

# Introduction to Linux

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# Outcomes

# Outcomes

**1. Be familiar with Linux terminal and Bash language**

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- 2. Be able to manipulate files and directories using command lines**

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- 1. Be familiar with Linux terminal and Bash language**
- 2. Be able to manipulate files and directories using command lines**
- 3. Be able to combine commands**

# How familiar are you with Bash, Unix and Command Lines?

**Go to this link:**

**<https://jamboard.google.com/d/10vAn-xCzZQOFhO9-5lf6smzwh7l7DhF0o8YQ7-H3b5s/edit?usp=sharing>**

**Draw a cross where the statement is reflecting your answer**

# Linux - What is it?

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## Open source Unix-like operating system

- Created by Linus Torvalds in 1991





# Linux - What is it?

## Open source Unix-like **operating system**

- Created by Linus Torvalds in 1991

Software that directly manages a system's hardware and resources (CPU, memory, storage)  
Makes the connections between all of your software and the physical resources

# Linux - What is it?

## Open source **Unix-like** operating system

- Created by Linus Torvalds in 1991

**UNIX:** Operating system developed in the 70's  
Published in 1973  
by Ken Thompson and Dennis Ritchie



# Linux - What is it?

## Open source Unix-like operating system

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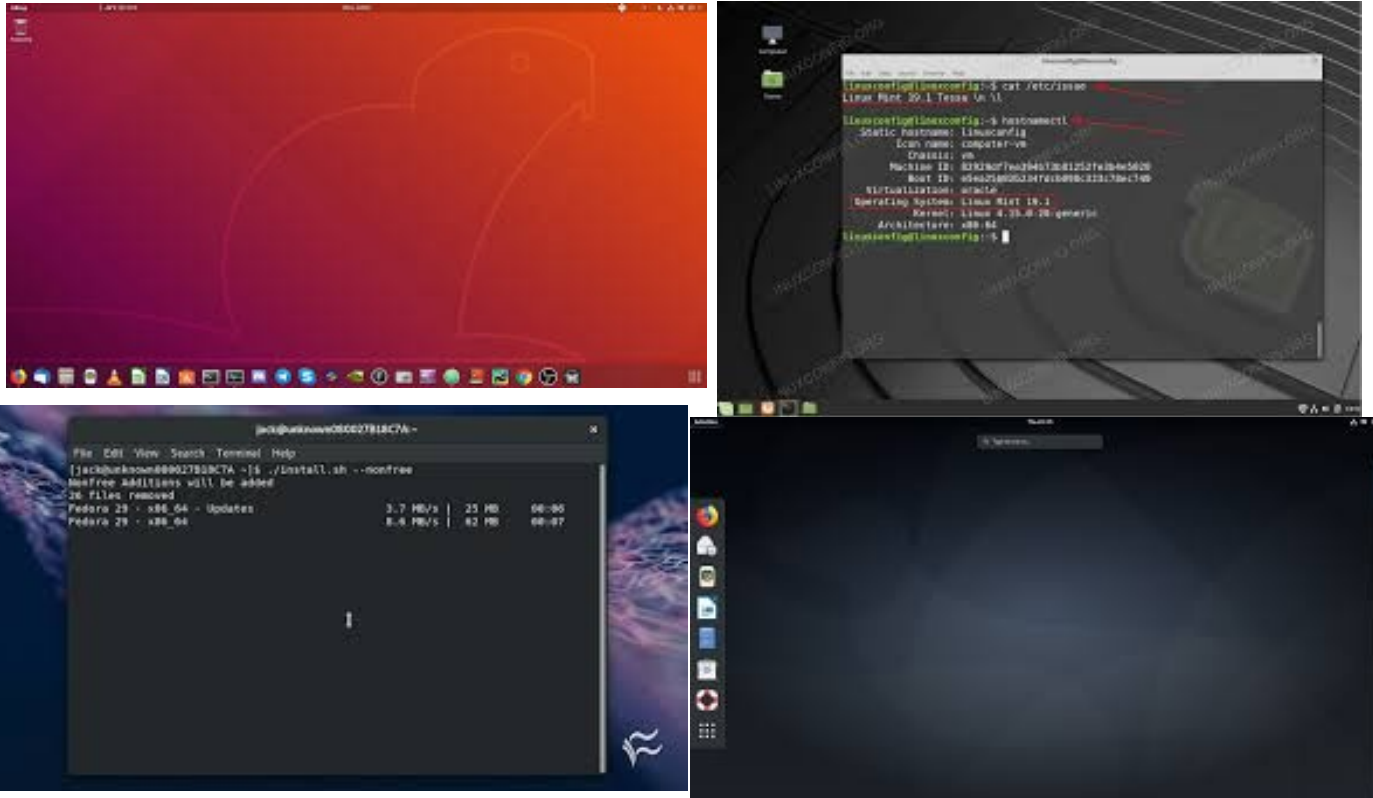
Under GNU General Public license:  
Anyone can download, use,  
share and modify the OS

