Programming for Evolutionary Biology
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Introduction to Unix systems
Part 2: Introducing the terminal

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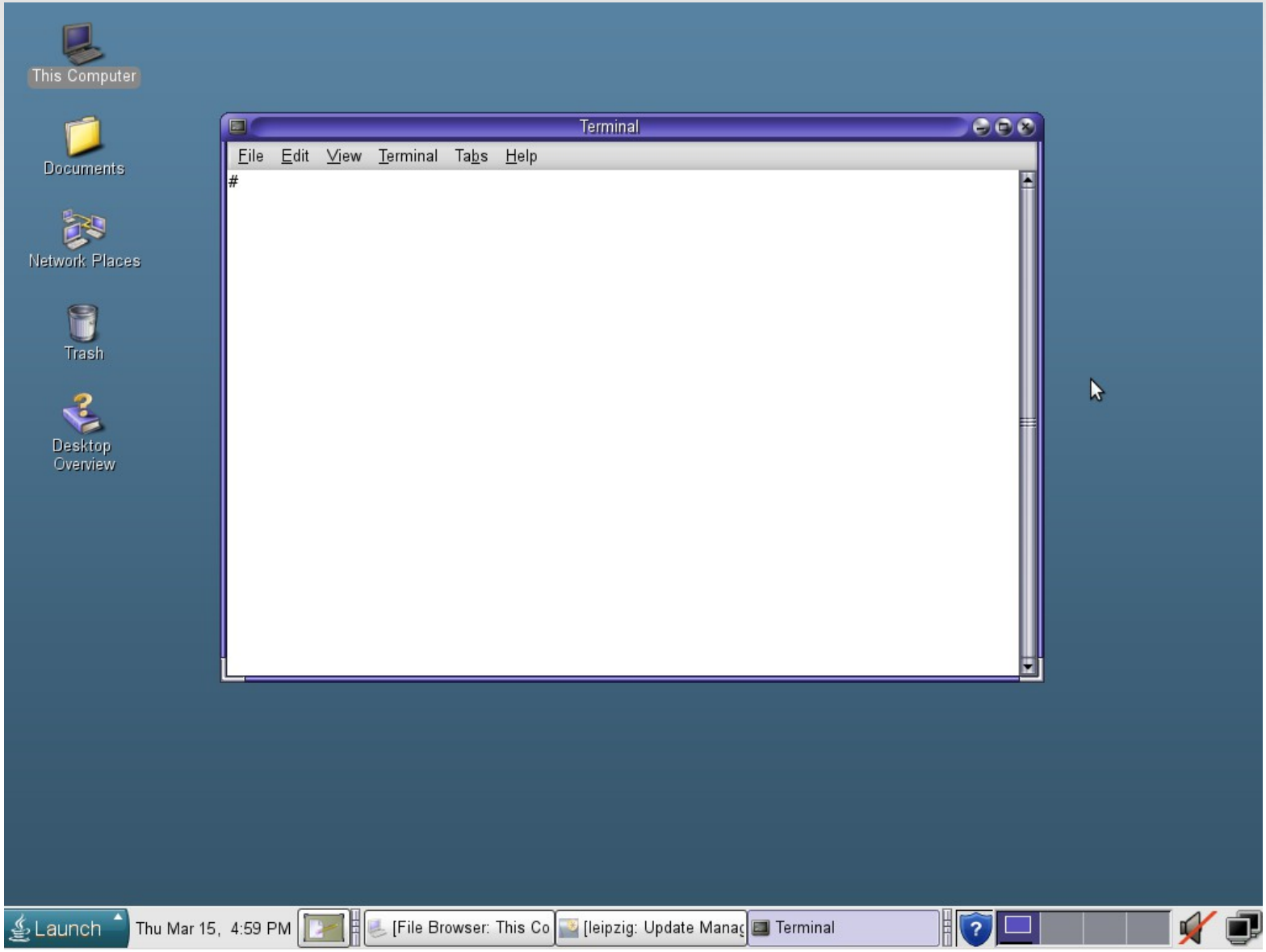
Schedule

- 9.30 – 11.00: “What is Unix?” and hands on a Fedora system
- **11.30 – 12.30: Introducing the terminal**
- 14:30 – 16:30: Grep & Unix philosophy
- 17:00 – 18:00: awk, sed and make

What is the terminal?

- The terminal is a software that allows to execute commands by typing
- Instead of clicking an icon in a menu, we call a software by writing its name

How does a terminal looks like?



The terminal: history and why

- Back in the '70s, when Unix was developed, computers did not have graphical interfaces
- Also, computer were mostly used for data analysis.

The terminal: history and why

- Back in the '70s, when Unix was developed, computers did not have graphical interfaces
- Also, computer were mostly used for data analysis.
    - The most common operations were analysis of datasets and manipulation of text files

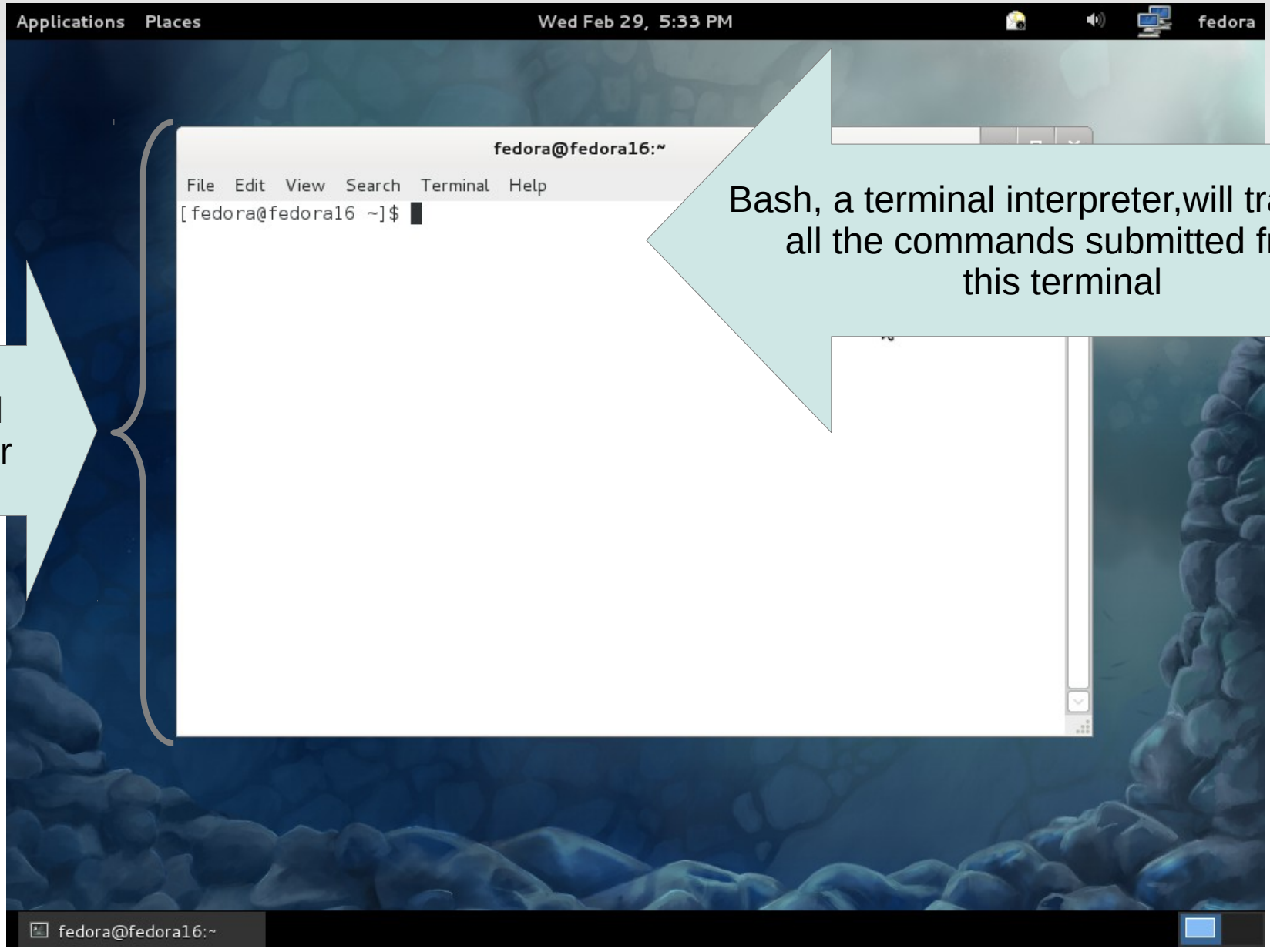
Why use the terminal today?

