BASH: THE BOURNE-AGAIN SHELL

https://www.gnu.org/software/bash/

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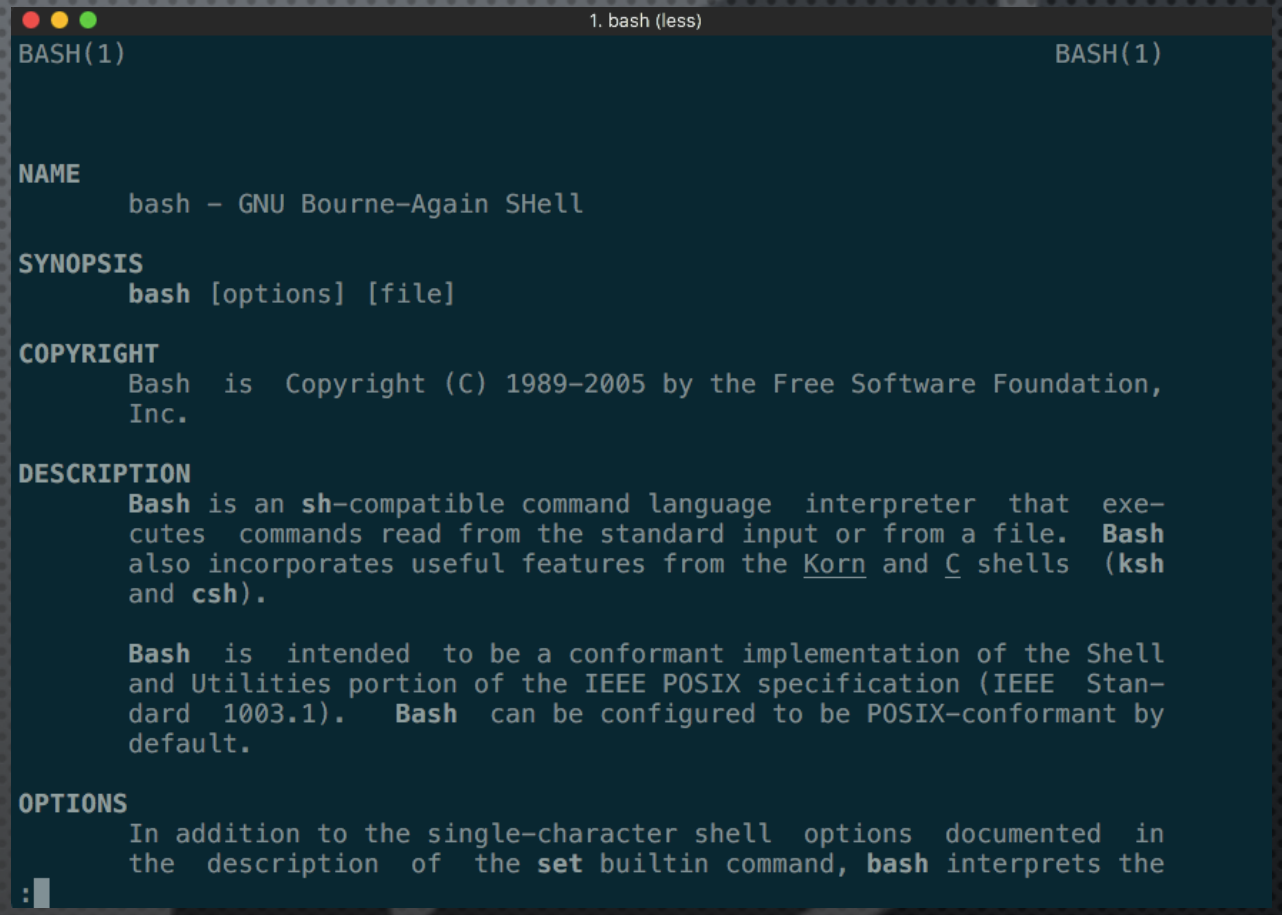
WHAT IS BASH?

- **Bash** stands for “Bourne-Again Shell”, which is based on the **Bourne** shell and mostly compatible with its features.
- A **Shell** is a interface that allows the user to interact with other programs.
- **Bash** is the *de facto* shell on most GNU/Linux distributions.
- Think of **Bash** as a way to speak to your system. It allows you to perform basic operations like math, run applications, or tests.
- “Bash is a *Shell program, and I tell it what to do.*”



“man bash”

HISTORY

- **Bash** initial release was in **June 8, 1989**.
- **Brian J. Fox** is the original author of the **GNU Bash Shell**.
- Written for the GNU Project as a replacement for the **Bourne Shell**.
- The **GNU Project** is a free software, mass-collaboration project that aims to develop software for users to control the way they use their computing devices.

