Operating System Project 1: Shell

16281123 Zhou Daye CS 1603

Overview

This project implements a simple shell in C, which can run in Linux distros. This project also implements some features like escape char sequence, multi-line command support and history support.

Process control method

Under linux, `fork()` in `unistd.h` can create a sub-process from a process, we can detect parent or child by the pid `fork()` returns. And `exec` series system call can replace process with another program.

Basically this program read and parse strings into arguments, then fork a child to run program with `execvp()` , and wait child to exit.

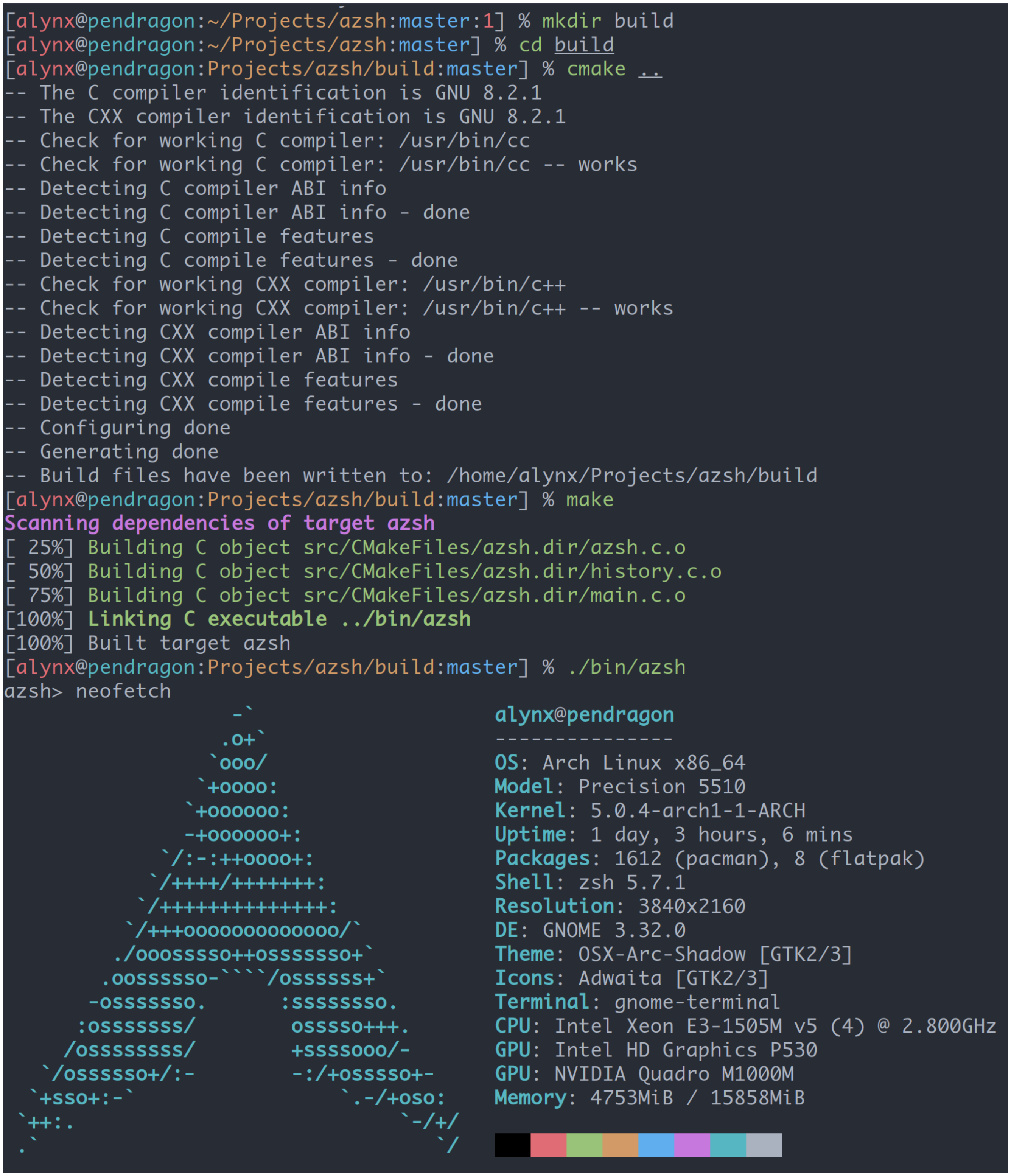
Design

It works in a loop: Read, Parse, Exec.

