Linux's advanced notions

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Math

Math in Bash base

Arithmetic operations in bash can only be performed on integers.

```
$(( INT OPERATION_TYPE INT))

# Ex 1: simple addition
username@hostname:~$ echo $(( 2 + 2 ))
4
username@hostname:~$ foo=$(( 2 + 2 ))
username@hostname:~$ echo $foo
4
username@hostname:~$ echo $(( $foo + 2 ))
6
```

Math in Bash operation type

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- addition : `+`
- substration : `-`
- multiplication : `*`
- division : `/`

Round in bash math

Bash rounds the result of operations “down” to get an integer.

```
username@hostname:~$ echo $(( 9 / 3 ))
3
username@hostname:~$ echo $(( 10 / 3 ))
3
```

Bc

If you need to perform arithmetic operation with float you need `bc` with its scale option
:

The syntax is as follows:

```
username@hostname:~$ echo "scale=3;10/3" | bc
3.333
username@hostname:~$ echo "scale=2;10/3" | bc
3.33
username@hostname:~$ echo "scale=1;10/3" | bc
3.3
```

Sequences

Sometimes it's usefull to generate a sequence of integer from a start to an end point. You can use the `seq` command to do so.

Example :

```
username@hostname:~$ seq 1 10
1
2
3
4
5
6
7
8
9
10
```

The flows

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- The input stream *"stdin"*
- The standard output stream *"stdout"*
- The error output stream *"stderr"*

Stdin

This is an invisible but very useful feed. It’s an input data of a command, generally from the keyboard or from another command.

Stdin (example)

Read from the keyboard gradually:

```
username@hostname:~$ sort << ENDSORT
> toto
> titi
> tata
> ENDSORT
tata
titi
toto
```

Terminal wait for some text. As long as the character string != keyword (here ENDSORT), continue. All data sent to `sort` until ENDSORT keyword detected. The result `sort` will be in its stdout. We can modify the stdout :

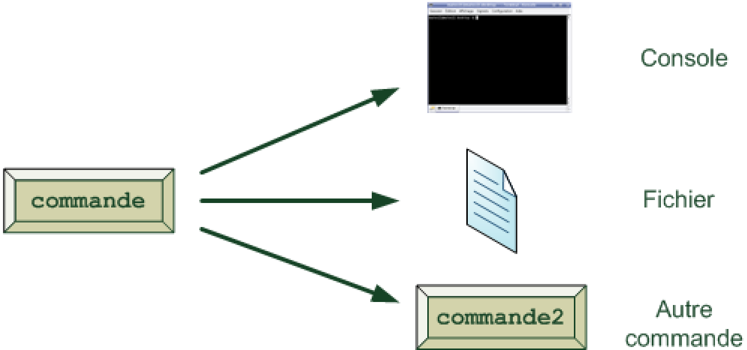
```
username@hostname:~$ sort << ENDSORT > file_sort.txt
```

Stdout

This is the most visible flow. By default, it will be displayed on the screen.

It is possible to :

- send it in a new file : `cmd > file`



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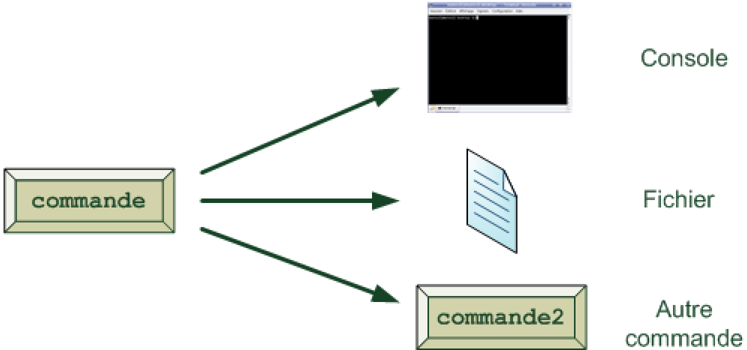

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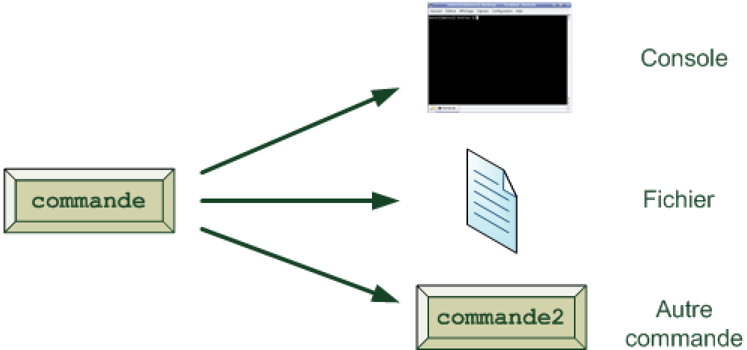
It is possible to :