- A common problem in bioinformatics is to deal with big collections of text files
- The terminal is a good instrument to manage big collections of text files. More than 30 years of experience.

some Terminology

- **Terminal emulator**: the software that shows the window where you type the commands, and prints the output of the commands
- **Interpreter**: the software that translate commands to the computer
- **Bash**: name of the most commonly used interpreter

Terminal emulator, interpreter and bash

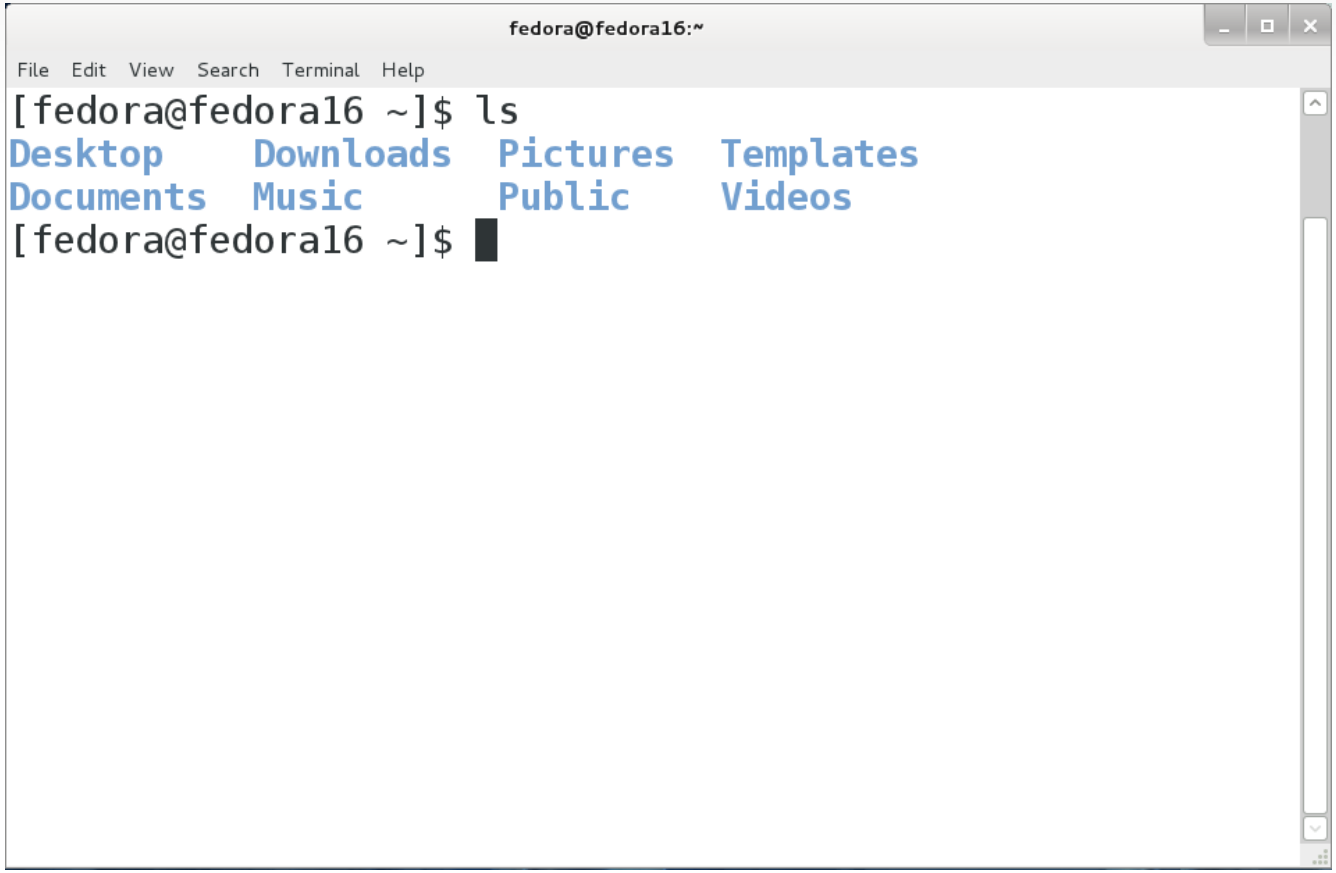


Terminal Emulator

Bash, a terminal interpreter,will translate all the commands submitted from this terminal

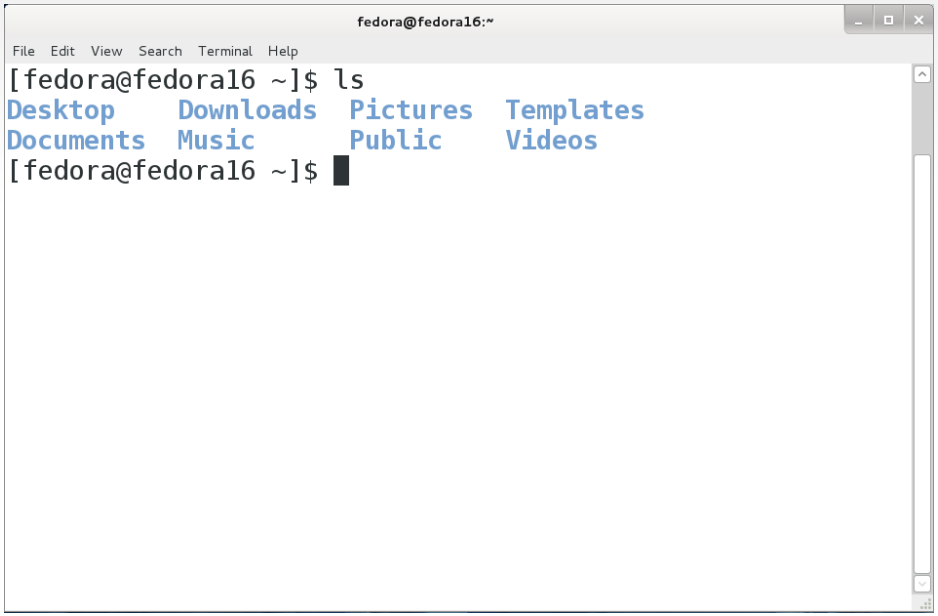
Your first command: ls

- ls is the command to show all the files in a folder
- It stands for “List Short” (list files in a short way)
- Try it!



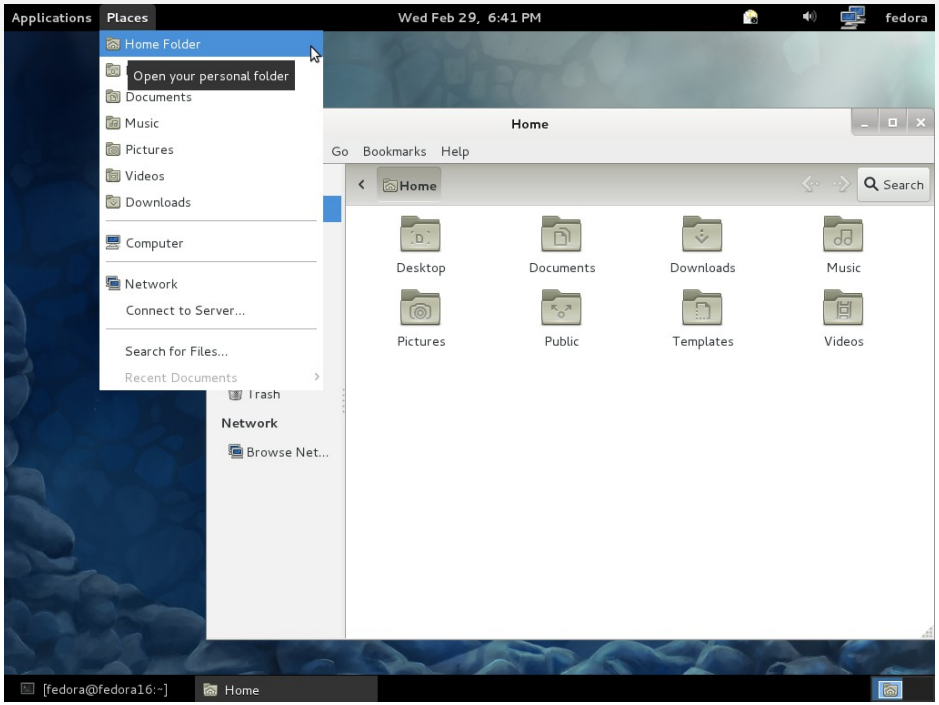
Output of “ls”

