TheAlternative.ch
for a sustainable digital world

LinuxDays

The Linux Toolkit

openclipart.org

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HS16, v1

Goals of this course

- Get acclimatized to the console
- Learn how to navigate in your folders
- Basics of running commands
- Simple file and folder manipulations
- Managing software
- Dealing with storage devices
- …getting you ready for the next course! :-)

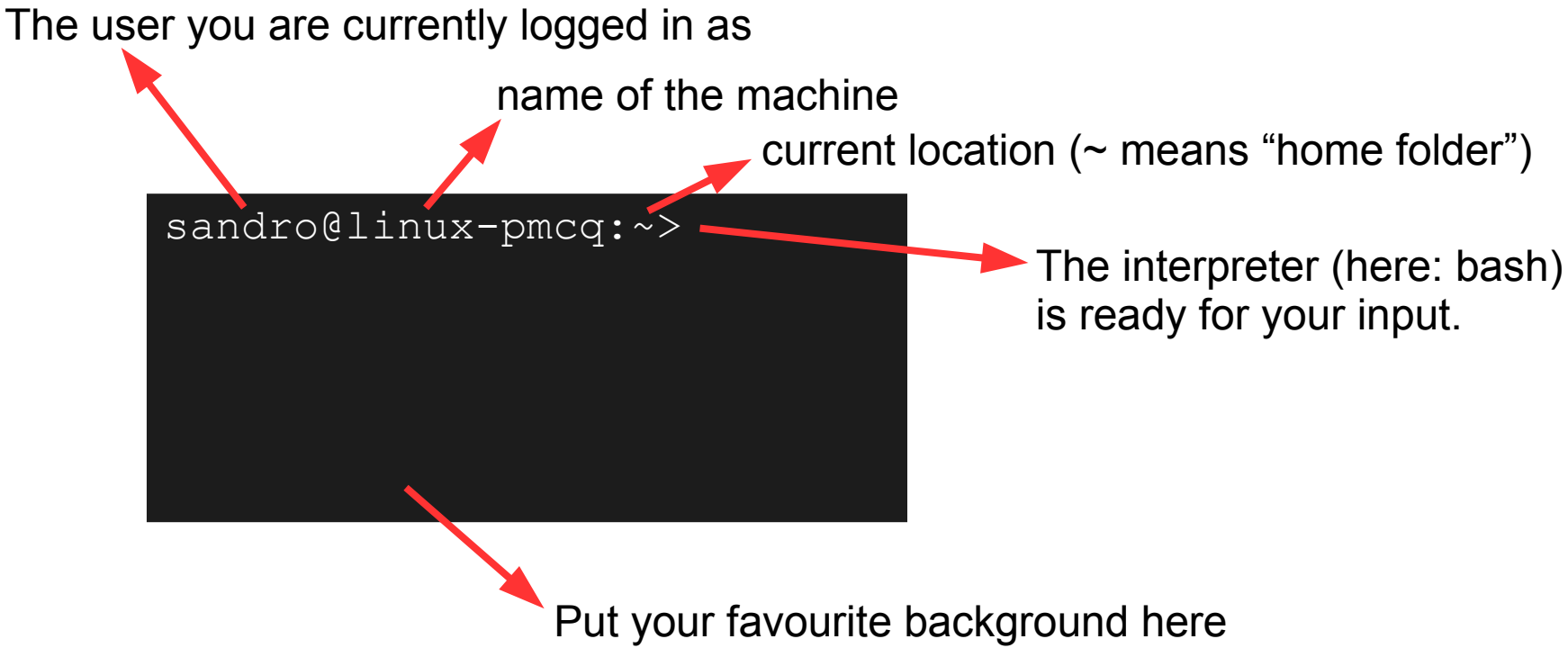
slides: thealternative.ch
=> Know-How

Why the console?

- because every semester, people asked us for more of it
- because it's the cleanest way to work on your router / NAS
- because it's the last thing alive when you break your system
- because that's the way to go for advanced tasks

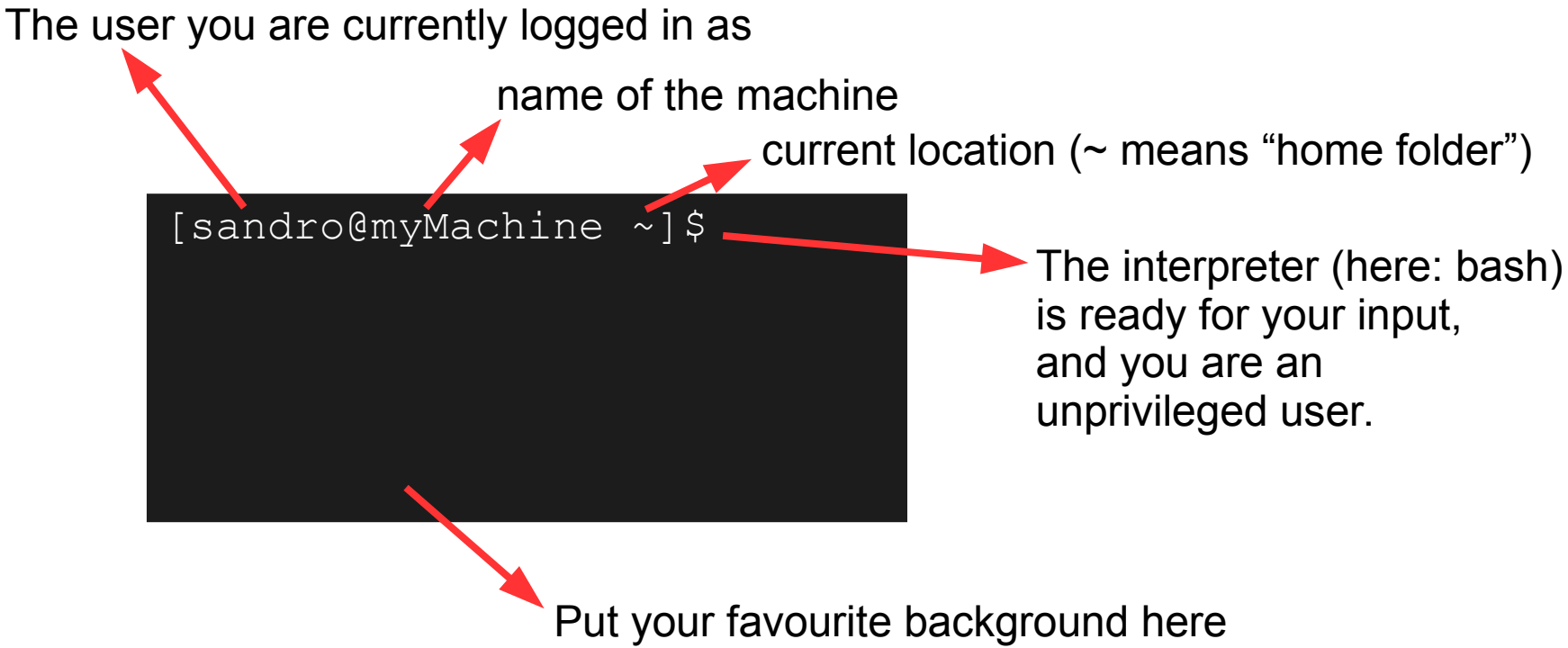
Look, a console!

The default console under OpenSUSE:



Other console styles

Bash under Arch Linux:



Other console styles

Fish is another interpreter, designed for beginner-friendliness:

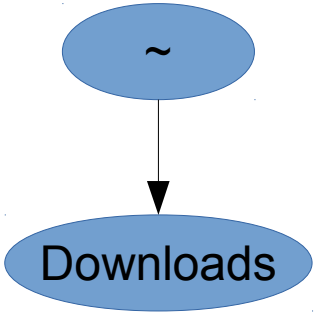
```
Welcome to fish, the friendly interactive shell
Type help for instructions on how to use fish
sandro@myMachine ~>
```

Navigating in the file hierarchy

cd: change directory

```
sandro@linux-pmcq:~> cd Downloads
sandro@linux-pmcq:~/Downloads>
```

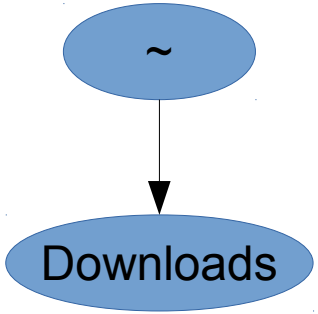
current location has changed!

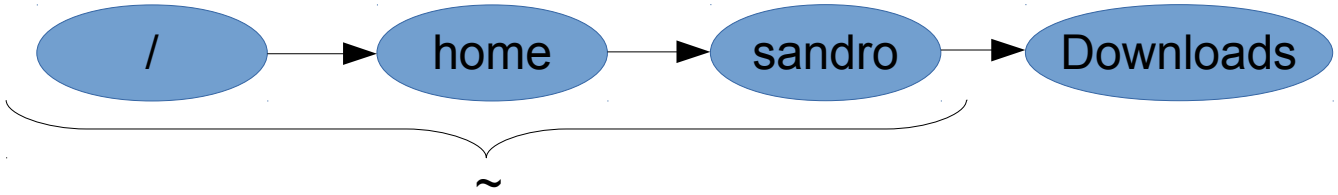


Navigating in the file hierarchy

pwd: Where am I?

```
sandro@linux-pmcq:~> cd Downloads
sandro@linux-pmcq:~/Downloads> pwd
/home/sandro/Downloads
sandro@linux-pmcq:~/Downloads>
```

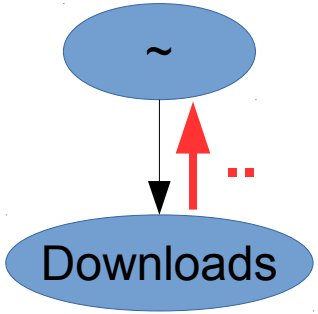


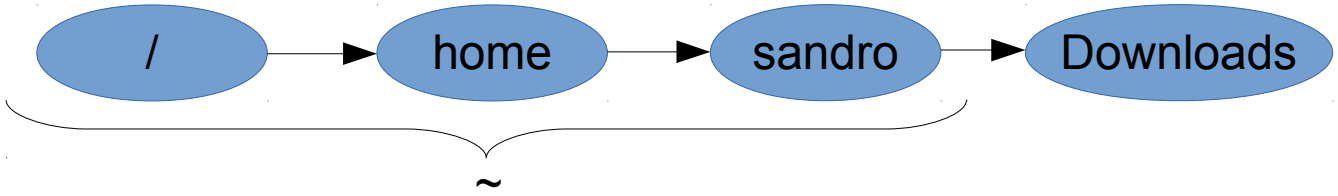


Navigating in the file hierarchy

.. : the directory above

```
sandro@linux-pmcq:~> cd Downloads
sandro@linux-pmcq:~/Downloads> pwd
/home/sandro/Downloads
sandro@linux-pmcq:~/Downloads> cd ..
sandro@linux-pmcq:~> pwd
/home/sandro
sandro@linux-pmcq:~>
```





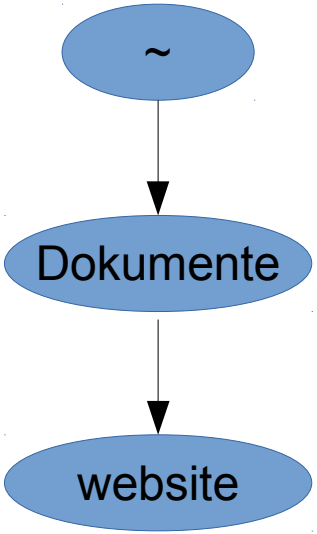
Navigating in the file hierarchy

Going down two folders at once...

```
sandro@linux-pmcq:~> cd Dokumente/website/
sandro@linux-pmcq:~/Dokumente/website>
```

