the Shell

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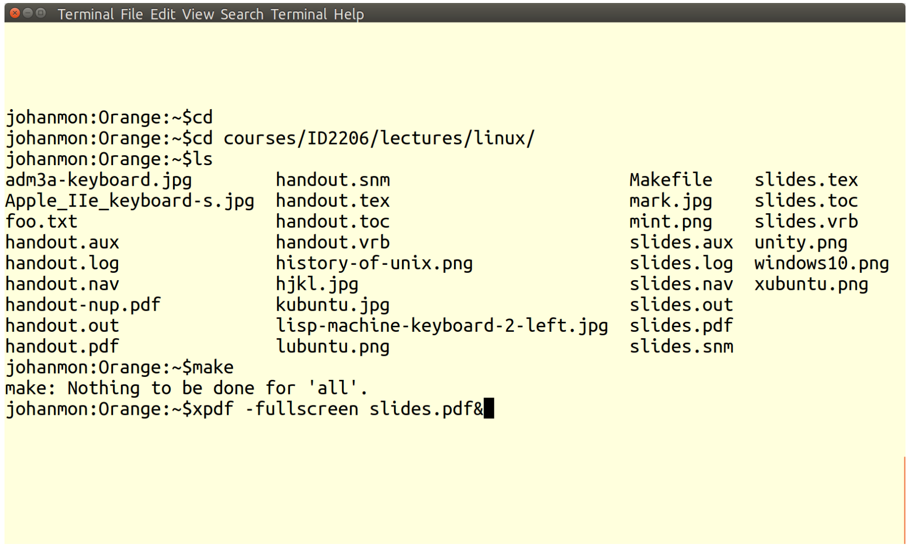
Some basic stuff

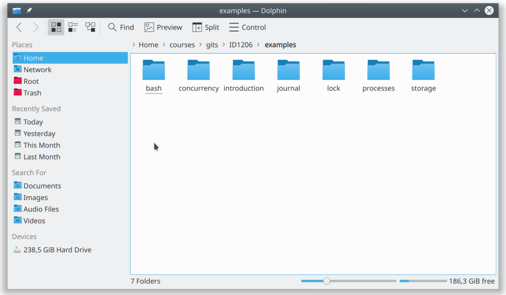
- the shell
- files and directories
- some tools: grep, wc, sed . . .
- write a thesis: gcc, latex, gnuplot, make
- environment variables

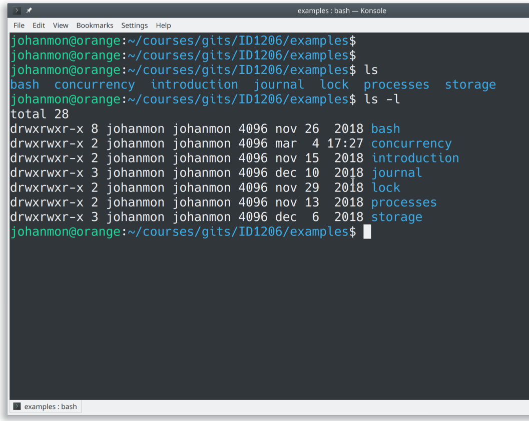
the shell



```
johanmon:Orange:~$cd
johanmon:Orange:~$cd courses/ID2206/lectures/linux/
johanmon:Orange:~$ls
adm3a-keyboard.jpg        handout.snm                     Makefile    slides.tex
Apple_IIe_keyboard-s.jpg  handout.tex                     mark.jpg    slides.toc
foo.txt                   handout.toc                     mint.png    slides.vrb
handout.aux               handout.vrb                     slides.aux  unity.png
handout.log               history-of-unix.png             slides.log  windows10.png
handout.nav               hjkl.jpg                        slides.nav  xubuntu.png
handout-nup.pdf           kubuntu.jpg                     slides.out
handout.out               lisp-machine-keyboard-2-left.jpg  slides.pdf
handout.pdf               lubuntu.png                     slides.snm
johanmon:Orange:~$make
make: Nothing to be done for 'all'.
johanmon:Orange:~$xpdf -fullscreen slides.pdf&
```

the file system





```
johanmon@orange:~/courses/gits/ID1206/examples$
johanmon@orange:~/courses/gits/ID1206/examples$
johanmon@orange:~/courses/gits/ID1206/examples$ ls
bash  concurrency  introduction  journal  lock  processes  storage
johanmon@orange:~/courses/gits/ID1206/examples$ ls -l
total 28
drwxrwxr-x 8 johanmon johanmon 4096 nov 26  2018 bash
drwxrwxr-x 2 johanmon johanmon 4096 mar  4 17:27 concurrency
drwxrwxr-x 2 johanmon johanmon 4096 nov 15  2018 introduction
drwxrwxr-x 3 johanmon johanmon 4096 dec 10  2018 journal
drwxrwxr-x 2 johanmon johanmon 4096 nov 29  2018 lock
drwxrwxr-x 2 johanmon johanmon 4096 nov 13  2018 processes
drwxrwxr-x 3 johanmon johanmon 4096 dec  6  2018 storage
johanmon@orange:~/courses/gits/ID1206/examples$
```

the directory

Commands that you should to know:

- `ls` - list files and directories
- `mkdir` - make a directory
- `rmdir` - remove a directory
- `cd` - change directory
- `pwd` - path of working directory
- `touch` - touch a file
- `rm` - remove a file
- `mv` - move a file
- `cp` - copy a file
- `ln` - create a link (soft/hard) to a file
- `stat` - information about a file

shell expansions

The shell will *expand* any input, depending on files in the directory, before issuing command.

- ~ precede by space - expands to home directory.
- * as in `*.c` - expands to a sequence of characters to matches files in the directory
- ? as in `f??.txt` - expands to any single character
- `[06]` as in `ID120[06].pdf` - expands one of the specified characters
- $ as in `$HOME` - expands to the *variable* value (more on this later)

Expansion can be controlled by enclosing arguments in single quotes `' '`*, double quotes* `" "` *(variables will be expanded) or precede character by backslash* `\`.

work with a text file

Some more or less simple ways to explore the content of a text file:

- `cat` - concatenate files
- `less` - less is of course more
- `head` - the beginning of a file
- `tail` - the end of a file
- `grep` - search a file for pattern
- `diff` - difference of two files
- `sort` - sort rows
- `wc` - word count
- `uniq` - remove duplicates
- `tr` - transpose char-by-char
- `sed` - stream editor
- `awk` - more powerful than sed

pipes and redirect

The shell can set a file as the standard input of a command or redirect the standard output and/or standard error.

- < as in `wc < foo.txt` will set standard input.
- > as in `ls > out.txt` will set standard output.
- 2> as in `grep foo bar.txt 2> err.txt` will set standard error.

The power of the UNIX shell is the concept of *pipes*.

```
grep typedef foo.c | sort | uniq | less
```

Standard output of one command becomes standard input of the next command

an example

Den bok jag nu sätter mig ner att skriva måste verka meningslös på många - om jag alls vågar tänka mig, att "många" får läsa den - eftersom jag alldeles självmant, utan någons order, börjar ett sådant arbete och ändå inte själv är riktigt på det klara med vad avsikten är.

```
2019 jag
1818 och
1505 att
1429 det
1045 i
 979 en
    :
```

from text to frequency list

Turn a raw text into and ordered frequency list.

- Remove special characters (.,?!;:-()") from text using `sed` or `tr`.
- Replace space by linefeed to turn the text into a list of words.
- Sort the list using `sort`.
- Remove duplicates but add frequency using `uniq`.
- Sort the result using `sort`.

Everything is of course connected using pipes.

Experiment yourself, the devil is in the details.

to write a thesis

Run the benchmark and save the result in a text file.

Use `gnuplot` to produce a graph.

Write the thesis, including the graph, using LaTeX.

Set up a `Makefile` to automate the process.

gnuplot

`gnuplot`

- generate graphs from data in text file (tab separated)
- interactive or from script
- not a program for statistics (for statistics use R)

LaTeX

`pdflatex`

- will let you focus on content
- easy to include content from other files
- generates pdf

make

`make`

- the work horse in any UNIX project
- script will set up the dependencies between files
- will run programs as needed to produce final output i.e "make"
- used for programming as well as documentation

shell variables

The shell maintains a set of variables that can be accessed from the shell, but not immediately from child processes.

- `set` - control the shell environment
- `<variable>=<value>` - defines a variable value
- `$<variable>` - access variable from shell

- `HOME` - home directory
- `PWD` - current directory
- `PATH` - paths searched when looking for executables
- `USER` - user name

the environment

The *environment* is a set variables that can be accessed by programs using the standard library function call `getenv()`.

The *shell* will set up a set of *exported* variables that will be visible as environment variables when a child process is created.

- `export <variable>` - make variable accessible from child process
- `printenv` - list all environment variables
- `env` - run command in specified environment

Functions from standard library.

- `getenv()` - get the value of variable
- `putenv()` - set the value of variable
- `execle()` - execute command in new environment
- `:` - there are more

package-configure-make-execute

package - a set of source files and scripts

configure - check that everything is available, build Makefile

make - make, compile, environment variables define the target

execute - execute, environment variables describe the session

Summary

- the shell - your interface to any UNIX system
- files and directories - learn to navigate the tree
- shell and environment variables
- work with text file, connect sequences with pipes

Do learn gnuplot, latex and make before starting your thesis.