As of 2006, ~2% of the Linux was written  
by Torvalds himself, because thousands  
have contributed

# Linux - What is it?

## Different versions or distributions

- Linux mint, Manjaro, Debian, Ubuntu, Antergos, Solus, Fedora



# Bash - What is it?

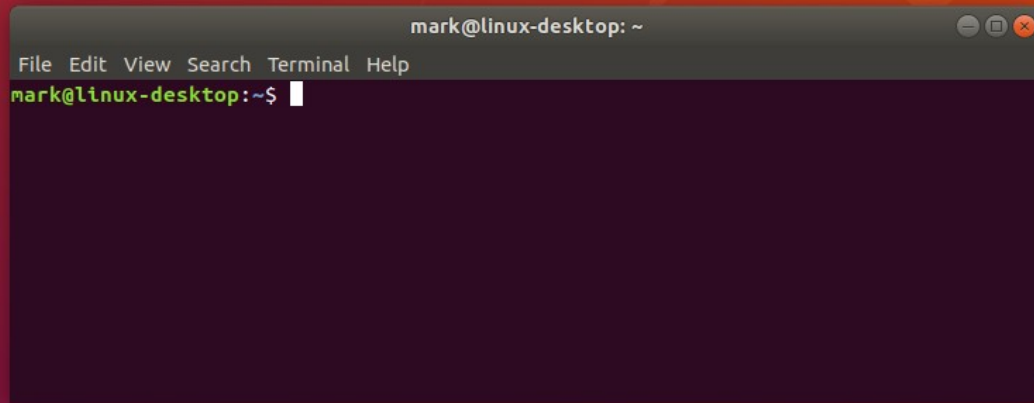
# Bash - What is it?

**Command language for Unix systems**

# Bash - What is it?

## Command language for Unix systems

- Bash commands in a terminal
  - "terminal", "command", "prompt", "shell"
  - Ctrl-Alt-T
- Bash reads and executes commands from a shell script



```
1 #!/bin/bash
2
3 if [ "$1" = "back" ]; then
4     sshcommand="user-backend@11.11.11.11"
5 elif [ "$1" = "front" ]; then
6     sshcommand="user-frontend@22.22.22.22"
7 else
8     echo "server side required"
9     exit 1
10 fi
11
12 echo "will execute"
13 echo "ssh $sshcommand"
```

# Just to quickly check

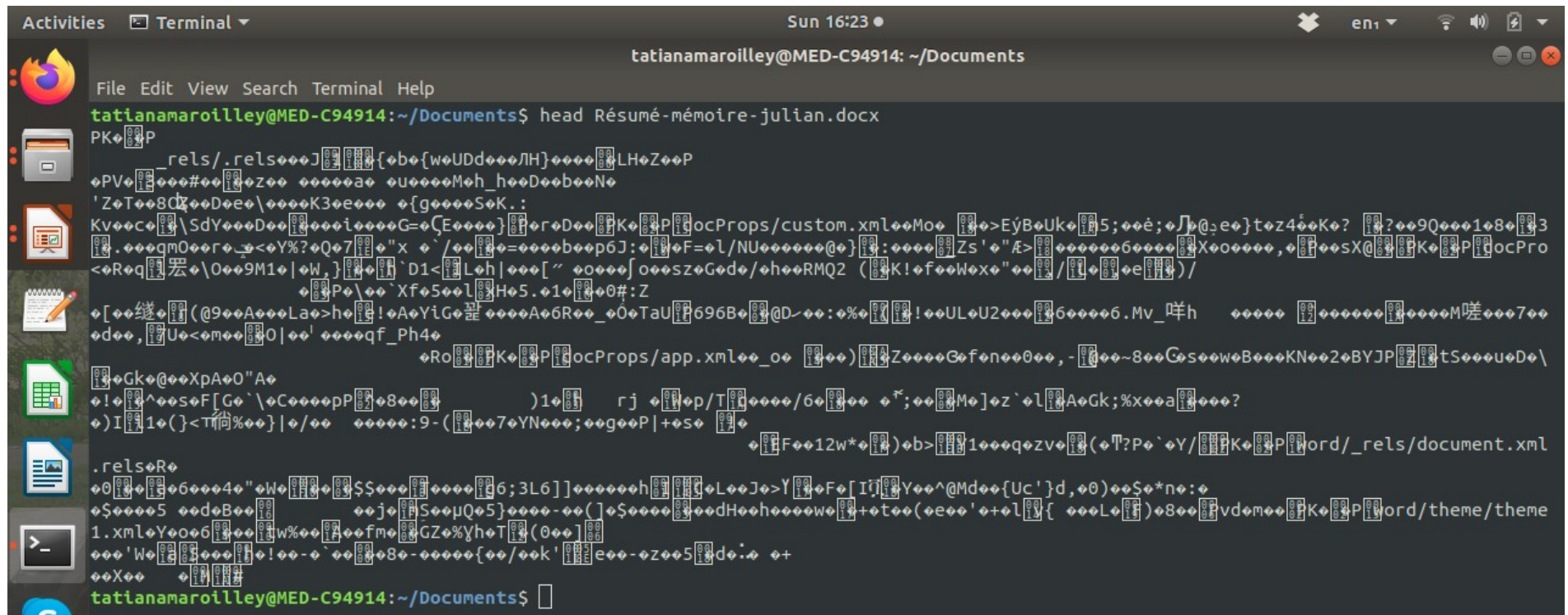
- **Turn off your camera**
- **Open a terminal**
- **Once done, turn on your camera**