...and up again

```
sandro@linux-pmcq:~/Dokumente/website> cd ../..
sandro@linux-pmcq:~>
```



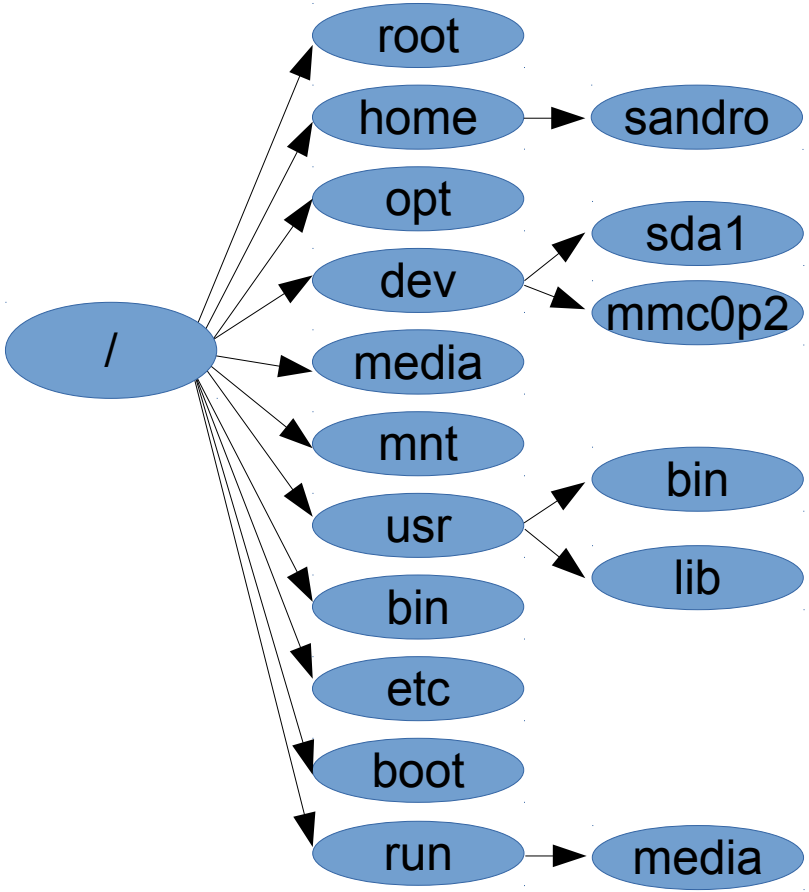
Navigating in the file hierarchy

Bring me home

```
sandro@linux-pmcq:~/Dokumente/website> cd
sandro@linux-pmcq:~>
```

Navigating in the file hierarchy

A typical Linux file hierarchy



root:	home folder of the superuser
home:	home folder of all regular users
opt:	manually installed software
dev:	devices on this computer
sda1:	1st hard disk (“a”), 1st partition (“1”)
mmc0p2:	1st SD card, 2nd partition
media:	mounted (active) storage, visible
mnt:	as above, but hidden by file manager
usr:	user software packages
bin:	basic system software
etc:	system-wide configuration files
boot:	files needed for the system start
run/media:	some file managers place USB sticks there

Navigating in the file hierarchy

ls: look around

```
sandro@linux-gttg:~> ls
bin              Documents  Pictures     Templates
Desktop          Downloads  Public       Videos
document 1.odt   Music      public_html
sandro@linux-gttg:~>
```

Using commands with arguments

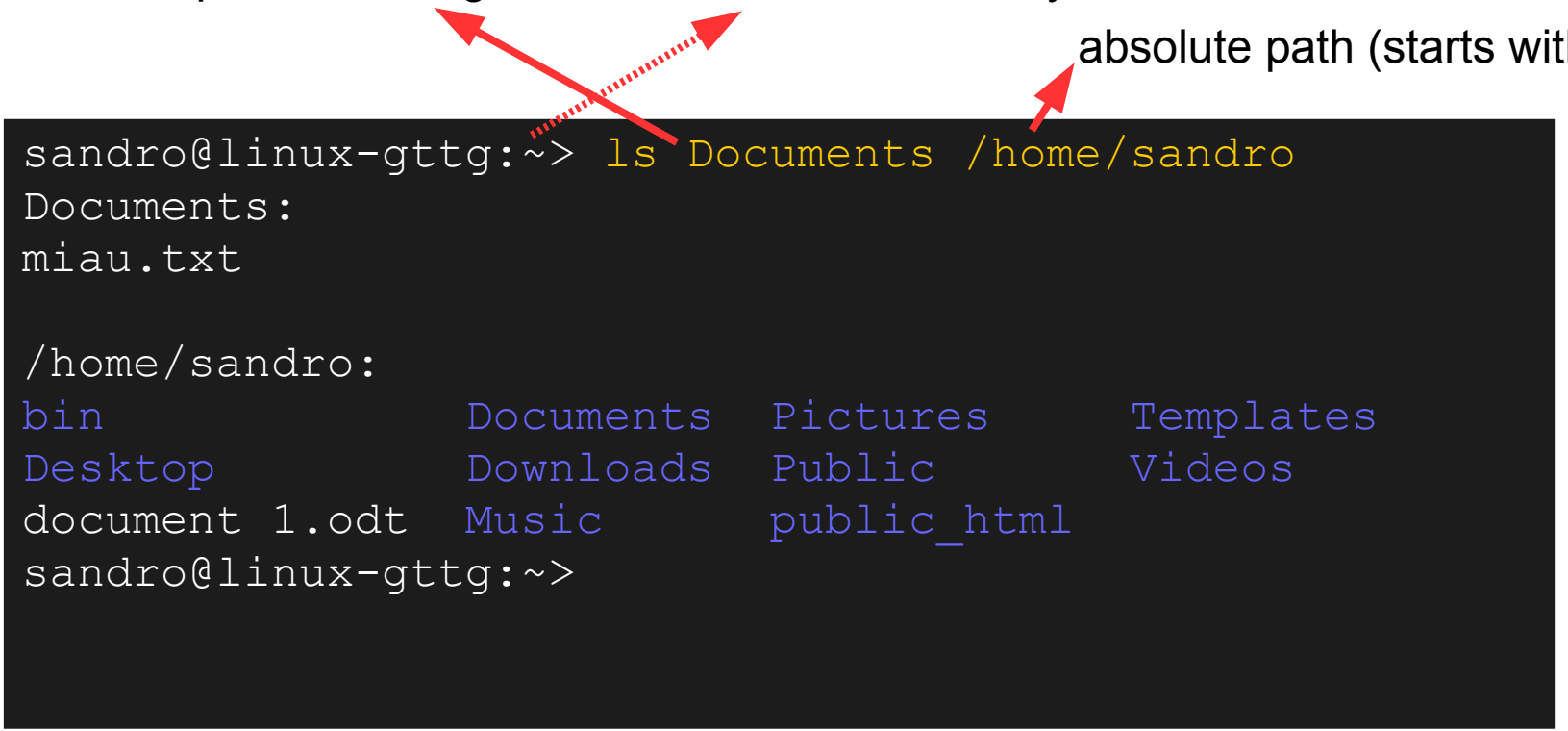
If cd gets an argument, it will interpret it as a file path and go there. Else, it goes to the home folder of the user that runs it.

Using commands with arguments

ls called with argument(s):

relative path, meaning: “within the current directory”

absolute path (starts with “/”)



Using commands with options

Options are special arguments altering the behavior of a command.

Typically, single-letter options are preceded by “-”,
multi-letter options are preceded by “--”

```
sandro@linux-gttg:~/Documents> ls
miau.txt
sandro@linux-gttg:~/Documents> ls -a
.  ..  .hidden_file  miau.txt
sandro@linux-gttg:~/Documents> ls --all
.  ..  .hidden_file  miau.txt
sandro@linux-gttg:~/Documents>
```

Notes:

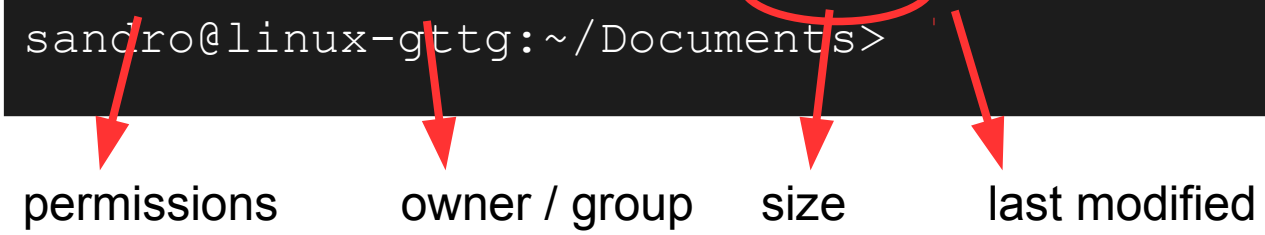
- In Linux, files / directories starting with a “.” are hidden.
- The --all (or -a) option makes ls show hidden files too, as well as two directories:
  - “.” is the current directory (here: Documents)
  - “..” is the parent folder (here: ~)

Using commands with options

ls -l : Show as a list, with sizes
ls -h: Show numbers in a more human-readable format

Concatenation (“-lh”) not possible with multi-letter options (--all, ...)

```
sandro@linux-gttg:~/Documents> ls -l
total 212088
-rw-r--r-- 1 sandro users 217178112 Jan 21 17:10 miau.txt
sandro@linux-gttg:~/Documents> ls -lh
total 208M
-rw-r--r-- 1 sandro users 208M Jan 21 17:10 miau.txt
sandro@linux-gttg:~/Documents>
```



Using arguments with spaces

You can use spaces in file names etc.

