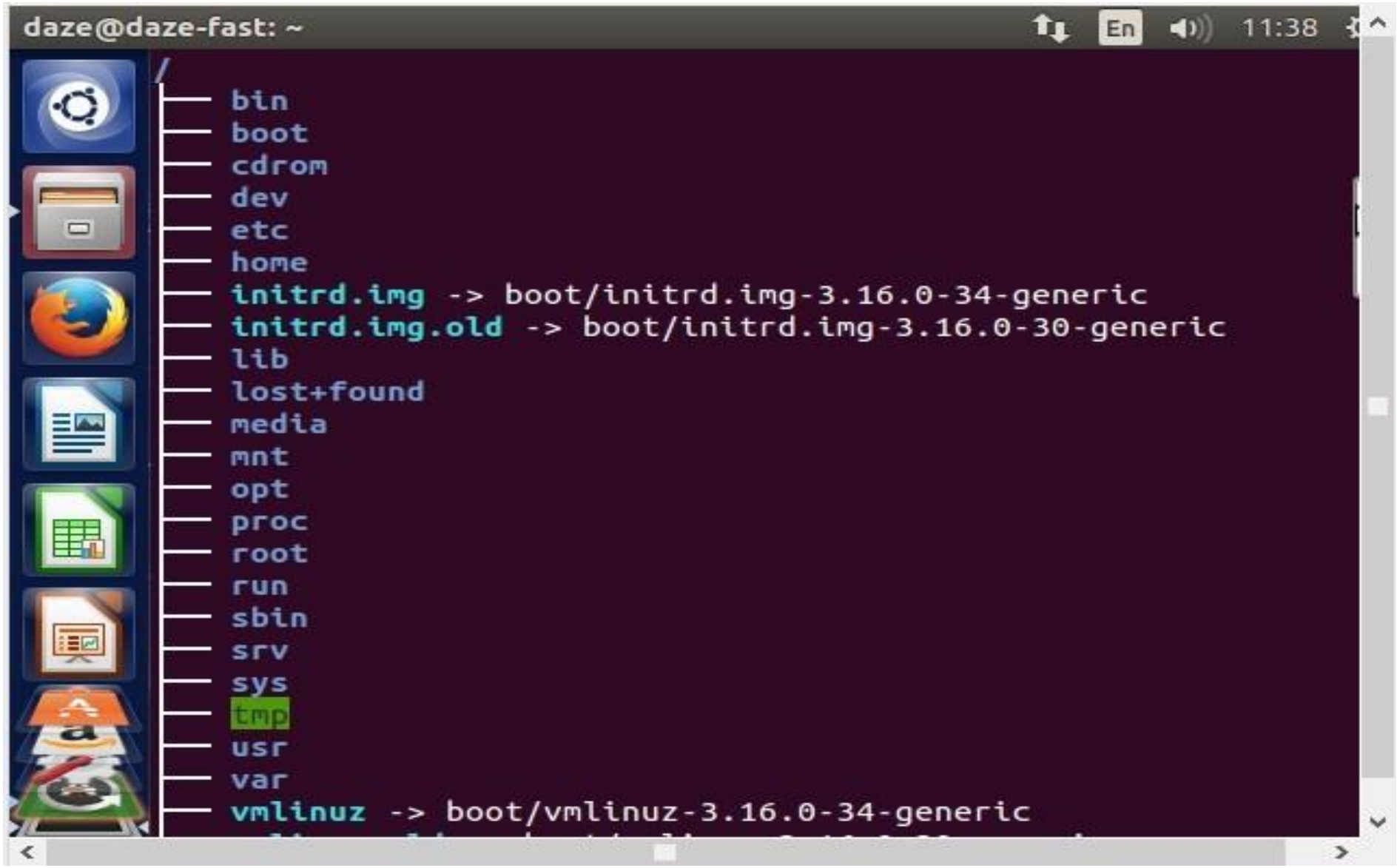
# Shell work

- Output an invitation (prompt) “>”
- Input command line
- If internal command, start it
- Otherwise, find executable file and start it
- Output results of command line processing
- Help: man, info

