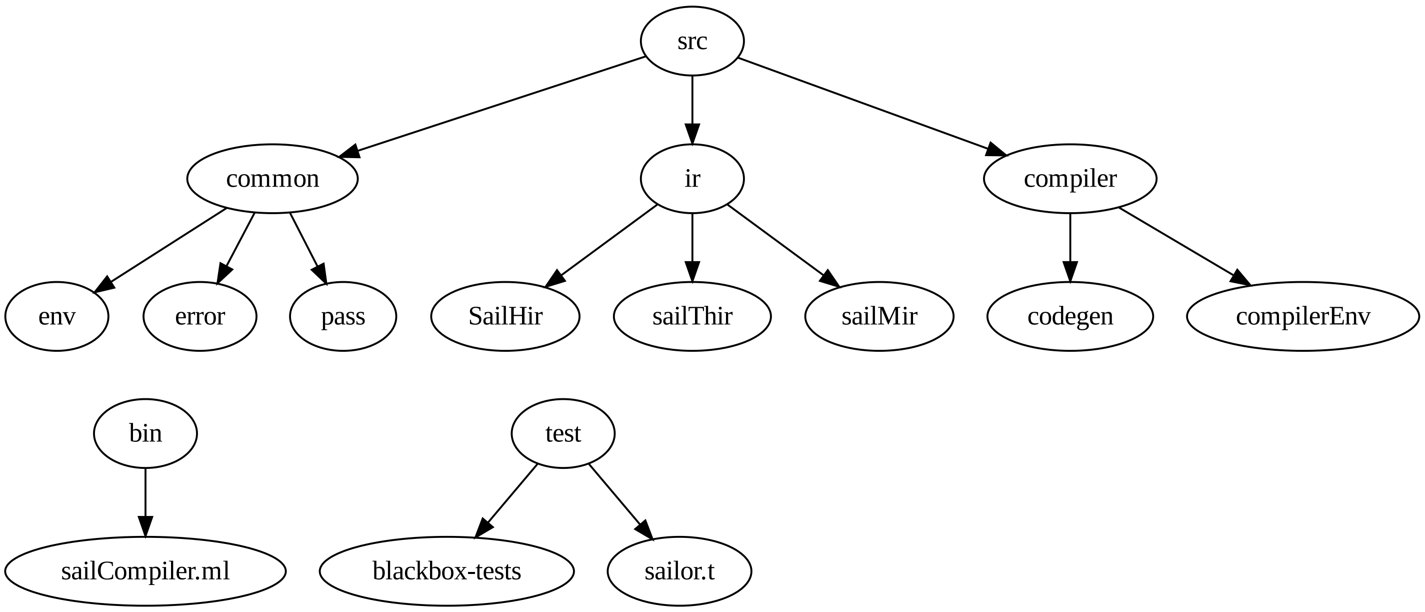
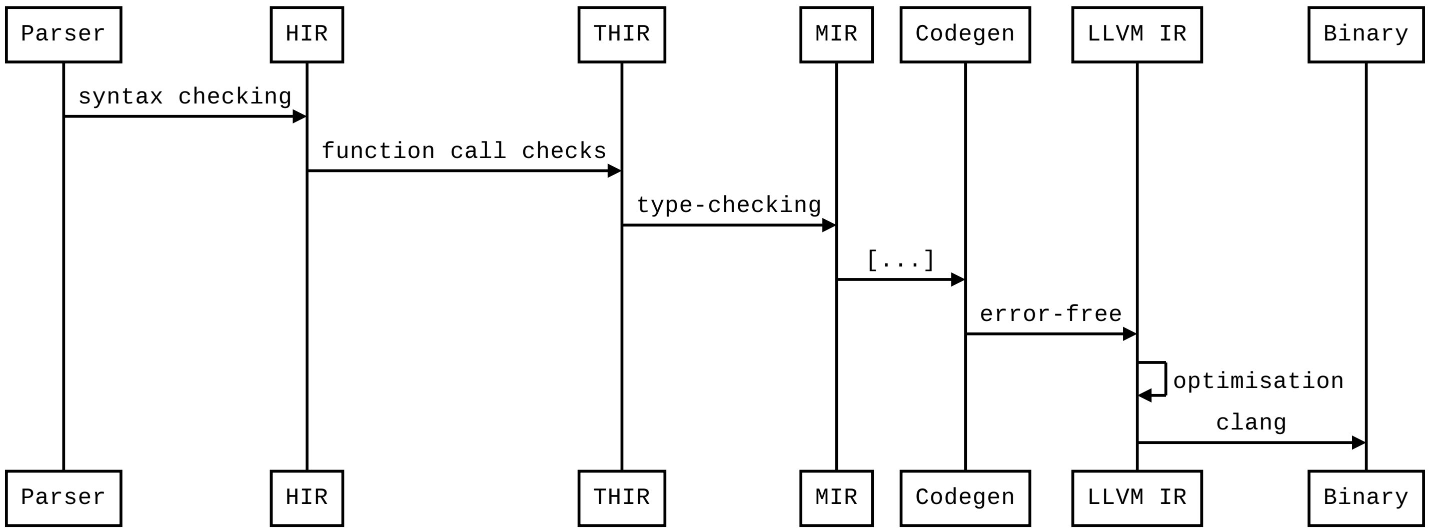
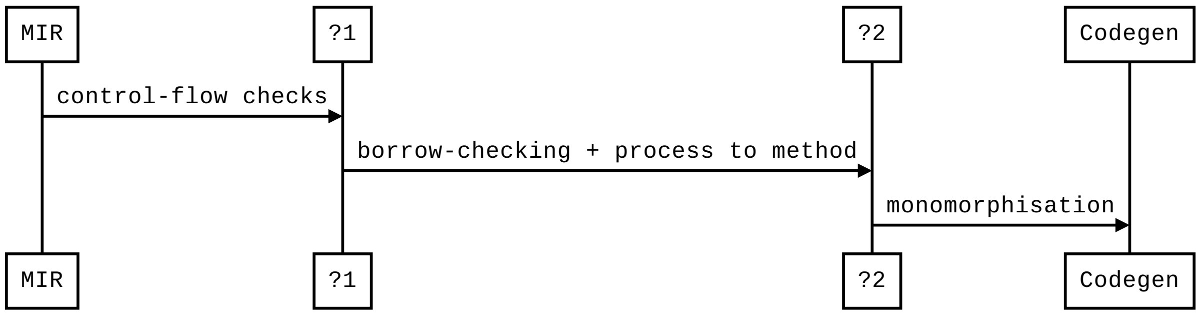
SailOR : Technical Documentation