How to tell them apart from spaces between arguments?
=> Escape spaces: put a backslash (“\”) in front of each space
=> Or use quotes:

```
sandro@linux-gttg:~> ls document\ 1.odt
document 1.odt
sandro@linux-gttg:~> ls 'document 1.odt'
document 1.odt
sandro@linux-gttg:~>
```

Get help (“RTFM”)

man [command]

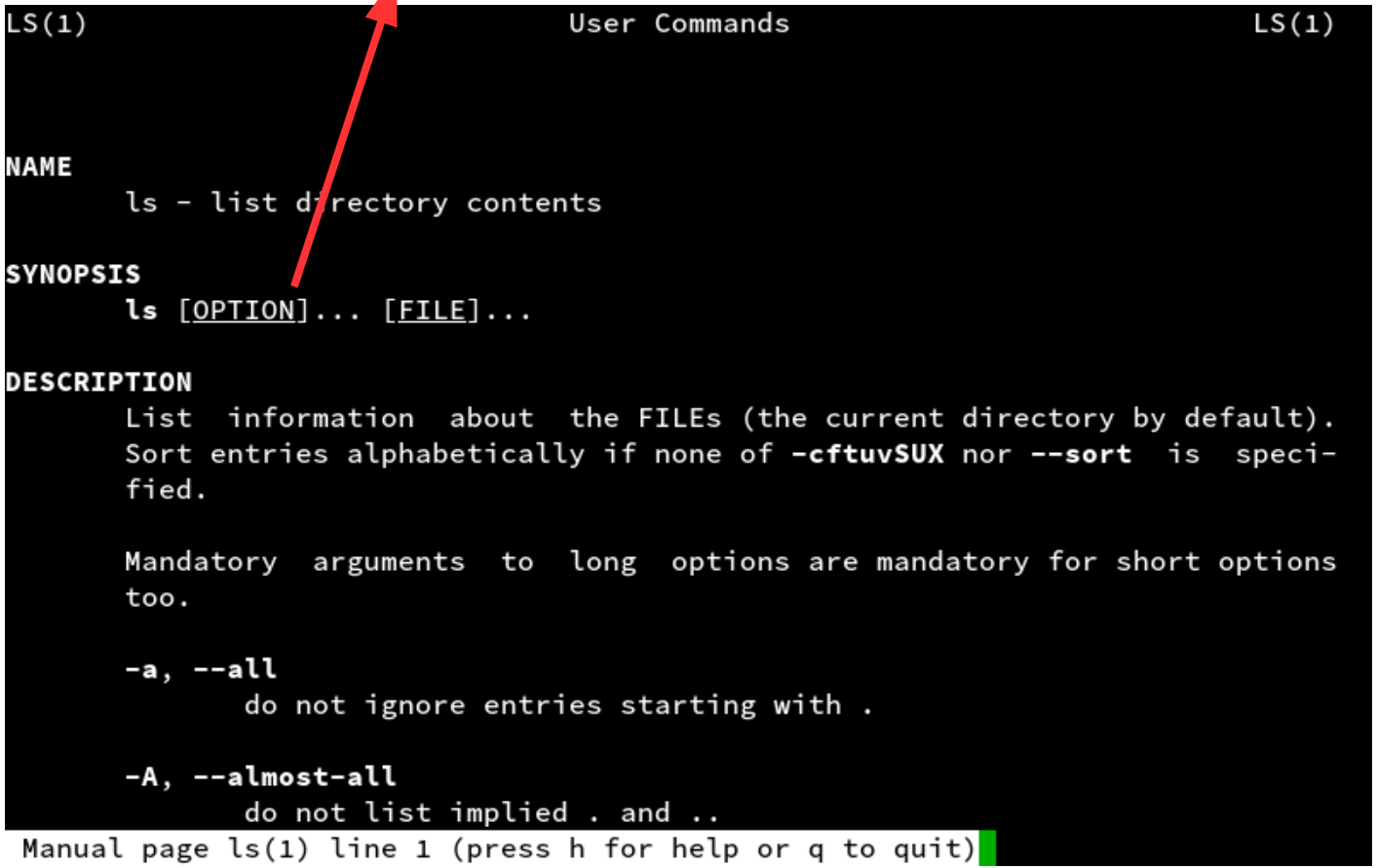
man stands for “manual”

```
sandro@linux-gttg:~> man ls
Man: find all matching manual pages (set MAN_POSIXLY_CORRECT to
avoid this)
 * ls (1)
   ls (1p)
Man: What manual page do you want?
Man:
```

just hit Enter

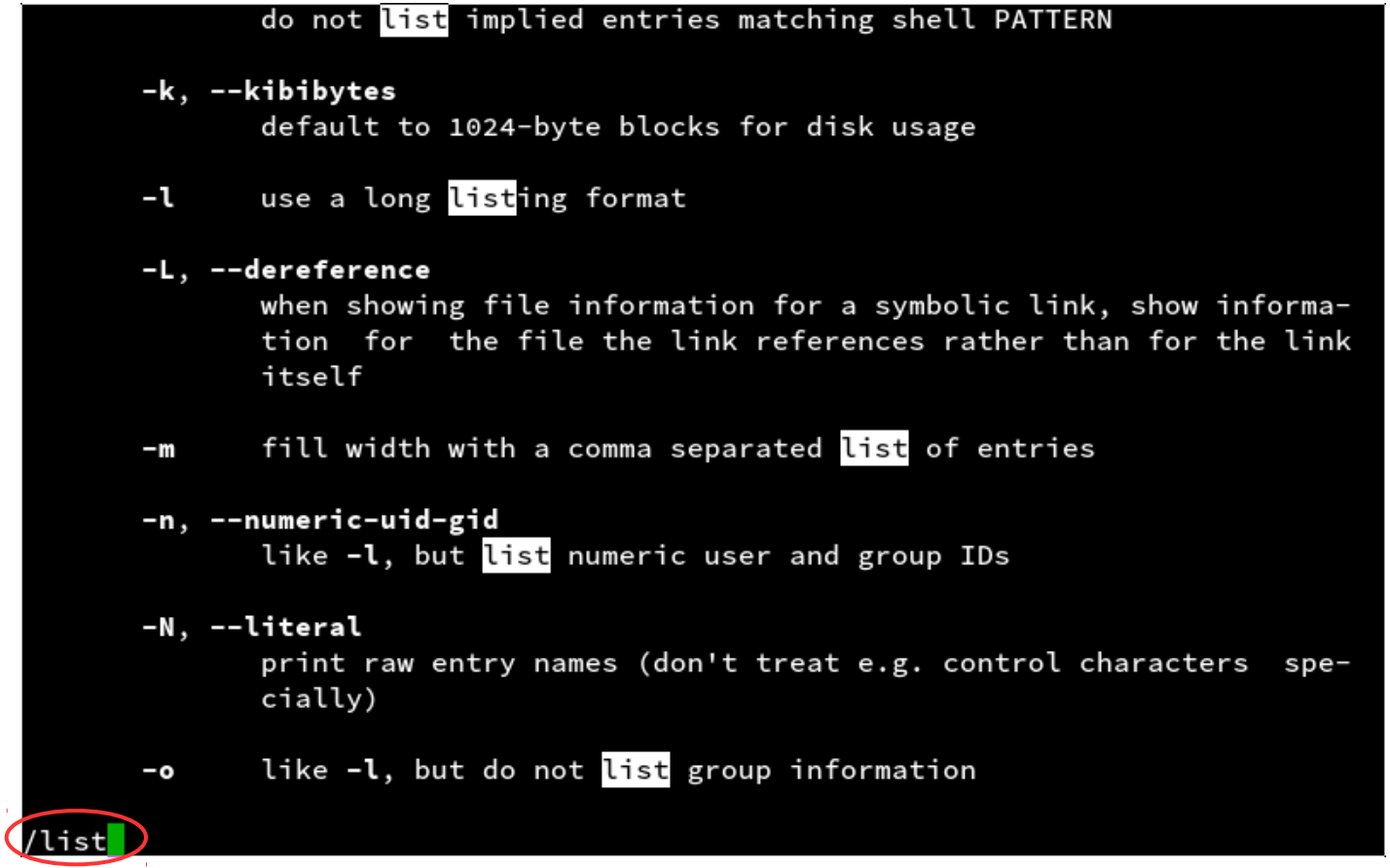
Get help

[ ] means that you can omit this (ls: can omit everyting and just go “ls”)



- q to quit
- / to search
- Arrows to scroll
- PgUp / PgDown
- to scroll fast
- In some terminals, mouse wheel scrolls, too!

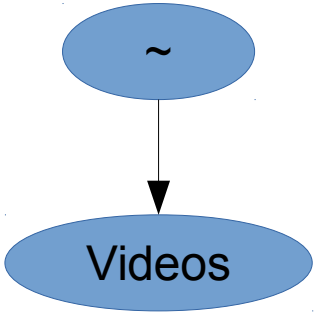
Get help



To search on for “list”, just type n (or N for backwd), the last item searched will automatically be searched again.

Be efficient!

Tab completition

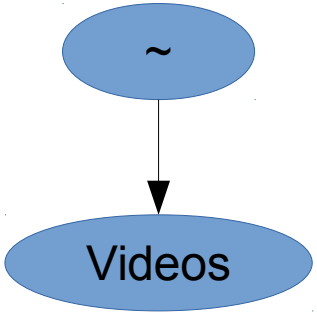



```
sandro@linux-gttg:~> cd V<tab!>
```

Be efficient!

Tab completition

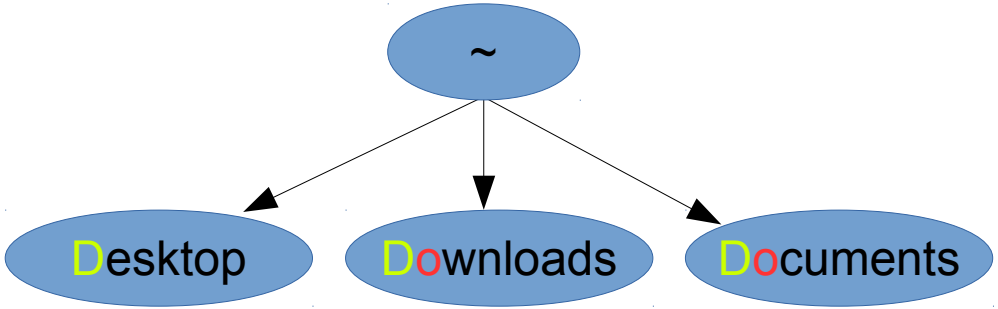
optional “/” to indicate a directory




```
sandro@linux-gttg:~> cd Videos/
```

Be efficient!

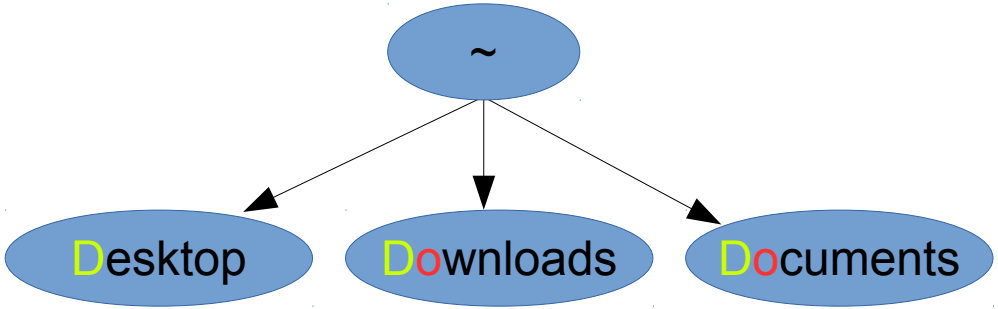
Tab completition




```
sandro@linux-gttg:~> cd D<tab!><tab!>
Desktop/   Documents/ Downloads/
sandro@linux-gttg:~> cd Do<tab!><tab!>
Documents/ Downloads/
sandro@linux-gttg:~> cd Dow<tab!>
```

Be efficient!

Tab completition




```
sandro@linux-gttg:~> cd D
Desktop/   Documents/ Downloads/
sandro@linux-gttg:~> cd Do
Documents/ Downloads/
sandro@linux-gttg:~> cd Downloads/
```

Be efficient!

Do a command again: Arrow keys

```
sandro@linux-gttg:~> <Arrow key up!>
```

Be efficient!

Do a command again: Arrow keys

```
sandro@linux-gttg:~> cd Downloads/
```

Be efficient!

Use your navigation keys

Your cursor behaves like in a text document:

- Use Home and End to jump to the beginning / end of your line
- Often, Ctrl+Arrows will jump one word

Be efficient!

Search command history: Ctrl+R

```
sandro@linux-gttg:~> ^R
```

Be efficient!

Search command history: Ctrl+R

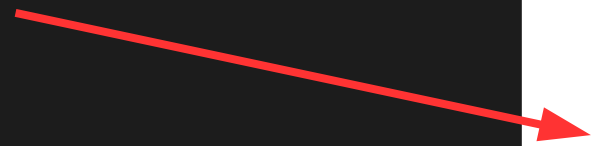
```
(reverse-i-search)`cd': cd Dokumente/website/
```

Autocompleted:
This is what we did with “cd[...]” recently

Be efficient!

