UNIX

Lecture 7 : Shell Programming (bash) (Part 1)

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Outline

Intended Learning Outcomes

ILO4

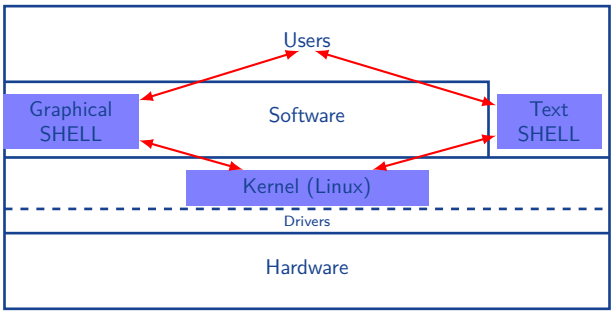
Produce, test, and verify the results of Shell scripts (in Bash) to perform tasks ranging from simple to complex algorithms.

Outline

Graphical Shell

GUI: Graphical User Interface

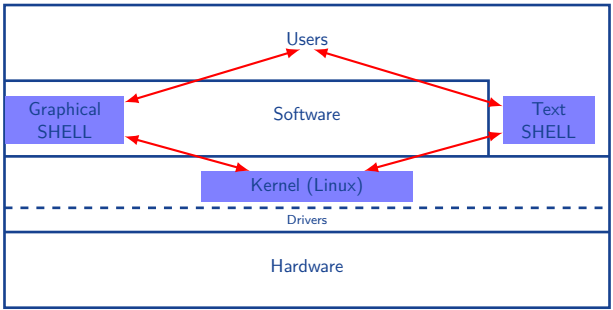
- There are several graphical environments in GNU/Linux:
  - GTK: Gnome, Unity, MATE, Xfce, etc.
  - Qt: KDE, LXQt, etc.
  - WSL (Windows): Xming



Text Shell

CLI: Command Line Interface

- There are different versions of command interpreters:
  - **bash: Bourne Again Shell**



Outline

SHELL Script

Definition

- Instructions are written in a file called a "shell script" or simply a script.
- Sequences of commands (batch) as opposed to the interactive mode of the command prompt.

Usage

- Direct access to the system and all commands.
- Automation of complex and repetitive tasks.
- Creating new commands (an advanced alias).
- System administration.

Special Considerations

- Caution! Strict syntax required!
- Caution! Readability is important!

Outline

First Script

Script Name

- By convention, shell scripts typically have the extension `.sh`.
- Example: `my_first_script.sh`

The First Line of the Script

- A script starts with the name of the script interpreter.
- The first two characters are `#!` (called "shabang").
- Then comes the path to the interpreter. Example: `#!/bin/bash`
- Fun Fact: You can start a script with other interpreters.
  - awk: `#!/usr/bin/awk`
  - perl: `#!/usr/bin/perl`
  - python: `#!/usr/bin/python3`

First Script

Comments

Commented lines begin with #.

```
#!/bin/bash
# This is my first bash script
# It displays the message "Hello World!"
echo "Hello World!"
```

Running the Script

- Give execution permission to the script using the command: `chmod u+x your_script_name`
- Then type `./` before the script name or enter the absolute path to the script to execute it.

Outline

Bash Variables

A Particular Syntax

- Every variable has a name and a value: `name=value` Example: `myVariable="Hello"`
- Note!!: There should be no space on either side of the equals sign.
- Caution: You can use uninitialized variables, which are then equal to an empty string.

Initializing a Variable from the Result of a Command

- Using backticks (AltGr+7). Example: `myVariable=‘ls‘`
- Using parentheses. Example: `myVariable=$(ls)` (more readable)

Accessing the Variable

- Use with the $ symbol or ${} Example: `echo $myVariable`
- Example: `echo $myVariable` (more readable)
- Display with `echo`

“Quotes”

- Apostrophes or “single quotes”: '
- Quotation marks or “ double quotes”: ""
- Backticks “ back quotes ”: `

Different Behaviors

- “ Single quotes” -> the variable is not displayed, and the $ is shown as is.
- “ Double quotes” -> ask bash to parse the message’s content. If it finds special symbols (like variables), it interprets them.
- “ Back quotes ” -> the entire string is interpreted.

`read` Command

It is possible to ask the user to enter text with the `read` command. This text will be immediately stored in a variable.
Example: `test.sh`

```
read first_name
echo "Your first name is:  $first_name"
```

`./test.sh`

```
Filipe
Your first name is:  Filipe
```

`read` Command

It is possible to simultaneously assign a value to multiple variables with `read`.

```
read last_name first_name
echo "Your last name is $last_name, and your first name is
$first_name"
```

`read -p "Message"`

```
read -p "Please enter your last name and first name:" last_name first_name
echo "Your last name is $last_name, and your first name is
$first_name"
```

Other options for `read`:

- `-n`: truncate the input string (e.g., "5 characters max").
- `-s`: hide the entered string (e.g., for passwords).

Mathematical Operations

In bash, variables are all strings of characters. Therefore, bash is not capable of performing operations directly.

`let` Command

Perform operations `+`, `-`, `*`, `/`, `**`, and `%` using `let`.

```
let "a=5"
let "a+=3"
let "b=3"
let "c=a+b"
echo "a = $a b = $b c = $c"
```

Mathematical Operations

$(())

Use `$(())` for mathematical operations.

```
a=5
b=3
c=$((a+b))
echo "a = $a b = $b c = $c"
```

For calculations involving decimal numbers, you can use the `bc` command. For example: `c=$(echo "scale=2;$a/$b"|bc)`.

Parameter Variables

Like all commands, bash scripts can also accept parameters. Thus, we could call our script like this. The different parameters are separated by spaces.

```
./params.sh param1 param2 param3
```

The values of these parameters can be retrieved in the script using predefined variables in bash:

- `$#` : Number of received parameters
- `$0` : Name of the script used
- `$*` : All parameters received as a single string
- `$@` : All parameters received as an array
- `$1, $2, $3, ...` : Refers to the i-th received parameter

Environment Variables

Currently, the variables you create in your bash scripts exist only within those scripts. Global variables from the `env` can be used in a script.

Useful Global Variables (in uppercase)

- `SHELL` : Indicates which type of shell is currently in use.
- `PATH` : A list of directories containing executables you want to run without specifying their directory.
- `HOME` : The location of your home directory.
- `PWD` : The directory you are currently in.
- `OLDPWD` : The directory you were in previously.

```
echo "Your home directory is: $HOME"
```