

Assignment 2: Writing a Basic Command Shell

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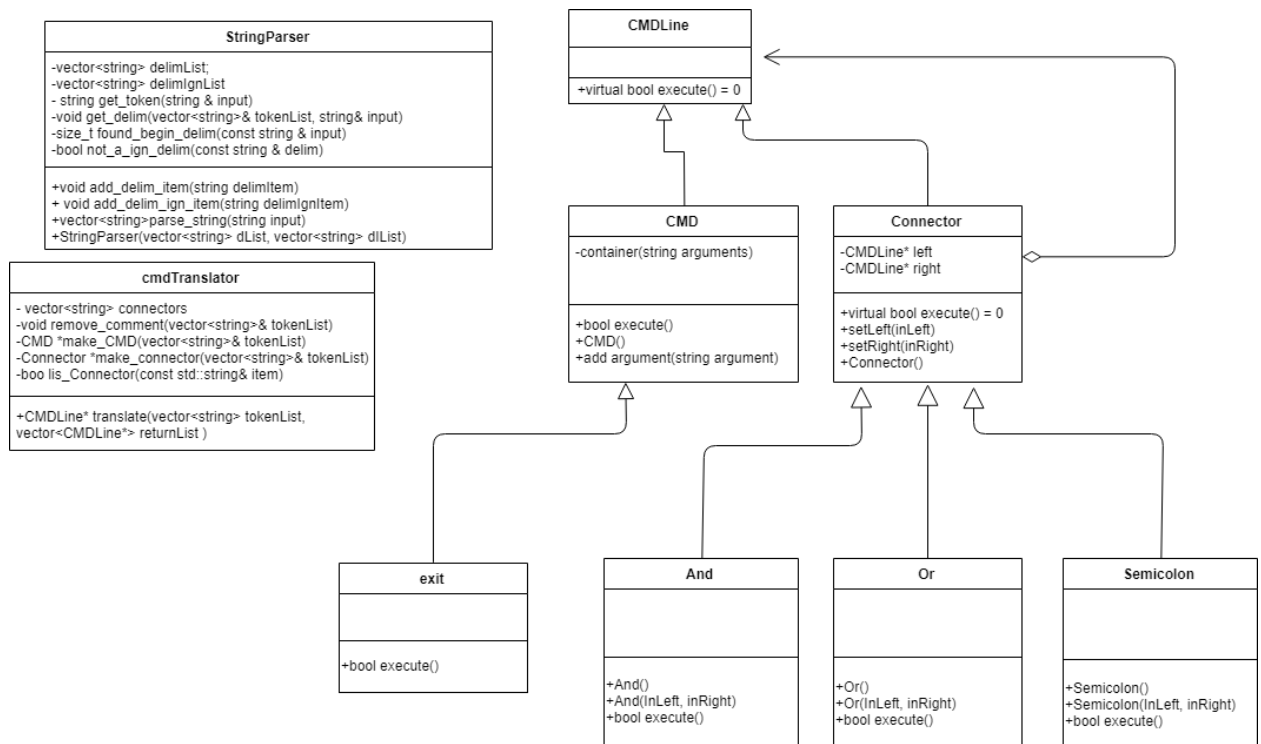
Christian Campos

Brandon Tran

- Introduction:

The main task of the assignment is to create a shell for the user to enter commands , arguments, and connectors in one line. Further, we are mainly using a composite pattern to implement the user interface. The commands and connectors will be implemented as hierarchy tree structure. The top of the hierarchy is CMDLine abstract class. The CMDLine base class will have virtual bool execute() function for all the subclasses to inherit. The next layers of the trees are CMD and Connector and then children of the CMD and Connectors are Exit,And, Or, and Semicolon. The CMD class will execute the appropriate commands using fork, execvp, and waitpid. Lastly, a Parser class was created to parse the user inputs from invalid inputs. During the assignment 2 sprint, we made new adjustments on the UML diagram. We added another class called cmdTranslator. The main goal for the cmdTranslator is to convert string tokens into objects. With this conversion, we can use the token objects to call the connector's children (And, Or, Semicolon) to execute the boolean condition. As the following the diagram demonstrates:

- Diagram:



- Classes/Class Groups:

- CMDLine (base)

The command line is the abstract base class. It will be the interface of the sub classes. A pure virtual function `execute()` will require all subclasses that inherit from the interface to execute a task, whether it is a composite or a leaf.

- CMD

The CMD class is a leaf to our composite structure. The CMD's purpose is to encapsulate one command and its arguments into an object. Example: If we have the command `ls -a; pwd`, then `ls -a` will be made into one CMD object and `pwd` will be different. We are treating a command input and its arguments as a single object.