Forgot sudo? sudo !!

```
sandro@linux-gttg:~> cat miau.txt
cat: miau.txt: Permission denied
sandro@linux-gttg:~> sudo !!
sudo cat miau.txt
meeeow :-)
sandro@linux-gttg:~>
```



Rerun last command with sudo

Be efficient!

Using globs / wildcards: * will be replaced by anything

```
sandro@linux-gttg:~/stuff> ls
analysis-slides.txt  docu-physics.txt
docu-analysis.txt    my analysis summary.odt
docu-bio.txt         slides of analysis.pdf
linalg.txt
sandro@linux-gttg:~/stuff>
```

We want to delete all files starting with “docu-”.

Be efficient!

Using globs / wildcards: * will be replaced by anything
We want to delete all files starting with “docu-”.

option “v” for “verbose”, meaning: tell me more

```
sandro@linux-gttg:~/stuff> rm -v docu-*
removed 'docu-analysis.txt'
removed 'docu-bio.txt'
removed 'docu-physics.txt'
sandro@linux-gttg:~/stuff>
```

Be efficient!

Using globs / wildcards: * will be replaced by anything

```
sandro@linux-gttg:~/stuff> ls
analysis-slides.txt  my analysis summary.odt
linalg.txt           slides of analysis.pdf
sandro@linux-gttg:~/stuff>
```

Now, we want to delete any file containing “analysis” in its name

Be efficient!

Using globs / wildcards: * will be replaced by anything
Now, we want to delete any file containing “analysis” in its name

```
sandro@linux-gttg:~/stuff> rm -v *analysis*
removed 'analysis-slides.txt'
removed 'my analysis summary.odt'
removed 'slides of analysis.pdf'
sandro@linux-gttg:~/stuff> ls
linalg.txt
sandro@linux-gttg:~/stuff>
```

Get me outta here!

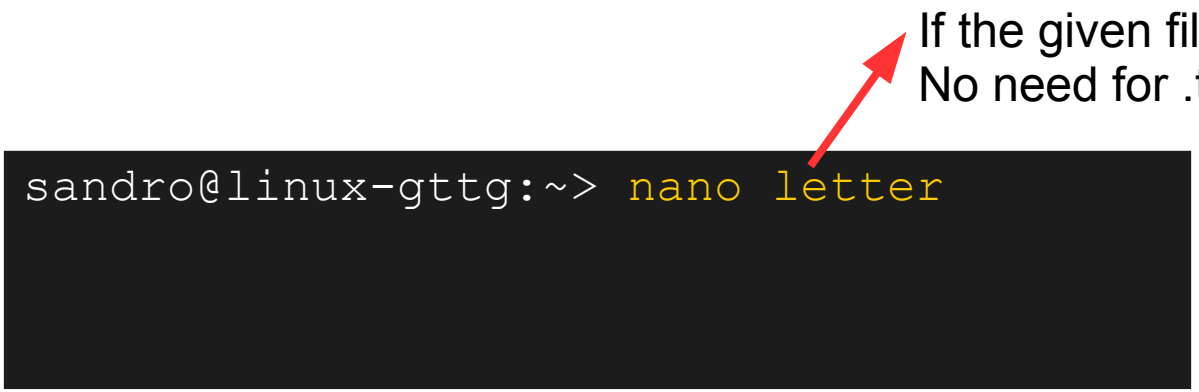
Ctrl+C: Kill a running command,
Clear unconfirmed command

yes : Repeat the given argument over and over

```
...
Hello world!
Hello world!
Hello world!
Hello world!
Hello world!
Hello world!
Hello^C
sandro@linux-gttg:~> yes Hello world! Let me^C
sandro@linux-gttg:~>
```

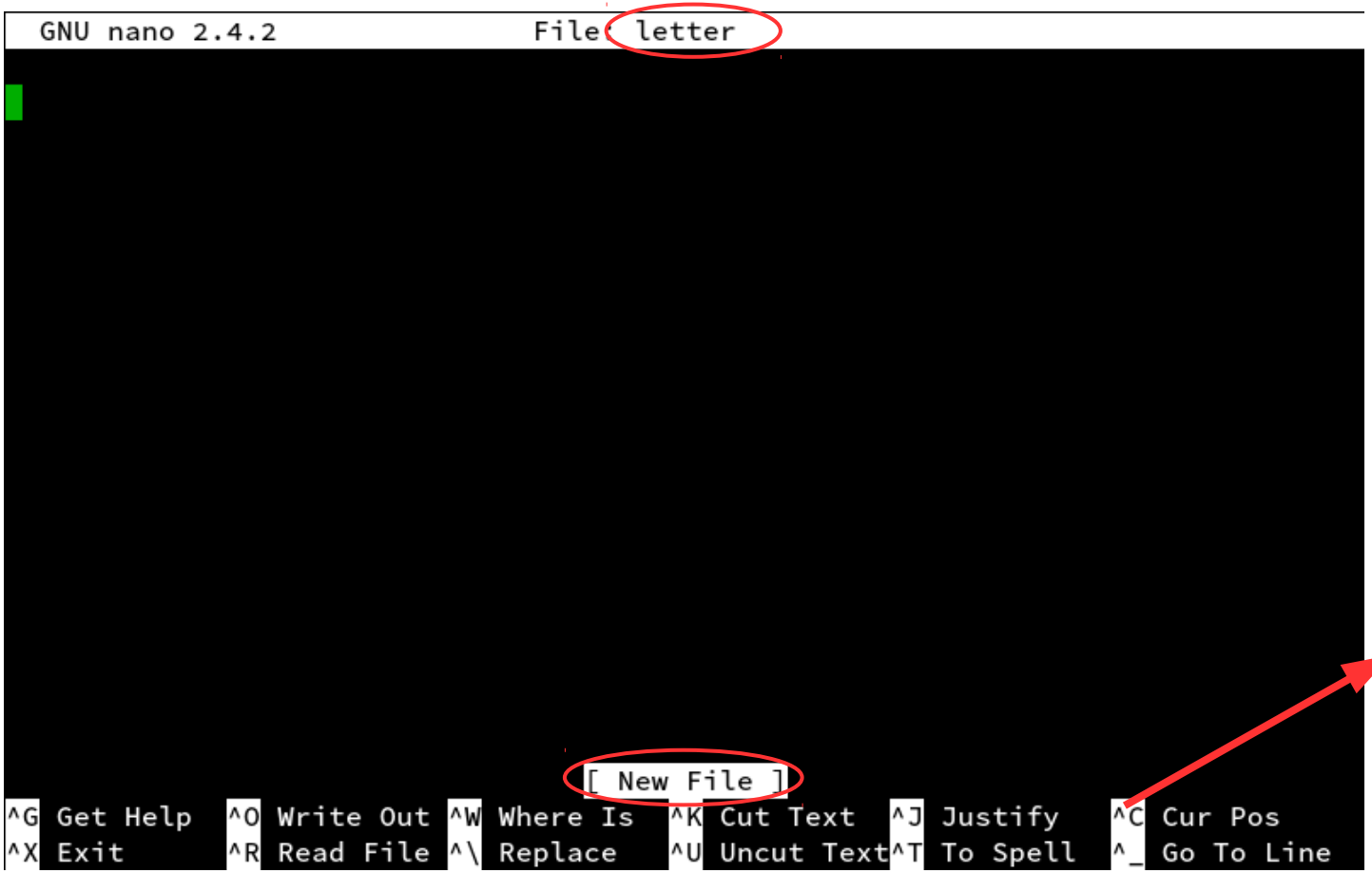
Editing text files

nano



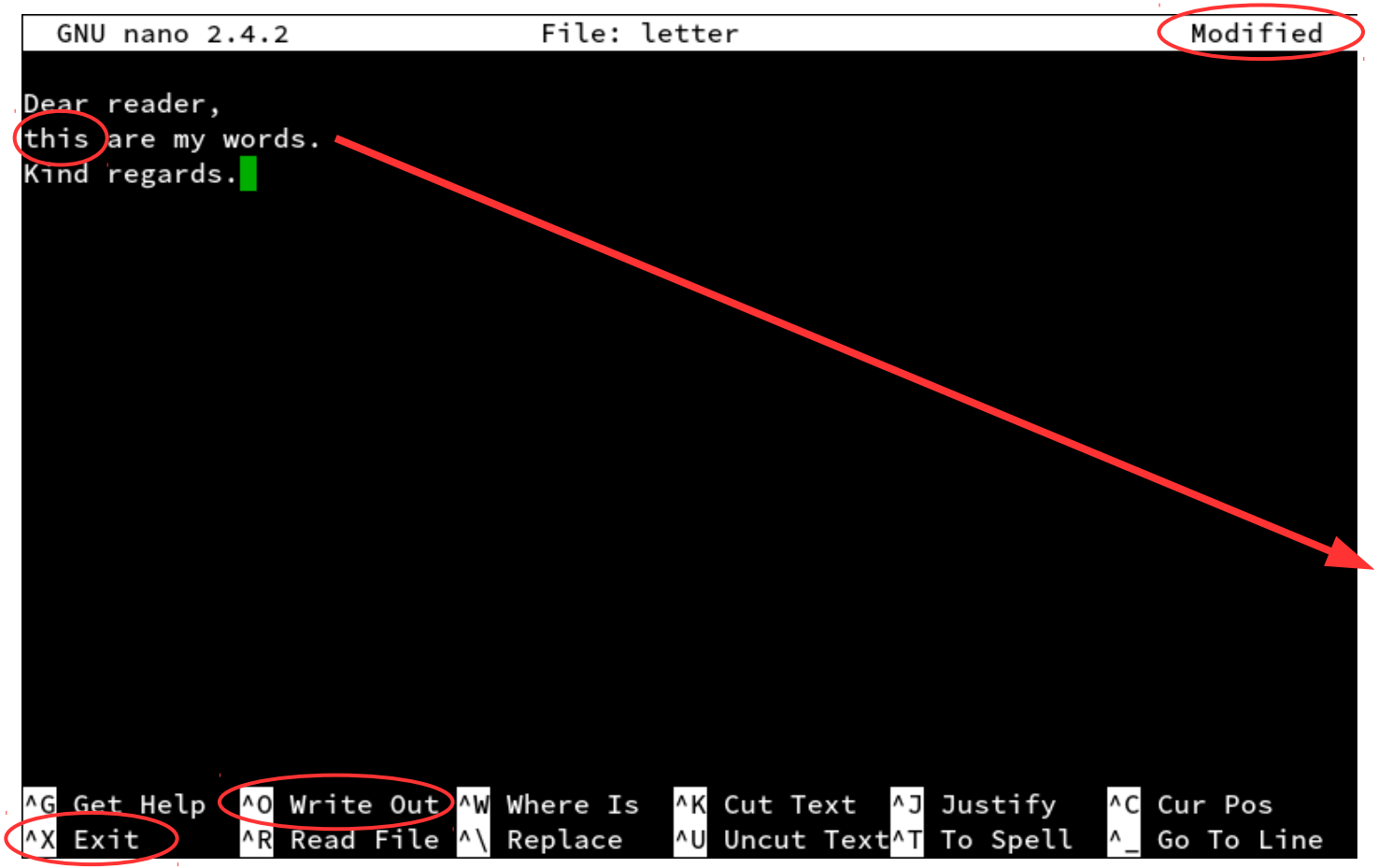
Power users often use the more advanced editor **vim**, presented in the Spotlight Course