**If you are having trouble getting a terminal to work with, this is the right time to shout out for help!**



# Tips before we start

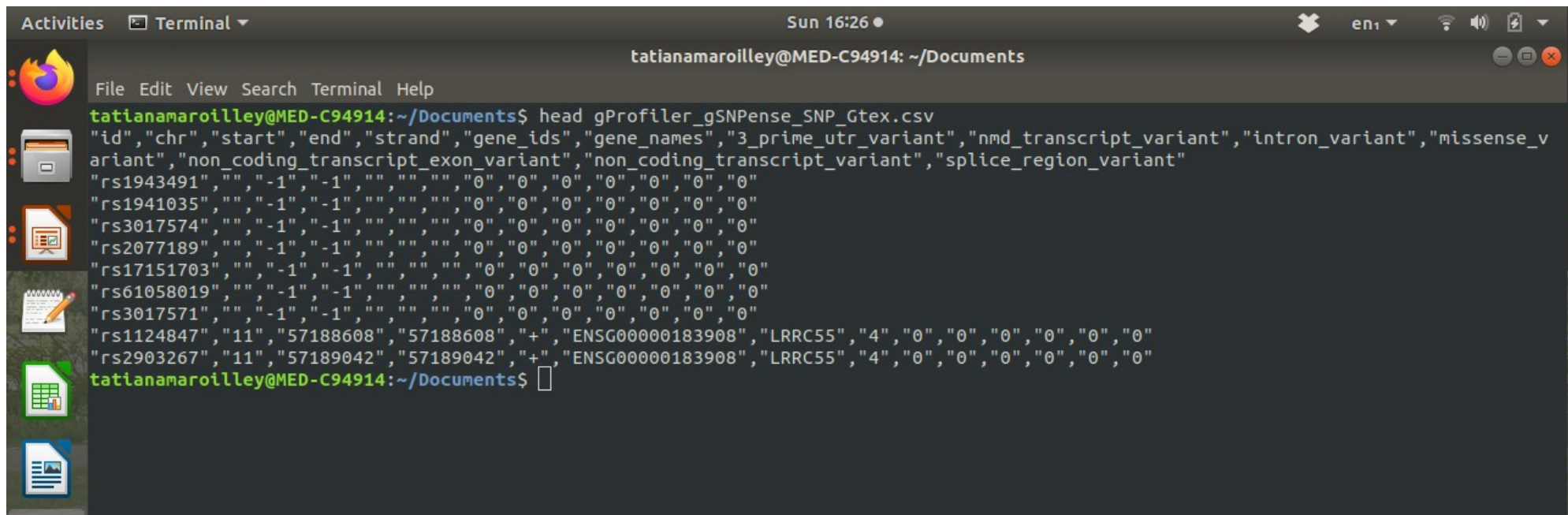
# Word/Excel files aren't readable by Linux terminal



