

Bioinformatics Practical
Part 1

Introduction to the Linux command line and Bash
scripting

MP235

Linux

- Wide array of operating systems based on the Linux kernel
- Free and open-source
- Reliable, modular and fast
- Widely used for special applications such as high-performance computing and web servers

Command Line Interfaces

```
Last login: Wed Sep  7 11:38:13 2022 from 62.143.226.57
krockenb@lummerland:~$ ssh -i kerocken92_ecdsa ubuntu@134.176.27.78 -p 30007
```

```

_ _ | _ _ | _ \ | _ _ ) _ _ |      de.NBI cloud
/_ _ / _ _ ) | _ _ \ | _ _ |      http://cloud.denbi.de
\_ _ \ _ _ ( ) \ _ _ / _ _ |      cloud@denbi.de

```

```
Welcome to Ubuntu 22.04 LTS (GNU/Linux 5.15.0-37-generic x86_64)
```

- * Documentation: <https://help.ubuntu.com>
- * Management: <https://landscape.canonical.com>
- * Support: <https://ubuntu.com/advantage>

System information as of Thu Sep 8 05:22:30 UTC 2022

```
System load: 0.1 Processes: 199
Usage of /: 13.3% of 19.76GB Users logged in: 0
Memory usage: 1% IPv4 address for ens3: 192.168.1.7
Swap usage: 0%
```

* Super-optimized for small spaces - read how we shrank the memory footprint of MicroK8s to make it the smallest full K8s around.

<https://ubuntu.com/blog/microk8s-memory-optimisation>

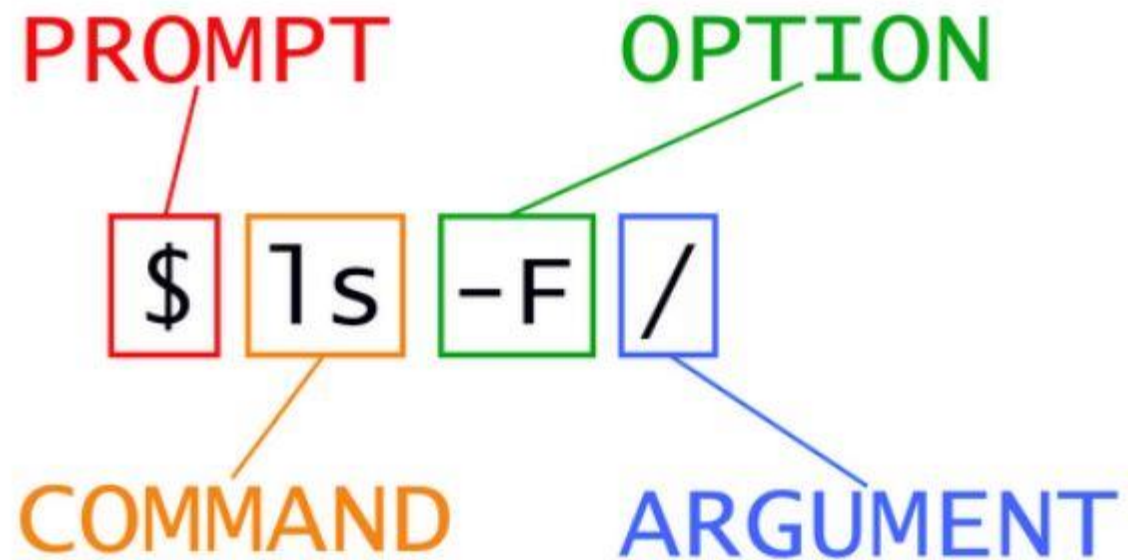
```
40 updates can be applied immediately.  
To see these additional updates run: apt list --upgradable
```

*** System restart required ***

```
Last login: Wed Sep  7 09:38:17 2022 from 192.168.1.110
ubuntu@fastrutherford-e8e3b:~$
```

- Allows for automation and efficient interaction with the machine
- Shell mediates between user and machine
- Standard shell in Linux is called Bash

Command Syntax



- Short and long form options
- Short options start with „-“ and can be strung together
- Long options often start with „--“
- Both commands and options can take arguments