Editing text files



^ stands for Ctrl

Editing text files



Ctrl+O; Enter to save

Ctrl+X to quit

No spell or grammar check under nano

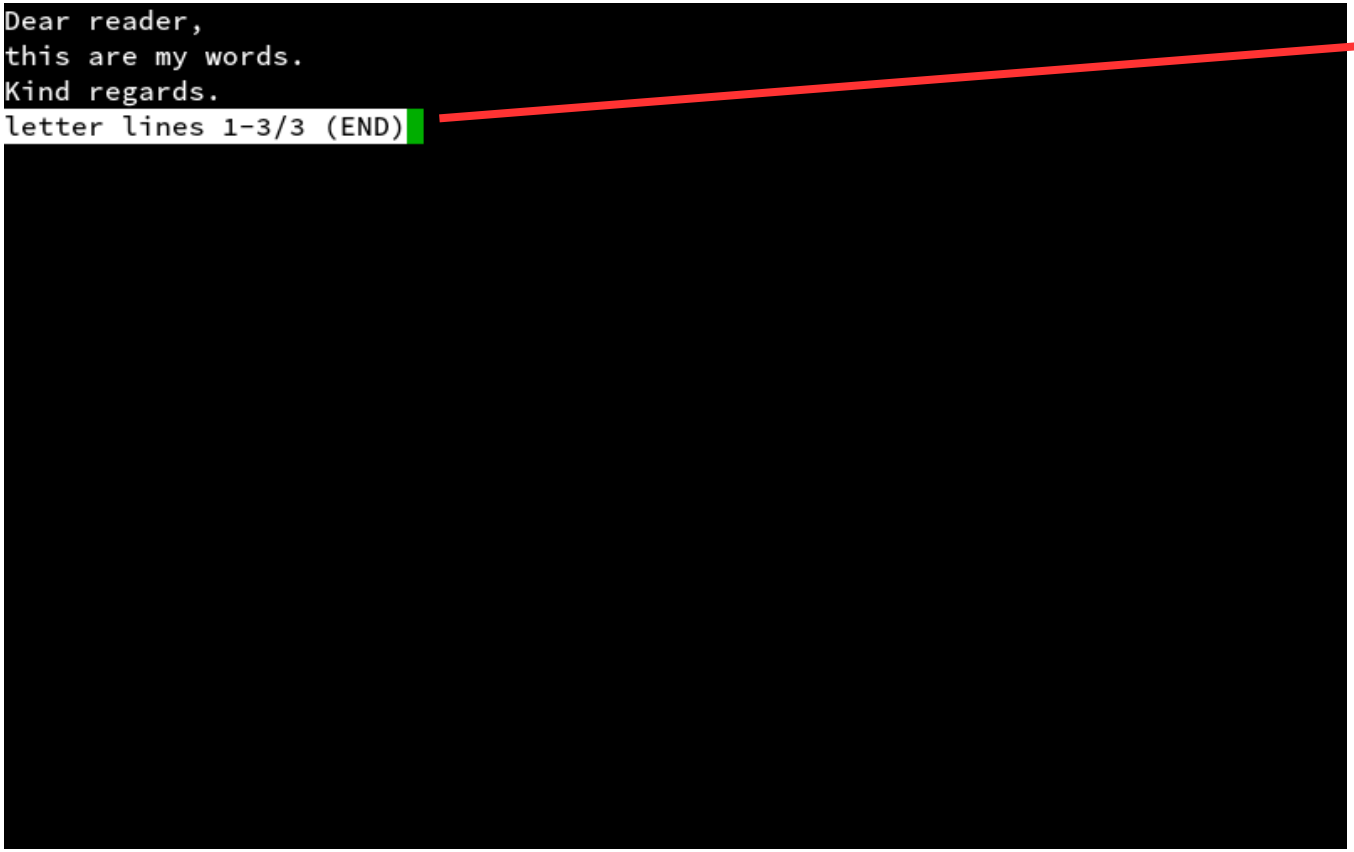
vim is a much more advanced text editor, but it's harder to learn

Looking at text files

less

```
sandro@linux-gttg:~> less letter
```

Looking at text files



less looks like man because man uses less to display the manual!

Therefore, the keyboard shortcuts are the same:

- / to search
- q to quit
- h for help
- etc.

Looking at text files

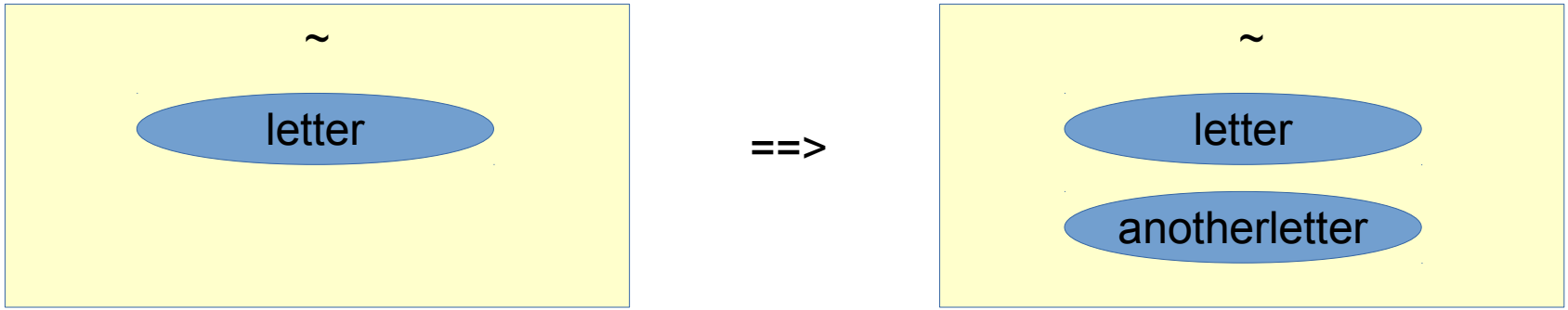
cat

```
sandro@linux-gttg:~> cat letter
Dear reader,
this are my words.
Kind regards.
sandro@linux-gttg:~>
```

Cats

Copying files

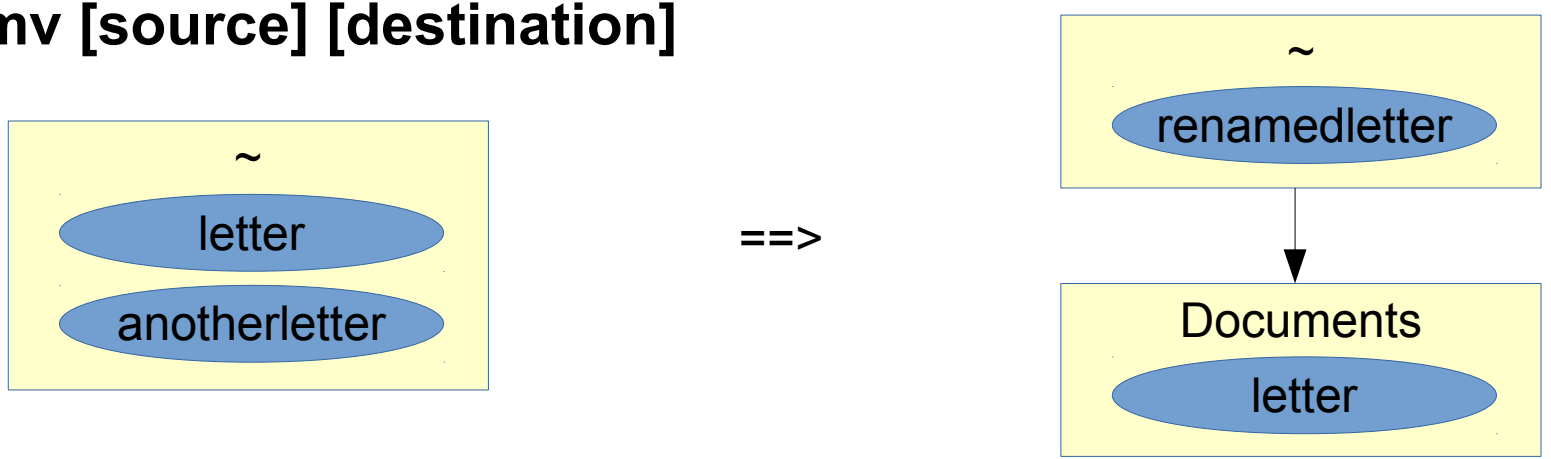
cp [source] [destination]




```
sandro@linux-gttg:~> cp letter anotherletter
sandro@linux-gttg:~>
```

Renaming / moving files

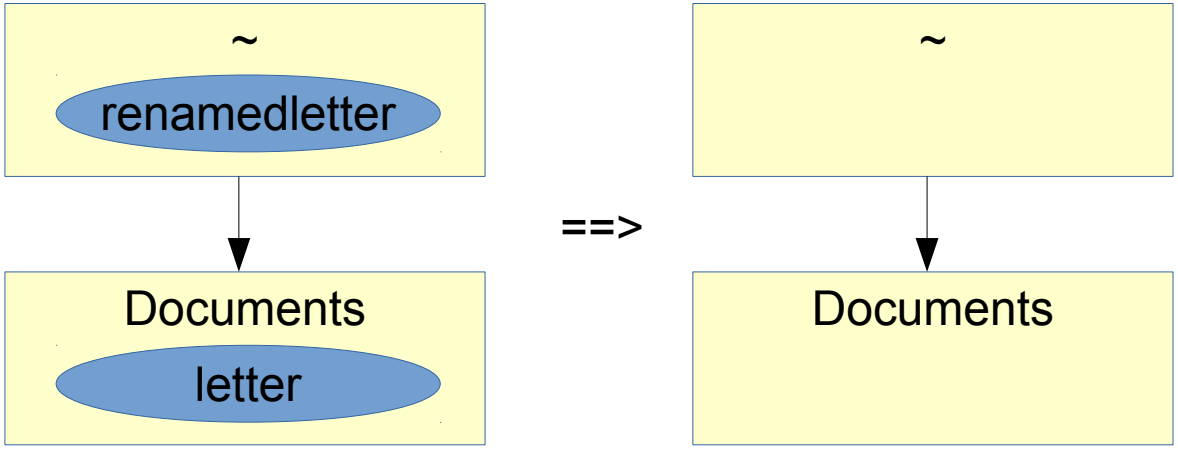
mv [source] [destination]




```
sandro@linux-gttg:~> mv anotherletter renamedletter
sandro@linux-gttg:~> mv letter Documents/
sandro@linux-gttg:~> ls Documents
letter  miau.txt
sandro@linux-gttg:~>
```

Deleting files

rm [file]




```
sandro@linux-gttg:~> rm renamedletter Documents/letter
sandro@linux-gttg:~>
```

rm is irreversible. One typo and the wrong file is gone forever!

Creating and deleting folders

mkdir, rmdir

```
sandro@linux-gttg:~/Downloads> mkdir aFolder
sandro@linux-gttg:~/Downloads> ls
aFolder  Video.ogv
sandro@linux-gttg:~/Downloads> rmdir aFolder/
sandro@linux-gttg:~/Downloads> ls
Video.ogv
sandro@linux-gttg:~/Downloads>
```

Delete recursively

rmdir is safe because it only deletes empty folders.

To delete a folder with all its contents, use rm -r (r for recursive):

```
sandro@linux-gttg:~> rmdir Downloads/
rmdir: failed to remove ‘Downloads/’: Directory not empty
sandro@linux-gttg:~> rm -r Downloads/
sandro@linux-gttg:~>
```

rm -r = The Ultimate Killer Command
rm -r on your home directory deletes...
... everything you have!
… irreversibly!
… forever!