- Connector

The connector class is a composite class that contains two CMDLine base objects. It is a parent class which contains only valid connectors that separate two command line objects. The children are `And`, `Or`, and `Semicolon` by the following assignment specifications. The commands should obey the connector rules to decide what it should be executed.

- Exit

The Exit class's sole purpose is to exit the program when the user enters the exit command. It is a subclass that inherits from the CMD class.

- And(&&)

The And class is a child of connector. The And operation holds two base pointers which are data pointers. The left data pointer will be executed first and it was able to execute properly, then the other data pointer will be executed. The right data pointer

will be executed if and only if the left data pointer was able to complete its instruction(s).

➤ Or (||)

The Or class is a child of connector. The Or operation inherits two base pointers from the connector. The Or operation will be executed only if one of the base pointers has a valid command input. The right hand data will be executed if and only if the left hand data failed.

➤ Semicolon (;)

The Semicolon class is child of connector. The Semicolon separates two CMD objects from the input. The semicolon operation will always execute the next command.

➤ Parser

The Parser class is to parse the user's input and convert to CMDLine objects. It's a class that doesn't inherit or composite the base class. Further, the Parser class will contain a C string library strtok function to parse the spaces, connectors, commands from the terminal.

➤ cmdTranslator

CmdTranslator's main task is to convert string tokens into objects. With this conversion, we can use the token objects to call the connector's children (And, Or, Semicolon) to execute the boolean condition.

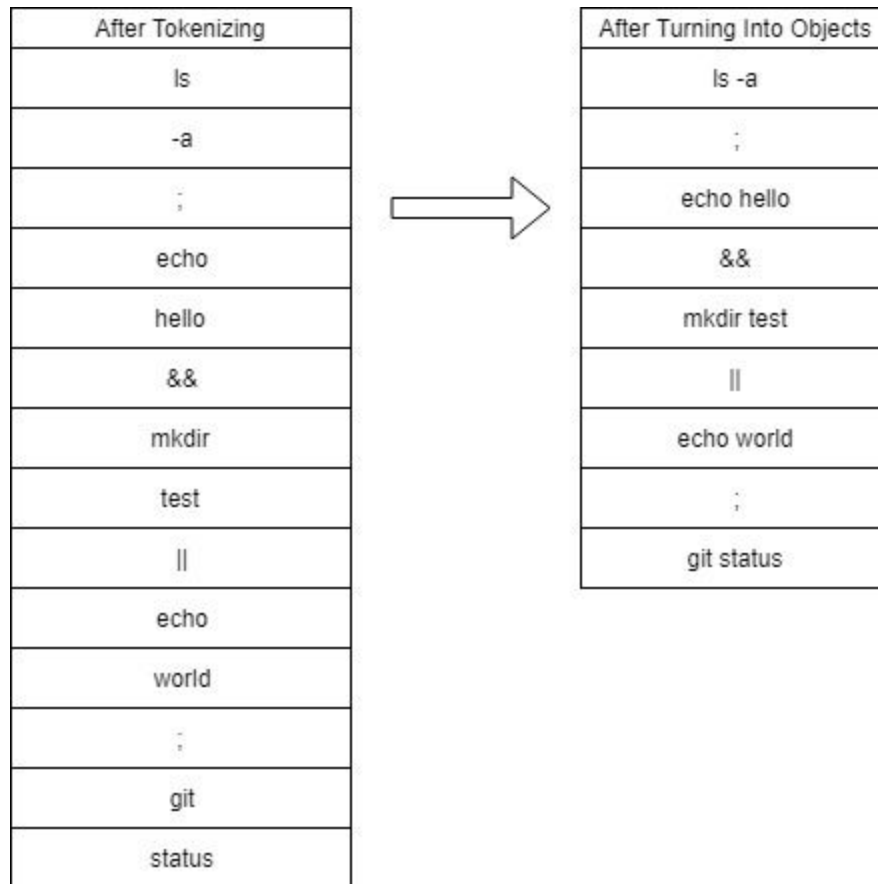
- Coding Strategy:

Brandon Tran - *Parsing the user's input*

Brandon's task will parse the command string the user enters. We are going to use the strtok function from the C standard libraries to parse the input. We are going to use the strtok function to split the input from the client/user into string tokens which will be turned into CMDLine objects. This will be implemented by the Parser class. For example: the client enters input,

```
$ ls -a; echo hello && mkdir test || echo world; git status
```

The input will then be parsed using spaces and connectors as the separators. After the input is tokenized, the tokens will then be created into CMDLine objects as the diagram shows below.



