Variables and Algo

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The variables

Protect a variable

Scripting base

Survival_Kit

Algo

Process management



The variables



Variables ?

A variable has 2 elements :

- the name



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- the name
- the value –> $name



Specific variables : environment

An environment variable is a dynamic variable used by processes or applications to define information paths or shortcuts. You can visualize all your environment variables with the **env** SHELL command. Usually all the environment variable are in capital case.

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- PS1
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- HOME



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- PATH
- PS1
- TERM
- HOME
- SHELL



PATH

PATH is a list of directory. With bash (and not sh) you don't have to write the absolute or relative path of a command. If the command you type exist in one of this directory, bash will call it.

```
1 isen@localhost:~$ echo $PATH
2 /sbin/:/home/isen/bin:/usr/local/bin:/usr/bin:/bin:/usr/local/games:/usr/games
3 isen@localhost:~$ id
4 uid=1000(isen) gid=1000(isen) groupes=1000(isen)
5 isen@localhost:~$ which id
6 /usr/bin/id
```



PS1

PS1 stands for “Prompt String One” or “Prompt Statement One”

It is the first prompt string (that you see at a command line).

You can change it easily “live” or in your .bashrc file to be effective in every SHELL terminal

```
1 isen@localhost:~$ echo $PS1
2 echo $PS1
3 \[\e]0;\u@\h: \w\a\]${debian_chroot:+($debian_chroot)}\[\033[01;32m\]\u@\h\[\033[
     00m\]:\[\033[01;34m\]\w\[\033[00m\]\$
4 isen@localhost:~$ PS1="Go for it->"
5 Go for it->echo $PS1
6 Go for it->
```



TERM

TERM variable defines the terminal type.

```
1 isen@localhost:~$ echo $TERM
2 xterm-256color
```



HOME

HOME is a Linux bash shell variable. It indicates the home directory of the current user. It also represent the default argument for the cd command. The value of this variable is also used when performing tilde expansion.

The value is set with the /etc/passwd file when the operating system is starting

```
1 isen@localhost:~$ echo $HOME
2 /home/isen
3 isen@localhost:~$ grep isen /etc/passwd
4 isen:x:1000:1000:A random user:/home/isen:/bin/bash
```



SHELL

The **SHELL** is an environment variable. The full pathname to the shell is in this environment variable.

The value is set with the /etc/passwd file when the operating system is starting

```
1 isen@localhost:~$ echo $SHELL
2 /bin/bash
3 isen@localhost:~$ grep isen /etc/passwd
4 isen:x:1000:1000:A random user:/home/isen:/bin/bash
```



List of SHELL linux

There is a lot of other shell on linux :

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- **C SH**ell : **/bin/csh**
- **Z**orn **SH**ell : **/bin/zsh**
- Bash (**B**ourne **A**gain **SH**ell, the Linux shell) : **/bin/bash**



Protect a variable



IFS

The **IFS** is an acronym for Internal Field Separator or Input Field Separator. The **IFS** is a special shell variable in Bash, ksh, sh, and POSIX. Let us see what **IFS** is and why you need to use it while writing shell scripts under Linux and Unix.

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By default the **IFS** is compased by:

- Carriage return
- Tabulation
- Space



Change IFS

IFS can be change before using a command or a function.

You may display the actual value of IFS with the following command

```
1 isen@localhost:$ echo "--$IFS--"
2 --
3 --
```

Warning: many Linux processes use the IFS.



Protect a variable : Syntax

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Protect a variable : Syntax

Theres is three essential quotes in SHELL :

- simple quote ’: the string between these will not be interpreted
- double quote “: the string between these will be interpreted (special character like $)
- backquote ‘: the string between these will be a SHELL COMMAND, you can use **$(COMMAND)** to make it more readable



Variable visibility 1/4

All your variables will have a “scope”, or a visibility. By default, the variables defined in a SHELL terminal are visible in your SHELL terminal and only in it.

```
1  isen@localhost:~$ Var=CONTENU
2  isen@localhost:~$ echo $Var
3  CONTENU
4  isen@localhost:~$ bash
5  isen@localhost:~$ ps
6    PID TTY          TIME CMD
7   12996 pts/2    00:00:00 bash
8   13009 pts/2    00:00:00 bash
9   13021 pts/2    00:00:00 ps
10 isen@localhost:~$ echo $Var
11
12 isen@localhost:~$ exit
```



