

Shell Design

March 30, 2021

1 Running Instructions

- In ubuntu 18.04
 - gcc shell.c
 - ./a.out
- In ubuntu 20.04, if the same instructions for 18.04 do not work, then
 - sudo su
 - gcc shell.c
 - ./a.out

2 Overview

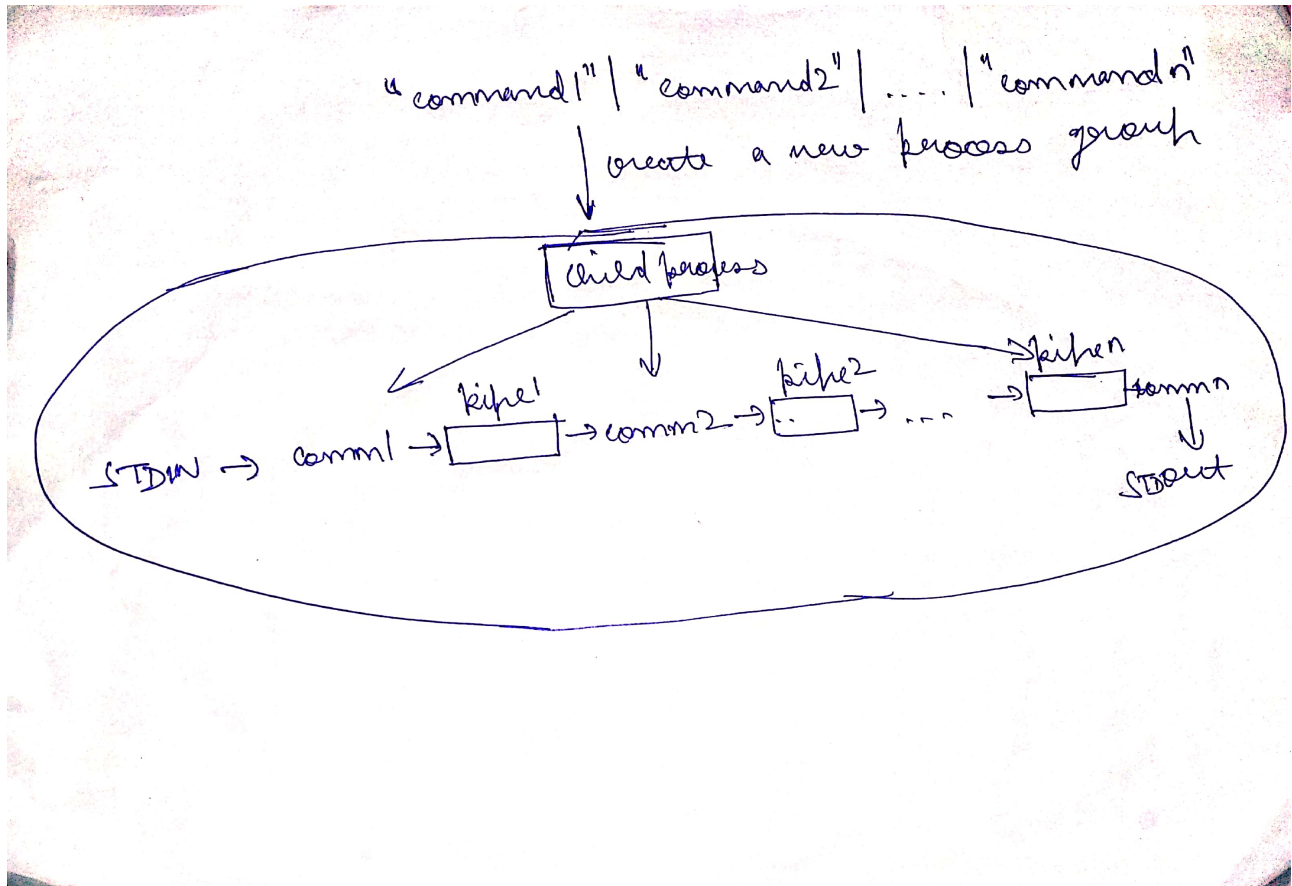


Figure 1:

- A command is tokenized using pipes as delimiters and stored in the command list structure. For each of the command a new process is created by the child if there is no || or ||| operator. fig. 3
- For pipeline operators || or |||, the value of p is set to be 1 and 2 respectively in the command structure. fig. 3
For non-pipelined commands, it is set to be 0.

```
typedef struct {
    int num_of_commands;
    char ** command_list;
    int p; // 0 if only single pipes, 1 if a double pipe, 2 if a triple pipe
} commands;
```

Figure 2: command data structure

- **Foreground command** A child process is created and the command is passed to the child which handles the completes execution of command. The parent process, waits until the child is completed. Also, the the process group of the child as 0, and a new process group is created. The parent makes the child process as foreground process using `tcsetgrp()` system call.
- **Background command** A child process is created and the command is passed to it for execution. But, the parent does not wait for the child process to complete the command execution.

- The path of the command is searched in the *findPath* function, which uses the *access()* system call internally.

3 Pipeline operators

- We have assumed, that the pipeline operator cannot be nested. This is achieved by not allowing brackets(,) in a command, by giving error: no command exists. Ex - `cat file.txt | ls || ls -l, wc, grep ^-` is invalid, as `||` is nested. No error will be shown, but the `grep ^-` is not executed. ??

```
Case 2: ls -l, wc, grep ^-
Case 2.2
Command1: ls -l
Command2: wc
Reading from pipe end 5
      31      31      242
```

Figure 3: Only 2 commands `ls -l` and `wc` are considered

- Also, we have assumed that pipeline operators cannot be in the middle of a command in case of multiple piped commands. i.e. The pipeline operator should either be in the first or the last command in the chain of commands. Ex -
 - First - `cat file.txt || grep ^q, grep ^w`
 - last - `ls | cat || grep ^-, grep`
- For implementing pipes, separate pipes are created for both the commands after `||`, the pipes are filled by an intermediate process which runs the command before `||`, and redirects the output to the pipes of the commands following `||`. Similar approach is used for `|||`.

4 Short-cut mode (SC mode)

- A lookup table is maintained as an array of strings. To insert a new command, `sc-i <index><command>` is used. To delete a command from an index, `sc-d <index>` is used.
- To print the lookup table at any instance, command *printlookup* is used.
- SC mode is completely handled by top level parent process.