- send it in a new file : `cmd > file`
- send it at the end of a file : `cmd >> file`
- send it to another command to make a chaining commands : `cmd1 |cmd2` (the stdout of *cmd1* will be the stdin of *cmd2*)



Stdout example (1/2)

```
username@hostname:~$ echo "this is my stdout"
this is my stdout
```

Stdout example (2/2)

```
username@hostname:~$ echo -e "toto\ntata" >> File.txt
username@hostname:~$ cat File.txt
toto
tata
username@hostname:~$ cat File.txt | grep "to"
toto
username@hostname:~$ cat File.txt | grep "to" | wc -l
1
```

Stderr

This is the flow that the terminal displays during an error. For this flow it is possible to :

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- send it in a new file : `cmd 2> file`
- send it at the end of a file : `cmd 2>> file`
- send it to stdout : `cmd 2>&1 > file` or `cmd &> file` (the set of stderr and stdout will be in *file*)

Stderr (example)

```
username@hostname:~$ ls
File
Directory
username@hostname:~$ cat FileNotExist
cat: FileNotExist: No such file or directory
username@hostname:~$ cat FileNotExist 2> ./stderr.txt
username@hostname:~$ cat FileNotExist 1> ./stdout.txt
username@hostname:~$ cat stderr.txt
cat: FileNotExist: No such file or directory
username@hostname:~$ cat stdout.txt

username@hostname:~$
```

ReGex

The different types

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- Extended regular expressions (grep -E, egrep, awk) : ERe

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The keywords of the regex

- "^" = Start of line : "^toto"
- "$" = End of line : "toto$"
- "." = Any character
- "?" = 0 or 1 time the previous character or grouping : "?t"
- "*" = 0 to n times the previous character or grouping : "*t"
- "+" = 1 to n times the previous character or grouping : "+t"

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- “[list_of_chars]” = A quoted character in the list : “[a-z]” “[A-Z]” “[0-9]”

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- “[^list_of_chars]” = A character that is not mentioned in the list : “[^0-9]”
- “(PATERN){n}” = Number of times of patern (ERe) : “(ti){2}”

Example of ReGex (1/3)

Let's take this text file as an example :

toto likes titi

Isen 2021

Toto likes titi

- Find lines that start with toto and end with titi

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen : grep "^toto.*titi$" exampleRegex.txt
toto likes titi
```

Example of ReGex (2/3)

- Find lines that start with a capital letter

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen : grep "^[A-Z]" exampleRegex.txt
Isen 2021
Toto likes titi
```

Example of ReGex (3/3)

- Find lines that contain “to” 2 times

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen : grep -E "(to){2}" exampleRegex.txt
toto likes titi
```

Grep

Introduction

Grep command can be used to find or search a regular expression or a string in a text file.

Searching in a specific file

Searching the pattern “Toto” in the file exempleRegex.txt.

```
isen@isen : grep "Toto" exempleRegex.txt
Toto love titi
Totope
```

Searching recursivly

Searching the pattern “Toto” recursivly in all files in /home/isen directory and sub directory.

```
isen@isen : grep -r "Toto" /home/isen
Toto love titi
Totope
Toto hate titi
```

Ignore case sensitivity

Searching the pattern “toto” by ignoring case sensitivity in the file exempleRegex.txt.

```
isen@isen : grep -i "Toto" exempleRegex.txt
Toto love titi
Totope
toto tata
TOTo titi
```

Sed

Introduction

Sed is a command that allows manipulation of text file from regular expression.

By default sed displays the result in the stdout. To do the action directly in the file you need the option -**i**.

Substitution

Change one patern by another.

```
sed "s/PATERN_TO_LOOK_FOR/REPLACEMENT_PATTERN/"
```

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen : sed "s/titi/loic/" exampleRegex.txt
toto likes loic
Isen 2021
Toto likes loic
```

Insert

Add a line before the wanted patern.

```
sed "/PATERN_TO_LOOK_FOR/iPATERN_TO_ADD/"
```

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen :  sed "/Toto/iTiti" exampleRegex.txt
toto likes titi
Isen 2021
Titi
Toto likes titi
```

Append

Add a line after the wanted patern.

```
sed "/PATERN_TO_LOOK_FOR/aPATERN_TO_ADD/"
```

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen :  sed "/toto/aTiti" exampleRegex.txt
toto likes titi
Titi
Isen 2021
Toto likes titi
```

Delete

Delete a line containing a pattern (by modifying permanently the file with **-i** option).

```
sed "/PATERN/d"
```

```
isen@isen : cat exampleRegex.txt
toto likes titi
Isen 2021
Toto likes titi
isen@isen : sed -i "/titi$/d" exampleRegex.txt
isen@isen : cat exampleRegex.txt
Isen 2021
```