



Agda formalisation of an elaborator for a language based on simply typed lambda calculus

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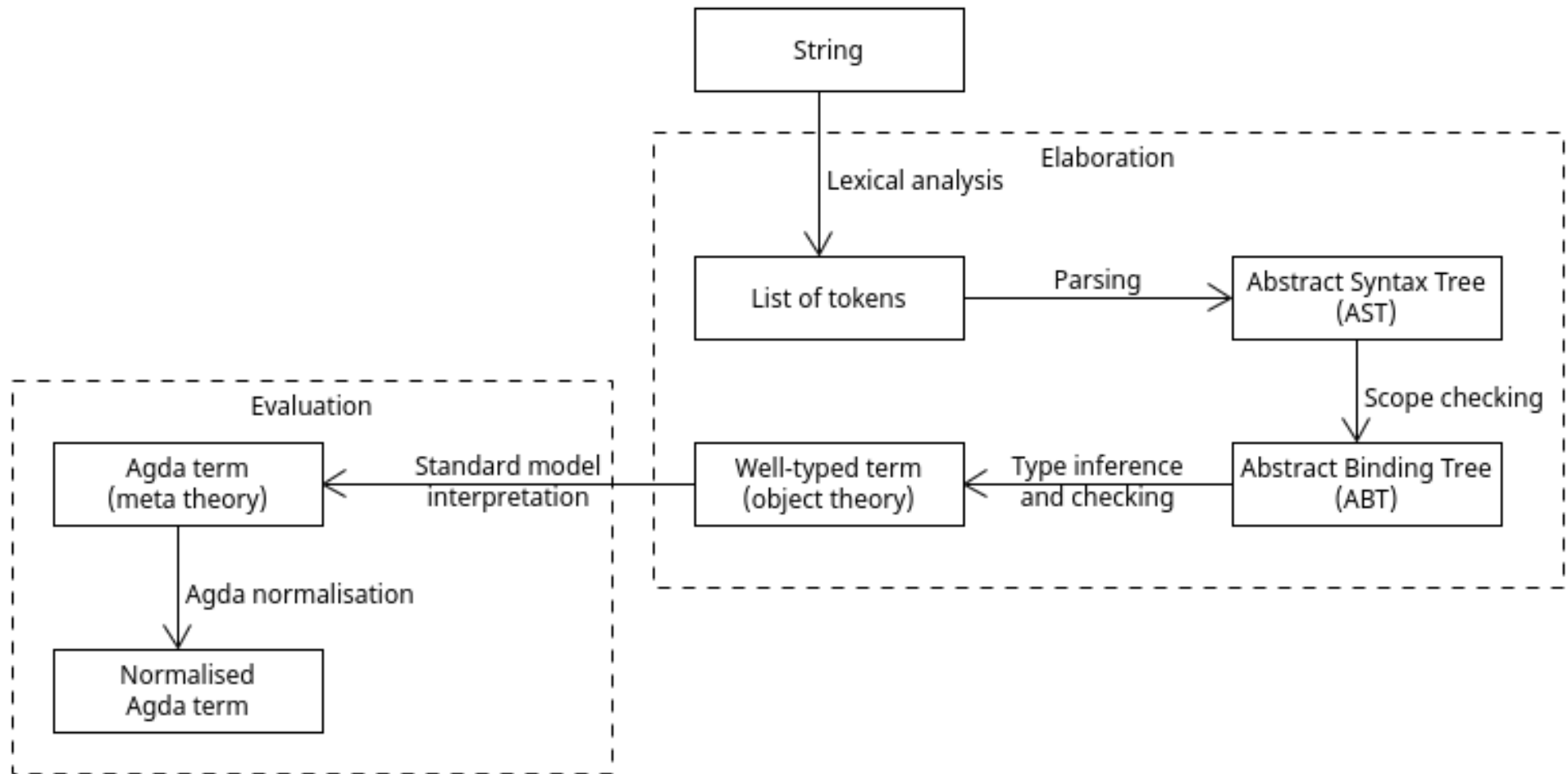
Research goals

- **Elaborator** formalisation
- Translating strings to an algebraic description (QIIT) of **simply typed λ -calculus**
- Both the models and translation to be **correct-by-construction**
- Implement a framework that is transparent and easy to use for educational or future research purposes

Methods

- **Agda** - programming language and theorem prover based on Intuitionistic type theory
- **Dependent types** - first order statements and proofs by Curry-Howard isomorphism
- **Totality** - termination of functions is guaranteed, no unhandled cases or runtime exceptions
- **agdarsec** - parser combinator library
- **Bidirectional type checking** - inference and checking rules

Levels of Abstraction



Implementation

- **ABT cannot be badly scoped, well-typed terms cannot be badly typed by definition, e.g.:**
data ABT ($n : \mathbb{N}$) : Set where
abt-var : Fin n \rightarrow ABT n
- **elaborate** function returns each level of abstraction until evaluation result or error
- **compile** and **eval** only return well-typed terms and standard model interpretations
- **Errors** are signaled to the user:
syntax-error, scope-error, type-error

Results

- **Easy to use** framework had been implemented
- **Modular**
Lexer.agda, Parser.agda, Scopecheck.agda, etc.
- **Extendable**
e.g.: adding polymorphism
- **Performance could be improved in the future**
(implicit argument instantiation)
- **Tests and examples in the public repository**