

# VIREX : Virtual Execution Console

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**VIREX** (VIRtual EXecuter) is a platform-independent virtual machine designed around a flexible intermediate language called **SASM** (Simulated Assembly). It's inspired by the **Java Virtual Machine (JVM)**, but unlike JVM bytecode, SASM is **open, readable, and writable** — you can program directly in it.



## What is SASM?

Just like Java compiles to bytecode for the JVM, any language can be compiled into SASM for VIREX. The difference is:

- SASM is **assembly-like**, human-readable, and editable.
- SASM is **open**, letting anyone build tools and languages around it.

You can even create your own programming language that compiles into SASM and runs anywhere VIREX runs — making your language instantly portable.



## Why SASM?

- Learn how **assembly-level code** works through a clean and simplified syntax.
- Build a **compiler** without worrying about machine-level code generation.
- Make your own language **platform-independent** by targeting SASM.



## Current Features

-  **VS Code syntax highlighter** for SASM
-  **AST visualizer** for seeing how your SASM code is parsed and compiled
-  A new programming language called **ORIN** is currently under development. It is being designed to compile directly to SASM.

If you're interested in compilers, language design, or virtual machines — **contributions are very welcome!**



## Project Structure

```
/docs/      # Reference documentation
/examples/  # Sample programs
/include/   # Public headers for VM, SASM, OCC
/src/       # Core implementation (VM, assembler, compiler)
/tests/     # Simple Test programs written in SASM
/tools/themes/vs_code/ # VS Code syntax highlighter
/install.sh # Install script for linux
```

# Getting Started (LINUX)

## 1. Clone this repo:

```
git clone https://github.com/Soham-Metha/virex.git
cd virex/
```

## 2. Build the project (requires **sudo**):

```
./install.sh
```

## 3. Run an example program:

```
cd ./examples/SASM/
virex
```

If the **TUI doesn't render properly**, try adjusting your **terminal font size**.

If that doesn't help, you can tweak layout values in **src/VM/vm\_tui.c::CreateWindows()**.  
The constants used are defined as **percentages** of the screen dimensions.

P.S. **kitty terminal** config, and font used, are available in **/tools**

## 4. Inside VIREX, do the following:

- Select **"Run SASM/ORIN command with custom flags"**
- Enter the following command:

```
-i helloWorld.sasm -I ./ -o tmp.sm
```

 use **Arrow keys** for navigation in menu.

- Select **"SASM build and exec"** by pressing **'a'**
- Enter the output filename (**tmp.sm**)

## 5. Activate the syntax highlighter in VS Code

- Open VS Code
- Press **Ctrl + Shift + P**
- Type: **Preferences: Color Theme**
- Select: **Palenight+sasm**

 Open any **.sasm** file in vs code to see the syntax highlighter at work!

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## Want to Contribute?

We're actively building:

1. The **ORIN** programming language
2. Improved **SASM** tooling (UI, debuggers, optimizers, etc.)
3. Expanded **Documentation** and **tutorials**

!!! info inline end ""

 For contribution guidelines and a roadmap, see [CONTRIBUTING.md]() (coming soon).