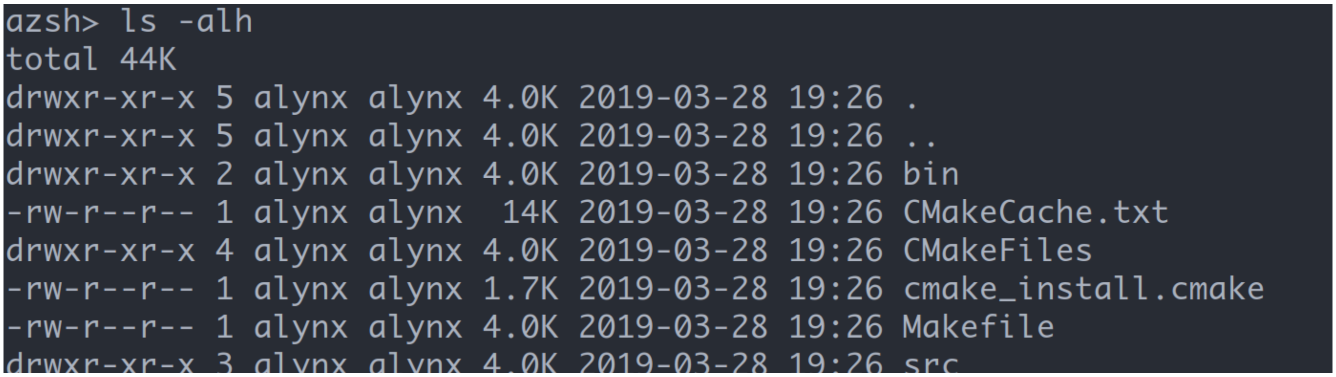
When loop starts, it read it's history file `~/.azhistory` to load history, then starts `azsh_readline()` to read user input: if user has a long command, he can use `\` in line end and continue to write command in next line.

`azsh_parse_args()` reads line and splits it into tokens, and store char pointer in a array to return. `azsh_run_command()` can pass this array to `execvp()` , or call internal funtion like `_azsh_cd()` or `_azsh_pwd()` .