# Tips before we start

## Word/Excel files aren't readable by Linux terminal

- Excel sheet: export it as .csv



```
Activities Terminal ▾ Sun 16:26 ● en1 🔊 🔌
tatianamaroille@MED-C94914: ~/Documents

File Edit View Search Terminal Help
tatianamaroille@MED-C94914:~/Documents$ head gProfiler_gSNPense_SNP_Gtex.csv
"id","chr","start","end","strand","gene_ids","gene_names","3_prime_utr_variant","nmd_transcript_variant","intron_variant","missense_v
ariant","non_coding_transcript_exon_variant","non_coding_transcript_variant","splice_region_variant"
"rs1943491","","-1","-1","","","","0","0","0","0","0","0","0"
"rs1941035","","-1","-1","","","","0","0","0","0","0","0","0"
"rs3017574","","-1","-1","","","","0","0","0","0","0","0","0"
"rs2077189","","-1","-1","","","","0","0","0","0","0","0","0"
"rs17151703","","-1","-1","","","","0","0","0","0","0","0","0"
"rs61058019","","-1","-1","","","","0","0","0","0","0","0","0"
"rs3017571","","-1","-1","","","","0","0","0","0","0","0","0"
"rs1124847","11","57188608","57188608","+","ENSG00000183908","LRRC55","4","0","0","0","0","0","0"
"rs2903267","11","57189042","57189042","+","ENSG00000183908","LRRC55","4","0","0","0","0","0","0"
tatianamaroille@MED-C94914:~/Documents$
```

# Tips before we start

**Tab completion will save you time**

# Tips before we start

## Tab completion will save you time

- Works for commands, file and directory names
  - 1) Type only the first letters of command/filename
  - 2) Push TAB
    - Linux will complete it if only one fits
    - If multiple hits, will draw a list of the possibilities

# Tips before we start

## Tab completion will save you time

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# Tips before we start

**Keep track of commands that worked well**

# Tips before we start

## Keep track of commands that worked well

- You do not want to spend another hour to find again how to do it
- Text file, Word file... what is comfortable for you



# Workshop

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- **Videos to present commands + Tips**

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- **Videos to present commands + Tips**
- **Directory containing**
  - Assignment with steps and questions to be answered
  - Index of commands
  - Data necessary for the workshop
  - Slides
  - Link to a video that summarizes commands and how to use them

# Workshop

- **Videos to present commands + Tips**
- **Directory containing**
  - Assignment with steps and questions to be answered
  - Index of commands
  - Data necessary for the workshop
  - Slides
  - Link to a video that summarizes commands and how to use them
- **Time in breakout rooms to work on assignment step by step**

# Assignment

- **10 questions**
- **To get full mark:**
  - Answer
  - Command / code used to find the answer
- **To be completed before tomorrow - 9am**
  - D2L
- **If you find different commands to answer one question, report them all - Bonus!**

# Tip #1

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**Any problem you are facing, someone probably already faced it**

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## **Any problem you are facing, someone probably already faced it**

- 1) Ask Google – How to ..... on Linux
- 2) Ask your peers and supervisors
- 3) Bioinformatics forums – StackOverFlow, BioStar
- 4) Contact the developers

# Get Data for our workshop

**GitHub - [github.com](https://github.com)**

# Get Data for our workshop

## **GitHub - [github.com](https://github.com) (Linus Torvalds)**

- Code hosting platform
- Version control and collaboration
- Project repository – Public or private

# Get Data for our workshop

## GitHub - github.com (Linus Torvalds)

- 1) Open terminal
- 2) Is Git installed?
  - 1) NO – install git
  - 2) YES – **git clone [https://github.com/tmaroilley/Linux\\_Course](https://github.com/tmaroilley/Linux_Course)**
- 3) No working?
  - 1) Go to [https://github.com/tmaroilley/Linux\\_Course](https://github.com/tmaroilley/Linux_Course)
  - 2) > Code
  - 3) > Download ZIP
  - 4) Extract files

# Basic commands

# Assignment #1

**Open Linux\_Course/assignment/assignment.txt with your favourite editor**

**Do Steps #1 to #4**



# Assignment #1

**Open `Linux_Course/assignment/assignment.txt` with your favourite editor**

**Do Steps #1 to #4**

# Management of files and directory

## Tip #2

**Name your files and directory wisely**

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- No space

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- Delimiters: \_.-

## Tip #2

### **Name your files and directory wisely**

- No space
- Delimiters: \_.-
- The user choose the extension of the file – not necessary for Linux to access the file
  - .txt, .tsv, .csv, .bed, .fa, .vcf ...