# Linux filesystem



# Filesystem example



# Absolute and relative file names

- /home/student/Documents/poem.pdf
- /etc/rc5.d/S99rc.local

- Working directory /home/student
- .profiles
- ../../etc/rc5.d/S99rc.local

# Unified tree

- Devices as files */dev*
- Hard disk */dev/sda1*
- *mount* – attach volume to the tree
- *umount* – detach volume from the tree
- Scheme of mounting */etc/mtab*
- Free space *df*

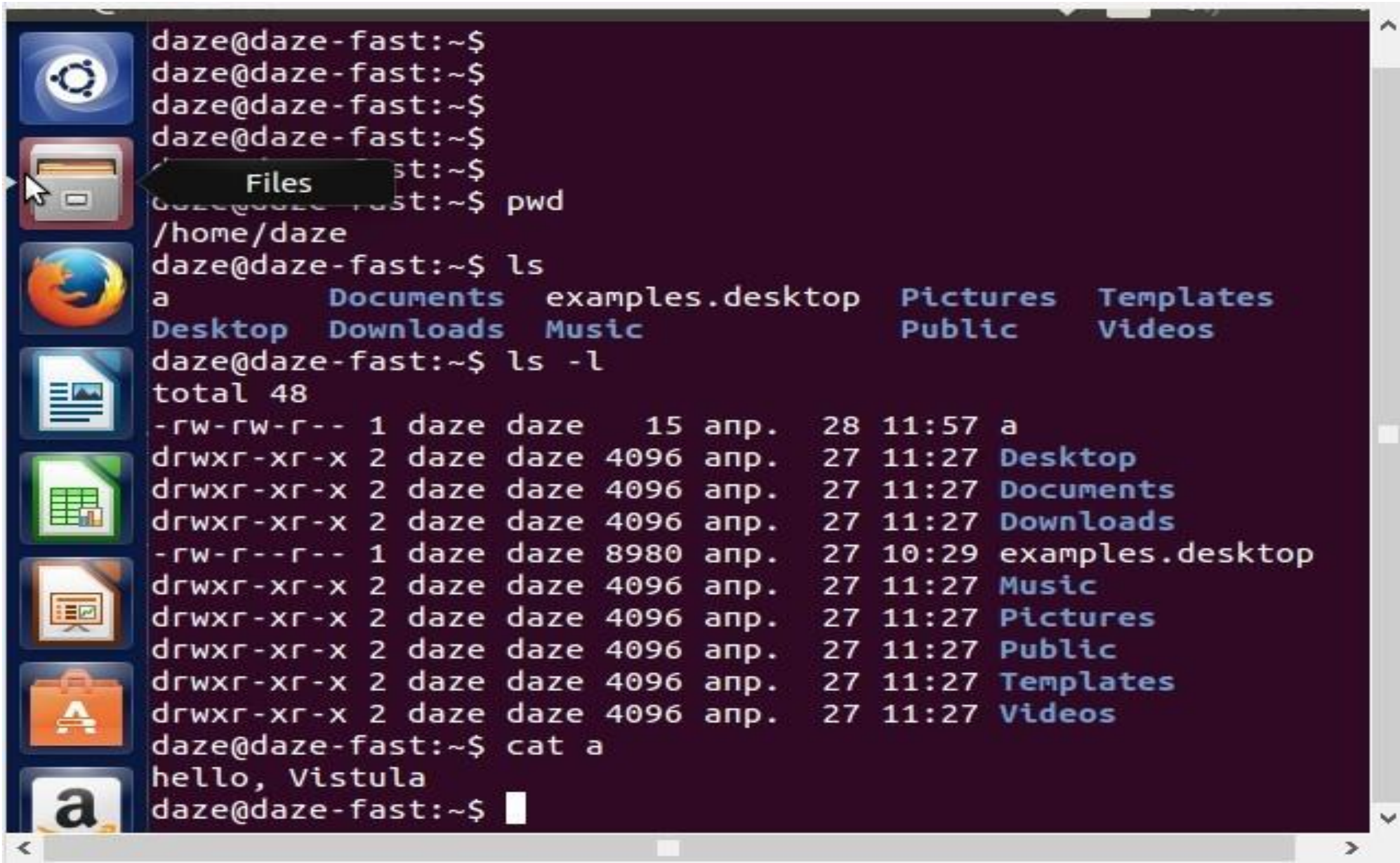
# Basic commands

- pwd – print working directory
- cd – change directory
- ls – list directory
- cat – output file (concatenate)