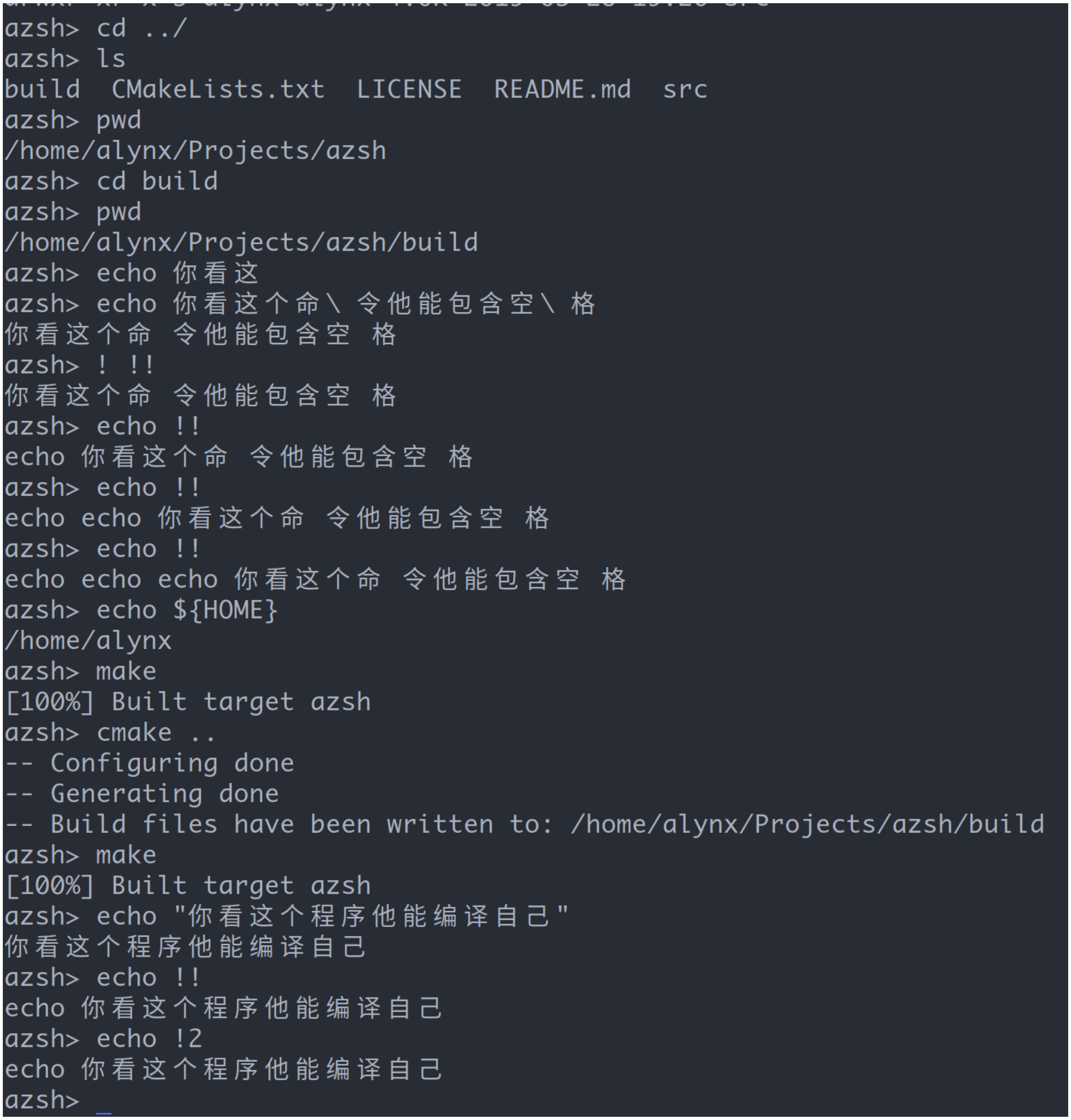
Snapshots



```
[alynx@pendragon:~/Projects/azsh:master:1] % mkdir build
[alynx@pendragon:~/Projects/azsh:master] % cd build
[alynx@pendragon:Projects/azsh/build:master] % cmake ..
-- The C compiler identification is GNU 8.2.1
-- The CXX compiler identification is GNU 8.2.1
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: /home/alynx/Projects/azsh/build
[alynx@pendragon:Projects/azsh/build:master] % make
Scanning dependencies of target azsh
[ 25%] Building C object src/CMakeFiles/azsh.dir/azsh.c.o
[ 50%] Building C object src/CMakeFiles/azsh.dir/history.c.o
[ 75%] Building C object src/CMakeFiles/azsh.dir/main.c.o
[100%] Linking C executable ../bin/azsh
[100%] Built target azsh
[alynx@pendragon:Projects/azsh/build:master] % ./bin/azsh
azsh> neofetch
                   -`                    alynx@pendragon
                  .o+`                   ---------------
                 `ooo/                   OS: Arch Linux x86_64
                `+oooo:                  Model: Precision 5510
               `+oooooo:                 Kernel: 5.0.4-arch1-1-ARCH
               -+oooooo+:                Uptime: 1 day, 3 hours, 6 mins
             `/:-:++oooo+:               Packages: 1612 (pacman), 8 (flatpak)
            `/++++/+++++++:              Shell: zsh 5.7.1
           `/++++++++++++++:             Resolution: 3840x2160
          `/+++ooooooooooooo/`           DE: GNOME 3.32.0
         ./ooosssso++osssssso+`          Theme: OSX-Arc-Shadow [GTK2/3]
        .oossssso-````/ossssss+`         Icons: Adwaita [GTK2/3]
       -osssssso.      :ssssssso.        Terminal: gnome-terminal
      :osssssss/        osssso+++.       CPU: Intel Xeon E3-1505M v5 (4) @ 2.800GHz
     /ossssssss/        +ssssooo/-       GPU: Intel HD Graphics P530
   `/ossssso+/:-        -:/+osssso+-     GPU: NVIDIA Quadro M1000M
  `+sso+:-`                 `.-/+oso:    Memory: 4753MiB / 15858MiB
 `++:.                           `-/+/
 .`                                 `/
```



```
azsh> ls -alh
total 44K
drwxr-xr-x 5 alynx alynx 4.0K 2019-03-28 19:26 .
drwxr-xr-x 5 alynx alynx 4.0K 2019-03-28 19:26 ..
drwxr-xr-x 2 alynx alynx 4.0K 2019-03-28 19:26 bin
-rw-r--r-- 1 alynx alynx  14K 2019-03-28 19:26 CMakeCache.txt
drwxr-xr-x 4 alynx alynx 4.0K 2019-03-28 19:26 CMakeFiles
-rw-r--r-- 1 alynx alynx 1.7K 2019-03-28 19:26 cmake_install.cmake
-rw-r--r-- 1 alynx alynx 4.0K 2019-03-28 19:26 Makefile
drwxr-xr-x 3 alynx alynx 4.0K 2019-03-28 19:26 src
```



```
azsh> cd ../
azsh> ls
build  CMakeLists.txt  LICENSE  README.md  src
azsh> pwd
/home/alynx/Projects/azsh
azsh> cd build
azsh> pwd
/home/alynx/Projects/azsh/build
azsh> echo 你看这
azsh> echo 你看这个命\ 令他能包含空\ 格
你看这个命 令他能包含空 格
azsh> ! !!
你看这个命 令他能包含空 格
azsh> echo !!
echo 你看这个命 令他能包含空 格
azsh> echo !!
echo echo 你看这个命 令他能包含空 格
azsh> echo !!
echo echo echo 你看这个命 令他能包含空 格
azsh> echo ${HOME}
/home/alynx
azsh> make
[100%] Built target azsh
azsh> cmake ..
-- Configuring done
-- Generating done
-- Build files have been written to: /home/alynx/Projects/azsh/build
azsh> make
[100%] Built target azsh
azsh> echo "你看这个程序他能编译自己"
你看这个程序他能编译自己
azsh> echo !!
echo 你看这个程序他能编译自己
azsh> echo !2
echo 你看这个程序他能编译自己
azsh> _
```

Limitation

I think shell actually uses lexer, it builds a grammer tree to parse input, however I didn’t implement this, because I don’t have enough time.

Using basic char in C cannot handle CJK characters (you can see in screenshots), needs UTF-8 support.