Variable visibility 2/4

You will have to export a variable to make it visible for other CHILD SHELL Terminal or script

```
1  isen@localhost:~$ Var=CONTENU
2  isen@localhost:~$ echo $Var
3  CONTENU
4  isen@localhost:~$ export Var
5  isen@localhost:~$ bash
6  isen@localhost:~$ ps
7     PID TTY          TIME CMD
8    12996 pts/2    00:00:00 bash
9    13406 pts/2    00:00:00 bash
10   13435 pts/2    00:00:00 ps
11 isen@localhost:~$ echo $Var
12 CONTENU
```



ISEN

Variable visibility 3/4

The same apply for your script, the scope of your variable will only be inside your script

You may source another script to extend the vivibility of your variables to the other script

Consider two scripts Prog1.sh and Prog2.sh as bellow

```
1  isen@localhost:~$ cat Prog1.sh
2  #!/bin/bash
3  Var=CONTENU
4  echo "Prog1 : $Var"
5  ./Prog2.sh
6  isen@localhost:~$ cat Prog2.sh
7  #!/bin/bash
8  echo "Prog2 : $Var"
9  isen@localhost:~$ ./Prog1.sh
10 Prog1 : CONTENU
11 Prog2 :
```



ISEN

Variable visibility 4/4

Now ! Consider two scripts Prog1.sh and Prog2.sh as bellow

```
1  isen@localhost:~$ cat Prog1.sh
2  #!/bin/bash
3  Var=CONTENU
4  echo "Prog1 : $Var"
5  source ./Prog2.sh
6  isen@localhost:~$ cat Prog2.sh
7  #!/bin/bash
8  echo "Prog2 : $Var"
9  isen@localhost:~$ ./Prog1.sh
10 Prog1 : CONTENU
11 Prog2 : CONTENU
```



Protect a variable : Exemples

```
1  isen@localhost:~$ Var="ONE"
2  isen@localhost:~$ echo "$Var"_FILE
3  ONE_FILE
4  isen@localhost:~$ Var="ONE"
5  isen@localhost:~$ echo '$Var'_FILE
6  '$Var'_FILE
7  isen@localhost:~$ echo '${Var}'_FILE
8  ${Var}_FILE
9  isen@localhost:~$ echo $Var_FILE
10 (nohing because Var_FILE dont exist)
11 isen@localhost:~$ echo ${Var}_FILE
12 ONE_FILE
13 isen@localhost:~$ls
14 C02 C03 C04 data EXAM Old ORIG
15 isen@localhost:~$ Var=$(ls) #or Var=`ls`
16 isen@localhost:~$ echo $Var
17 C02 C03 C04 data EXAM Old ORIG
```



Scripting base



What is a script

Instead of launching the commands directly in a terminal, we can write a text file with the shebang and the execution rights

```
1 username@hostname:~$ cat myfirstscript.sh
2 #!/bin/bash
3
4 echo toto
5 username@hostname:~$ chmod +x myfirstscript.sh
6 username@hostname:~$ ./myfirstscript.sh
7 toto
```



Advantages/Disadvantages

- **Advantages**



Advantages/Disadvantages

- **Advantages**
  - More readable



Advantages/Disadvantages

- **Advantages**
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- **Disadvantages**



Advantages/Disadvantages

- **Advantages**
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- **Disadvantages**
  - Debugging



Variable of a script

Name	Description
$0	the name of the current shell program.
$1...${n}	the n parameters passed to the program (to the shell) when it is called.
$#	the number of parameters passed to the shell program call (not included the $0 parameter)
$*	the list of parameters passed to the shell program call (not included the $0 parameter)
$$	the current process number (there is a unique number per process on the machine)
$?	the error code of the last command executed.



