Simple Linux Shell

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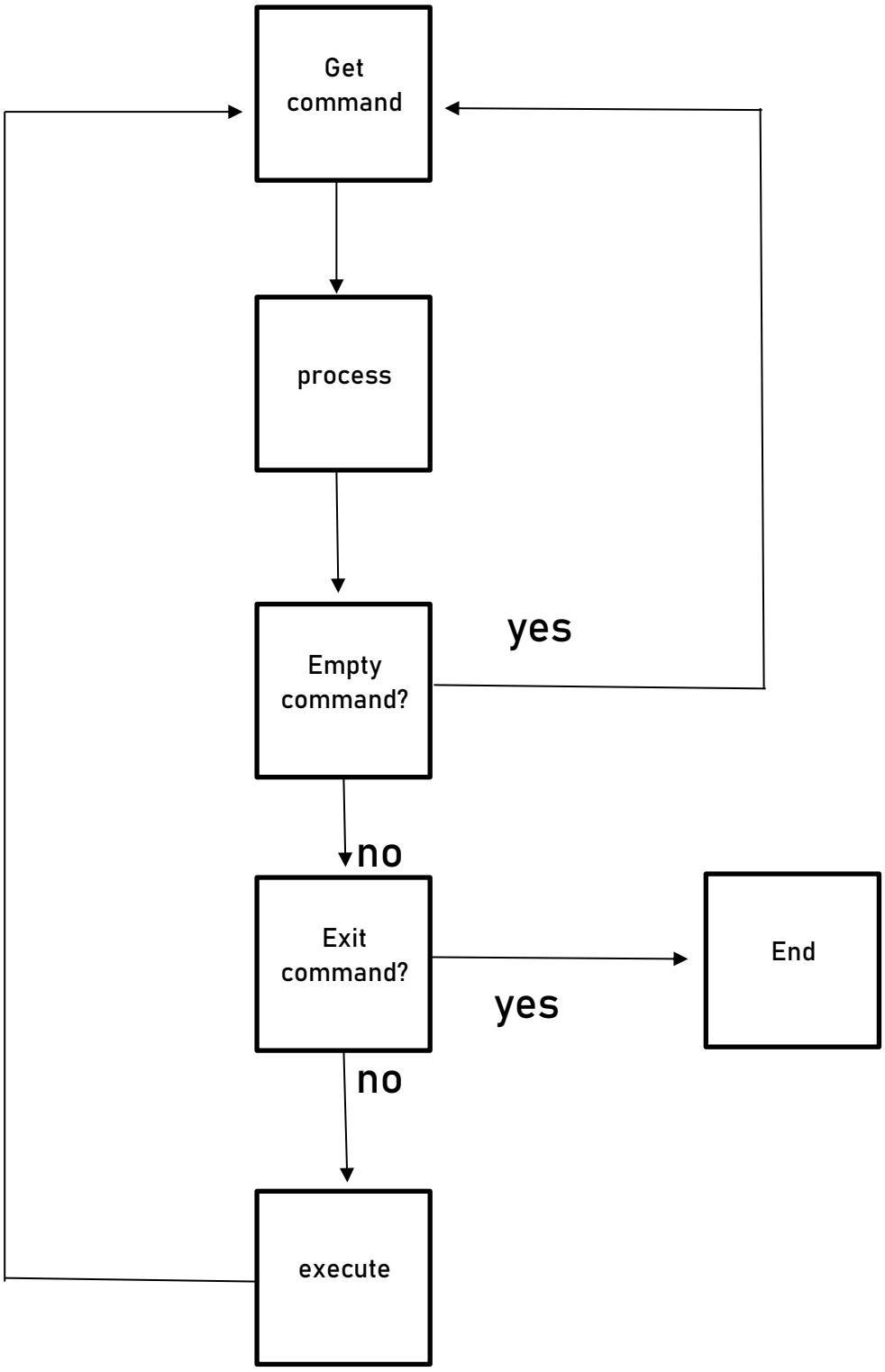
It's required to simulate linux shell. We must take the command and it's arguments (if found) and process them then execute it.