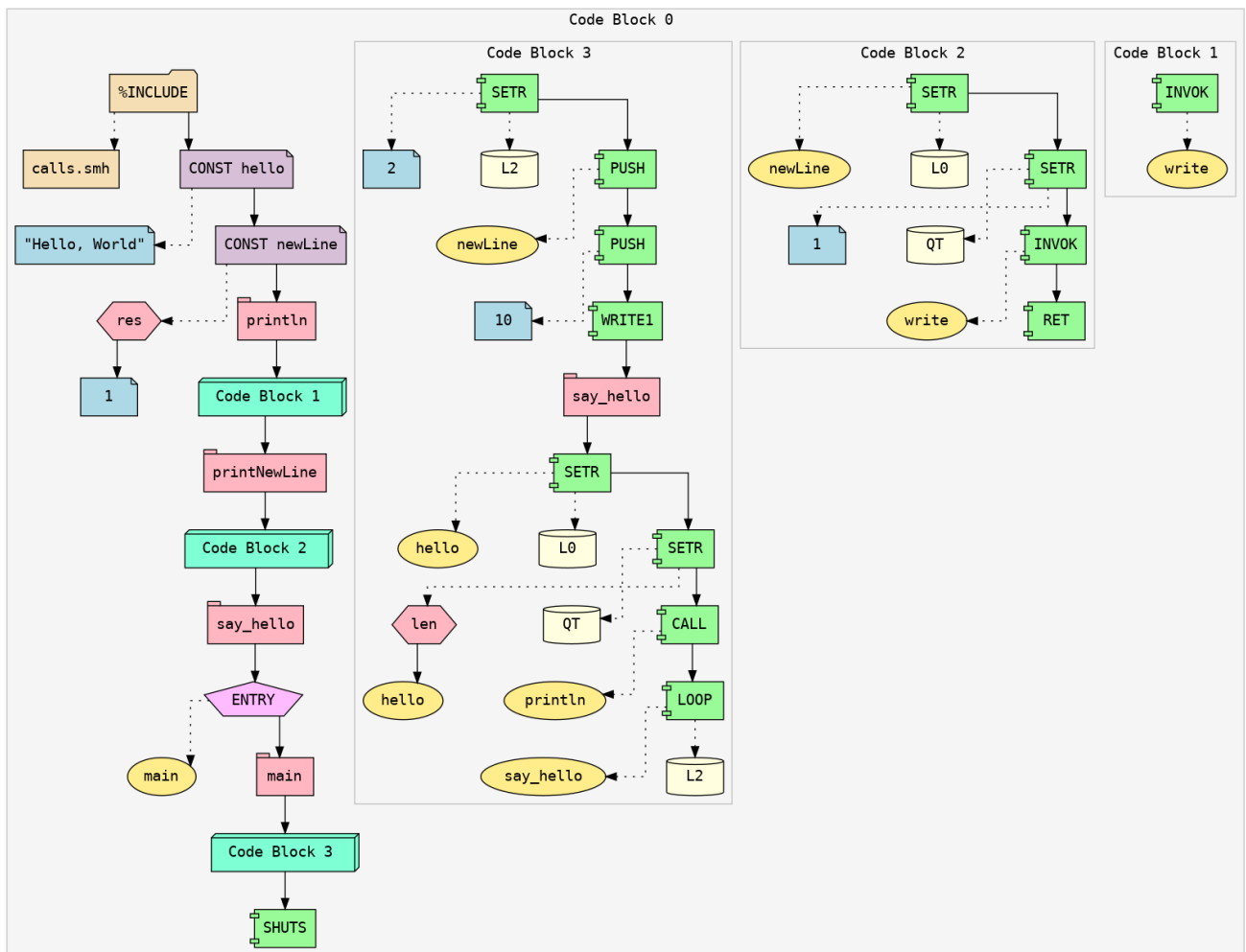
## Examples

### Syntax Highlighting:

```
helloWorld.sasm M X
extras > samplePrograms > helloWorld.sasm
You, 2 minutes ago | 1 author (You)
1 %include "calls.smh"
2
3 %bind hello "Hello, World" ; Compile-time Escape characters not yet supported, specify at runtime instead
4 %bind newLine res(1) ; reserves 1 byte in memory for the newline character
5
6 println:
7 %scope ; "write" is a integer const defined in 'calls.smh'
8 | INVOKE write ; INVOK is used to invoke a syscall(vsyscall?)
9 %end ; No RET here will lead to a fallthrough, printing a newline as well
10 printNewLine:
11 %scope
12 | SETR newLine [L0] ; SETR expects reference to a register(register ID), we can specify
13 | SETR 1 [QT] ; reference or value using ref([QT]) or val([QT]), default is ref()
14 | INVOKE write ; Will print QT(Quantity of) characters starting from location stored in L0
15 | RET
16 %end You, last month • Sasm Parser Rewrite done ...
17
18 say_hello: ; global 'say_hello'
19 %entry main: ; inline define label 'main' as the entry point of the program
20 %scope ; start local scope for main, optional, if not done, main runs in global scope
21 | SETR 2 [L2] ; SET Register 'L2' to 2
22 | PUSH newLine ; ptr to location
23 | PUSH 10 ; ASCII for newline
24 | WRITE1 ; Override 1 byte in memory, can use WRITE{1,2,4,8} depending on byte count
25 say_hello: ; local 'say_hello'
26 | SETR hello [L0] ; register L0 -> pointer to hello msg
27 | SETR len(hello) [QT] ; register QT -> length of hello msg
28 | CALL println
29 | LOOP say_hello [L2] ; Loop over label 'say_hello' - 'L2' times, P.S. zero inclusive
30 %end ; end local scope of main
31 SHUTS ; SHUT System
32
```

{ width="400" }

### AST:



!!! info "Local/Global Scopes"

Each Code Block in the visualized AST represents a Scope, Block 0 being global scope.

## Binary Executable:

helloWorld.sm

00000000	53	4F	48	00	41	4D	00	00	0E	00	00	00	00	00	00	05	00	00	00	00	00	00	0D	00	00	00	SOH.AM.....