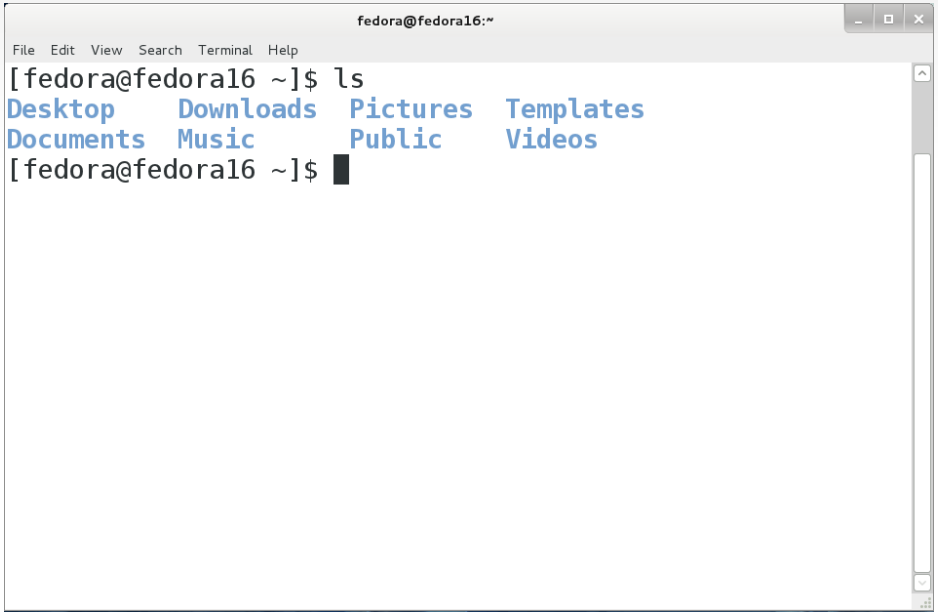
- ls will list the files in the current directory
- By default, when you open the terminal, you are in your “home” folder



“ls” is showing the contents of the “home” folder

- If you want to see which files are being shown by ls, you can type nautilus as we did in the previous session





Anatomy of a command

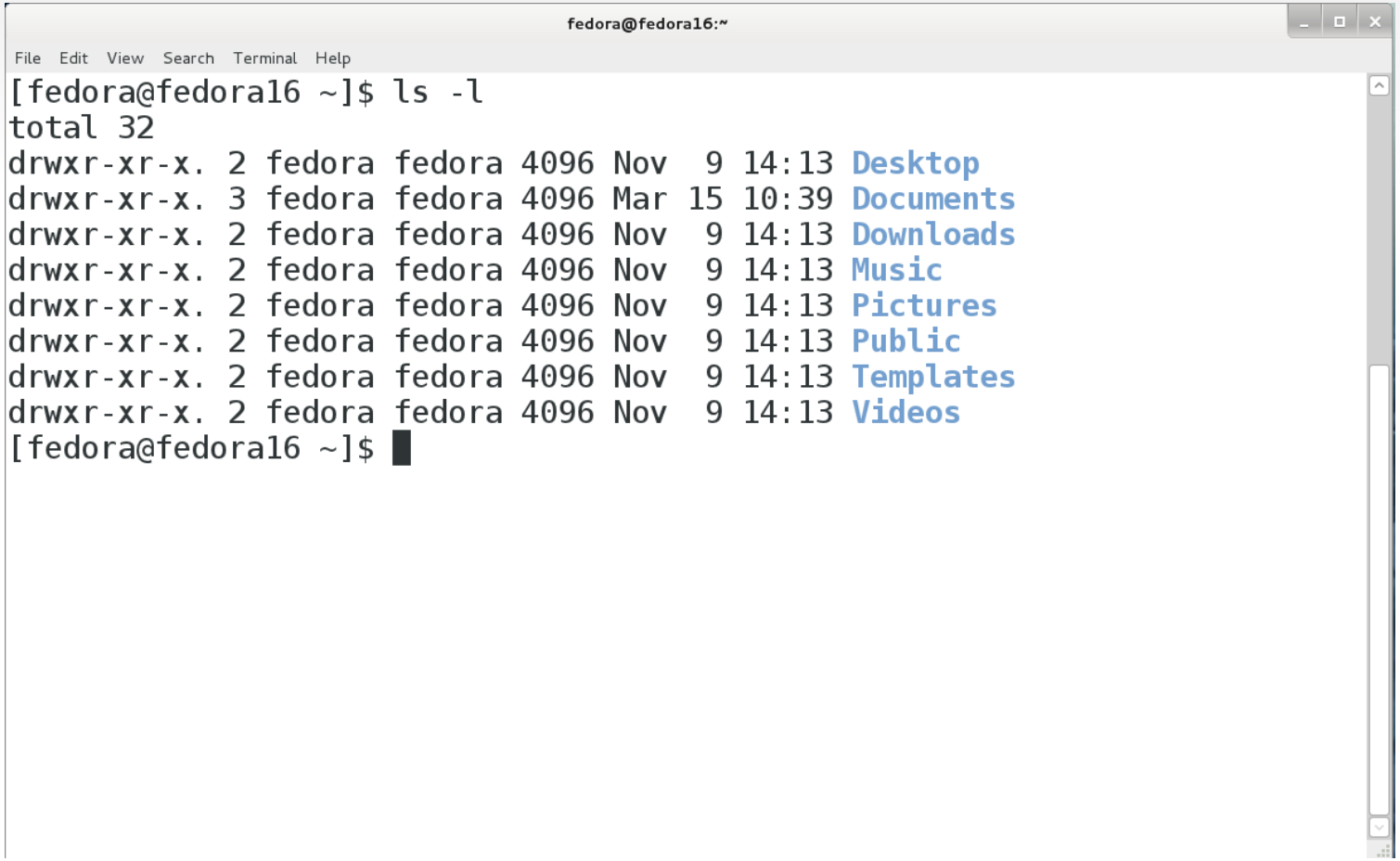
- Each command call is usually composed by three parts:
  - The command itself
  - Parameters (optionals)
  - Arguments

ls: some parameters

- Parameters are optional items that can be used to customize the behaviour of a command
- For example:
  - ls -l shows the list of files in a long format
  - ls -a shows hidden files
  - ls -t list files by modification time

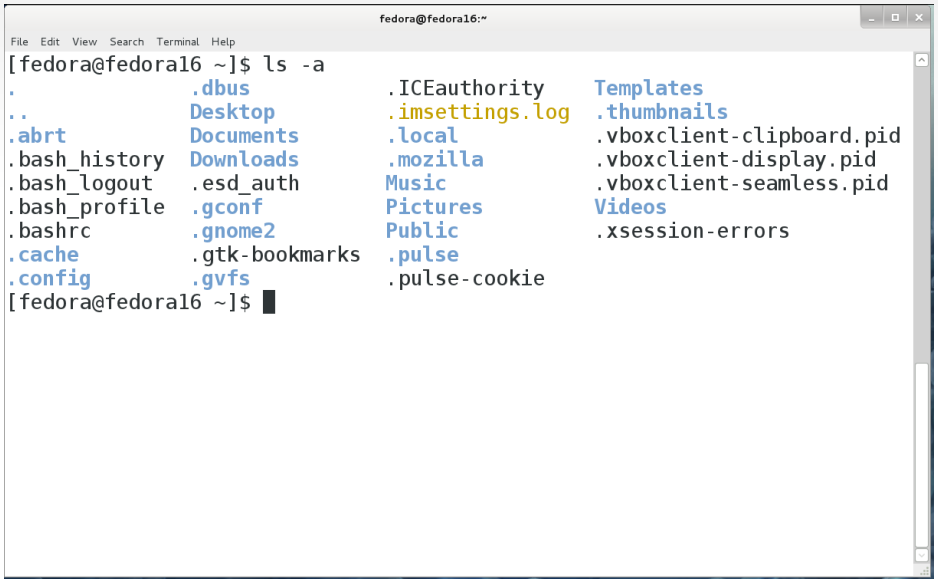
“ls -l”