Example of use

```
1  username@hostname:~$ cat mysecondscript.sh
2  #!/bin/bash
3  echo "Thx to launch ${0}"
4  echo "There are ${#} arguments"
5  echo "They are : ${*} but the second is $2"
6  false
7  echo ${?}
8
9  username@hostname:~$ ./mysecondscript.sh toto titi tutu
10 Thx to launch ./mysecondscript.sh
11 There are 3 arguments
12 They are : toto titi tutu but the second is titi
13 1
```



Survival_Kit



Golden rules

- Indent your script



Golden rules

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- Comment your script



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- Use a Naming rule



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- Use the man, level 1 (try a man -k)



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- Declare your variable at the start of your script
- Always test your entries
- Give your script some “fresh air”
- Test the return value of your SHELL commands ($?)
- Use the man, level 1 (try a man -k)
- Render your script executable : **chmod +x Mynewscript.sh**



Golden rules example 1/2

```
1 #BAD
2 if [[ -f $titi ]];then echo "your parameter is a file";cp $1 "$1".old;fi
3 #GOOD
4 if [[ -f ${Nom_Fichier_Saisi} ]]
5 then
6     echo "your parameter is a file"
7     cp $1 "${Nom_Fichier_Saisi}".old
8 fi
```



Golden rules example 2/2

if your script is waiting for an argument representing a name of a file.

```
1  #Test of arguments
2  if [ $# -lt 1 ]
3  then
4      echo "You must give an argument for the script"
5      exit 1
6  fi
7  #Test of the type of the first argument
8  if [ -e $1 ]
9  then
10     echo "You must give an valid file name for the first argument for the script"
11     exit 2
12 fi
```



ISEN

Algo



IF Condition

IF condition
SO
——> Launch_action
END IF



Example of if condition

```
1 isen@localhost:~$ cat exampleIf.sh
2 #!/bin/bash
3 if [ $1 -eq 1 ]; then
4         echo "The first argument is 1"
5 fi
6 isen@localhost:~$ bash exampleIf.sh 2
7
8 isen@localhost:~$ bash exampleIf.sh 1
9 The first argument is 1
```



if/else condition

IF condition

SO

——> *Launch_action*

ELSE

——> *Launch_action*

END IF



Example of if/else condition

```
1  isen@localhost:~$ cat exampleIfElse.sh
2   #!/bin/bash
3  if [ $1 -eq 1 ]; then
4          echo "The first argument is 1"
5  else
6          echo "The first argument is not 1"
7  fi
8  isen@localhost:~$ exempleIfElse.sh 2
9  The first argument is not 1
10 isen@localhost:~$ exempleIfElse.sh 1
11 The first argument is 1
```



if/elif condition

IF condition

SO

——> *Launch_action*

ELSE IF other_condition

SO

——> *Launch_action*

END IF



Example of if/elif condition

```
1  isen@localhost:~$ exampleIfelIf.sh
2   #!/bin/bash
3  if [ $1 -eq 1 ]; then
4          echo "The first argument is 1"
5  elif [ $1 -eq 2 ]; then
6          echo "The first argument is 2"
7  fi
8  isen@localhost:~$ exampleIfelIf.sh 10
9  isen@localhost:~$ exampleIfelIf.sh 1
10 The first argument is 1
11 isen@localhost:~$ exampleIfelIf.sh 2
12 The first argument is 2
```



if/elif/else condition

IF condition

SO

——> *Launch_action*

ELSE IF other_condition

SO

——> *Launch_action*

ELSE

——> *Launch_action*

END IF



Exemple of condition if/elif/else

```
1  isen@localhost:~$ cat exampleIfelIfElse.sh
2   #!/bin/bash
3  if [ $1 -eq 1 ]; then
4          echo "The first argument is 1"
5  elif [ $1 -eq 2 ]; then
6          echo "The first argument is 2"
7  else
8          echo "I do not understant"
9  fi
10 isen@localhost:~$ bash exampleIfelIfElse.sh 10
11 I do not understant
12 isen@localhost:~$ bash exampleIfelIfElse.sh 1
13 The first argument is 1
14 isen@localhost:~$ bash xampleIfelIfElse.sh 2
15 The first argument is 2
```