0000001c	00	00	00	00	0D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
00000038	07	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	06	00	00	00	.....
00000054	00	00	00	00	00	00	00	00	00	00	00	06	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
00000070	06	00	00	00	00	00	00	01	00	00	00	00	00	00	00	10	00	00	00	00	00	00	00	00	00	00	.....
0000008c	00	00	00	01	00	00	00	00	00	00	07	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
000000a8	00	00	00	00	00	00	00	21	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....!
000000c4	00	00	00	00	00	00	00	00	00	00	06	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....!
000000e0	08	00	00	00	00	00	00	00	00	00	00	00	00	00	0A	00	00	00	00	00	00	00	00	00	00	00	.....
000000fc	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	0A	00	00	00	00	.....E..
00000118	0A	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	45	00	00	00	.....E..
00000134	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
00000150	06	00	00	00	00	00	00	01	00	00	00	00	00	00	06	00	00	00	00	00	00	00	00	00	00	00	.....
0000016c	00	00	00	06	00	00	00	00	00	0C	00	00	00	00	00	00	00	10	00	00	00	00	00	00	00	00	.....
00000188	00	00	00	00	00	00	00	08	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
000001a4	00	00	00	00	00	00	00	00	00	09	00	00	00	00	00	00	00	09	00	00	00	00	00	00	00	00	.....
000001c0	08	00	00	00	00	00	00	00	00	00	00	00	05	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
000001dc	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	48	65	6C	6C	6F	2C	20		.....Hello,	
000001f8	57	6F	72	6C	64																					World	

Signed 8 bit: 72

Unsigned 8 bit: 0x48

Signed 16 bit: 18533

Unsigned 16 bit: 0x4865

Signed 32 bit: 1214606444

Unsigned 32 bit: 0x48656c6c

Float 32 bit: 234929.7

Float 64 bit: 5.83203948143097E+40

Hexadecimal: 48 65 6C 6C

Decimal: 072 101 108 108

Octal: 110 145 154 154

Binary: 01001000011001010110110001101100

Show little endian decoding

Show unsigned as hexadecimal

ASCII Text: Hell

Offset: 0x1f1 / 0x1fc

Selection: 0x1f1 to 0x1f5 (0x5 bytes)