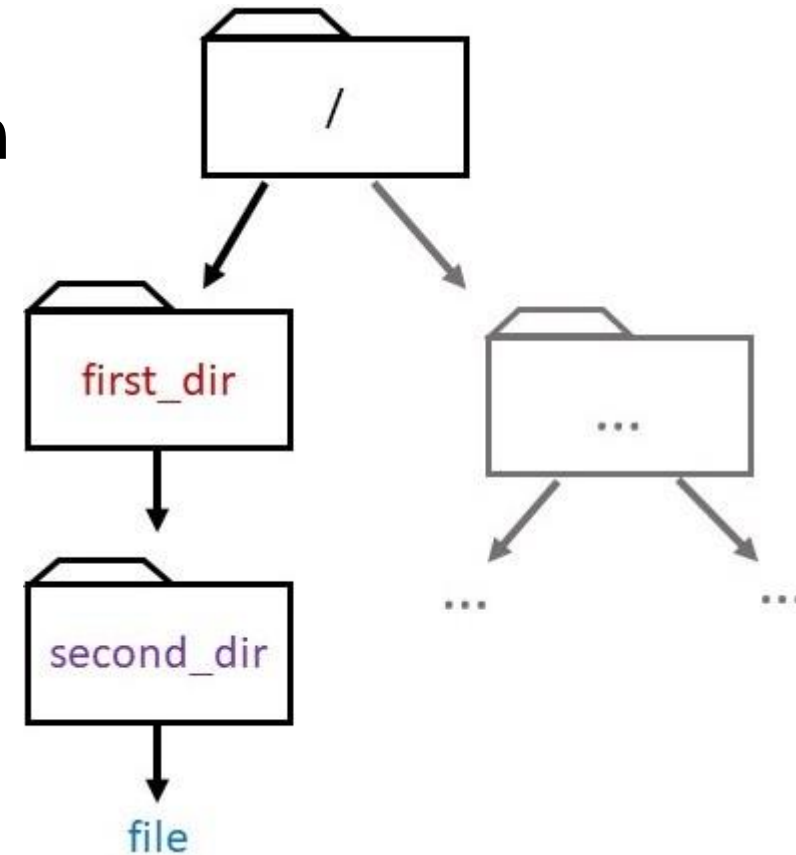
The Linux File system

- Hierarchical organization of files
- Each file is associated with an **absolute path** starting from the **root directory**

/first_directory/second_directory/file

↑ ↑ ↑

root parent directory subdirectory



The Linux File system

- You always operate from some location within the file system!
- The default location is your home directory
- The current location at any point in time is called the working directory
- **relative paths** start from **your working directory**
(do not start with “ / ”)

directory_within_working_directory/file

Navigating the File System

`pwd` shows your present working directory

`ls` lists contents of your working directory

`cd` changes the working directory

`ll = ls -laF`

Shortcuts

- / the root directory
- ~ your home directory
- the last directory you were in
- . the present working directory
- .. the parent directory of the working directory

Exercise 6.4

practical exercise

Exercise 6.5

theoretical exercise

Exercises of Section 1

Working With Files and Directories

`mkdir` create a directory

`touch` create a file

`mv` move files and directories within the
file system

`cp` copy files and directories

`rm` remove files and directories

Exercises of Section 2

Pipes and Filters

`wc` count characters, words and lines

`sort` sort contents

`uniq` filter out adjacent matches

`|` redirect output into another command

`>` redirect output into a file

`>>` ???

Displaying Contents

echo print a string onto the screen

cat print contents of a file

less browse through content of a file

head print the first few lines of a file

tail print the last few lines of a file

Exercises of Section 3

Loops

Iterate over a list of items.

Very useful when performing repetitive tasks.

```
for item in list_of_items  
do  
    operation_using $item  
done
```


Exercises for Section 4

Bash Scripting

- Save sequences of shell commands for later usage in a file ending in .sh
- Fewer chances for typos
- Better reproducibility
- Easier debugging and rerunning of pipelines
- Write comments to let users (your future self) know what the script does!

```
# Everything behind this symbol does not get  
# interpreted by the shell
```

Bash Scripting

`nano` opens text editor

`bash` runs a bash script

Within nano:

`Ctrl+X (^X)` closes nano

`Ctrl+O (^O)` saves progress

`Alt+U (M-U)` undo last change

Exercises for Section 5

Finding Things

grep find lines containing a pattern

special symbols:

^ find pattern at the beginning of the line

\$ find pattern at the end of the line

find find files and directories

Exercises for Section 6