Run samples:

```
>>>ls
builtInFunctions.c  log.txt  main.c   shell.h
builtInFunctions.h  main     shell.c
>>>pwd
/home/taghreed/os/linux shell
>>>ls
builtInFunctions.c  log.txt  main.c   shell.h
builtInFunctions.h  main     shell.c
>>>ls -a
.   builtInFunctions.c  log.txt  main.c   shell.h
..  builtInFunctions.h  main     shell.c
>>>ls -1
builtInFunctions.c
builtInFunctions.h
log.txt
main
main.c
shell.c
shell.h
>>>
>>>
>>>sleep 3
>>>
>>>
```

Here, we trying commands without argument (ls, pwd), commands with arguments (ls -a, ls -1, sleep 3,) and empty commands.

```
>>>lss
Error executing...
: No such file or directory
>>>exit
taghreed@taghreed-VirtualBox:~/os/linux shell$
```

Here, trying wrong command and exit command.

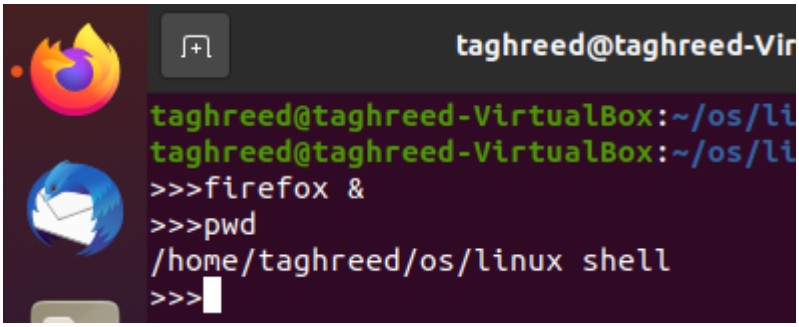
```
>>>ls
builtInFunctions.c  builtInFunctions.h  main  main.c  shell.c  shell.h
>>>ls
builtInFunctions.c  log.txt  main.c   shell.h
builtInFunctions.h  main     shell.c
>>>pwd
/home/taghreed/os/linux shell
>>>ls -a
.   builtInFunctions.c  log.txt  main.c   shell.h
..  builtInFunctions.h  main     shell.c
>>>exit
taghreed@taghreed-VirtualBox:~/os/linux shell$
```

```
child proccess terminated.
child proccess terminated.
child proccess terminated.
child proccess terminated.
```

Here, showing logging file.

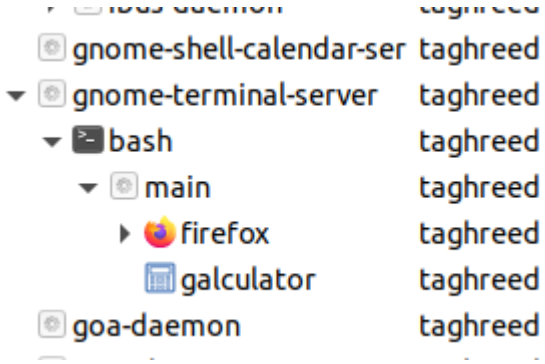
```
>>>firefox
ls
pwd
ls -a
>>>builtInFunctions.c  log.txt  main.c   shell.h
builtInFunctions.h  main     shell.c
>>>/home/taghreed/os/linux shell
>>>.   builtInFunctions.c       log.txt  main.c   shell.h
..  builtInFunctions.h  main     shell.c
>>>
```

Without (&) new commands cannot execute until we closed firefox.



With (&) new commands executed until we still using firefox.

```
>>>firefox &
>>>galculator &
>>>
```



Firefox and calculator are child processes to the main process.

Full code:

main.c file:

```c
#include "shell.h"

int main(){
    signal(SIGCHLD, LogHandle); //attach signal with logging file
    getJobDone();
    return 0;
}
```

Shell.h file:

```c
#ifndef _SHELL_C_INCLUDED_
#include "builtInFunctions.h"
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <string.h>
#include <stdbool.h>
#include <sys/wait.h>
#include <signal.h>

#define TOKEN_BUFFER_SIZE 64
#define TOKEN_DELIMTER " \t\r\n\a"

void getJobDone();
char* readLine();
char** readArgs(char* line);
bool launchShell(char** args);
bool executeShell(char** args);
void LogHandle(int sig);

#include "shell.c"
#define  _SHELL_C_INCLUDED_
#endif
```