ISEN

Tests - File

Operand	Description	example
-e filename	true if filename exist	[-e /etc/shadow]
-d filename	true if filename is a directory	[-d /tmp/trash]
-f filename	true if filename is an ordinary file	[-f /tmp/Log.txt]
-L filename	true if filename is a symbolic link	[-L /home]
-r filename	true if filename is readable (r)	[-r /boot/vmlinuz]
-w filename	true if filename is modifiable (w)	[-w /var/log]
-x filename	true if filename is an executable (x)	[-x /sbin/halt]



Tests - Strings

Operand	Description	example
-z txt	true if the string is empty	`[ -z "${VAR}"]`
-n txt	true if the string is NOT empty	`[ -n "${VAR}"]`
txt **=** txt	true if the two string are equal	`[ "${VAR}"= "toto"]`
txt **!=** txt	true if the two string are NOT equal	`[ "${VAR}"!= "toto"]`



Tests - Numeric

Operand	**Description**	**example**
num1 **-eq** num2	equality	[$Number -eq 42]
num1 **-ne** num2	not equal	[$Number -ne 42]
num1 **-lt** num2	lesser than (<)	[$Number -lt 42]
num1 **-le** num2	lesser or equal (<=)	[$Number -le 42]
num1 **-gt** num2	greater than (>)	[$Number -gt 42]
num1 **-ge** num2	greater or equal (>=)	[$Number -ge 42]



Example of test (1/2)

```
1  #!/bin/bash
2  # directory exists ? 1/2
3  test -d /home/isen
4  rc=$?
5  if [ $rc -ne 0 ]; then
6      echo "The directory /home/isen does not exist"
7  fi
```



Example de test (2/2)

```
1  #!/bin/bash
2  # directory exists ? 2/2
3  if [ -d "/home/isen" ]; then
4          echo "the directory /home/isen exists"
5  fi
6  # comparison of 2 strings
7  if [ "toto" = "titi" ]; then
8          echo "toto is not equal to titi"
9  fi
```



While loop

WHILE condition

DO

——> *Launch_action*

RESTART



Example of while loop (1/2)

```
1  isen@localhost:~$ cat while.sh
2  #!/bin/bash
3  a=0
4  while [ $a -le 3 ]
5  do
6      echo "$a"
7      a=$(( $a + 1 ))
8  done
9
10 isen@localhost:~$ bash while.sh
11 0
12 1
13 2
14 3
```



ISEN

Example of while loop (2/2)

```
1 while true; do
2     echo $RANDOM
3 done
```

The bash is compiled as a 64-bit monothread. With this command your bash will use 100% of a CPU core. To protect your CPU, always put an “useless/time-out” action

```
1 while true; do
2     echo $RANDOM
3     sleep 1
4 done
```



for loop

FOR variable IN value1 value2 value3

DO

——> *Launch_action*

NEXT_ACTION



Example of for loop (1/2)

```
1  isen@localhost:~$ cat for1.sh
2  #!/bin/bash
3  for var in 'value1' 'value2' 'value3'; do
4      echo "Var =  ${var}" ;
5  done
6
7  isen@localhost:~$ bash for1.sh
8  Var = value1
9  Var = value2
10 Var = value3
```



Example of for loop (2/2)

To get closer to the c code (this syntax is not widely used in bash):

```
1
2  isen@localhost:~$ cat for2.sh
3  #!/bin/bash
4  for i in $(seq 0 2)
5  do
6      echo $i
7  done
8
9  isen@localhost:~$ bash for2.sh
10 0
11 1
12 2
```

This syntax **$(seq 0 3)** is equivalent to **((i=0;i<=3;i++))**



Case/Esac

```
1  case ${vars} in
2      1)  command1
3          command1bis
4          ;;
5      2)  command2
6          command2bis
7          ;;
8      *)  commanddefault
9          commanddefault2
10         ;;
11 esac
```



