Karlsruhe Institute of Technology

Introduction to Linux: Command Line Interface – The basics

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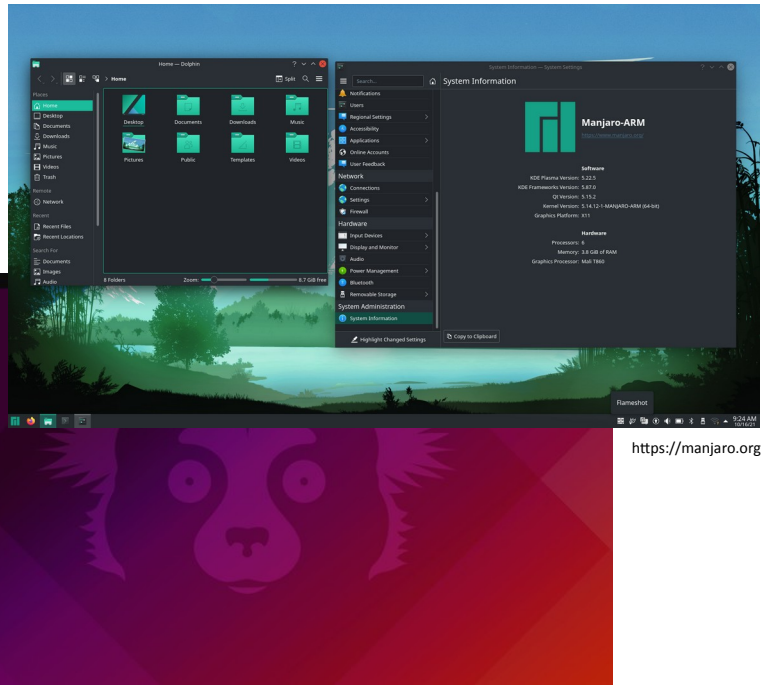
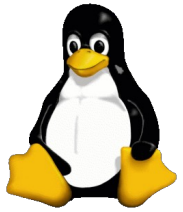
Linux

- Operating system
- **Kernel**: Layer between Hardware and (User-) software
- **Desktop Environment**
  - KDE
  - GNOME
  - …
- **Distribution**: software collection + package management system
  - Ubuntu
  - Manjaro
  - Fedora
  - …
  - Red Hat Enterprise Linux



https://manjaro.org

https://ubuntu.com



Command Line: Motivation

- Command-line interface (CLI) is often the most powerful and flexible way to interact with a computer
- Commands that tell the computer what to do
- These commands can be combined
- **HPC** context:
  - Often no GUI needed
  - Overhead of GUI
  - SSH access

- Shell: User interface for OS
  - Bash (other flavors exist)
  - Command line interpreter
  - **Scripting language** (!)
- Not Linux-only: Windows, MacOS, …

- You can feel like a real `haxxor`

What is this course about and what not?

We will present the *basics* of the command line:

- simple commands
- navigating
- some usability features
- no special command
- no programming (what you can do inside of the command line)

The command line interface

```
[projects]$ ls -l foo.txt
```

- prompt `[projects]$`
- command line `ls -l foo.txt`
  - command `ls`
  - option `-l`
  - argument `foo.txt`
  - cursor

The first command

```
$ echo hello bwHPC
hello bwHPC
$
```

Echo the STRING(s) to standard output.

```
$ echo hello             bwHPC
hello bwHPC
$
```

→ *Task:* Please do all examples by yourself.

Using *up-Arrow* for the last command. Use *double* or *single* quote to mark strings.

```
$ echo "hello             bwHPC"
hello           bwHPC
$ echo 'hello             bwHPC'
hello           bwHPC
$
```

Getting out of trouble

You can get in trouble by:

- unfinished typing of a command
- long or endless running command
- command expecting further input

Solution: holding Ctrl-Key (Strg) and pressing C. Short written as `Ctrl-C` or `^C` (remember as 'cancel')

If it is not working try `Ctrl-D` (remember as 'end of transmission', 'end of input'), `ESC` or just `q`.

→ *Task:* Try and exit the following commands:

- `$ echo "hello`
- `$ yes`
- `$ cat`

Effect of single and double quotes

Each variable begins with *$*. There are many variable set that defines the environment.

```
$ echo My home is $HOME
My home is /home/kit/scc/ab1337
```

→ *Task:* Try out the different effects of quoting by print out the variable `$HOME`.

Getting help

`$man echo` open the manual pages of the command `echo`. It uses `less` as a page viewer, where you can use the arrow keys to navigate.

less basics:

- `up & down arrow` Move up or down one line
- `spacebar` Move forward one page
- `q` quit
- `/<string>` search file for `<string>`.
- `n` Move to next search result.
- `N` Move to previous search result.
- `p` goto beginning of the file
- `h` help

→ *Task*: Find out how to print text without the newline at the end.

