Bash like shell implementation

System programming 2020 fall - programming assignment 3

Ahn, Junho (20175097) 2020 NOV 17

github: https://github.com/ahn9807/Minish

Environment

- linux 5.4.0-53-generic in vmware funsion of machintosh
- gcc version 9.3.0 (Ubuntu 9.3.0-17ubuntu1~20.04)

Functionality

Built in functions

help

help prints the help documetation of minish.

```
junho:/home/junho/Desktop/HW3$ help
MINISH Help
These shell commands are defined internally.  Type `help' to see this list

quit, pwd, cd ,help, path, status(not working correctly), cap
```

quit

quit quitting the minish shell.

```
junho:/home/junho/Desktop/HW3$ quit
```

pwd

pwd prints current directories.

```
junho:/home/junho/Desktop/HW3$ pwd
/home/junho/Desktop/HW3
```

cd

cd changes current directories.

```
junho:/home/junho/Desktop/HW3$ pwd
/home/junho/Desktop/HW3
junho:/home/junho/Desktop/HW3$ cd ..
```

path

path prints current path variable. with two arguments, we can set path variables.

```
junho:/home/junho/Desktop$ path
PATH
:/home/junho/.local/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:
/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

cap

cap makes current shell into bash shell with printing "Green one is not zelda"

```
junho:/home/junho/Desktop$ cap
Green one is not zelda
junho@junho-virtual-machine:~/Desktop$
```

Piping

We can redirect standard-output to standard-in of another program using piping. Some elf programe such as grep or wc takes input of STDIN of system /dev/..., and execute itself by taking input from that. So we can implemented piping by using pipe() system call and dup2() at stdin and stdout.

```
junho:/home/junho/Desktop/HW3$ ls -al | grep exec
-rw-rw-r-- 1 junho junho   1790 Nov 17 19:39 exec_builtin.c
-rw-rw-r-- 1 junho junho    150 Nov 16 02:10 exec_builtin.h
-rw-rw-r-- 1 junho junho   1164 Nov 17 19:29 exec_commend.c
-rw-rw-r-- 1 junho junho     86 Nov 16 11:58 exec_commend.h
-rw-rw-r-- 1 junho junho    606 Nov 17 19:23 exec_external.c
-rw-rw-r-- 1 junho junho     93 Nov 16 02:10 exec_external.h
-rw-rw-r-- 1 junho junho   1761 Nov 17 19:40 exec_piped.c
-rw-rw-r-- 1 junho junho    105 Nov 16 11:47 exec_piped.h
-rw-rw-r-- 1 junho junho   1266 Nov 17 19:17 exec_redirected.c
-rw-rw-r-- 1 junho junho    212 Nov 17 00:55 exec_redirected.h
```

Redirection

Basically, linux prints results of execution to default system I/O devices such as monitor or files. But we can redirect this by intercepting the stdin or files to another files.

```
junho:/home/junho/Desktop/HW3$ wc /etc/passwd > out.txt
junho:/home/junho/Desktop/HW3$ cat out.txt
46   81 2738 /etc/passwd
```

External Programes

Minish can run external programes by searching path variables at another process by fork() system-call.

```
junho:/home/junho/Desktop/HW3$ ssh
usage: ssh [-46AaCfGgKkMNnqsTtVvXxYy] [-B bind_interface]
           [-b bind_address] [-c cipher_spec] [-D [bind_address:]port]
           [-E log_file] [-e escape_char] [-F configfile] [-I pkcs11]
           [-i identity_file] [-J [user@]host[:port]] [-L address]
           [-l login_name] [-m mac_spec] [-O ctl_cmd] [-o option] [-p port]
           [-Q query_option] [-R address] [-S ctl_path] [-W host:port]
           [-w local_tun[:remote_tun]] destination [command]
```

Way of implementations

shell.c

As an entry point of shell.c, infinite loop keeps minish run until quit commend is given. Also, shell.c allocate memories for queue and some other unallocated memories. Shell.c also register signal handler.

minish_io.c / parser.c

minish_io.c and parser.c take part of I/O and string parser in minish. Minish_io.c takes input and makes output shell prompt screen. Parser.c has various kinds of important parser including parse_space and parser_input. parse_input is the most important part of the parser.c. parse_input parse the input string and decide witch

exec_commend.c exec_builtin.c exec_piped.c exec_redirected.c

exec_commend.c get input as an argument of itself. With aid of parser.c, exec_commend parse the argument and call appropriate function to execute builtin, piped, redirected commend.

queue.c

This is help script for implementing background and foreground job scheduling. Queue is implemented in linked list fasioned.

signal_handler.c

signal_halder.c register appropriate actions for each siganls.

Conclusion

We can make bash like shell in c with aid of systemcall. Actually, shell such as zsh or bash is a just a programe that runs systemcall to execute any other programe user friendly in TUI environments. Some features such as auto complete or history is not implemented in this project. I want to extend my shell to have more real bash like strucuture if I have time.

Overall architecture structure is designed by myself.