- ls -l shows the same files as ls, but on a more detailed format



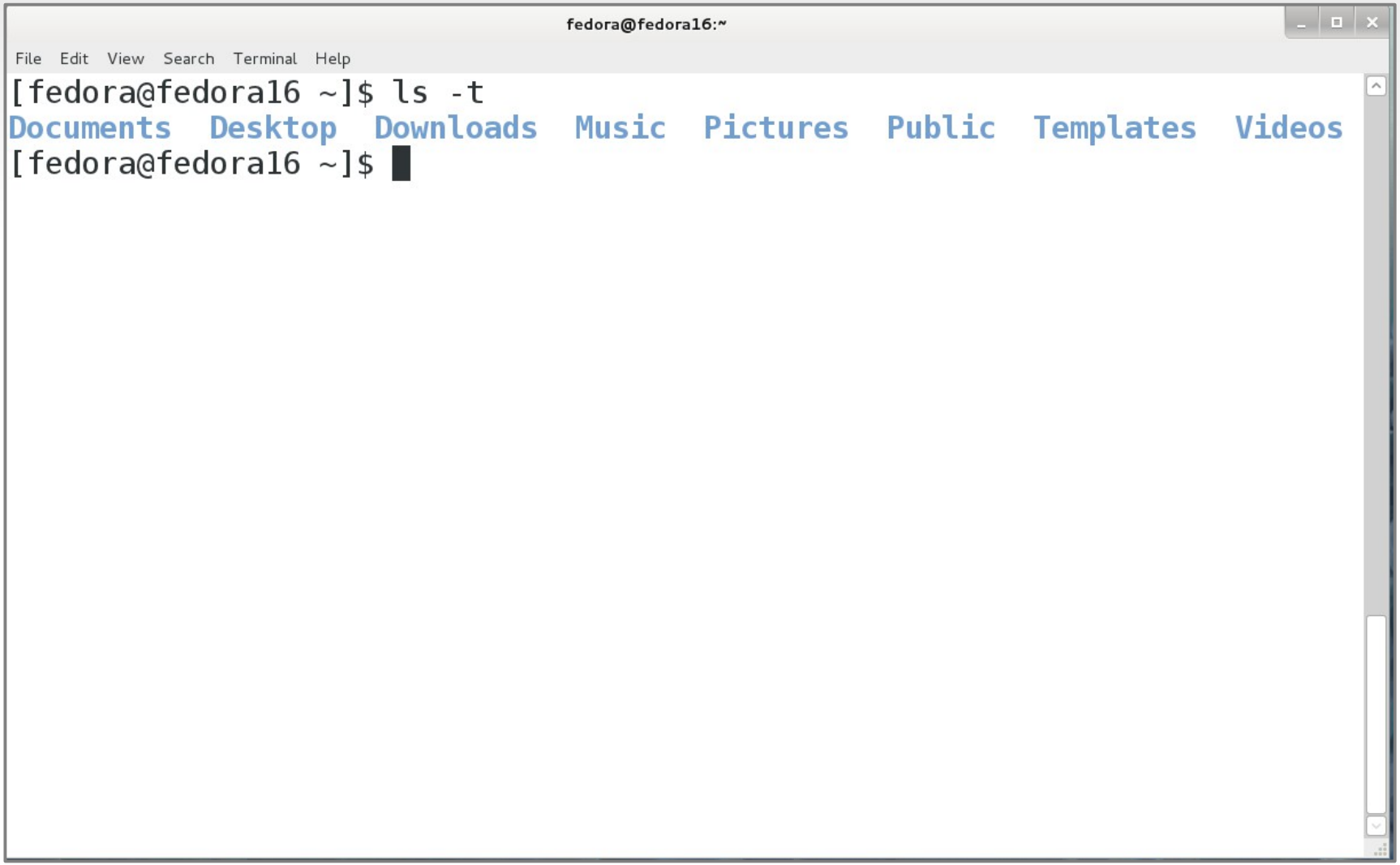
“ls -a”

- ls -a shows all the files, including the hidden ones
- Hidden files have a name that begin with a “.”
- Most of them are configuration files, you can ignore them.



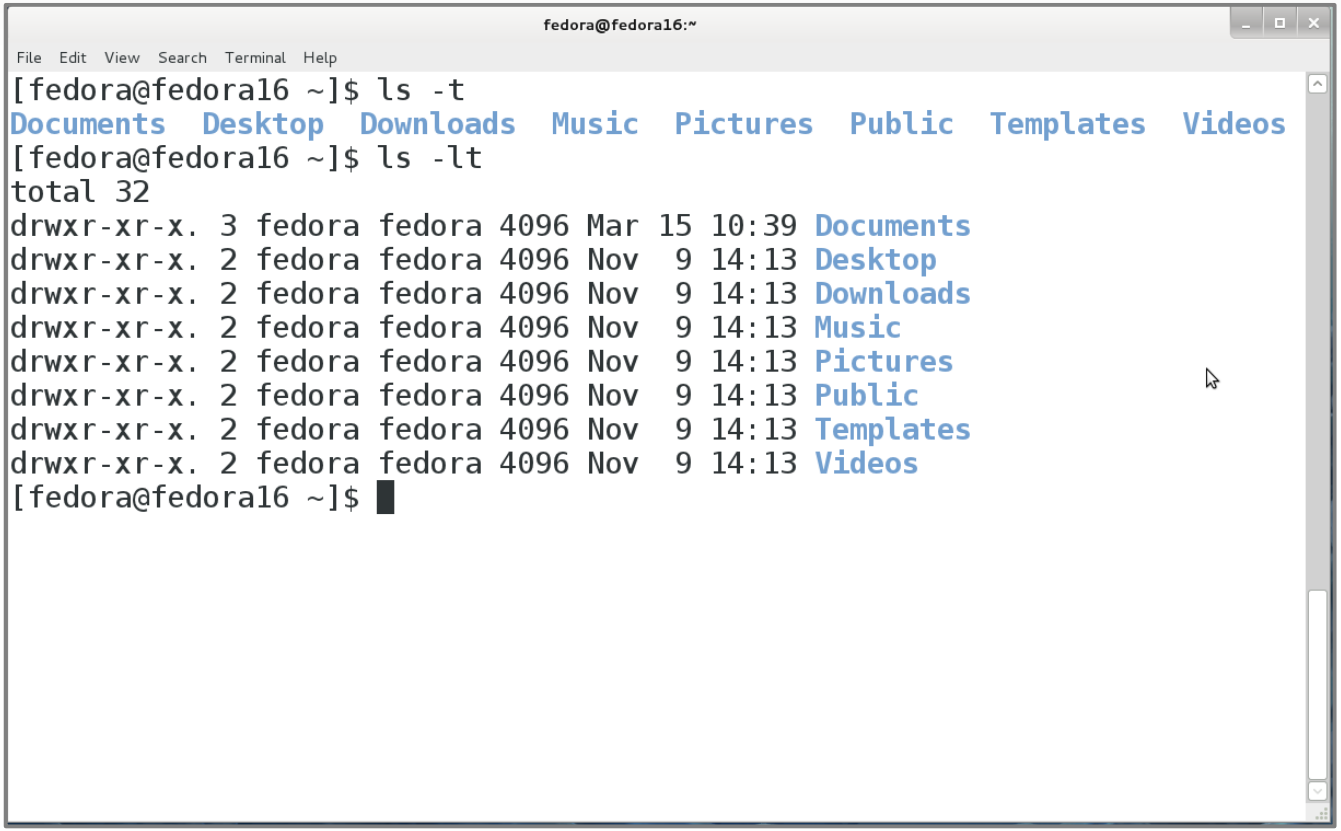
“ls -t”

- ls -t lists the files by modification date



“ls -lt”

- You can combine parameters together
- ls -lt shows the files in a long format, sorted by date



Arguments

- Arguments define the target of the command
- On which files/folders/targets do I want to run my command?
- Example:
  - ls unix_intro -> shows the files in the unix_intro directory

Quick exercise

- In the following call, which are the commands, the parameters and the arguments?
  - ls -la /homes/evopserver

How to get the documentation of a command?

- Three methods:
  - --help
  - man
  - info

“ls --help”

- The simplest way to get the documentation of a command is by using the --help parameter
- For example:

  ls --help
- Most unix command accept a --help or -h parameter

Consulting the documentation of a command: man

- The command man is used to see the documentation of a command
- Understanding how to read the documentation is the key to learn how to use the shell

Your second command: man

- The command “man” is used to see the documentation of a command
- Usage: man <name of the command>
- Try it:
    - man ls

“man ls”

```
LS(1)                          User Commands                          LS(1)

NAME
       ls - list directory contents

SYNOPSIS
       ls [OPTION]... [FILE]...

DESCRIPTION
       List  information  about  the FILEs (the current directory by default).
       Sort entries alphabetically if none of -cftuvSUX nor --sort.

       Mandatory arguments to long options are  mandatory  for  short  options
       too.

       -a, --all
              do not ignore entries starting with .

       -A, --almost-all
              do not list implied . and ..

       --author
              with -l, print the author of each file

       -b, --escape
              print C-style escapes for nongraphic characters

       --block-size=SIZE
              use SIZE-byte blocks.  See SIZE format below

       -B, --ignore-backups
              do not list implied entries ending with ~

       -c     with -lt: sort by, and show, ctime (time of last modification of
              file status information) with -l: show ctime and  sort  by  name
              otherwise: sort by ctime

       -C     list entries by columns
```

Understanding a man page

- Each manual page is composed by at least three sections:
  - NAME (the name of the command)
  - SYNOPSIS (how to launch the command)
  - DESCRIPTION/OPTIONS (description of what the command does, and its options)