Summary

- `echo <string>` Prints string to screen.
- `man <command>` Displays manual page for command.
- `^C` Get out of trouble.
- *Up & down arrow* Scrolls through previous command history.

Manipulating files

Create files

```
$ touch foobar
$ touch foobaz
```

redirecting standard output (stdout) to a file:

- redirect operator > (overwrites files)
- append operator >>

```
$ echo "This is the first line." > foobar.txt
$ echo "This is the second line." >> foobar.txt
$ cat foobar.txt
This is the first line.
This is the second line.
```

Listing

```
$ ls
foobar  foobar.txt  foobaz
```

→ *Task:* What does `ls -lha` do? Try also `-t` and `-r`. Use different combinations.

Note: For short flags you can combine the flags instead of using `ls -l -h -a`. Long flags beginning with two dashes `ls --help`

Make life easier (Tab completion)

use the *tab key* ↹

```
$ cat f↹
```

expands to

```
$ cat fooba
```

twice tab print possible matches

```
$ cat fooba↹↹
```

foobar foobar.txt foobaz

```
$ cat foobar.↹
```

→ *Task:* Print out `foobar.txt` without typing to much. How many keystrokes are needed?

Make life easier (copy and paste by mouse)

```
$ ls
foobar  foobar.txt  foobaz
$ cat
```

Mark `foobar.txt` with mouse. Click middle mouse button to insert at cursor.

→ *Tasks:*

- Print out `foobar.txt`.
- What will happen when you print out `foobaz ` including the space after *z*?

Make life easier (reverse search)

Search the history.

```
$ ^R echo
(reverse-i-search)`echo': echo "This is the
second line." >> foobar.txt
```

- `^C` cancel
- `^R` previous search
- `Enter` run command
- `right arrow` select command for editing

→ *Task:* Insert a third line to `foobar.txt`.

Manipulating files: Rename, copy, delete

Moving

Moving a file will rename it.

```
mv foobaz test
$ ls
foobar  foobar.txt  test
```

Manipulating files: Rename, copy, delete

Copy from source to target

```
cp foobar.txt test_text.txt
$ ls
foobar  foobar.txt  test test_text.txt
```

Manipulating files: Rename, copy, delete

Remove

WARNING: It is deleted, really, no trash, nothing.

```
rm foobar.txt
$ ls
foobar  foobar.txt  test test_text.txt
```

Editors (nano)

A basic editor

```
$ nano test_text.txt
```

Help for some useful commands see bottom lines

Try `^K^K^U^U` to cut and uncut lines

exit nano

`^X` exits and asks for save changes, type `y`, type filename or press enter for current filename.

Editors (vim)

A much more powerful and very fast editor

```
$ vim test_text.txt
```

Press `i` to go to insert mode. Now you can type text.

exit vim

Press `ESC` to go back to the normal (command) mode. Type `:q` to quit. If you change something you have to write and quit `:wq` or force quit `:q!`.

LEARN vim!

`$ vimtutor` (-g language)

It takes 25-30 min. You can start at the end of this course.

Summary

- `>` Redirect output to filename
- `>>` Append output to filename
- `touch <file>` Create an empty file
- `cat <file>` Print contents of file to screen
- `ls` List directory or file
- `mv <old> <new>` Rename (move) from old to new
- `cp <old> <new>` Copy from old to new
- `rm <file>` Delete (remove) file (no recovery!)
- ⇥ Auto completion
- `^R` Reverse search
- `vimtutor` Tutor for learning vim

Directories

```
$ pwd
/home/kit/scc/ab1337
```

Prints the current working path, starting with the root directory `/` followed by the directories `home`, `kit`, `scc` and `ab1337`.

Create directory

```
$ mkdir text_files
$ mkdir example
```

This is relative. Paths are normally relative from the current working path. Absolute paths beginning with the root `/`.

Moving directories

Move files to directories

```
$ mv *.txt text_files/
$ ls text_files/
```

Use tabs! `*.txt` is a Wildcard matching all files ended on `.txt`.

Moving directories

Move (rename) directories

```
$ mv example/ data
$ ls
```

Changing directories (Navigation)

```
$ cd text_files/
$ cd ..
$ cd data
```

`cd ..` goes one directory up.

→ *Task:* Double check directories with `pwd` and `ls`.

Relative changing

A path beginning with `../` goes relative to the current working directory one directory layer for each `../` up. Try

```
$ cd ../text_files/
```

Tab completion adds automatically a `/` at end of directory name. (Don't matter at the moment.)