Running a program in the current folder

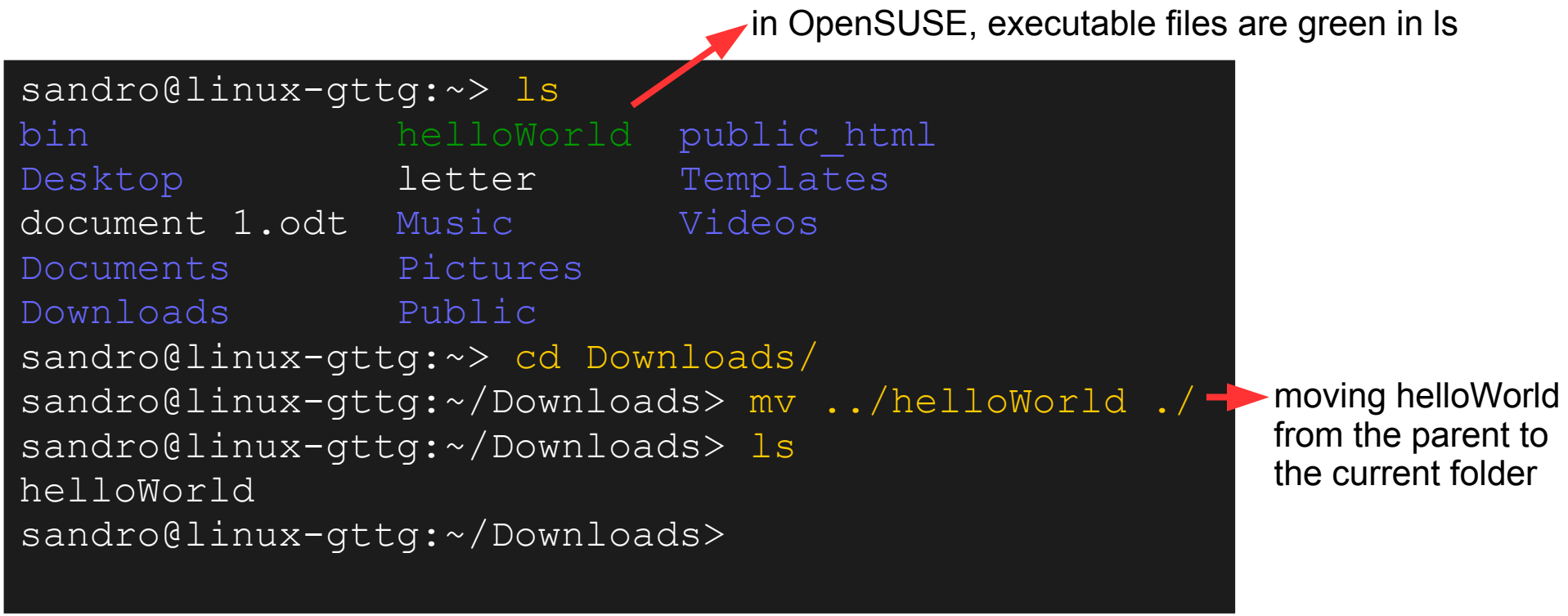
Simply typing a command looks for the executable program in a few predefined directories.

On OpenSUSE:

/home/sandro/bin
/usr/local/bin
/usr/bin
/bin
/usr/bin/X11
/usr/games

Running a program in the current folder

Just like “..” means “parent directory”, “.” means “current dir”.



Running a program in the current folder

To run an executable in the current folder, you must add "./" before the file name of the desired executable file.

run a program in the current directory

```
sandro@linux-gttg:~/Downloads> ./helloWorld
Hi there :-)
I'm done now.
sandro@linux-gttg:~/Downloads> cd ..
sandro@linux-gttg:~> Downloads/helloWorld
Hi there :-)
I'm done now.
sandro@linux-gttg:~>
```

"." not necessary for subfolders or absolute paths

Where is the configuration saved?

Per-user settings: hidden directories in the home folder

```
sandro@linux-gttg:~> ls -a
.                    .emacs              .vboxclient-clipboard.pid
..                   .fonts              .vboxclient-display.pid
.bash_history        .gstreamer-0.10     .vboxclient-draganddrop.pid
.bashrc              .i18n               .vboxclient-hostversion.pid
bin                  .ICEauthority       .vboxclient-seamless.pid
.cache               .inputrc            Videos
.config              .local              .xfce4-session.verbose-log
.dbus                Music               .xfce4-session.verbose-log.last
Desktop              Pictures            .xim.template
.dmrc                .profile            .xinitrc.template
document 1.odt       Public              .xsession-errors
Documents            public_html         .xsession-errors-:0
Downloads            Templates           .xsession-errors.old
sandro@linux-gttg:~>
```

(!): some of these files are not supposed to be edited manually

Where is the configuration saved?

Often stored in ~/.config/

```
sandro@linux-gttg:~> ls .config/
goa-1.0  gtk-3.0  Thunar  user-dirs.dirs
user-dirs.locale  xfce4
sandro@linux-gttg:~>
```

File Manager configuration

Configuration for the XFCE Desktop Environment

Where is the configuration saved?

System wide configuration: typically in /etc/ (coloring omitted)

```
sandro@linux-gttg:~> ls /etc/
adjtime                 cron.monthly    gemrc                issue             modules-load.d       permissions.secure                samba              systemd
aliases                 crontab         gimp                 issue.net         motd                pkcs11                            sane.d             termcap
aliases.d               cron.weekly     gnome-chess          java              mtab                pki                               sasl2              tmpdirs.d
aliases.db              csh.cshrc       gnome_defaults.conf  joe               mtools.conf         plymouth                          screenrc           tmpfiles.d
alternatives            csh.login       gnupg                jvm               named.d             polkit-1                          securetty          ttytype
apparmor                cups            gpm                  jvm-commmon       netconfig           polkit-default-privs.local        security           tuned
apparmor.d              cupshelpers     group                kde4              netconfig.d         polkit-default-privs.restrictive  selinux            udev
at.deny                 dbus-1          group-               krb5.conf         netgroup            polkit-default-privs.standard     sensors3.conf      uefi
at-spi2                 dconf           grub.d               ksh.kshrc         NetworkManager      postfix                           sensors.d          UPower
audisp                  default         gtk-2.0              ld.so.cache       networks            ppp                               services           usb_modeswitch.conf
audit                   defaultdomain   gtk-3.0              ld.so.conf        news                pptp.d                            shadow             uucp
autofs_ldap_auth.conf   depmod.d        host.conf            ld.so.conf.d      nfsmount.conf       printcap                          shadow-            vconsole.conf
auto.master             dhclient6.conf  hostname             lesskey           nscd.conf           products.d                        shadow.YaST2save   vdpau_wrapper.cfg
auto.master.d           dhclient.conf   HOSTNAME             lesskey.bin       nsswitch.conf       profile                           shells             vimrc
auto.misc               dialogrc        hosts                libao.conf        nsswitch.confbak    profile.d                         silc               vnc
auto.net                DIR_COLORS      hosts.allow          libaudit.conf     ntp.conf            protocols                         skel               wgetrc
auto.smb                dnsmasq.conf    hosts.deny           libnl             ntp.keys            pulse                             slp.conf           wicked
avahi                   dnsmasq.d       hosts.equiv          lightdm           omc                 purple                            slp.reg.d          wpa_supplicant
bash.bashrc             dracut.conf     hosts.lpd            lirc              openldap            python3start                      slp.spi            X11
bash_command_not_found  dracut.conf.d   hp                   localtime         opt                 pythonstart                       smartd.conf        xattr.conf
bash_completion.d       drirc           hushlogins           login.defs        os-release          raw                               smart_drivedb.h    xdg
bind.keys               environment     icewm                logrotate.conf    PackageKit          rc.d                              smartd_warning.sh  xfce_defaults.conf
bindresvport.blacklist  esd.conf        idmapd.conf          logrotate.d       pam.d               rc.splash                         snapper            xinetd.conf
binfmt.d                ethers          idnalias.conf        lvm               pango               rc.status                         ssh                xinetd.d
blkid.conf              exports         idn.conf             machine-id        passwd              reader.conf.d                     ssl                xscreensaver
bootsplash              filesystems     ifplugd              magic             passwd-             request-key.conf                  sudoers            YaST2
ca-certificates         fonts           ImageMagick-6_Q16-1  mail.rc           passwd.YaST2save    request-key.d                     sudoers.d          yp.conf
cifs-utils              fstab           init.d               manpath.config    pcmcia              resolv.conf                       SUSE-brand         zprofile
ConsoleKit              ftpusers        inputrc              maven             permissions         rmt                               susehelp.d         zsh_command_not_found
cron.d                  gai.conf        insserv.conf         mcelog            permissions.d       rpc                               SuSE-release       zsh_completion.d
cron.daily              gconf           iproute2             mime.types        permissions.easy    rpm                               sysconfig          zshenv
cron.deny               gdbinit         iscsi                mke2fs.conf       permissions.local   rsyncd.conf                       sysctl.conf        zshrc
cron.hourly             gdbinit.d       iscsid.conf          modprobe.d        permissions.paranoid  rsyncd.secrets                  sysctl.d           zypp
sandro@linux-gttg:~>
```

Where is the configuration saved?

System wide configuration: typically in /etc/

cron.*:	Auto-execution schedules (“tasks”)
cups:	Printing
fonts:	Installed text fonts
fstab:	Autoloading drives at boot
grub:	Bootloader
hostname:	Name of this computer
NetworkManager:	Wireless networks
ntp:	Setting the clock from the internet
pulse:	Audio system
samba:	Windows shares
systemd:	Initialization stuff

...and many more

The superuser

sandro

- ~ is /home/sandro
- has full access to that folder
- can change own settings (~/.config, etc.)
- may not access home folder of other users
- may not change system-wide settings
- may start and stop own processes

root

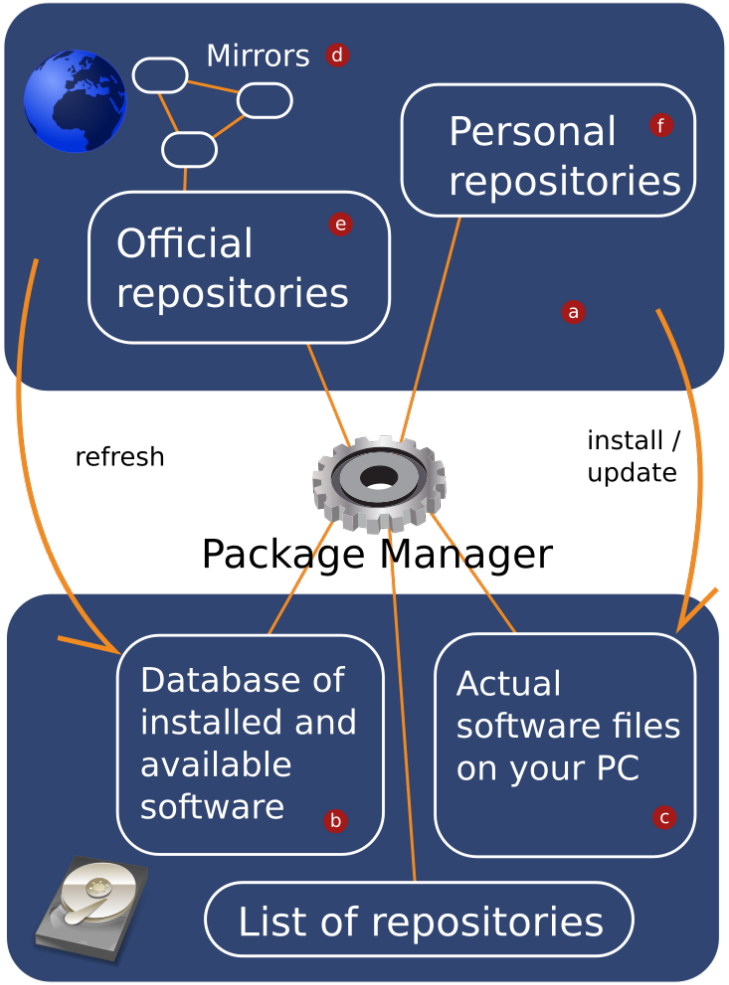
- ~ is /root
- has full access to any file and folder on the machine
- can change anything
- may access all home folders
- is the only one to be able to:
  - change system-wide config
  - install / remove software
  - starting and stopping any process

