Part II Project: Progress Report

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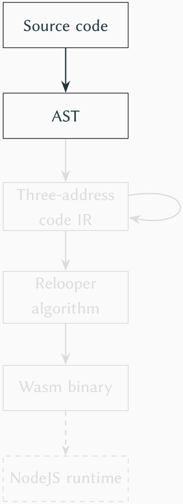
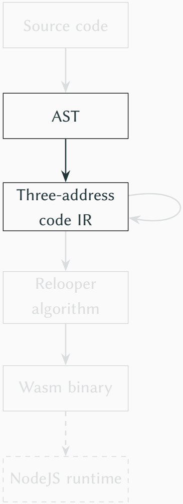
Main compiler pipeline



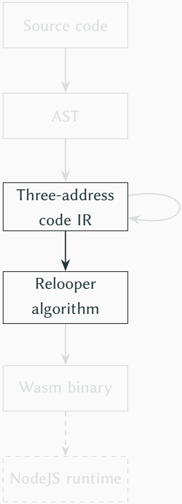
- Rust parser generator: LALRPOP
- Custom lexer, to handle `typedef` definitions (context-sensitivity).
- Avoiding ambiguities e.g. dangling `else`

Main compiler pipeline



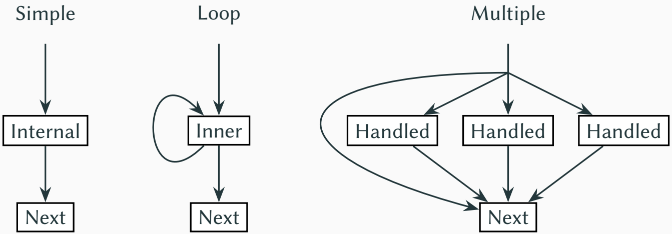
- Defined three-address code representation
- For each node in the AST, defined transformation to three-address code
- Complexity:
  - Switch statement logic: fall-through and `default` cases
  - Assignment: evaluating an expression either as loading a value or storing to that address

Main compiler pipeline

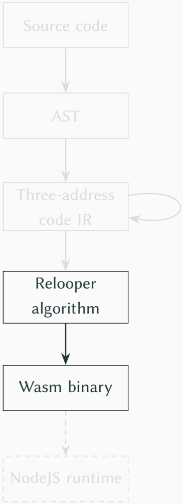


Implemented the Relooper algorithm

- Turning the linear sequence of IR instructions into a structure of ‘blocks’



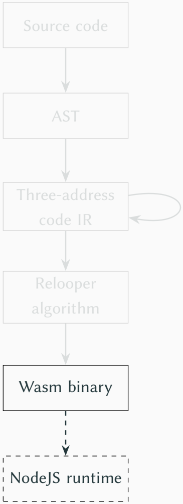
Main compiler pipeline



Target code generation

- Defined WebAssembly instructions for each IR instruction
- Pushing/popping function call stack frames
- Updating stack and frame pointers
- Allocating addresses for variables

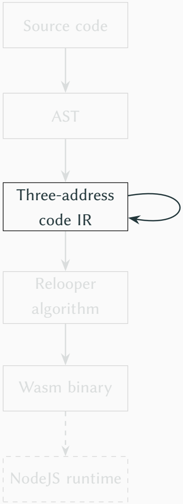
Main compiler pipeline



NodeJS runtime:

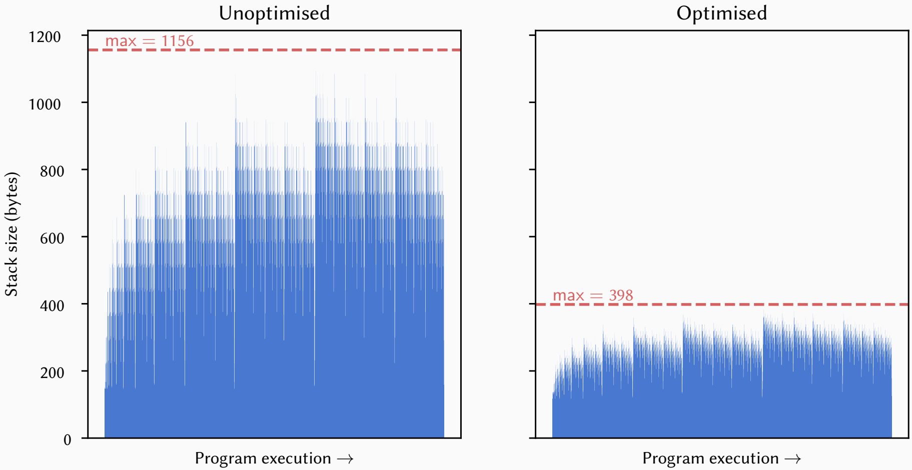
- Instantiate WebAssembly module
- Initialise memory, and store program arguments
- Implemented some of the C standard library, e.g. `printf`

Implemented optimisations



- Tail-call optimisation
  - Find recursive tail-calls in each procedure
  - Instead, set the parameter variables to the new values and loop back to the entry point
- Unreachable procedure elimination
  - Generate call graph
  - Walk call graph, marking all reached functions
  - Remove all unmarked functions

Optimised stack allocation


Unoptimised
Optimised
Stack size (bytes)
max = 1156
max = 398
Program execution →
Program execution →