PROGRAMMING LANGUAGE OR SCRIPTING LANGUAGE?

- **Bash** not only is an excellent command line shell, but also a scripting language.
- **Shell Scripting** allows the use of the shell's abilities and to automate a lot of the tasks that would otherwise require a lot of commands.
- The difference between a scripting language and programming language Is programming languages are more powerful and a lot faster, and generally programming languages start off a source code and compiled down into an executable.
- Scripting languages on the other hand, also starts from source code, but is not compiled down to an executable. Rather an interpreter reads the instructions in the source file and executes the instructions.

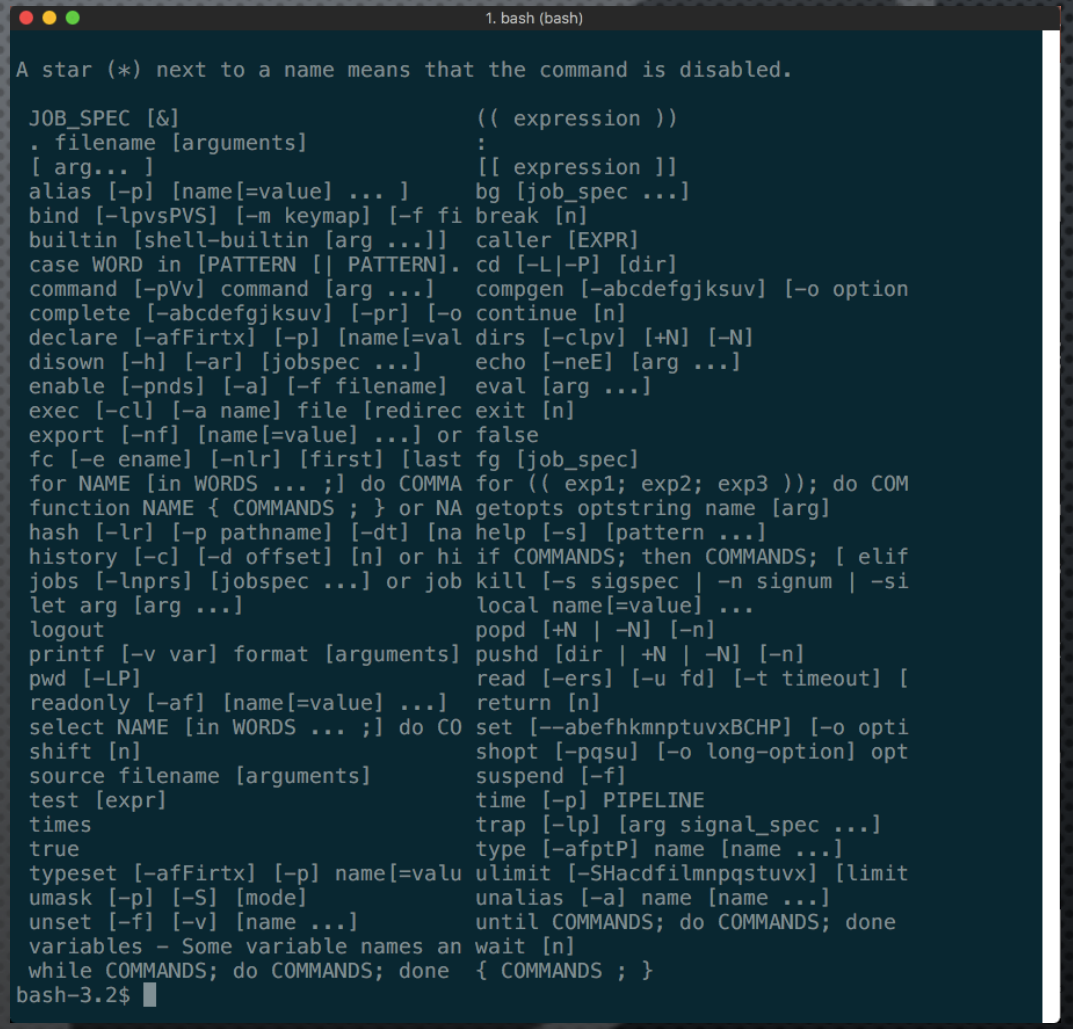
DESIGN

- **Bash** implements *Simple Commands* separated by spaces.
  - chmod u=rwx test1.txt
    - Sets test1.txt to readable/writeable/executable.
- You can pipe commands together using the (|) symbol.
  - ls -l | grep "\.docx$”
    - Pipes the output of “ls –l” to “grep “\.docx$”” which finds the occurrences with “.docx”.
- You can redirect output into files or redirect input from a file into a command/program/file.
- You can automate tasks using **scripts**.

```
asajenkins@Asas-MacBook-Air ~/Desktop/myWork
  % vi hello-world.sh
  1 # HEADER
  2 #!/bin/bash
  3
  4 # VARIABLE
  5 STRING="HELLO WORLD"
  6
  7 # PRINT VARIABLE
  8 echo $STRING
asajenkins@Asas-MacBook-Air ~/Desktop/myWork
  % chmod u=rwx hello-world.sh
asajenkins@Asas-MacBook-Air ~/Desktop/myWork
  % ./hello-world.sh
HELLO WORLD
```