Become a different user

sudo [cmd]:	**Execute cmd as the user root**
sudo su:	**Permanently become root**
sudo su [user]:	**Become a different user**
exit (or Ctrl+D):	**Log out of current session**

```
sandro@linux-gttg:~> cp /etc/fstab /etc/anotherfstab
cp: cannot create regular file '/etc/anotherfstab': Permission denied
sandro@linux-gttg:~> sudo cp /etc/fstab /etc/anotherfstab
root's password:
sandro@linux-gttg:~> rm /etc/anotherfstab
rm: remove write-protected regular file '/etc/anotherfstab'? y
rm: cannot remove '/etc/anotherfstab': Permission denied
sandro@linux-gttg:~> sudo su
linux-gttg:/home/sandro # rm /etc/anotherfstab
linux-gttg:/home/sandro # exit
exit
sandro@linux-gttg:~>
```

Install and remove software packages



Disk, file, gear and globe from openclipart.org

Package: Group of files, forming pieces of software, often providing one or multiple programs

Repositories: Online resources providing software

Refresh (Ubuntu: “update”): Package Manager goes through the list of repositories you are subscribed to and downloads information about available packages (e.g. version, size, dependencies, …)

Update (Ubuntu: “upgrade”): PM downloads and installs the packages that are newer in the repos than on your system.

When installing a program, the PM checks whether additional programs are needed to run it (**dependencies**)

Note: Different distros, different PMs!
e.g. Ubuntu has apt (aptitude / apt-get)

Zypper: OpenSUSE's package manager

Check for updates: **zypper refresh (short: zypper ref)**
Install updates: **zypper update (short: zypper up)**

Remember: Need to be root!

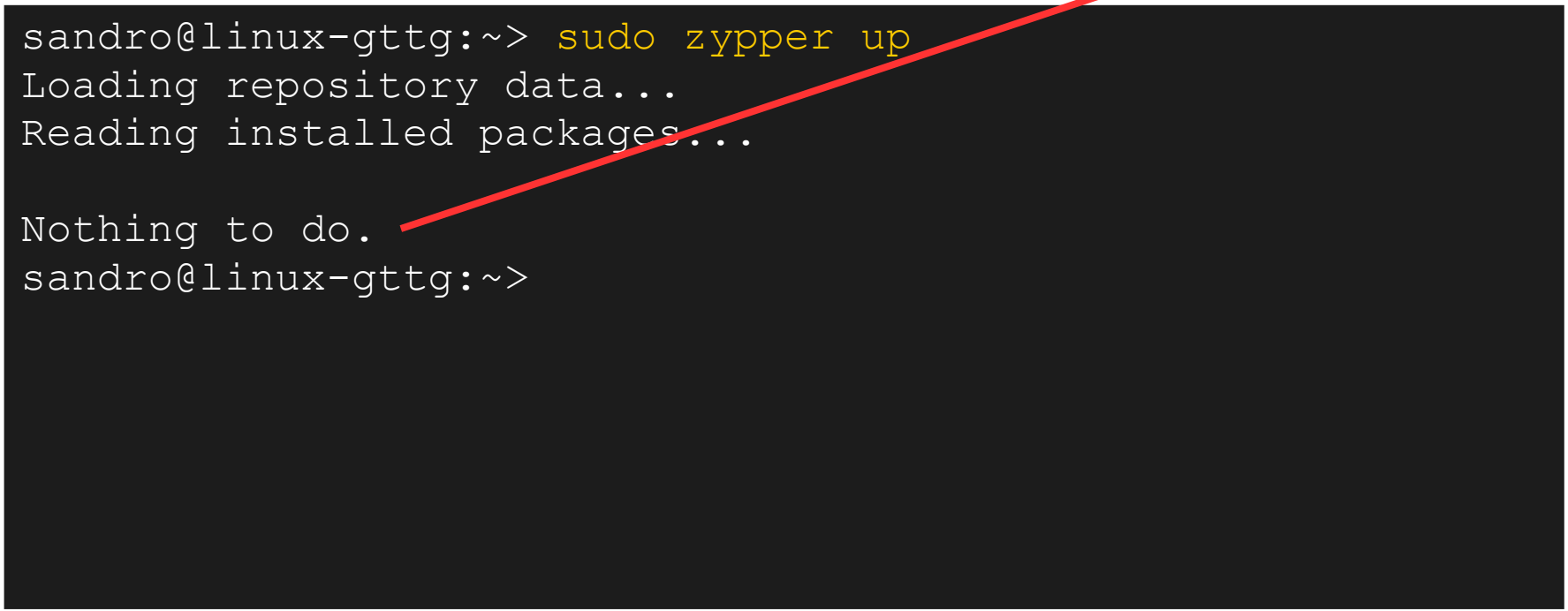
Note that if the repos are out of date, zypper will refresh automatically.

```
sandro@linux-gttg:~> sudo zypper ref
root's password:
Repository 'Main Repository (NON-OSS)' is up to date.
Repository 'Update Repository (Non-Oss)' is up to date.
Repository 'Main Repository (OSS)' is up to date.
Retrieving repository 'Main Update Repository' meta[done]
Building repository 'Main Update Repository' cache [done]
Repository 'openSUSE-42.1-0' is up to date.
Retrieving repository 'openSUSE-Leap-42.1-Update' m[done]
Building repository 'openSUSE-Leap-42.1-Update' cac[done]
All repositories have been refreshed.
sandro@linux-gttg:~>
```

Zypper: OpenSUSE's package manager

Check for updates: **zypper refresh (short: zypper ref)**
Install updates: **zypper update (short: zypper up)**

Remember: Need to be root!



Zypper: OpenSUSE's package manager

Search a package: **zypper search (short: zypper se)**
Install a package: **zypper install (short: zypper in)**
Remove a package: **zypper remove (short: zypper rm)**

```
sandro@linux-gttg:~> zypper se chromium
Loading repository data...
Reading installed packages...

S  | Name                       | Summary                | Type
---+----------------------------+------------------------+------------
   | Chromium Web Browser       | Browse the World->     | application
   | chromium                   | Google's opens s->     | package
   | chromium                   | Google's opens s->     | srcpackage
   | chromium-desktop-gnome     | Update to chromi->     | package
   | chromium-desktop-kde       | Update to chromi->     | package
   | chromium-ffmpegsumo        | Library to provi->     | package
sandro@linux-gttg:~>
```

Zypper: OpenSUSE's package manager

Search a package: **zypper search (short: zypper se)**
Install a package: **zypper install (short: zypper in)**
Remove a package: **zypper remove (short: zypper rm)**

```
sandro@linux-gttg:~> sudo zypper in chromium
Loading repository data...
Reading installed packages...
Resolving package dependencies...

The following 3 NEW packages are going to be installed:
  chromium chromium-ffmpegsumo libjpeg62

3 new packages to install.
Overall download size: 53.2 MiB. Already cached: 0 B.
After the operation, additional 213.3 MiB will be used.
Continue? [y/n/? shows all options] (y):
```

chromium needs those in order to run => automatically installed

“(y)”: just hitting Enter = yes

Zypper: OpenSUSE's package manager

Search a package: **zypper search (short: zypper se)**
Install a package: **zypper install (short: zypper in)**
Remove a package: **zypper remove (short: zypper rm)**

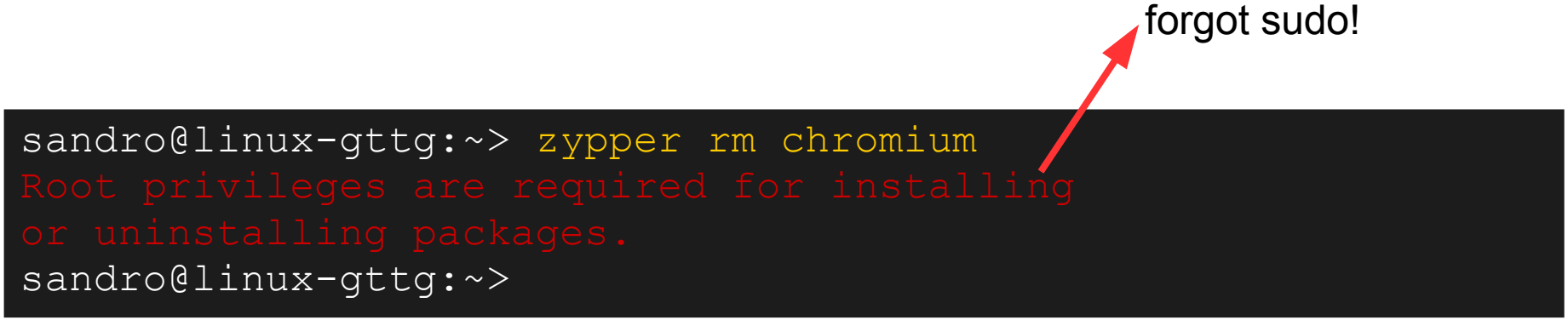
```
...
Retrieving: chromium-47.0.2526.106-10.1.x86[done (3.1 MiB/s)]
Checking for file conflicts: .........................[done]
(1/3) Installing: libjpeg62-62.1.0-31.1 ..............[done]
(2/3) Installing: chromium-ffmpegsumo-47.0.2526.106-10.[done]
(3/3) Installing: chromium-47.0.2526.106-10.1 ........[done]
Additional rpm output:
update-alternatives: using /usr/lib64/chromium/chromium-generic
to provide /usr/bin/chromium (chromium) in auto mode


sandro@linux-gttg:~>
```

ready for your input ==> installation completed

Zypper: OpenSUSE's package manager

Search a package: **zypper search (short: zypper se)**
Install a package: **zypper install (short: zypper in)**
Remove a package: **zypper remove (short: zypper rm)**



Zypper: OpenSUSE's package manager

Search a package: **zypper search (short: zypper se)**
Install a package: **zypper install (short: zypper in)**
Remove a package: **zypper remove (short: zypper rm)**

```
sandro@linux-gttg:~> sudo zypper rm chromium
Loading repository data...
Reading installed packages...
Resolving package dependencies...

The following 2 packages are going to be REMOVED:
  chromium chromium-ffmpegsumo

2 packages to remove.
After the operation, 213.1 MiB will be freed.
Continue? [y/n/? shows all options] (y):
```