→ *Task:* create `foo/bar/` at once.

Special navigation

Moving to the last directory

```
$ cd -
```

Moving to the home directory

```
$ cd
$ cd ~
$ cd $HOME
```

`$HOME` is the already known variable for the home directory. See later courses for other path variables.

Copying directories

Add `-r` option for recursive

```
$ cd
$ mkdir foobar
$ cd foobar/
$ cp -r ../text_files .
$ ls
text_files
```

`.` is the current directory.

→ *Task:* What happens if you add a `/` to the source directory `../text_files/`?

```
$ cp -r ../text_files/ .
$ ls
text_files text.txt
```

Remember as `../text_files` is the directory and `../text_files/` is already inside the directory.

Remove directories

Add `-r` option for recursive

```
$ cd
$ rm -r foobar
```

Warning: Again, there is no warning, it will be deleted, not trash, nothing.

→ *Task:* Do not execute it! What are the options `-f` and `-r` are doing in `rm`? Why you should *NEVER* use `rm -rf /`?

Summary

- `mkdir <name>` Make directory with name
- `pwd` Print working directory
- `cd <dir>` Change to `<dir>`
- `cd ~/<dir>` cd relative to home
- `cd` Change to home directory
- `cd -` Change to previous directory
- `.` The current directory
- `..` One directory up
- `cp -r <old> <new>` Copy recursively
- `rm -r <dir>` Remove dir and content

Find files

→ *Task*: create some `.txt` files in different directories.

```
$ find . -name "*.txt"
```

Search recursively for files beginning in the current directory `.`, filter by name, only display files ending with `.txt`.

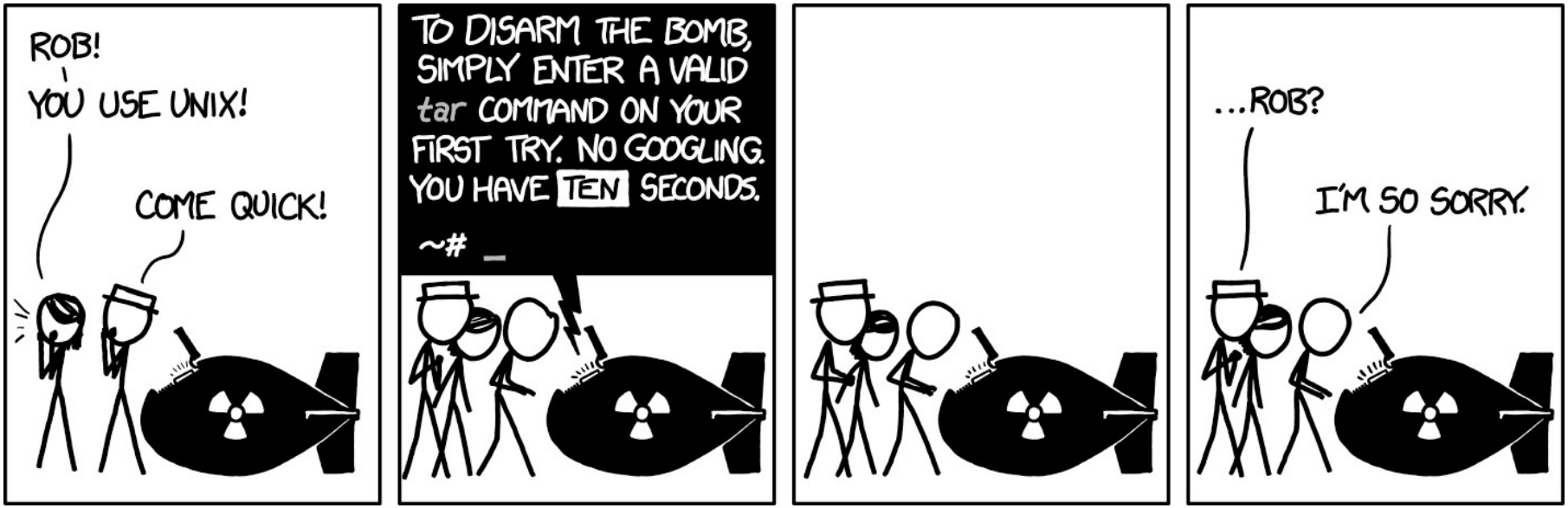
```
$ grep -r line
```

Search recursively (`-r`) for files and print lines containing `line`.

→ *Task*:

- Print line number of lines with 'first' using `grep`
- Print lines not containing 'first' using `grep`

Any Questions Left?



https://xkcd.com/1168