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Report lab OS 1

- **What is this program?**

  - This is a Linux terminal that I made using the C programming language to showcase the use of multiprocessing to execute the commands and the handling of zombie processes.

  - It has two types of commands

    - Built-in:

      - cd

      - echo

      - export

    - Not built-in which are the normal Linux terminal commands such as mkdir or any other command and those are the ones that utilize the **multiprocessing**

- **Code organization**
  - o The code is split into three main parts
    - Taking and parsing the input

      - Which is actually most of the work done, since C isn't really that popular with string manipulation.

      - In this part we first replace all the environment variables in the input with their actual value using
        char* replaceEnvVars(char* str);

      - And then depending on the command we might split the input using
        char** split_input(char* str);
        or tokenize it using strtok()

    - Deciding the type of command and executing it

      - Here we use
        int input_type(char* ins);
        to check the type of command entered whether it is a built-in, not built-in or exit command

      - Depending on the type we execute the command

- If it is built-in we use
  void execute_shell_bultin(char* command)

  > which utilizes the built-in functions in C to execute the command and doesn't require multiprocessing

- If it isn't built-in we then use
  void execute_command(char* command, int len)
  which creates child processes using fork() and to execute the commands using execvp(), and it runs all the processes, but only waits for foreground processes.

- Child signal handler

  - Which catches and handles the exit signal of background processes to protect the system from zombie processes
    signal(SIGCHLD, on_child_exit);

Note: when any process exits and gets acknowledged by the parent, its pid is logged in the log.txt file which can be found in the home directory
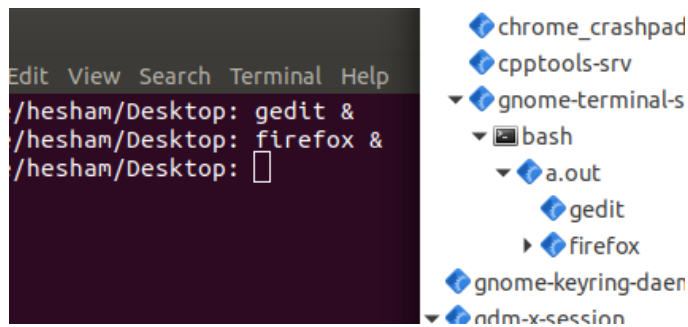
- Sample runs

```
File  Edit  View  Search  Terminal  Help
/home/hesham/Desktop: cd ..
/home/hesham: cd Desktop
/home/hesham/Desktop: echo "hello world"
hello world
/home/hesham/Desktop: export x="hello"
/home/hesham/Desktop: echo "world $x"
world hello
/home/hesham/Desktop:
```

```
File  Edit  View  Search  Terminal  Help
/home/hesham/Desktop: ls
 a.out    lab1.c   test   'test'$'\n'    test2
/home/hesham/Desktop: ls -l
total 40
-rwxrwxr-x 1 hesham hesham 18360 مار  9 03:58  a.out
-rw-rw-rw- 1 hesham hesham  5821 مار  9 03:58  lab1.c
drwxrwxr-x 2 hesham hesham  4096 مار  9 03:03  test
drwxrwxr-x 2 hesham hesham  4096 مار  9 03:04 'test'$'\n'
drwxrwxr-x 2 hesham hesham  4096 مار  9 03:05  test2
/home/hesham/Desktop: ls -l -a
total 48
drwxr-xr-x  5 hesham hesham  4096 مار  9 03:58  .
drwxr-xr-x 21 hesham hesham  4096 مار  9 03:02  ..
-rwxrwxr-x  1 hesham hesham 18360 مار  9 03:58  a.out
-rw-rw-rw-  1 hesham hesham  5821 مار  9 03:58  lab1.c
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:03  test
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:04 'test'$'\n'
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:05  test2
/home/hesham/Desktop: export x="-l -a"
/home/hesham/Desktop: ls $x
total 48
drwxr-xr-x  5 hesham hesham  4096 مار  9 03:58  .
drwxr-xr-x 21 hesham hesham  4096 مار  9 03:02  ..
-rwxrwxr-x  1 hesham hesham 18360 مار  9 03:58  a.out
-rw-rw-rw-  1 hesham hesham  5821 مار  9 03:58  lab1.c
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:03  test
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:04 'test'$'\n'
drwxrwxr-x  2 hesham hesham  4096 مار  9 03:05  test2
/home/hesham/Desktop:
```
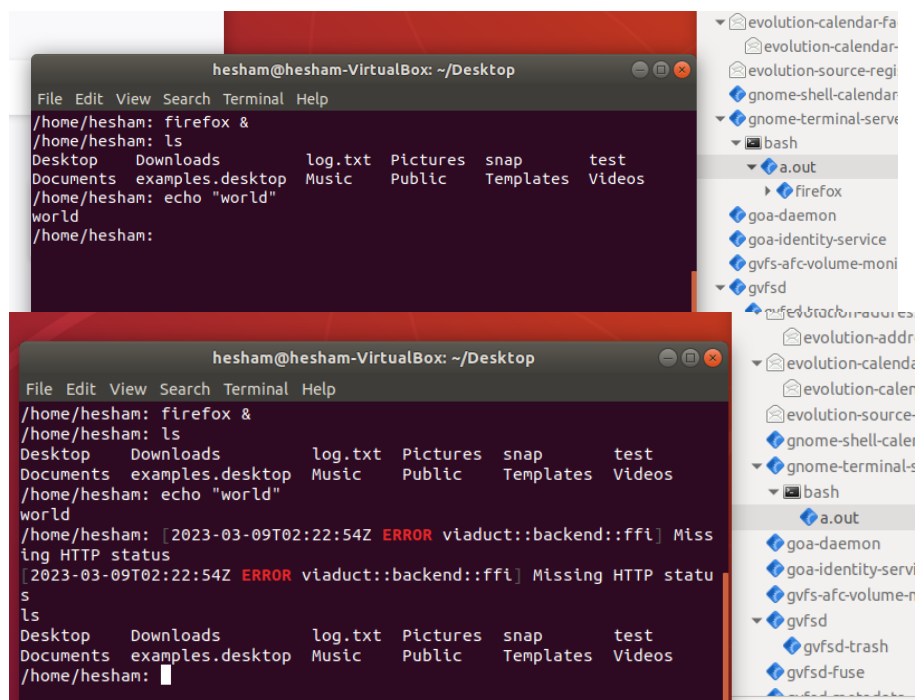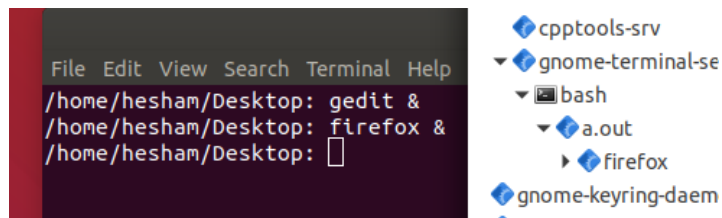
```
File  Edit  View  Search  Terminal  Help
/home/hesham/Desktop: gedit
ls
/home/hesham/Desktop:  a.out     lab1.c   test   'test'$'\n'    test2
/home/hesham/Desktop: gedit &
/home/hesham/Desktop: ls
 a.out    lab1.c   test   'test'$'\n'    test2
/home/hesham/Desktop:
```

- Processes hierarchy
  -
  - After closing gedit

    Note: the error is normal and appears in the main terminal too