SHELL BUILT-IN COMMANDS

- Built-in commands are contained with in the shell itself.
- When built-in commands are used in *simple commands*, the shell executes the command directly, without creating a new process.
- Built-in commands are necessary to implement functionality impossible or inconvenient to obtain with other utilities.



BUILT-IN COMMAND EXAMPLES

- Bourne Built-in commands
  - cd – Change directory
  - pwd – Print working directory
  - readonly – set something to read only or CONST
- Bash Built-in commands examples:
  - logout – logout current shell
  - echo – like cout a print statement
  - read – like cin a stdin
- Special Built-in commands:
  - hash - hash command maintains a hash table, which has the used command’s path names
  - exec – Set current shell to program
  - eval – Evaluates several commands and arguements

SIMPLE COMMANDS

- Simple commands are usually followed by arguments specified by the user.
- These are referred to as simple commands, because they’re usually the ones executed more frequently.
- The first word generally specifies a command which is followed by arguments.
  - chmod u=rwx test1.txt
  - ls –l
  - cd ../

PIPELINES

- A *pipeline* is the sequence of commands divided by (|) symbols.
- The output of each command is sent as input into the next command.
  - ls –l | grep “example”
  - more test1.txt | grep –i “hello”

REDIRECTION

- Command > output_file
  - Redirects command into a file.
- Command < input_file
  - Redirects input into a command/program/file
- Command < input_file > output_file
  - Redirects input into a command/program/file, and redirects the output of that into a file

LISTS

- A *list* is a sequence of one or more pipelines seperated by one or more ‘;’, ‘&’, ‘&&’, or ‘||’.
- Optionally terminated by ‘;’ , ‘&’, or newline.
  - command1 && command2
  - command1 || command2

ARITHMETIC EXPANSION

Operator	Meaning
VAR++ and VAR--	variable post-increment and post-decrement
++VAR and --VAR	variable pre-increment and pre-decrement
- and +	unary minus and plus
! and ~	logical and bitwise negation
**	exponentiation
*, / and %	multiplication, division, remainder
+ and -	addition, subtraction
<< and >>	left and right bitwise shifts
<=, >=, < and >	comparison operators
== and !=	equality and inequality
&	bitwise AND
^	bitwise exclusive OR
|	bitwise OR
&&	logical AND
||	logical OR
expr ? expr : expr	conditional evaluation
=, *=, /=, %=, +=, -=, <<=, >>=, &=, ^= and |=	assignments
,	separator between expressions

SYNTAX

- Variables
  - Bash variables does not need a type.
  - Use ‘declare’ to initialize later.
    - Ex. declare –I number
  - Bash variables are mutable.
  - Important to note (=) symbol has no space between variable and message.
- Conditionals
  - If / then / elif / else / fi
  - Conditionals are similar in evaluation as in c++.
  - Conditionals are set by flags.
    - Example, -gt = greater than

```
bash-3.2$ egg="hello world"
bash-3.2$ echo $egg
hello world
```

```
if [ condition1 ]
then
   command1
   command2
   command3
elif [ condition2 ]
# Same as else if
then
   command4
   command5
else
   default-command
fi
```

SYNTAX CONT.

- Loops
  - For loop
  - While loop
  - Until loop
- Arrays
- Functions

```
#!/bin/bash
for i in $( ls ); do
    echo item: $i
done
```

```
#!/bin/bash
COUNTER=0
while [  $COUNTER -lt 10 ]; do
    echo The counter is $COUNTER
    let COUNTER=COUNTER+1
done
```

```
#!/bin/bash
COUNTER=20
until [  $COUNTER -lt 10 ]; do
    echo COUNTER $COUNTER
    let COUNTER-=1
done
```

```
#!/bin/bash
function quit {
    exit
}
function hello {
    echo Hello!
}
hello
quit
echo foo
```

```
## declare an array variable
declare -a arr=("element1" "element2" "element3")

## now loop through the above array
for i in "${arr[@]}"
do
   echo "$i"
   # or do whatever with individual element of the array
done

# You can access them using echo "${arr[0]}", "${arr[1]}" also
```

SO WHY USE BASH?

1. Very useful in day to day tasks.
2. Automates tasks.
3. Speeds up productivity.
4. Very handy for file manipulation.


FIN