“man ls”

```
LS(1)                          User Commands                          LS(1)

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Name of the command

Synopsis (how to use it)
Options in square brackets are optional

Parameters & arguments

Using a man page

- Use arrows or PageUp/PageDown keys to scroll the man page
- Press “/” followed by a word to search text
    - Example: /sort
- Press “q” to exit

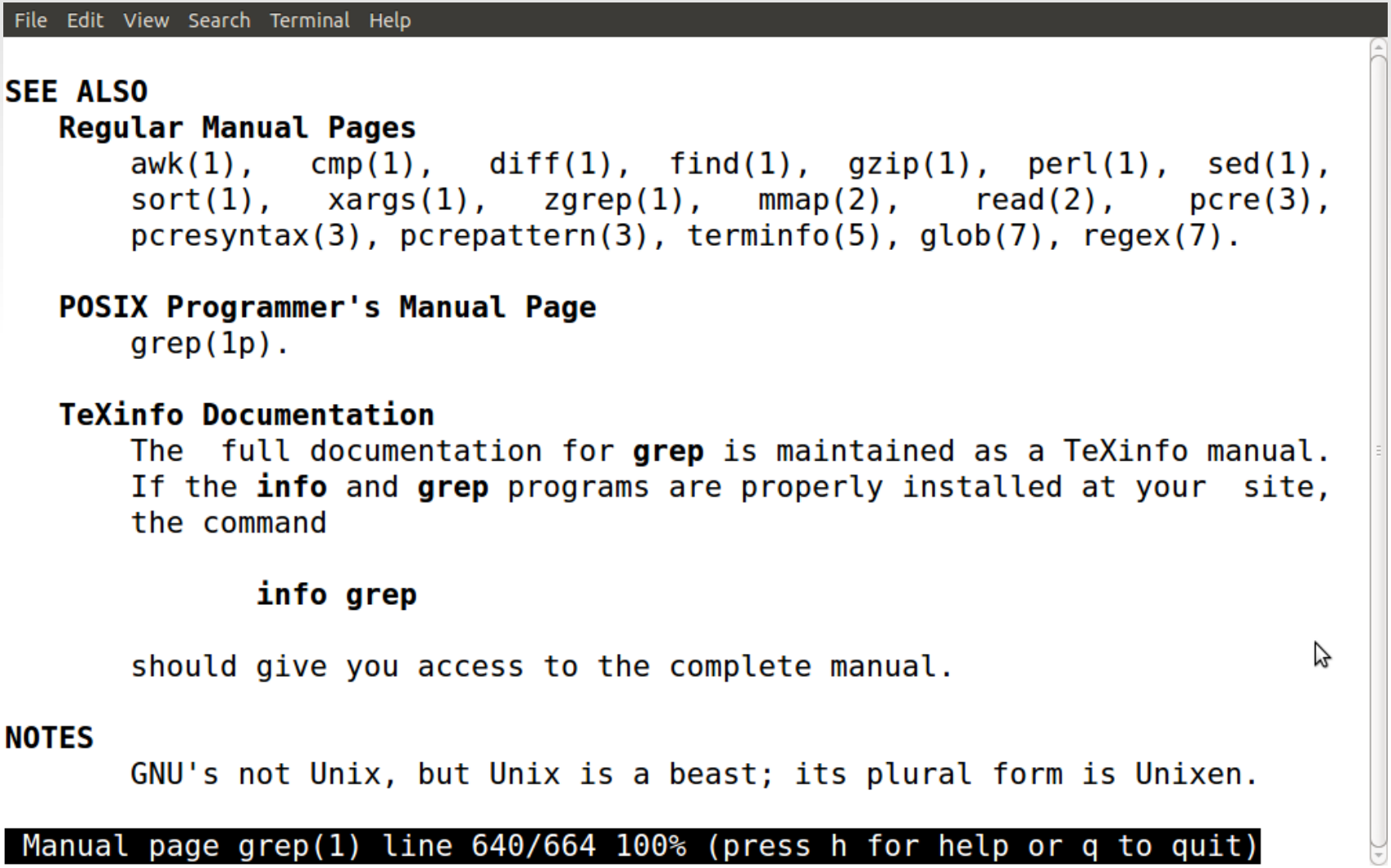
Searching for a man page

- You can search all the manuals using the -k option
  - Example: man -k “list dir”
- Another similar command is “apropos”
  - Example: apropos “list dir”

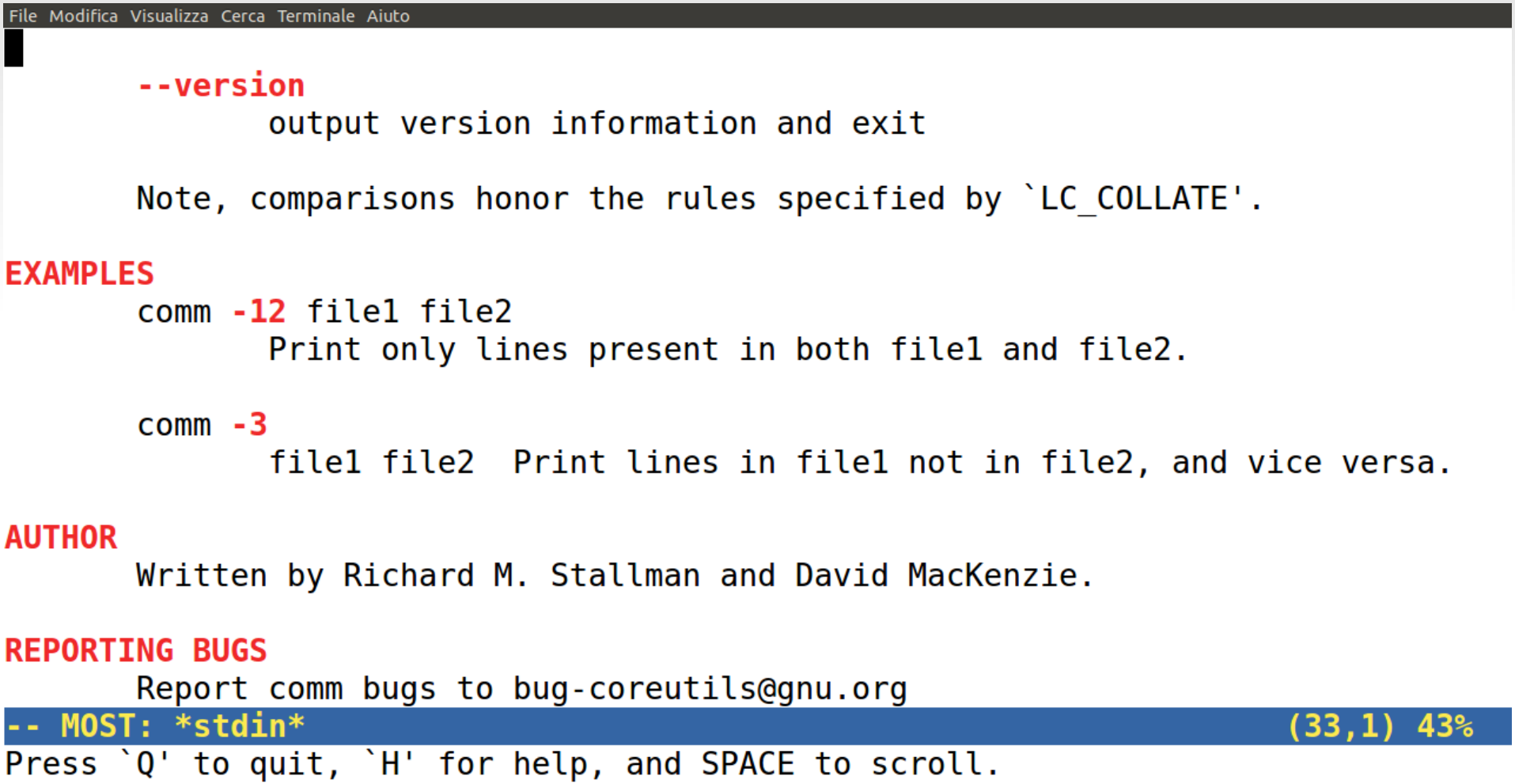
Other sections in a man page

- SEE ALSO: some man pages contain references to similar commands
- EXAMPLES: some man pages contain an “examples” section

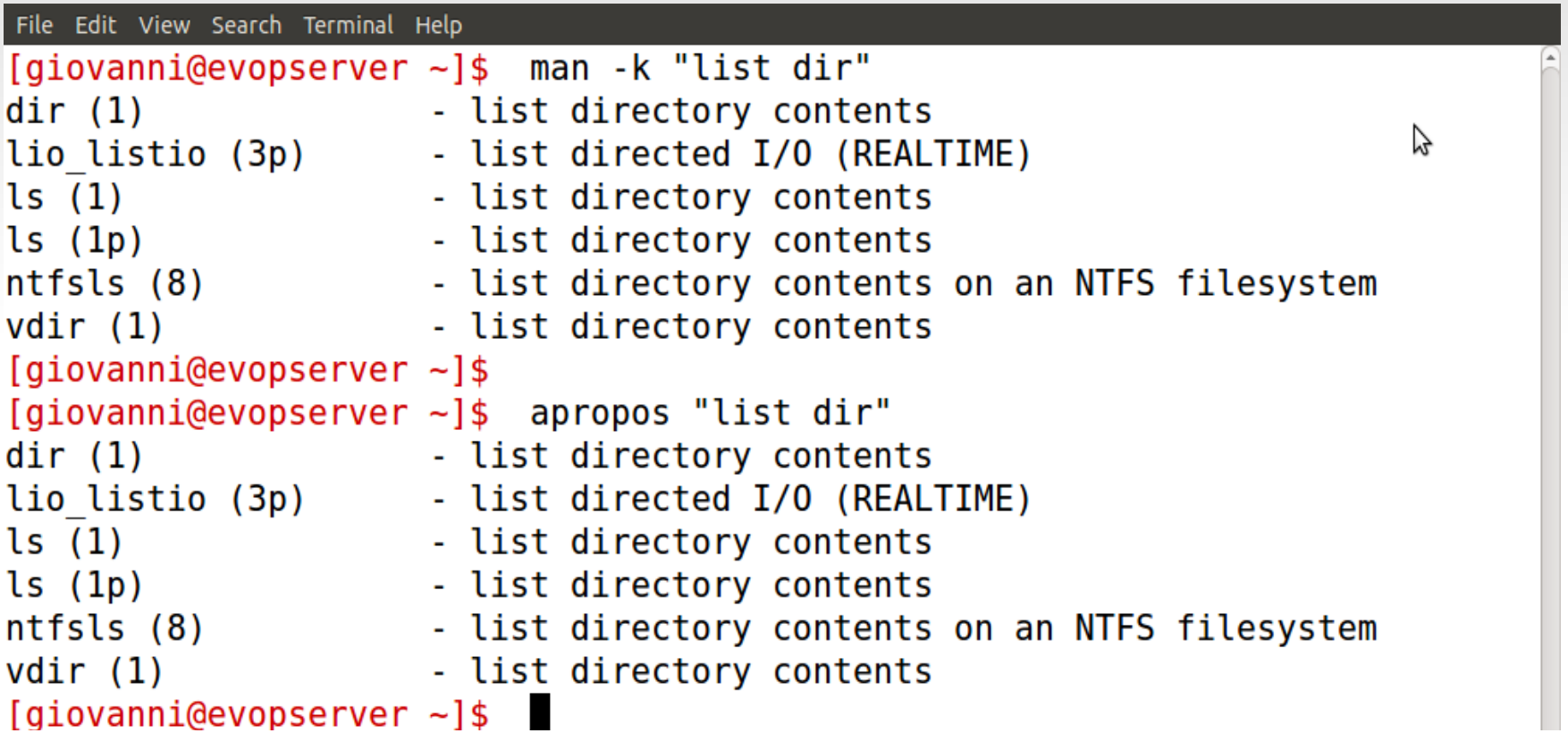
“SEE ALSO” and “EXAMPLES” sections



“SEE ALSO” and “EXAMPLES” sections



“man -k 'list dir'” and apropos



Another way to access documentation: “info”

- The command “info” shows a more descriptive documentation of a command
- Example:
    - info ls

The “info” command

