Software Carpentry Course
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Automating tasks with the Unix shell

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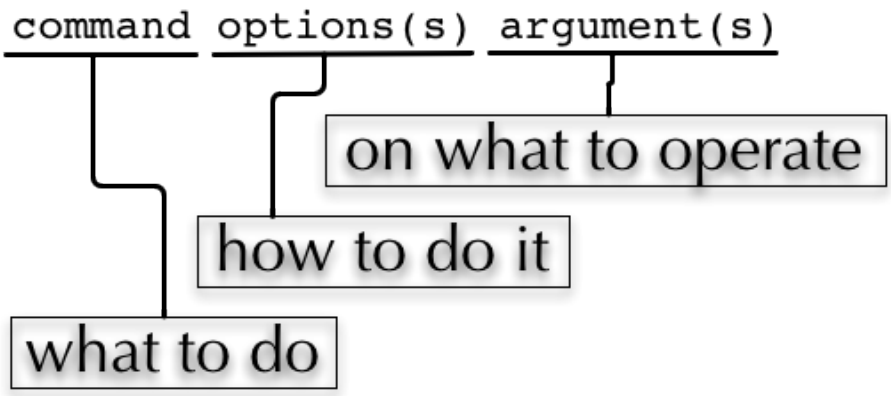
(based on previous work with Holger Dinkel, EMBL Heidelberg, see acknowledgements)

General Structure of Linux Commands



Commandline options are sometimes called commandline switches.

Most common form of commandline switches:

- Short form: `-h`
- Short for with additional parameter: `-f myfile`
- Long form: `--help`
- Long form with additional parameter: `--file=myfile`

Mixed forms and parameters without leading dash can also be encountered.

Getting Help

Help option: `cmd -h / cmd --help`
Manual page of a command: `man command`
List manpages containing a keyword in their description: `apropos keyword`
Files in /usr/share/doc

Who and Where am I?

Print your username: `whoami`
Print the name of the computer: `hostname`
Print the current working directory: `pwd`
Print current date and time: `date`

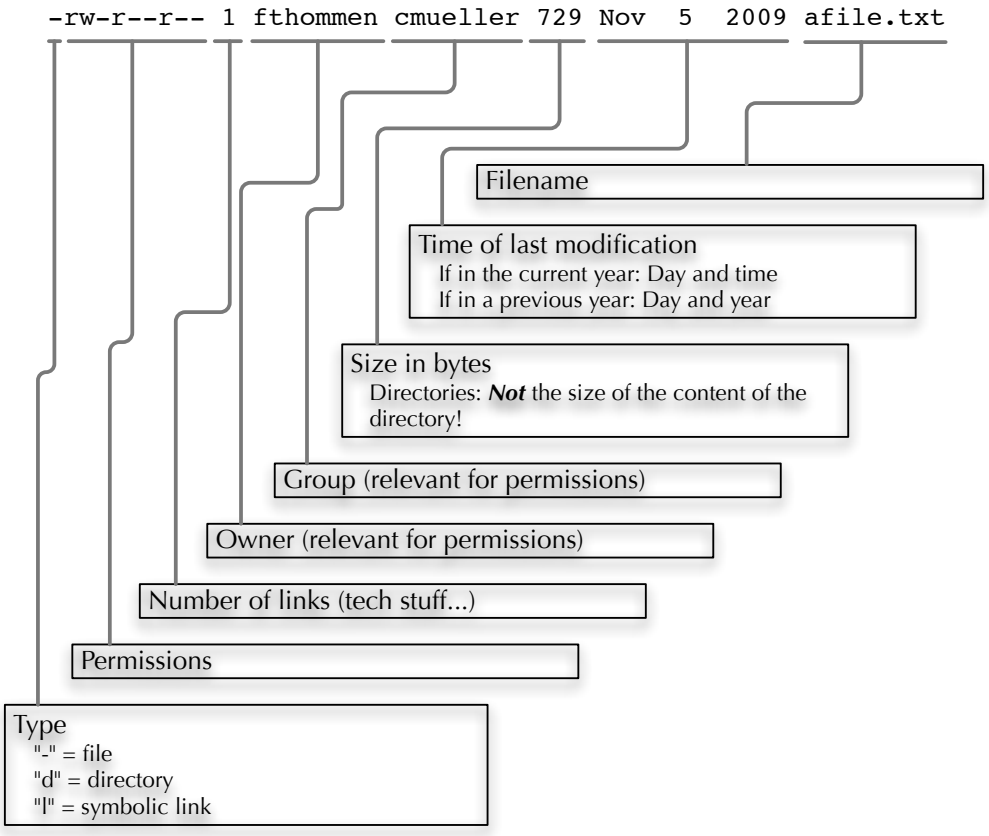
Moving Around

Change the working directory: `cd [new_directory]`

See What's Around

List directory contents: `ls [options] [file(s) or dir/s]`

-l (Long) / -1 (one column) / -a (all files) / -A (almost all files) / -F (show filetypes) / -d (directory information instead of directory content) / -t (most recent on top)



On shell globs
Files and folders can't only be referred to with their full name, but also with so-called "Shell Globs", which are a kind of simple pattern to address groups of files and folders. Instead of explicit names you can use the following placeholders:

?:	Any single character
*:	Any number of any character (including no character at all)
[…]:	One of the characters included in the brackets. Use "-" to define ranges of characters
[!…]:	*Not* one of the characters included in the brackets.
[^…]:	dito.
~:	User's homedirectory (only if first element of a path

On filenames
- Stick with lowercase names
- Don't use blanks in filenames
- Don't use other characters then alphabetic characters, numbers, "-", "." and "_"

Organizing Files and Folders

Remove files and directories:
```
rm [options] file(s)
rm -r [options] directory/ies
```
-i (interactive) / -r (recursion) / -f (force)

Dangerous command!