Example of Case/Esac

```
isen@localhost:~$ cat myScriptCase.sh
#!/bin/bash
case ${1} in
    toto) echo "toto is a beautifull name";;
    titi) echo "I prefer toto as a name";;
    *) echo "i do not understand"
esac

isen@localhost:~$ bash myScriptCase.sh toto
toto is a beautifull name
isen@localhost:~$ bash myScriptCase.sh titi
I prefer toto as a name
isen@localhost:~$ bash myScriptCase.sh Loic
i do not understand
```



ISEN

BREAK/CONTINUE

```
1  isen@localhost:~$ cat for3.sh
2  #!/bin/bash
3  for var in value1 value2 value3 value4 value5; do
4      [ "$var" = "value2" ] && continue
5      [ "$var" = "value4" ] && break
6      echo $var
7  done
8
9  isen@localhost:~$ bash for3.sh
10 value1
11 value3
```

BREAK = stop the loop

CONTINUE = go to the next iterration



Process management



Process management

Linux being a multitasking system, several programs can run at the same time.

When a program is started, a process is created. This is an active entity that has characteristics (priority, registers, ordinal counter, memory, etc.). Some characteristics may change over time

The system identifies the processes using an identifier (PID = **P**rocess **ID**entification).

The management of processes in Linux is said to be hierarchical.

A process can itself create another process (fork + exec). The created process is called a child process. The creator is called the parent process.



nice & renice

The nice and renice commands allow you to set or change the priority of a process.

The range of possible values is -20 (most favorable priority) to 19 (least favorable).

```
1 isen@localhost:~$ nice -n -20 find / -type f -name "*.sh"
2 isen@localhost:~$ renice 20 7643
```



kill

The kill command sends a signal to a process. Overlays to the kill command exist killall, pgrep / pkill, xkill

```
1 isen@localhost:~$ kill 456
2 isen@localhost:~$ kill -9 -1
3 isen@localhost:~$ pkill firefox
```



Managing tasks in an interactive session

Interactive processes are started and managed from the user's terminal. There are 2 modes:

- Foreground mode



Managing tasks in an interactive session

Interactive processes are started and managed from the user's terminal. There are 2 modes:

- Foreground mode
- Background mode



Managing tasks in an interactive session - Foreground mode

The process monopolizes the terminal until its termination

```
1 isen@localhost:~$ sleep 10
2 [...]
```



Managing tasks in an interactive session - Mode background

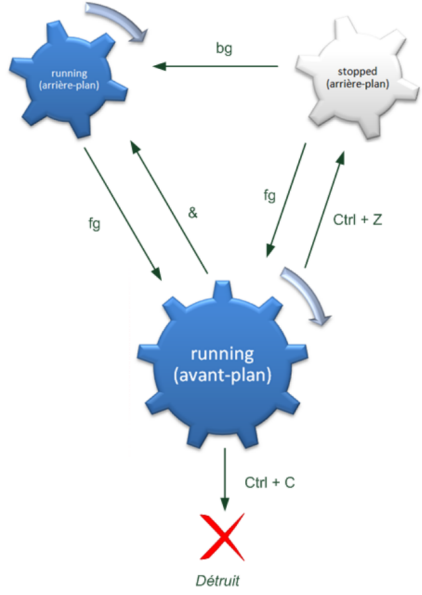
The process works in parallel with the terminal

```
1 isen@localhost:~$ sleep 10 &
2 [1] 3384
3 $
```

The “ctrl-z” key sequence and the commands “jobs, bg, fg commands” allow you to switch a process from one mode to the other.



Synthesis


running
(arrière-plan)
bg
stopped
(arrière-plan)
fg
&
fg
Ctrl + Z
running
(avant-plan)
Ctrl + C
Détruit


ISEN

Display the processes

You can use the SHELL command ps to display all the processes currently in execution on your computer

example to see the processes belonging to your **current SHELL** :

```
isen@localhost:~$ ps
   3837 pts/2    00:00:00 bash
 137967 pts/2    00:00:09 evince
 144605 pts/2    00:00:00 ps
```

example to see the processes belonging to you **current owner** :

```
isen@localhost:~$ ps -u isen
   PID TTY          TIME CMD
   2053 ?        00:00:02 systemd
   2054 ?        00:00:00 (sd-pam)
   2059 ?        00:04:16 pulseaudio
....
```



ISEN