>ls –al

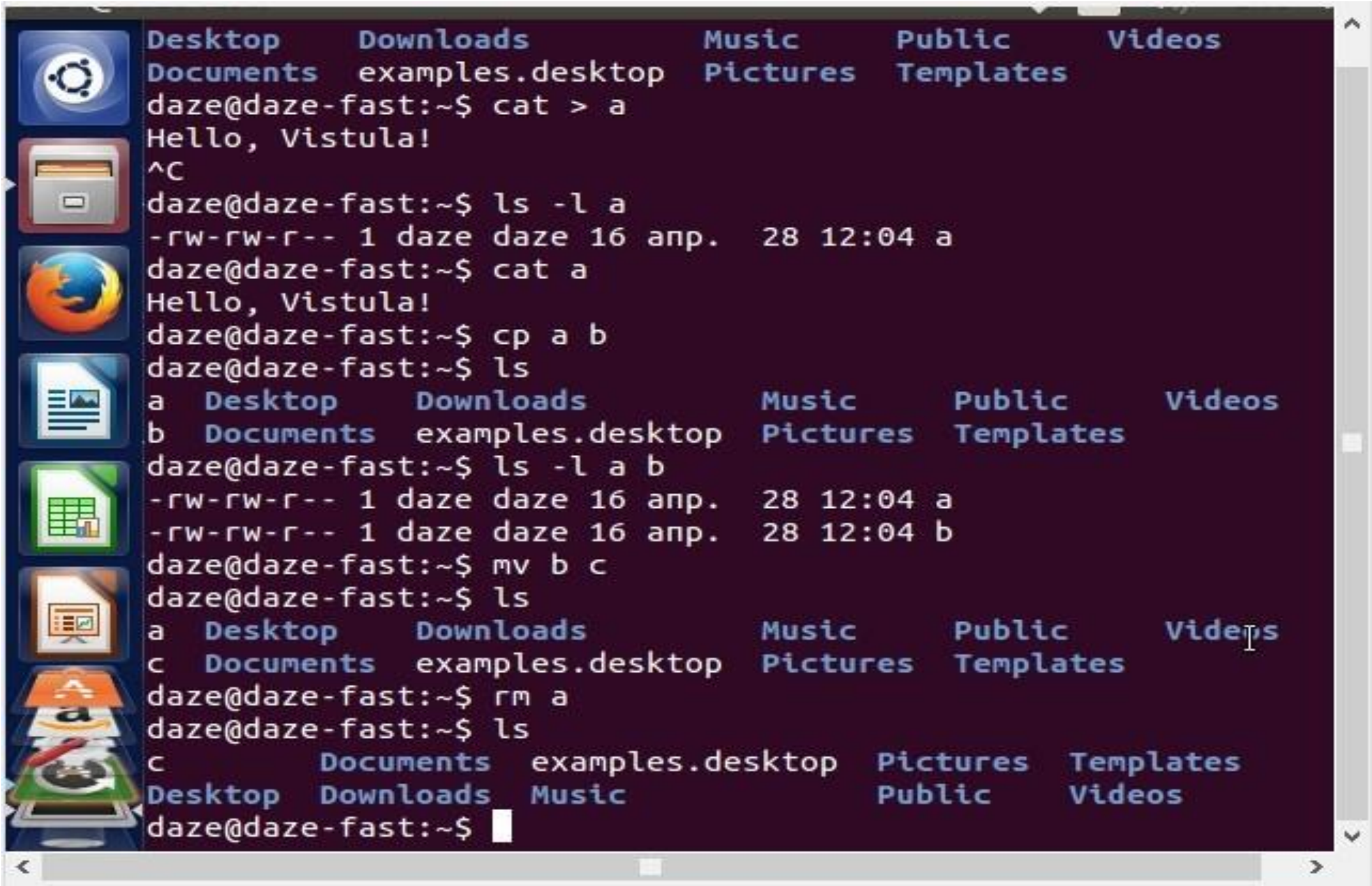
>cd /etc

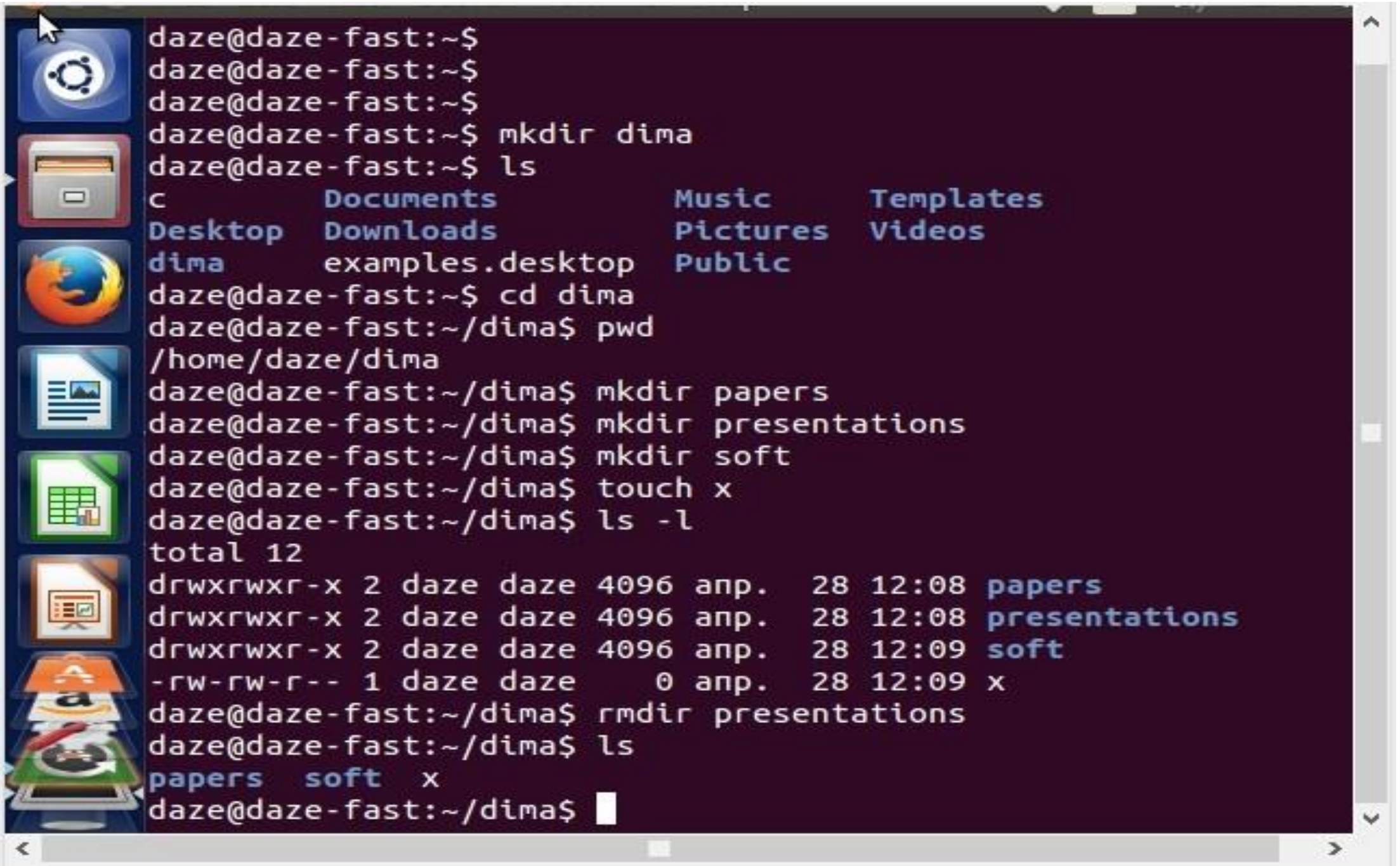
>cat passwd


Files
daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$ pwd
/home/daze
daze@daze-fast:~$ ls
a Documents examples.desktop Pictures Templates
Desktop Downloads Music Public Videos
daze@daze-fast:~$ ls -l
total 48
-rw-rw-r-- 1 daze daze 15 anp. 28 11:57 a
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Desktop
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Documents
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Downloads
-rw-r--r-- 1 daze daze 8980 anp. 27 10:29 examples.desktop
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Music
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Pictures
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Public
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Templates
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Videos
daze@daze-fast:~$ cat a
hello, Vistula
daze@daze-fast:~$

# More commands

- touch – create file
- cp – copy file
- mv – move (rename) file
- rm – remove
- mkdir – create directory
- rmdir – remove directory


Desktop Downloads Music Public Videos
Documents examples.desktop Pictures Templates