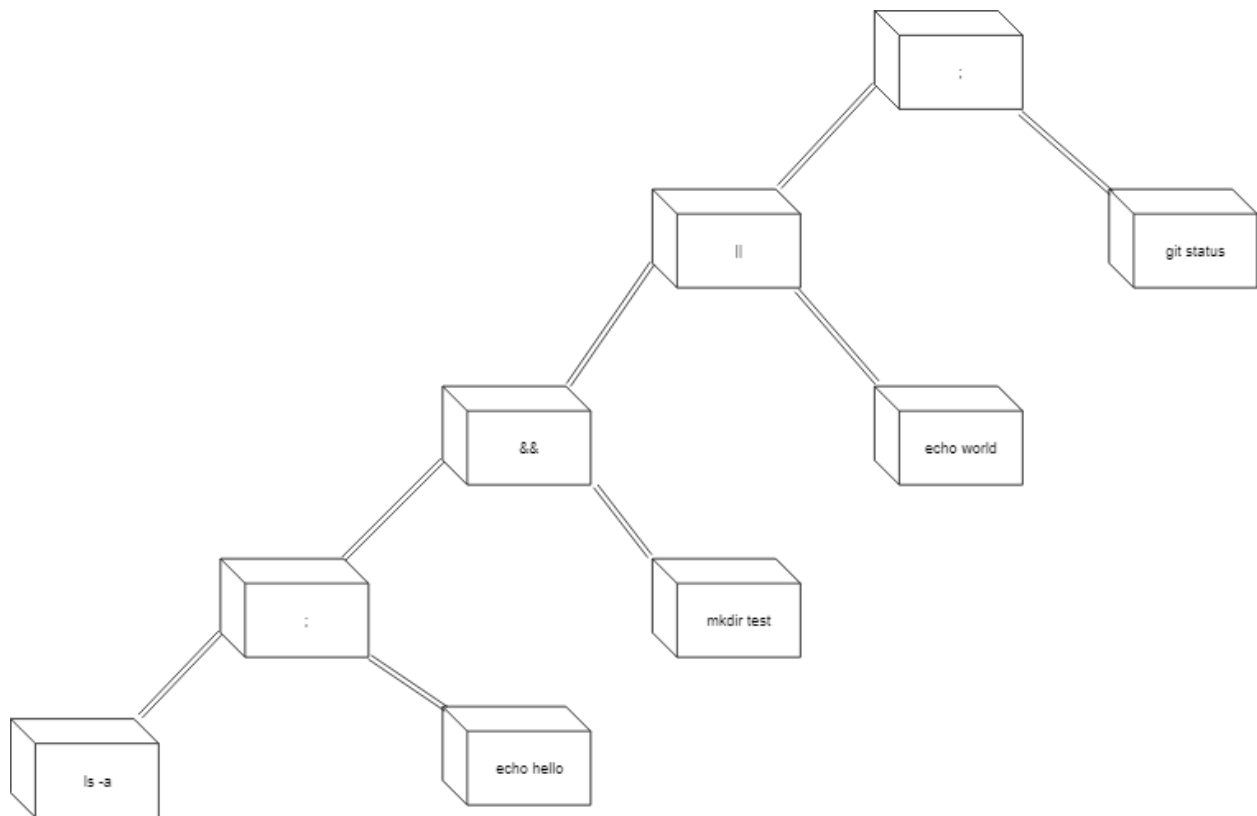
The CMDLine objects will be added from left to right ordering for its execution:

```
$ (((ls -a; echo hello) && mkdir test) || echo world); git status)
```

Christian Campos - *Commands and Connector Tree*

Since the basic command shell is based on a hierarchy system, the first command and its arguments from the input will be the lowest level of the tree structure. For example: let's use the command input used in the parsing. The top node of the tree will be the last command or connectors that will be executed from the user's input. Once the execute() function is called, the root node of the class will execute() and traveled down to the lowest level of the tree which is "ls -a". The command "ls -a" will be executed and returns a boolean value to transerve one level up towards the connectors, ";". Then a boolean value will returned based on what connectors command interacts. If the bool value returns true from "ls -a", then execute() will then travel to the right side of the tree to perform execute on the command "echo hello". As a result, it will

recursively transverse to the top node of the tree until all the nodes in the tree are executed with the true boolean value. The following recursive and tree structure can be shown in the diagram below:



- Roadblocks:

A roadblock that can hinder our project structures is the system calls. We don't fully understand how fork, execvp, and waitpid because we never used system calls before. However, we will thoroughly read multiple articles and watch youtube videos to help us comprehend the unix functions.

An another potential roadblock that can occur is parsing the user input with strtok function. Since our previous projects we were mostly creating our own parse for the user

input, strtok is new to us. Nevertheless, we will read c++ documentation and articles, and watch youtube videos on strtok function. “Zombie” children can be a potential roadblock because our program runs on a continuous loop and we create multiple children process id for every new command input from the user , but our program has perror for every sys call. However, we will keep an eye on any “Zombie” children lurking in our program.