## Tip #2

### **Name your files and directory wisely**

- No space
- Delimiters: `_` `.` `-`
- The user choose the extension of the file – not necessary for Linux to access the file
  - `.txt`, `.tsv`, `.csv`, `.bed`, `.fa`, `.vcf` ...
- Case sensitive
  - Avoid: `MyFiLNaMe.txt` – Prefer `myfilemane.txt` or `my_filename.txt`

# Assignment #2

**Do Steps #5 to #8**

**Breakout rooms - 10'**



# Manipulating files

## Tip #3

### Modifying files with command lines

## Tip #3

### **Modifying files with command lines**

- Any change is definitive - No UNDO button

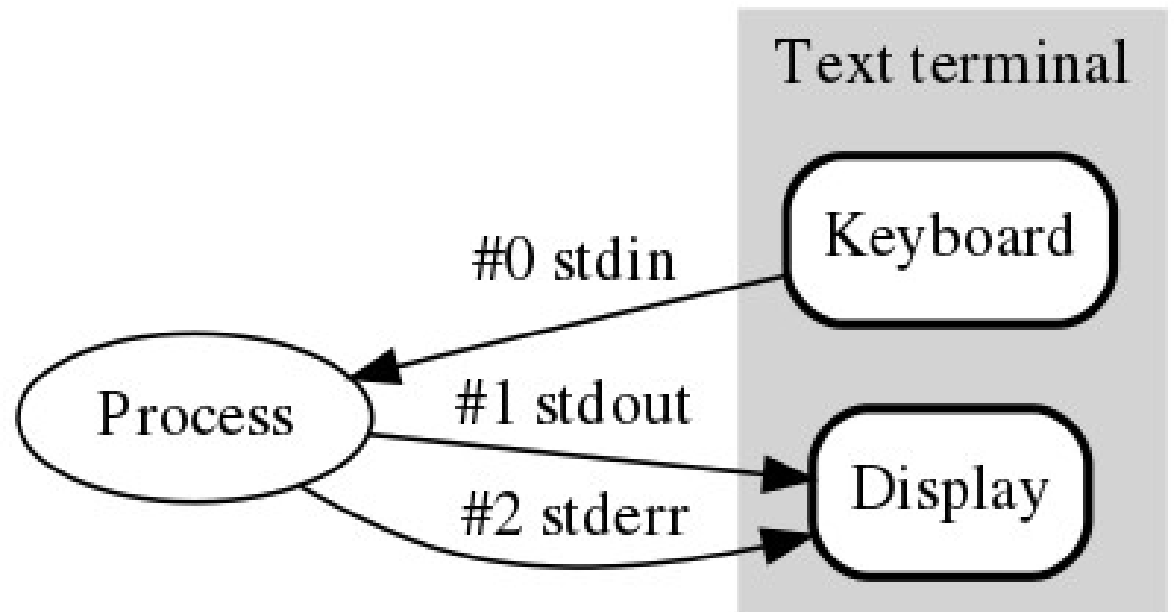
## Tip #3

### **Modifying files with command lines**

- Any change is definitive - No UNDO button
- Make a copy of the original file

# Streams - Flux of data

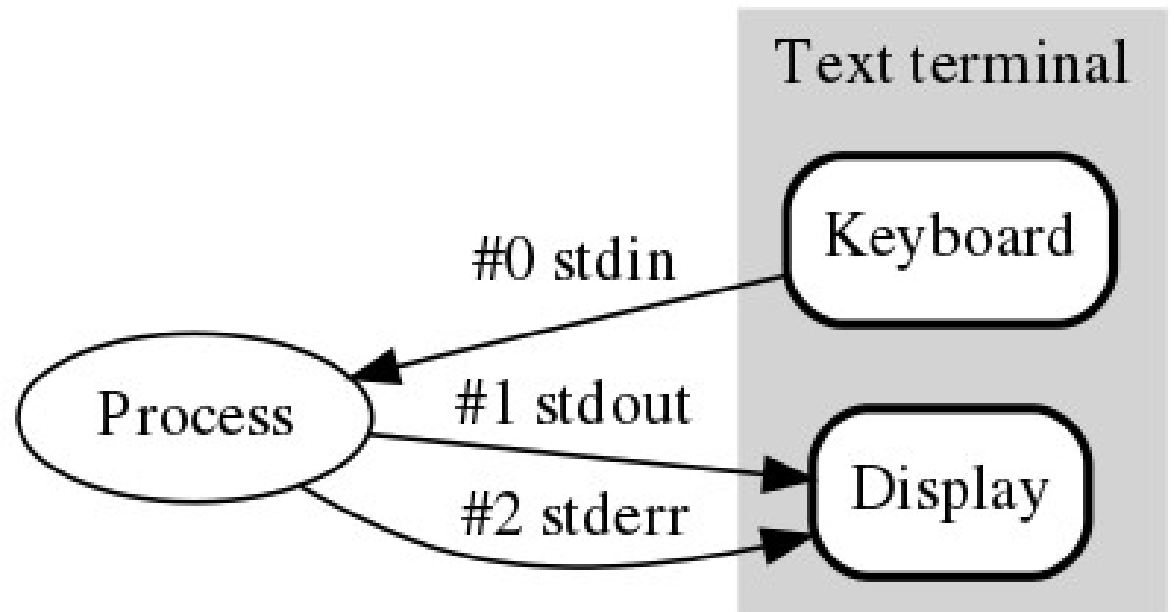
**3 standard streams established when a command is executed:**