```
File  Edit  View  Search  Terminal  Help
File: coreutils.info,  Node: ls invocation,  Next: dir inv
ectory listing

10.1 `ls': List directory contents
==================================

The `ls' program lists information about files (of any typ
directories).  Options and file arguments can be intermixed
arbitrarily, as usual.

   For non-option command-line arguments that are directories, by
default `ls' lists the contents of directories, not recursively, and
omitting files with names beginning with `.'.  For other non-option
arguments, by default `ls' lists just the file name.  If no non-option
argument is specified, `ls' operates on the current directory, acting
as if it had been invoked with a single argument of `.'.

   By default, the output is sorted alphabetically, according to the
locale settings in effect.(1) If standard output is a terminal, the
output is in columns (sorted vertically) and control characters are
output as question marks; otherwise, the output is listed one per line
--zz-Info: (coreutils.info.gz)ls invocation, 58 lines --Top-----------------
```

Use arrows to scroll
Press Enter on a keyword to open a page
Press “n” and “p” to change pages

Short exercise

- Which parameter can be passed to “ls” to sort files by size?
- How to show the contents of directory recursively
- Which command can be used to show the contents of a folder as a tree? (hint: use apropos)

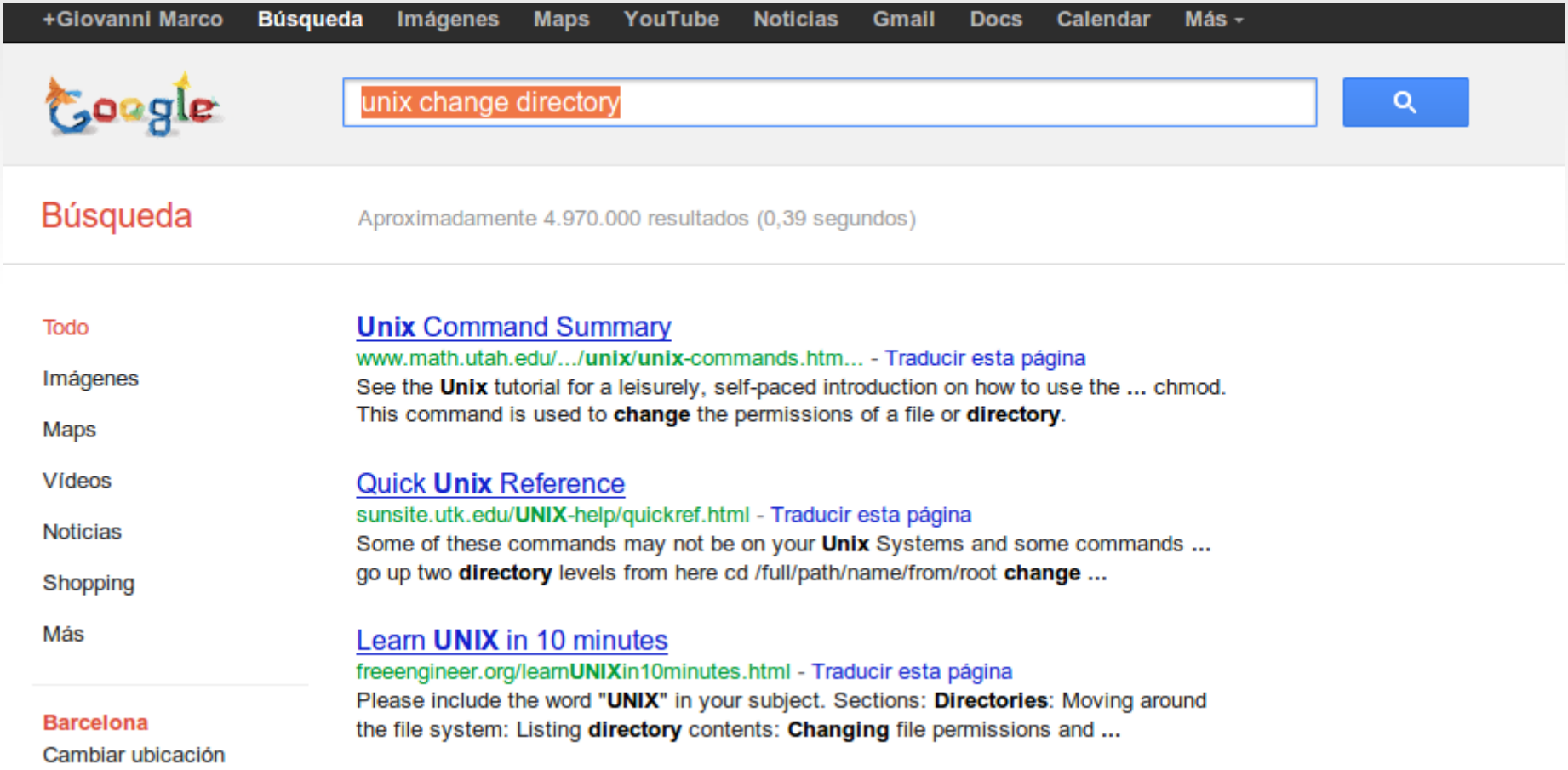
How to get help: Internet

- Apart from “--help”, man and info, the best place to look for help on a command is.. Internet!

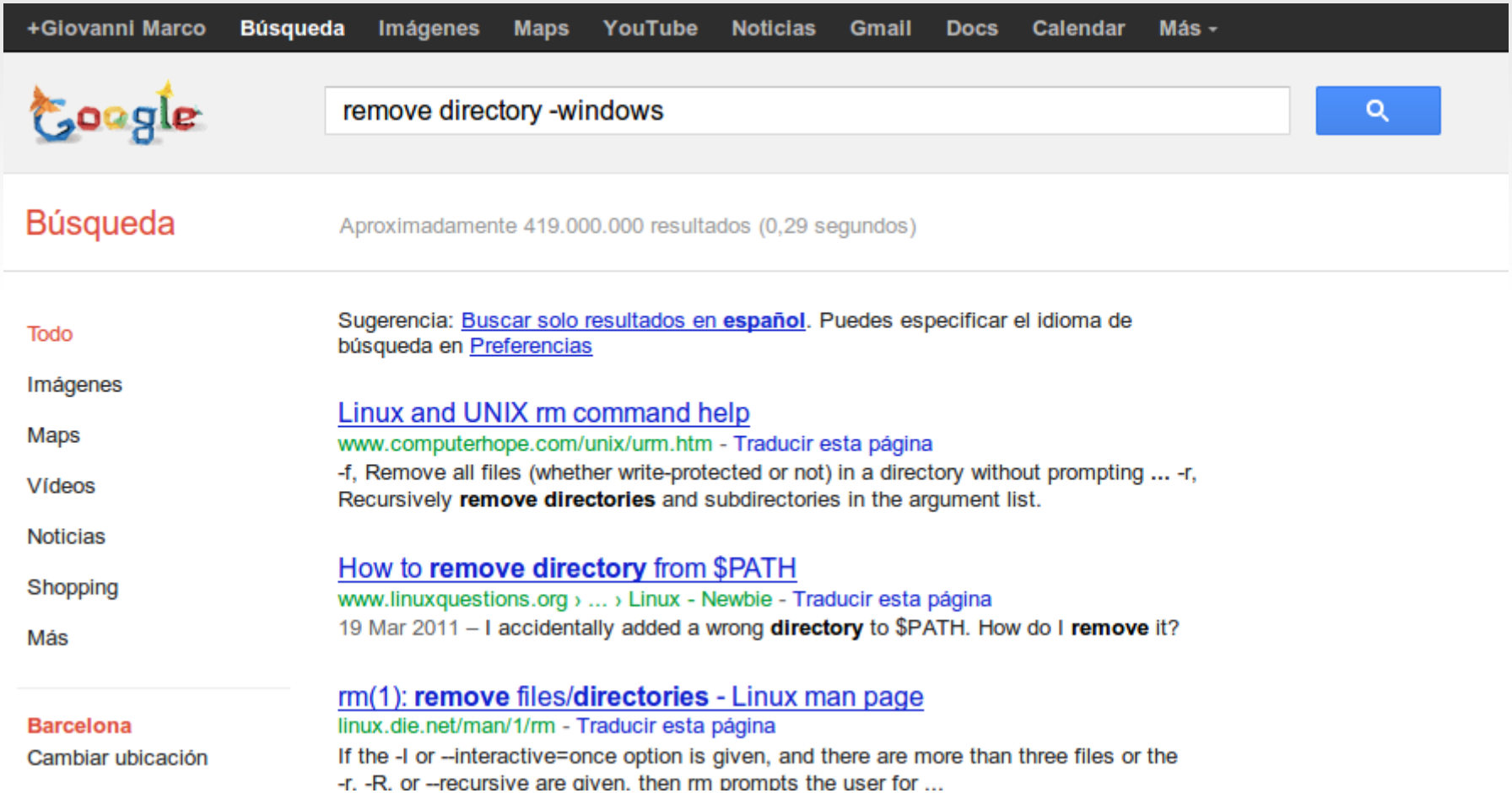
How to get help: Internet

- Apart from “--help”, man and info, the best place to look for help on a command is.. Internet!
- Tips to get better results when searching the documentation of a Unix command on Internet:
  - Add keywords such as “Unix”, “bash”, “fedora”