INS

## GUI:

DETAILS

REGISTERS

H0 : 0

H1 : 0

P0 : 4

P1 : 6

P2 : 0

P3 : 0

J5 : 0

KC : 0

NX : 67

IO : 0

I1 : 0

L0 : 37

L1 : 0.000000

L2 : 5

L3 : 0

OP : 0

QT : 1

RF : 0

FLAGS

H1 : F F1 : F

F2 : F F3 : F

F4 : F F5 : F

F6 : F F7 : F

INSTRUCTION

33 RET

OUTPUT

Binary Searching for 5

Used array :

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E

Found at :

5

MEMORY

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 4F 74 20 46 6F 75 6E 44 21 20 46 6F 75 6E 64 20

61 74 20 3A 20 0A 42 69 6E 61 72 79 20 53 65 61 72 63 68 69 6E 67 20 66 6F 72 20 35 55 73 65 64

20 61 72 72 61 79 20 3A 20 00

00 00

00 00

00 00

00 00

00 00

00 00

00 00

PROGRAM

65 CALL 37

66 CALL 0

67 SHUTS

VIREX

VIATUAL EXECUTOR

INPUT

Enter the name of the SM file : tap.sm

Debug Mode?

0. No

1. Yes

2. Fast Debug

Your choice : 2

CREDITS

VIREX, SASM : SOHAM METHA

AST Visualizer : SOHAM METHA

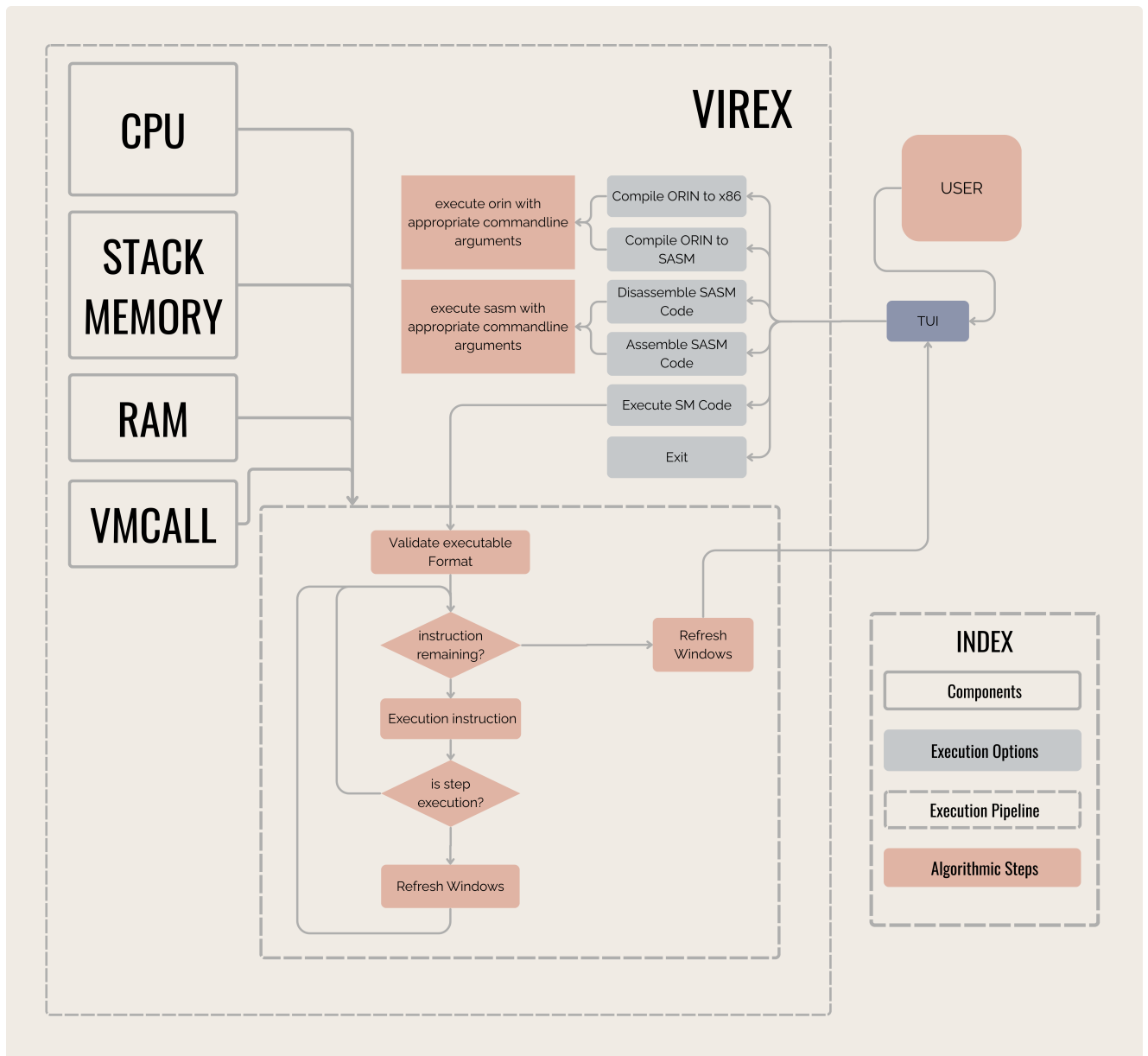
Syntax Highlighter : SOHAM METHA

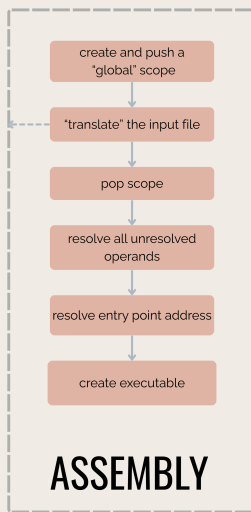
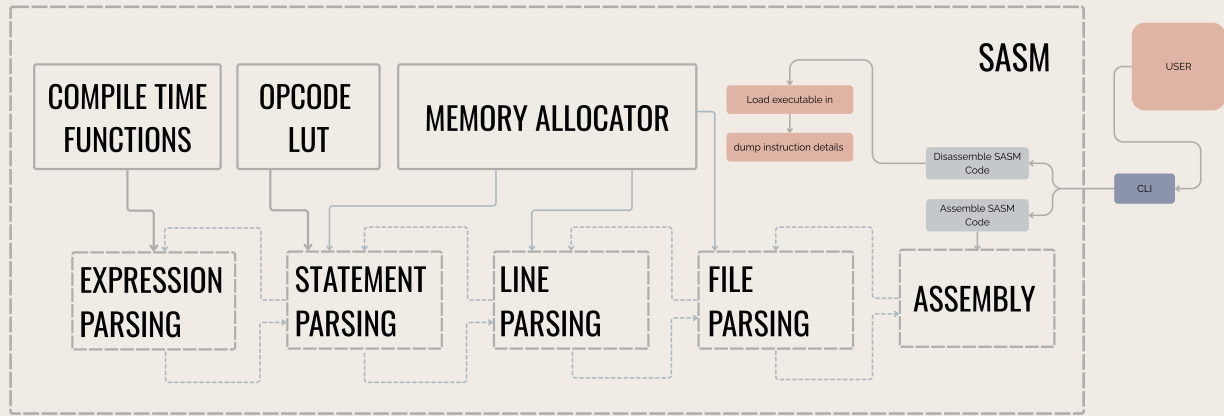
ORIN Compiler : ONKAR JAGTAP