# Streams - Flux of data

## 3 standard streams established when a command is executed:

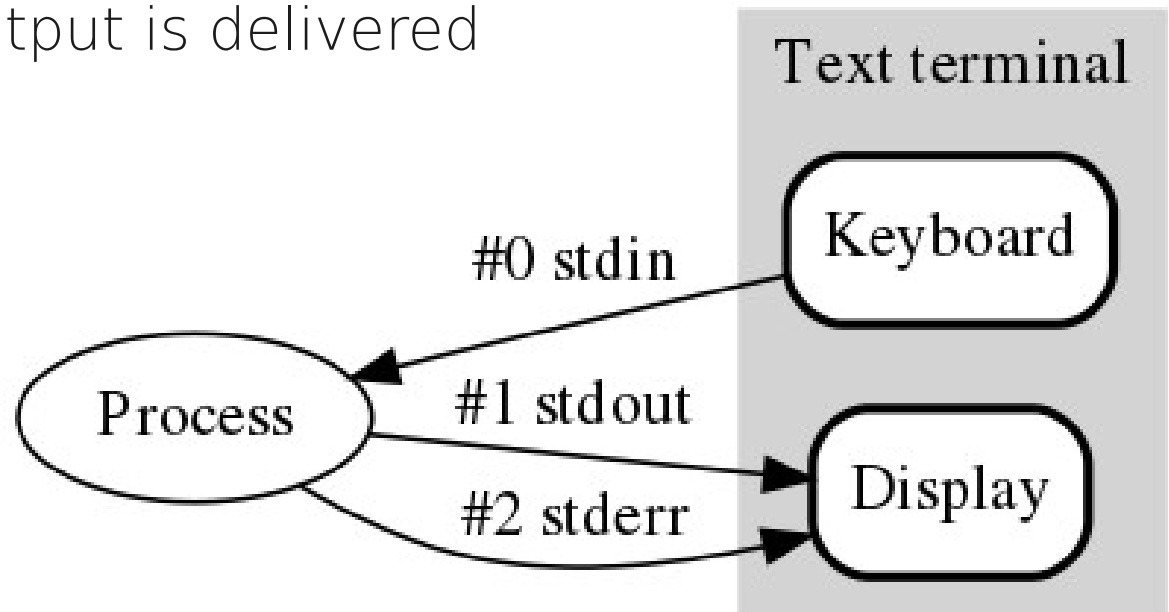
- STDIN: standard input stream



# Streams – Flux of data

## 3 standard streams established when a command is executed:

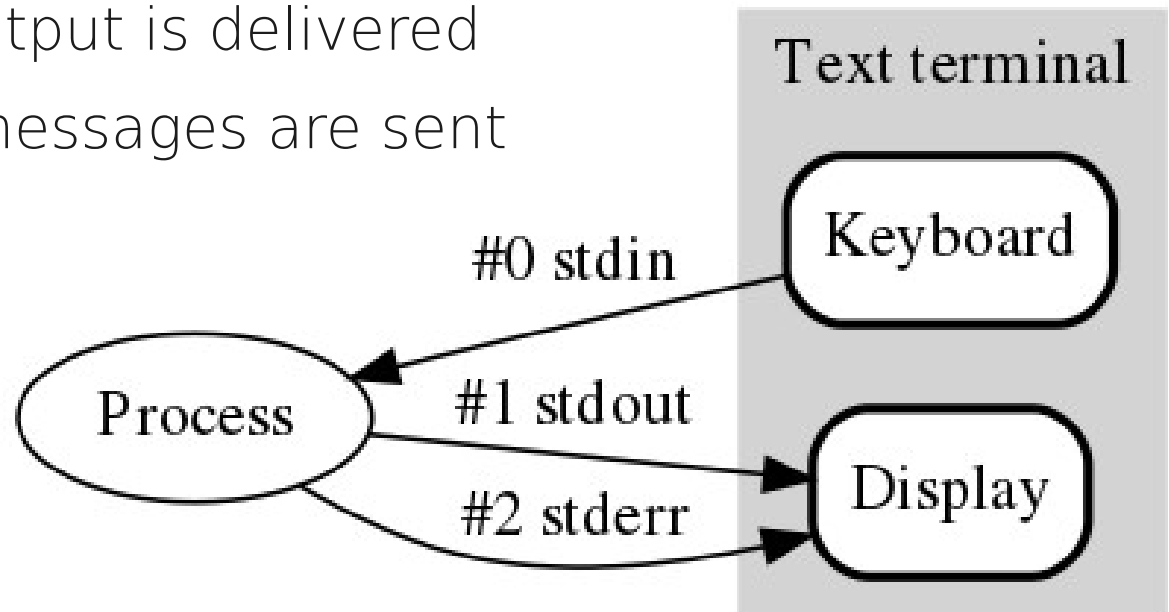
- STDIN: standard input stream
- STDOUT: where text output is delivered