  - Use the “-” operator on google to remove junk results
  - If you have problem with a software or with your installation, copy and paste the error on google.

Adding keywords such as “Unix”, “bash”, “fedora”, “terminal”



The “-” operator on google



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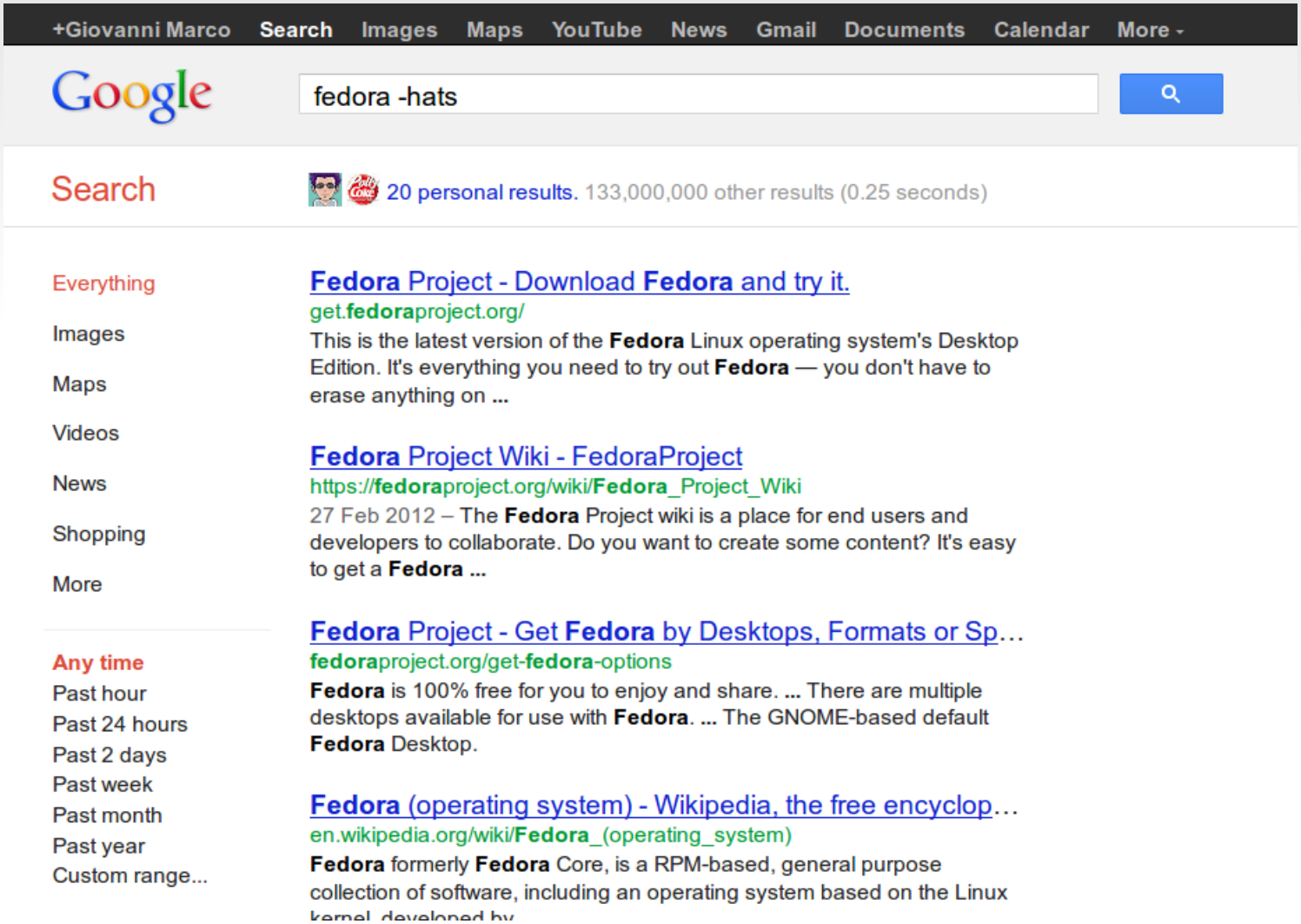
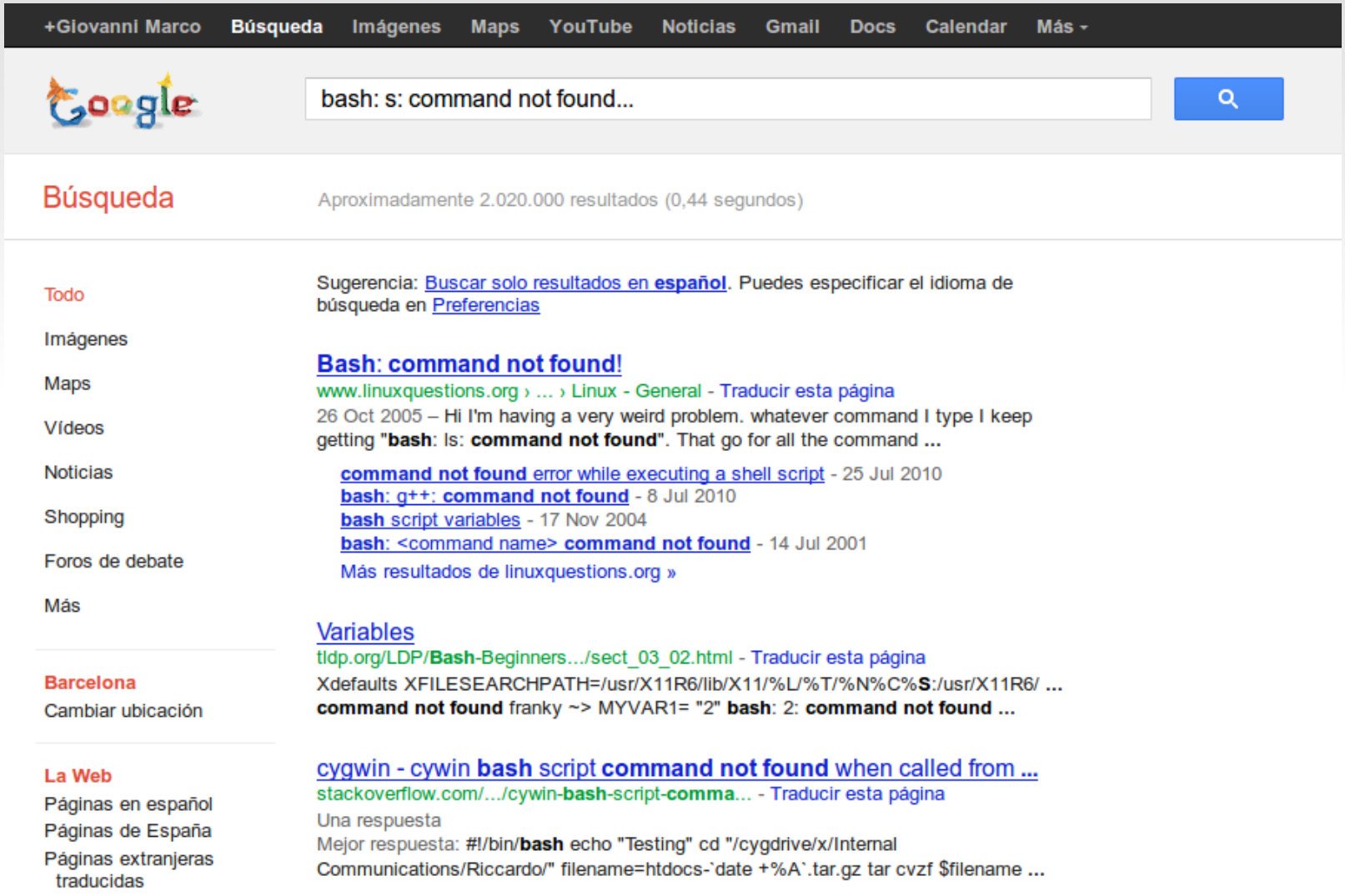


Troubleshooting in Linux



Navigating the file system from the terminal

- We will now see how to navigate folders and files from the terminal

Change directory: cd

- Let's start navigating the file system!
- The command cd allows you to move to another folder
- Let's enter the folder of the course:
  - cd unix_intro
  - ls

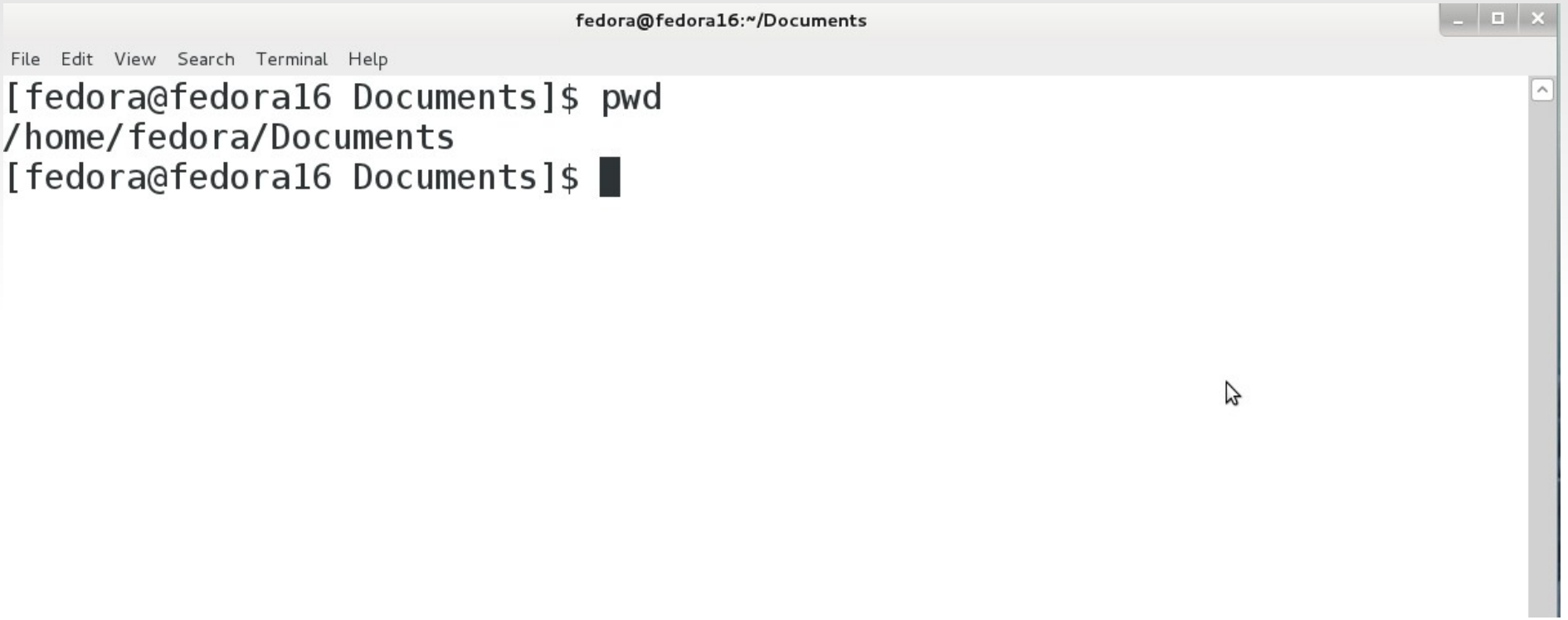
The “cd” man page

- Note: the cd command is documented inside the “bash” man page
  - Type man bash and then look for ls
- You can also look at:
  - man dir (dir is a similar command to ls)
  - info coreutils ls

Which folder am I?

- If you don't know which folder are you in, you can use the command pwd
- Also, if you run cd without arguments, it will return to the home folder

pwd


fedora@fedora16:~/Documents
File Edit View Search Terminal Help
[fedora@fedora16 Documents]$ pwd
/home/fedora/Documents
[fedora@fedora16 Documents]$

If you get lost: type “cd” without arguments

- Typing cd without arguments will bring you to your home directory

“cd ..”

- “cd ..” lets you return to the parent folder
- Example:
  - cd unix_intro → goes to the unix_intro folder
  - cd .. → returns to the home folder

A tip: bash completion

- You can use the “tab” key on the keyboard to complete commands and arguments
- Example:
  - cd Docu<tab> will complete to cd Documents
- Thanks to tab completion, you can save a lot of typing

Let's look at the files in the course folder

- Type, in the following order:

cd (to go back to the home folder)
cd /homes/evopserver/lectures/unix_intro (use the tab key for autocompletion)
ls
cd exercises
ls

Check with your teaching assistant that you are in the correct folder.

Let's see some “fasta” files

- Go to the folder /homes/evopserver/lectures/unix_intro/exercises/fasta
    - fasta, not fastq!
- You should see some fasta files there:
    - MGAT1.fasta, MGAT2.fasta, MGAT3.fasta, MGAT4A.fasta, MGAT5.fasta

head & tail

- The head and tail print the first or the last lines in a file
- Let's try it:
  - head MGAT1.fasta → the first lines of MGAT1.fasta
  - tail MGAT3.fasta → the last lines of the file
- head and tail are useful to inspect big text files

The symbol “*”

- The symbol * (wildcard) can be used to represent all the files in the current folder
- Try it:
    - head * → will show the first lines of all the files in the folder

The man page for “head”

- Exercise:
  - open the man page for head
  - determine which parameter is used for printing a custom number of lines

“cat” & “less”

- The cat command prints the content of a file to the screen
- The less command allows to read the content of a file, with the same interface as for the man pages

Launching gedit from the command line

- Note that you can use the command line to launch any software installed in the computer
  - gedit → text editor
  - google-chrome → web browser
  - gnome-terminal → other terminal

Other useful commands (1)

- clean → clear the terminal
- rm → delete files
- mkdir → create directory
- more → like less, good for piping

Other useful commands (2)

- echo → print a message
- history → show the history of the commands typed
- dos2unix → clean files edited in MS Windows notepad for unix

Resume of the session:

- man and info → documentation
- cd, ls, pwd → navigate folders
- head, less → show contents of files

Time for lunch!

See you here at 14:30!