General Structure



Compiler process overview





Use of monads

Error handling

LoggerMonad

Pass

Pass functor

Env

Tests

Parsing

Parsing is done with mehhir from the lexems given by ocamllex.
There are two parsing functions : a fast one with few info in case of an error and a slow one with better info. The fast one falls back to the slow one when a syntax error is encountered for better error handling while maintaing fast parsing speed.

If parsing is sucessful, an AST of type `string * AstParser.statement SailModule` is created and passed on to *HIR*
Else, we check if there is an explicit message for the specific syntax error defined in *parserMessages.messages* and throw an error using the *Logger* monad.

HIR

- Input : `string * AstParser.statement SailModule.t`
- Output : `loc AstHir.expression AstHir.statement SailModule.t`

Main objectives : de-sugarize the code, integrate token location into the AST type constructors

Details :

- Check if methods and processes exists
- Extract a method call from an expression into a statement
- Make sure no reactive statements or process call are contained inside a method

THIR

- Input : `loc AstHir.expression AstHir.statement SailModule.t`
- Output : `(loc * sailtype) AstHir.expression AstHir.statement SailModule.t`

Main objective : add type to expressions

Details :

- Do type-checking on variables, structures, function parameters and return type
- Check for usage of undefined variables
- Make sure we only dereference actual references
- Simple out-of-bounds check for static arrays
- Check correct usage of lvalue / rvalue
- Infere type for typeless variable declaration & assignement

MIR

- Input : `(loc * sailtype) AstHir.expression AstHir.statement SailModule.t`
- Output : `declaration list * cfg` where *declaration* is `{location : loc; mut : bool; id : string; varType : sailtype}` and *cfg* is a set of blocks with an input and output representing control-flow information

Main objective : construct a control-flow graph representation of THIR for use by the borrow-checker

Details :

- Eliminate 'If' / 'While' / 'Seq' or other control-flow constructs
- Add predecessors to each block
- Do some simple control-flow checks

Codegen

- Input : `declaration list * cfg`
- Output : `llmodule`

Main objective : Translate the CFG representation of the program into LLVM Intermediate Representation. Any error at this point is considered fatal.