Shell.c file:

```c
void getJobDone(){
    char *line;
    char **args;
    bool status;

    do {
        printf(">>>");
        line = readLine();  //get command and arguments
        args = readArgs(line);   //put it in suitable form for execution
        status = executeShell(args);  //execute command

        free(line);
        free(args);
    } while(status);  //repeat till exit
}
```

```c
char* readLine(){
    //get command from user
    char *line = NULL;
    size_t buffersize = 0;

    if(getline(&line, &buffersize, stdin) == -1){
        // checking for error in getting the command
        if(feof(stdin)){
            exit(EXIT_SUCCESS);
        }else{
            perror("Error in Reading Line...\n");
            exit(EXIT_FAILURE);
        }
    }
    return line;
}
```

```c
char** readArgs(char* line){
    // putting input in the form of [command , arguments , NULL]
    int buffersize = TOKEN_BUFFER_SIZE;
    int position = 0;
    char **tokens = malloc(buffersize*sizeof(char*));
    char *token;

    if(!token){
        fprintf(stderr, "Allocate Error\n");
        exit(EXIT_FAILURE);}

    token = strtok(line, TOKEN_DELIMTER);
    while(token != NULL){
        tokens[position] = token;
        ++position;
        if(position >= buffersize){//check if we need more space
        buffersize += TOKEN_BUFFER_SIZE;
        tokens = realloc(tokens, buffersize*sizeof(char*));
            if(!tokens){
                fprintf(stderr, "Allocate Error...\n");
                exit(EXIT_FAILURE);}}
        token = strtok(NULL, TOKEN_DELIMTER);}
    tokens[position] = NULL;
    return tokens;
}

bool executeShell(char** args){
    if(args[0] == NULL)//if empty command start again and get new command
        return true;
    //check for (cd,help,exit) and execute it
    for(int i=0; i<getBuiltInNums(); ++i){
        if(strcmp(args[0], builtInChar[i]) == 0)
            return (*builtInFunctions[i])(args);
    }

    return launchShell(args);
}
```

```
bool launchShell(char** args){
    pid_t pid, wpid;
    int status, i = 0, toWait = true;
    const char* AND_OPERATOR = "&";
    // check for & in the command
    while(args[i] != NULL){
        if(strcmp(args[i], AND_OPERATOR) == 0){
            args[i] = NULL;
            toWait = false;}
        ++i;}

    pid = fork();
    if(pid == 0){
        if(execvp(args[0], args) == -1){
            perror("Error executing...\n");
            exit(EXIT_FAILURE);}}
    else if(pid < 0){perror("Error in processes...\n");}
    else{
        if(toWait){
            do{
                wpid = waitpid(pid, &status, WUNTRACED);
            } while(!WIFEXITED(status) && !WIFSIGNALED(status));}}

    return true;
}

void LogHandle(int sig){
    //logging file
    FILE *pFile;
    pFile = fopen("log.txt", "a+");
    if(pFile==NULL) perror("Error opening file.");
    else fprintf(pFile, "child proccess terminated.\n");
    fclose(pFile);
}
```

builtInFunctions.h file:

```
#ifndef _BUILTINFUNCTIONS_C_INCLUDED_

#include <stdio.h>
#include <unistd.h>
#include <stdbool.h>

bool checkCD(char** args);
bool checkHelp(char** args);
bool checkExit(char** args);
int getBuiltInNums();

char *builtInChar[] = {
  "cd",
  "help",
  "exit"
};
bool (*builtInFunctions[]) (char **) = {
  &checkCD,
  &checkHelp,
  &checkExit
};

#include "builtInFunctions.c"
#define _BUILTINFUNCTIONS_C_INCLUDED_
#endif
```

builtInFunctions.c file:

```
bool checkCD(char** args){
    //dealing with cd
    if(args[1] == NULL)
        fprintf(stderr, "Expected command after cd...\n");
    else{
        if(chdir(args[1]) != 0)
            perror("Error in Changing Directory...\n");
    }

    return true;
}

bool checkHelp(char** args){//dealing with help
    printf("***welcom to help***\nlist of commands supported:
\n>cd\n>ls\n>exit\n>all other general commands available in UNIX
shell\n>improper space handling\n");
    return true;
}

bool checkExit(char** args){//dealing with exit
    return false;
}

int getBuiltInNums(){
    return sizeof(builtInChar) / sizeof(char*);
}
```