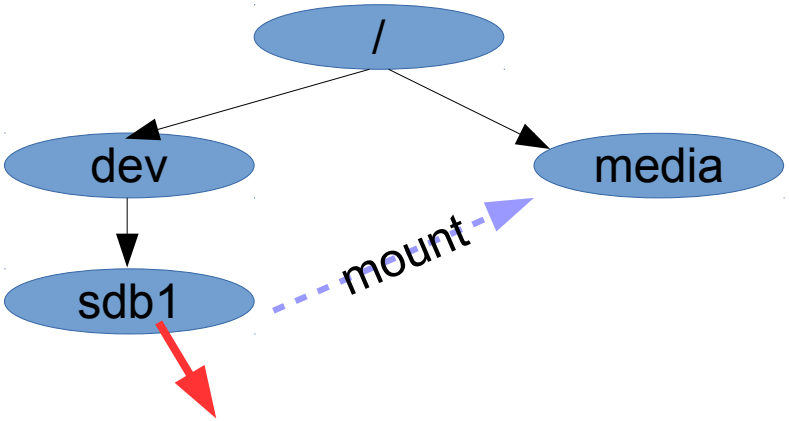
newly unneeded dependencies are removed as well

Apt: Debian / Ubuntu's package manager

Check for updates:	**apt update**
Install updates:	**apt upgrade**
Search a package:	**apt search**
Install a package:	**apt install**
Remove a package:	**apt-get autoremove**

Dealing with storage devices

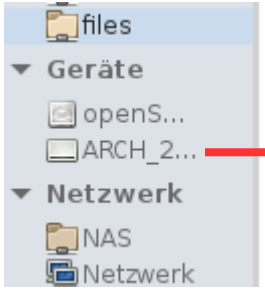
- **Under Linux, devices show up as files in /dev/**
- **In order to access a device (i.e. the directores and files that it countains), the device must be mounted.**
- **You may mount a device into any folder you wish.**



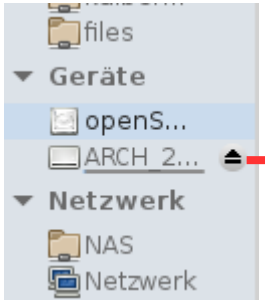
1st partition on your 2nd device (e.g. your USB disk)

Dealing with storage devices

Mounting and unmounting in the file manager:



Clicking the disk will mount and open it.



Clicking the eject button will unmount the disk after writing the changes to it (“flush” the caches)

Dealing with storage devices

mount [device] [mount point]

folder must exist!

```
sandro@linux-gttg:~> sudo mount /dev/sdb1 /media/myUSB
sandro@linux-gttg:~>
```

mount returns silently ==> success!

You will now find the contents of your USB disk under /media/myUSB/

Dealing with storage devices

sync: just flush cache to disk

```
sandro@linux-gttg:~> sudo mount /dev/sdb1 /media/myUSB
sandro@linux-gttg:~> sync
```

this may take a while,
wait for the command to return

Dealing with storage devices

umount [device or mount point]

This includes sync.

```
sandro@linux-gttg:~> sudo mount /dev/sdb1 /media/myUSB
sandro@linux-gttg:~> sudo umount /media/myUSB
sandro@linux-gttg:~>
```

equivalent to `sudo umount /dev/sdb1`

command has returned ==> safe to remove disk now

Always unmount devices before pulling the cable.

Managing free space on your disk

df -h : Show disk usage (human readable format)

```
sandro@linux-gttg:~> df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        1.2G     0  1.2G   0% /dev
tmpfs           1.2G     0  1.2G   0% /dev/shm
tmpfs           1.2G  1.9M  1.2G   1% /run
tmpfs           1.2G     0  1.2G   0% /sys/fs/cgroup
/dev/sda2       6.6G  4.2G  2.1G  68% /
sandro@linux-gttg:~>
```

This is the root folder.
We have 2.1 GB free.

Clearing the package cache to gain space

- **Remember: We installed chromium and threw it away again.**
- **The package files are still cached so that it's not necessary to download them again for a reinstall.**
- **sudo zypper clean: Delete cached packages**

```
sandro@linux-gttg:~> df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2       6.6G  4.6G  1.7G  74% /
sandro@linux-gttg:~> sudo zypper clean
root's password:
All repositories have been cleaned up.
sandro@linux-gttg:~> df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2       6.6G  4.2G  2.1G  68% /
sandro@linux-gttg:~>
```

sudo apt-get clean

Scripting: automatize your workflow

- **There are many scripting languages out there: bash, python, …**
- **Scripts are run by so-called interpreters.**
- **All the commands you have used so far are bash commands.**
- **How can the computer tell what interpreter to use?**
  - **either run a command specifying the interpreter to run:**

```
sandro@linux-gttg:~> bash myscript.bash
sandro@linux-gttg:~> sh myscript.sh
sandro@linux-gttg:~> python myscript.py
```

Unlike under Windows, the file extension doesn't matter.

bash and sh (“shell”) scripts are essentially the same.

  - **or begin the script with #!/path/to/interpreter**

Scripting: very basic shell scripting

miau.sh

```
#!/bin/sh
echo hello world!
cp "$0" copyOfMyself.sh
ls
```

put every command on a single line

```
sandro@linux-gttg:~> sh miau.sh
hello world!
copyOfMyself.sh  miau.sh
sandro@linux-gttg:~> ./miau.sh
bash: ./miau.sh: Permission denied
```

The file has not been marked as executable yet!

Scripting: very basic shell scripting

chmod a+x [file]: Making a file executable

chmod is out of the scope of this course.

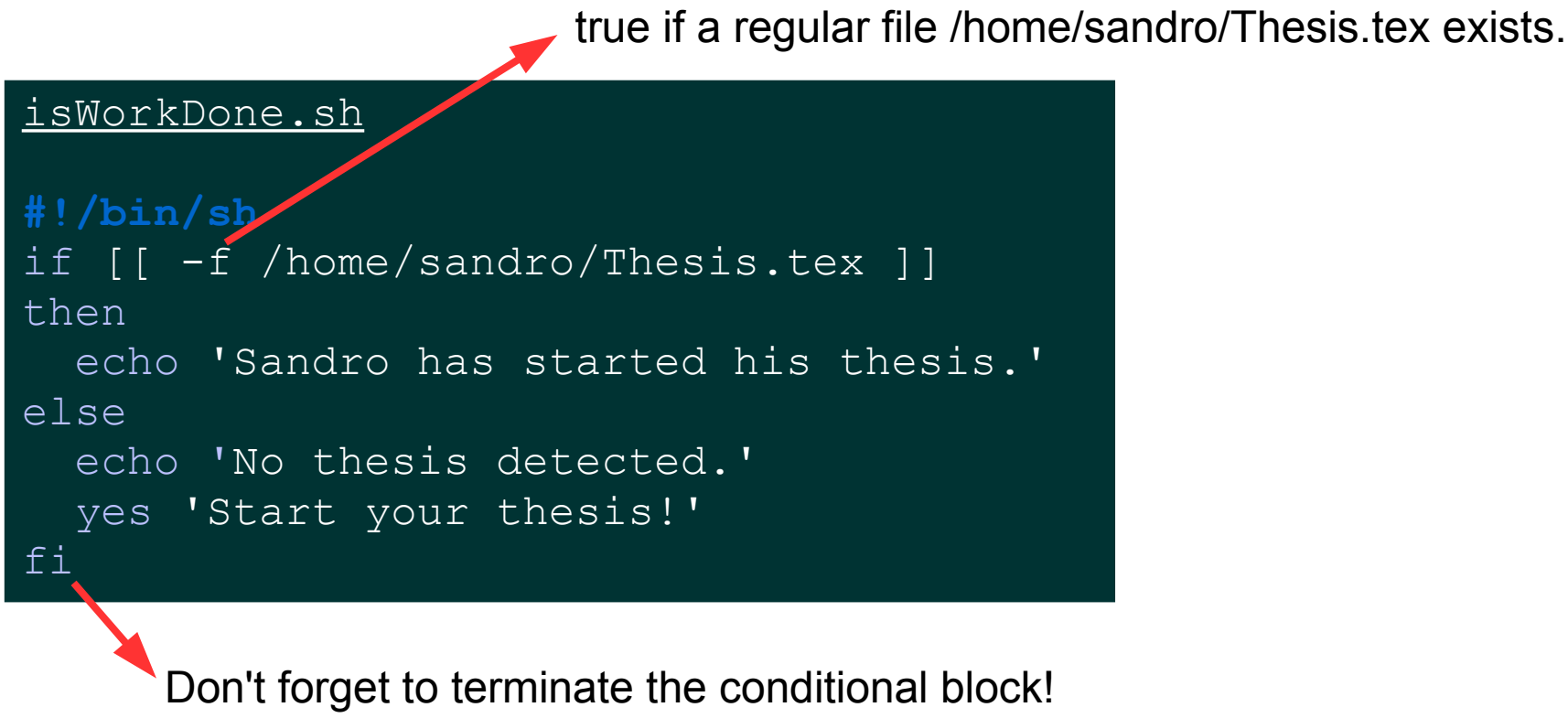
To learn about chmod, check the man page or read our course script.

```
sandro@linux-gttg:~/scripting> chmod a+x miau.sh
sandro@linux-gttg:~/scripting> ./miau.sh
hello world!
copyOfMyself.sh  miau.sh
sandro@linux-gttg:~/scripting>
```

We can not execute the script as if it was an actual program, thanks to the #!... line

Scripting: very basic shell scripting

Example: conditional execution



Scripting: very basic shell scripting

Example: loops

equivalent to: `for i in 1 2 3 4 5`

countToSeven.sh

```
#!/bin/sh
for i in {1..7}
do
   echo "Counting sheep no. $i"
done
```

Don't forget to terminate the loop!

To retrieve variables, start them with $
=> Need double quotes (“)
not single quotes (')

Scripting: automatize your workflow

- **Bash is very powerful and way beyond this course**
- **You can type loops etc. directly in the console (the interpreter treats your commands like a script, hitting Enter corresponds to a line break)**
- **Can run scripts at startup, upon login, before shutdown, etc. etc.**
- **Often, pre-installed commands are actually bash scripts (e.g. /usr/bin/xflock4 which locks the screen under XFCE) => you can modify them at will for arbitrary behavior**
- **In scripts you can even read hardware sensors (e.g. on HP laptops, the file /sys/devices/platform/lis3lv02d/position contains data from a tilting sensor, can read out temperatures etc.)**
- **Many tutorials and examples available online**

Commands are universal

- **Under Linux, every installed “program” is run as a command**
- **Shutdown, reboot, screen brightness, volume, WiFi and pretty much any system functionality can be controlled from the console and therefore be included into scripts**
- **If your computer has a sensor for environmental brightness, you could easily write your own script to set your screen brightness according to the light around you and the time etc.**
- **Scripts can themselves be reused as commands**
- **Pipe commands together (live demo using fortune and cowsay)**
- **Any command sequence can be bound to a keyboard shortcut... See the power of commands?**

The course script

- **More complete than this course**
- **Written in HS15 for OpenSUSE or in FS15 for Ubuntu**
- **Available under www.thealternative.ch → Know-How → HS'15**
- **Starts from zero, goes to more advanced topics**

Coming up

- **“The Power of Linux”**
  - **20.10.16 | 17:15-19:00 | ETH HG F 1 (tomorrow)**
  - **Real-life applications that rock!**

- **Bash workshop (“sold” out)**
  - **21.10.16 | 17:15-19:00 | ETH HG E 41**
  - **24.10.16 | 17:15-19:00 | ETH HG E 22**

- **“The Developer's Toolkit or Things I Wish I'd Known Earlier”**
  - **25.10.16 | 17:15-19:00 | ETH HG D 5.2**
  - **This semester's spotlight course**

- **Stammtische: Community meetings in a casual setting (i.e. beer!)**