

Project Proposal:

The Pipeline Language

Team: Brandon Bakhshai (bab2209), Ben Lai (bl2633), Jeffrey Serio (jjs2240),
and Somya Vasudevan (sv2500)

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1 Motivation

Concurrent programming has become a very important paradigm in modern times, with mainstream languages such as Java, Python, and C++ offering concurrent programming mechanisms as part of their APIs. However, they tend to be complicated - sometimes necessarily - and invite a host of additional concerns like atomicity. And of course, complexity of code is strongly correlated with bugs.

Node.js has emerged as a framework with a unique approach toward asynchronous programming - the single-threaded (but not really) asynchronous programming. The event-driven architecture of Node.js and nonblocking I/O API makes it a perfect fit for backend web development.

We want to build a simple language that encompasses these features from Javascript and the Node.js framework - easy asynchronous programming using the event-driven architecture and a speedy I/O API.

2 Description of Pipeline

The asynchronous programming model takes after that of Node.js, while the syntax is more like that of Go. The way chains of functions which depend on the results of the previous function are handled is in a manner similar to Promises from Javascript, except we use the pipe, "|", syntax from bash shell. A chain of blocking functions which rely on each other is written as follows:

```
firstDoThis() | secondDoThis(_) | thirdDoThis(_) | fourthDoThis(_) || errorHandler();
```

As soon as `firstDoThis()` blocks, the program will continue on to the next line, without executing `secondDoThis()`. Only when `firstDoThis()` returns does `secondDoThis()` run with the return value of `firstDoThis()`. If there is an error in any function, then the pipeline jumps to `errorHandler()`.

The language is designed for web-based programming, leveraging features like non-blocking I/O for external client communication.

3 Pipeline's Features and syntax

Data types

a. Primitives

int: Basic integer type, 4 byte in size

char: ASCII characters, 1 byte in size

float: Floating point numbers, 4 bytes in size

pointer: A memory address stored in a 8 byte

function: Takes in parameters and return if needed

3.0.a. Compound type

String:String type, support basic string manipulation.

List:A collection of data supports basic list operation.

Struct: set of grouped variables.

3.1 Control Flow:

if - else - if else:

```
if condition {  
    #statements  
} else if condition {  
    #statements  
} else condition {  
    #statements  
}
```

for - It is a control flow statement for iterations. Syntax :

```
for init; condition; inc/dec { statements }
```

while - while (condition) {statements;}

break - breaks the control flow out of loop

continue - forces the next iteration of the loop to take place, skipping any code in between.

return terminates the execution of a function and returns control to the calling function.

3.2 Operators

Arithmetic: we use the standard C operators +,=,*,/,%

Assignment: =, +=, -=, /=, %=

Comparison: ==, !=, <=, >=

Increment/Decrement: ++, --

Logical: (these are the only operators that differ from c) and, or, not

3.3 Keywords

null - The return statement terminates the execution of a function and returns control to the calling function.

/*...*/ - Comments

@ - Dereferencing

***** - Referencing

| - Pipeline operator

|| - Error Handler at the end of a pipeline

pipe - feed returned pipe data into here

. - Name space indicator

4 Example Programs

4.1 simple program

This program is to give the reader an example of how we intend the syntax to be. It is a simple GCD function, and it shows how the pipes are to run asynchronously from each other.

```
function gcd(int a, int b)(int)
{
    if a < 0 { a = -a;}
    if b < 0 { b = -b;}
    if b > a {
        int temp = a;
        a = b;
        b = temp;
    }
    while 1 {
        if b == 0 { return a;}
        a = a % b;
        if a == 0 { return b;}
        b = b % a;
    }
}

function main(void)(int)
{
    /* Here is one way to type it */
    pipe gcd(a, b)| gcd(1031940, pipe)| gcd(49980, pipe)| printf("gcd: %d", pipe) ||
        printf("invalid numbers");

    /* Here is an alternative way to type the same thing*/
    pipe gcd(a, b)|
    gcd(1031940, pipe)|
    gcd(49980, pipe)|
    printf("gcd_2: %d", pipe)||
    printf("invalid numbers");

    /* the idea is that these two pipes will be executed asynchronously, but
    * the functions inside the pipe will be executed synchronously */
}
```