# Streams – Flux of data

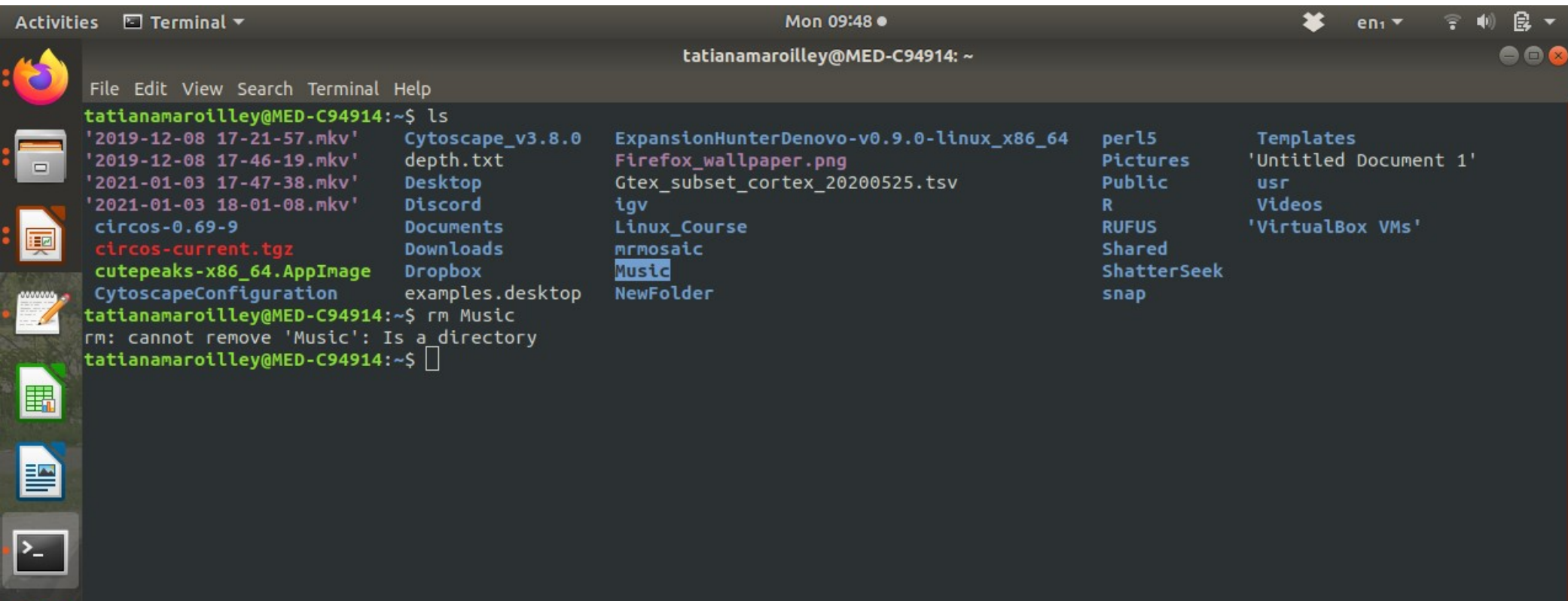
## 3 standard streams established when a command is executed:

- STDIN: standard input stream
- STDOUT: where text output is delivered
- STDERR: where error messages are sent