Move and rename files and folders:
```
mv [options] source dest
mv [options] file(s) dir
```
-i (interactive)

Dangerous command!

Create a new directory:
```
mkdir [options] directory
```

Remove an empty directory:
```
rmdir directory
```

Copy files and folders:
```
cp [options] src dest
cp [options] src(s) destdir
```
-r (recursion) / -i (interactive) / -p (preserve)

View Files

Print files on terminal (concatenate):
```
cat [options] file(s)
```

View and navigate files:
```
less [options] file(s)
```

Extracting Informations from Files

Find lines matching a pattern in files:
```
grep [options] pattern file(s)
```

-v (not matching lines) / -i (case insensitive) / -l (list filenames) / -L (list iles w/o matches) / -c (print counts of matching lines)

Print first lines of a textfile: `head [options] file(s)`

-n *num*

Print last lines of a textfile: `tail [options] file(s)`

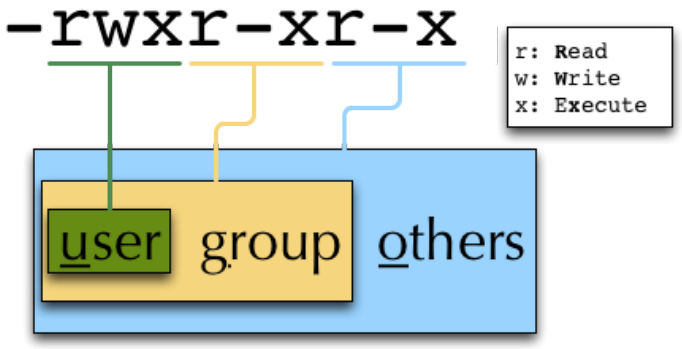
-n *num* / -f ("follow")

Useful Filetools

Search/find files in any given directory: `find [start] [filter]`

find is very powerful. Refer to the manual page for possible filters

Permissions



List Permissions: `ls -l file / ls -ld directory`

Set Permissions: `chmod [options] mode(s) files(s)`

The mode is composed of

Who		What		Which permission	
u:	user/owner	+:	add this permission	r:	read
g:	group	-:	remove this permission	w:	write
o:	other	=:	set exactly this permission	x:	execute
a:	all				

IO and Redirections

Redirect the output of one program into e.g. a file: (**Caution**: you can easily overwrite files by this!)

```
# date > file_containing_date
```

Append something to a file (rather than overwriting it):

```
# date >> file_containing_date
```

Feed the output of one program into the next progam

```
# ls -al | wc -l
```

Varia:

Display text on screen: `echo text`

for loop

```
for variable in list
do
  commands
done
```

if statement

```
if condition1
then
  commands
elif condition2
  more commands
[…]
else
  even more commands
fi
```

File conditions

`-e file`	*file* exists
`-f file`	*file* exists and is a regular file
`-d file`	*file* exists and is a directory
`-r file`	*file* exists and is readable
`-w file`	*file* exists and is writeable
`-x file`	*file* exists and is executable
`-s file`	*file* exists and has a size > 0

String Comparisons

`-n s1`	String *s1* has non-zero length
`-z s1`	String *s1* has zero length
`s1 = s2`	Strings *s1* and *s2* are identical
`s1 != s2`	Strings *s1* and *s2* differ
`string`	String *string* is not null

Integer Comparisons

`n1 –eq n2`	*n1* equals *n2*
`n1 –ge n2`	*n1* is greater than or equal to *n2*
`n1 –gt n2`	*n1* is greater than *n2*
`n1 –le n2`	*n1* is less than or equal to *n2*
`n1 –lt n2`	*n1* is less than *n2*
`n1 –ne n2`	*n1* it not equal to *n2*

Links and Further Information

- A full 500 page book about the Linux commandline for free(!): LinuxCommand.org (http://linuxcommand.org/)
- Another nice introduction: "A beginner's guide to UNIX/Linux" (http://www.mn.uio.no/astro/english/services/it/help/basic-services/linux/guide.html)
- The "commandline starter" chapter of an O'Reilly book: Learning Debian GNU/Linux – Issuing Linux Commands (http://oreilly.com/openbook/debian/book/ch04_01.html)
- A nice introduction to Linux/UNIX file permissions: "chmod Tutorial" (http://catcode.com/teachmod/)
- Linux Cheatsheets (http://www.cheat-sheets.org/#Linux)
- For the technically interested:
  Linux Filesystem Hierarchy Standard (http://www.pathname.com/fhs/) and Linux Standard Base (http://www.linuxfoundation.org/collaborate/workgroups/lsb)

Acknowledgements

- These pages are a very, very abbreviated version of a more detailed documentation of a Linux course given between 2013 and 2015 by Holger Dinkel and Frank Thommen at EMBL Heidelberg in the frame of the Bio-IT project. You can find the most recent handouts of this course at http://bio-it.embl.de in the "Courses" section
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