Core lib(Hashtable) : ONKAR JAGTAP

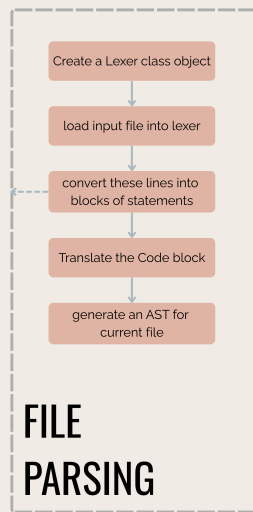
Core lib(sOther) : SOHAM METHA

## System Design and Architecture

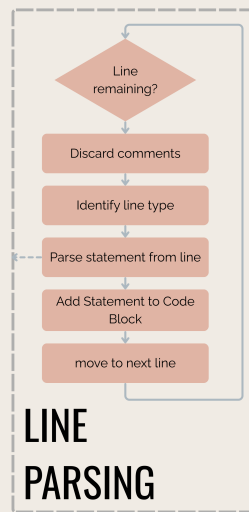




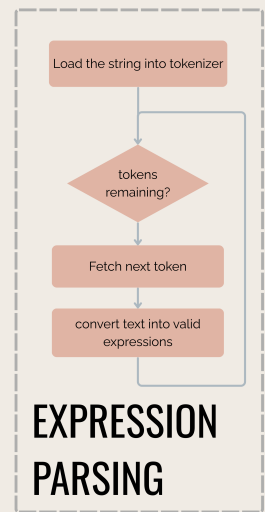
(a) Assembly Pipeline



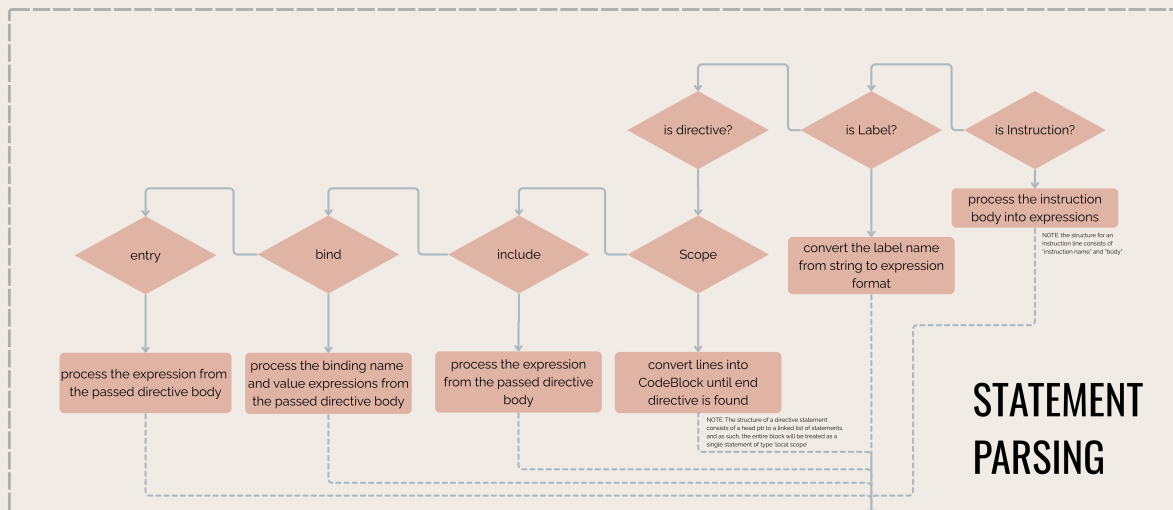
(b) File Parsing



(c) Line Parsing



(e) Expression Parsing



(d) Statement Parsing

## Tech Stack

- **Programming Language: C**

- **Version Control:** Git
  - **Build System:** GNU Make
  - **AST VISUALIZER:** Graphviz
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## Maintainers

Tool	Maintainer
VIREX, SASM	Soham Metha
AST visualizer	Soham Metha
Syntax Highlighter	Soham Metha
ORIN Compiler	Omkar Jagtap
Core lib(Hashtable)	Omkar Jagtap
Core libs(other)	Soham Metha

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## References

- [Tsoding](#)
  - [Dr Birch](#)
  - [Low Byte Productions](#)
  - [Cobb Coding](#)
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