# Streams – Flux of data



The screenshot shows a Linux terminal window with a dark theme. The window title is "tatianamaroilley@MED-C94914: ~". The terminal output shows a directory listing of the home directory. The files and directories are listed in two columns. The first column contains files like '2019-12-08 17-21-57.mkv', '2019-12-08 17-46-19.mkv', '2021-01-03 17-47-38.mkv', '2021-01-03 18-01-08.mkv', 'circos-0.69-9', 'circos-current.tgz', 'cutepeaks-x86\_64.AppImage', and 'CytoscapeConfiguration'. The second column contains directories like 'Cytoscape\_v3.8.0', 'depth.txt', 'Desktop', 'Discord', 'Documents', 'Downloads', 'Dropbox', 'examples.desktop', 'ExpansionHunterDenovo-v0.9.0-linux\_x86\_64', 'Firefox\_wallpaper.png', 'Gtex\_subset\_cortex\_20200525.tsv', 'igv', 'Linux\_Course', 'mrmosaic', 'Music', and 'NewFolder'. The third column contains directories like 'perl5', 'Pictures', 'Public', 'R', 'RUFUS', 'Shared', 'ShatterSeek', and 'snap'. The fourth column contains directories like 'Templates', ''Untitled Document 1'', 'usr', 'Videos', and ''VirtualBox VMs''. The terminal shows the command 'ls' being executed, followed by the command 'rm Music'. The output of 'rm Music' is 'rm: cannot remove 'Music': Is a directory'. The prompt 'tatianamaroilley@MED-C94914:~\$' is shown at the end of the line.

```
tatianamaroilley@MED-C94914:~$ ls
'2019-12-08 17-21-57.mkv'  Cytoscape_v3.8.0  ExpansionHunterDenovo-v0.9.0-linux_x86_64  perl5  Templates
'2019-12-08 17-46-19.mkv'  depth.txt          Firefox_wallpaper.png  Pictures  'Untitled Document 1'
'2021-01-03 17-47-38.mkv'  Desktop           Gtex_subset_cortex_20200525.tsv  Public   usr
'2021-01-03 18-01-08.mkv'  Discord           igv                             R         Videos
circos-0.69-9              Documents         Linux_Course              RUFUS    'VirtualBox VMs'
circos-current.tgz         Downloads        mrmosaic                 Shared   ShatterSeek
cutepeaks-x86_64.AppImage  Dropbox          Music                    ShatterSeek  snap
CytoscapeConfiguration    examples.desktop NewFolder
```

```
tatianamaroilley@MED-C94914:~$ rm Music
rm: cannot remove 'Music': Is a directory
tatianamaroilley@MED-C94914:~$
```

# Streams – Flux of data

## Redirection of **STDOUT** into files

- `head FILE > output.txt`
  - Send the 10 first lines into output file - created or overwritten
- `head FILE >> output.txt`
  - If output.txt exists, add STDOUT at the end of it

# Assignment #3

**Do Steps #9 to #12**

**Breakout rooms - 15'**

# More complex commands

# Combining commands

## Redirection of **STDOUT** as input to another command

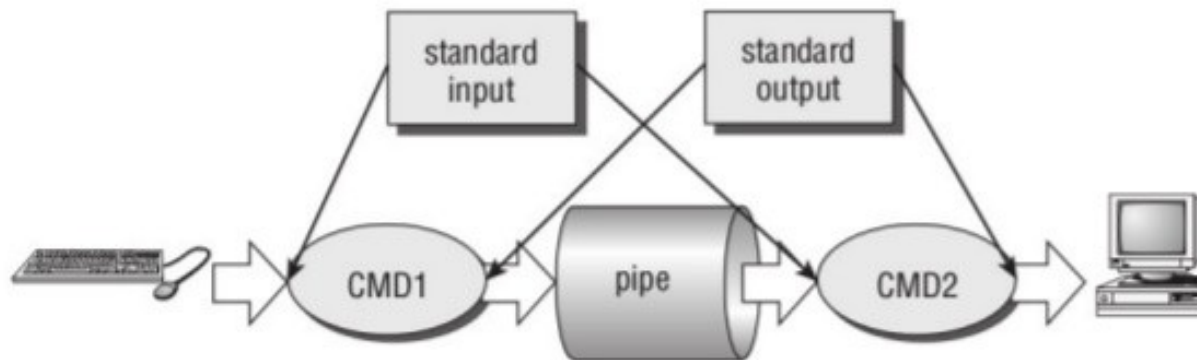
- `comm -1 -2 <(sort file1.txt) <(sort file2.txt)`

# Combining commands

## Pipe

The second command will be apply on the output of the first one

- `cut -f2 mart_export.txt | sort | uniq | wc -l`
- `grep ATX3 mart_export.txt | awk '{print $1"\t"$4}' | sort | head`



# Assignment #4

**Do Steps #13 to #15**  
**Breakout rooms - 20'**

# The end

**Please send your assignment by tomorrow 9am**

- D2L

**•Questions?**