daze@daze-fast:~$ cat > a
Hello, Vistula!
^C
daze@daze-fast:~$ ls -l a
-rw-rw-r-- 1 daze daze 16 апр. 28 12:04 a
daze@daze-fast:~$ cat a
Hello, Vistula!
daze@daze-fast:~$ cp a b
daze@daze-fast:~$ ls
a Desktop Downloads Music Public Videos
b Documents examples.desktop Pictures Templates
daze@daze-fast:~$ ls -l a b
-rw-rw-r-- 1 daze daze 16 апр. 28 12:04 a
-rw-rw-r-- 1 daze daze 16 апр. 28 12:04 b
daze@daze-fast:~$ mv b c
daze@daze-fast:~$ ls
a Desktop Downloads Music Public Videos
c Documents examples.desktop Pictures Templates
daze@daze-fast:~$ rm a
daze@daze-fast:~$ ls
c Documents examples.desktop Pictures Templates
Desktop Downloads Music Public Videos
daze@daze-fast:~$


daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$
daze@daze-fast:~$ mkdir dima
daze@daze-fast:~$ ls
c Documents Music Templates
Desktop Downloads Pictures Videos
dima examples.desktop Public
daze@daze-fast:~$ cd dima
daze@daze-fast:~/dima$ pwd
/home/daze/dima
daze@daze-fast:~/dima$ mkdir papers
daze@daze-fast:~/dima$ mkdir presentations
daze@daze-fast:~/dima$ mkdir soft
daze@daze-fast:~/dima$ touch x
daze@daze-fast:~/dima$ ls -l
total 12
drwxrwxr-x 2 daze daze 4096 anp. 28 12:08 papers
drwxrwxr-x 2 daze daze 4096 anp. 28 12:08 presentations
drwxrwxr-x 2 daze daze 4096 anp. 28 12:09 soft
-rw-rw-r-- 1 daze daze 0 anp. 28 12:09 x
daze@daze-fast:~/dima$ rmdir presentations
daze@daze-fast:~/dima$ ls
papers soft x
daze@daze-fast:~/dima$

# File name patterns

- * any string
- ? any character

- ls p*
- ls ??
- ls a?b

# How systemd starts up the system

- Activate all units that are dependencies of default.target (as well as recursively all dependencies of dependencies).
- Usually, default.target is simply an alias of graphical.target or multi-user.target, depending on whether the system is configured for a graphical UI or only for a text console.
- To enforce minimal ordering between the units pulled in, a number of well-known target units are available, as listed on systemd.special.

# Switching target

- systemctl list-units --type target
- systemctl isolate multi-user.target
- systemctl isolate graphical.target

# Switching default target

- systemctl get-default
- sudo systemctl set-default multi-user.target
- sudo systemctl reboot
- sudo systemctl set-default graphical.target
- sudo reboot

# Start/stop service

- systemctl list-unit-files --type service –all
- systemctl status apache2
- sudo systemctl enable apache2
- sudo systemctl disable apache2