C*

A Language That Could’ve Been

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Current State of the Project

- Unfortunately, I didn’t have to time finish the project, and so extremely little is done at this point
- I’m sorry, it was really hard this semester
- I received barely any help from my team throughout the semester, and then in the last week they decided to leave me as well
- I worked really hard throughout this whole semester
- But evidently, this was not supposed to be a single-person project

What C* Was Meant To Be

- Instead, I’ll discuss in this presentation what the language C* could have been
- Go over the language itself
- Discuss the (intended) architecture of the compiler

C*: the Language

- A systems programming language
- Semantic simplicity of C
- No hidden costs
- But closer to the expressiveness of Zig and Rust
- A unique fluid and postfix syntax

Major Features of C*

- Expression-oriented: everything is an expression
- Everything is postfix:
  - Except for binary operators
  - But method calls, unary operators, control flow keywords can all be postfix
- Helps the programmer code in a straightforward manner
- I.e., very little jumping back and forth is necessary while coding
- Means IDEs can provide better intellisense since everything is left-to-right

```
let line = client_stream.&mut.read_line(buf.&mut)
    .map_err(fn(_) = Status.BadRequest).?
    .split(fn(b) = " \t\r\n".contains(b)).match {
        [method, uri, version] => RequestLine { method, uri, version },
        _ => Err(Status.NotImplemented).?,
    };
```

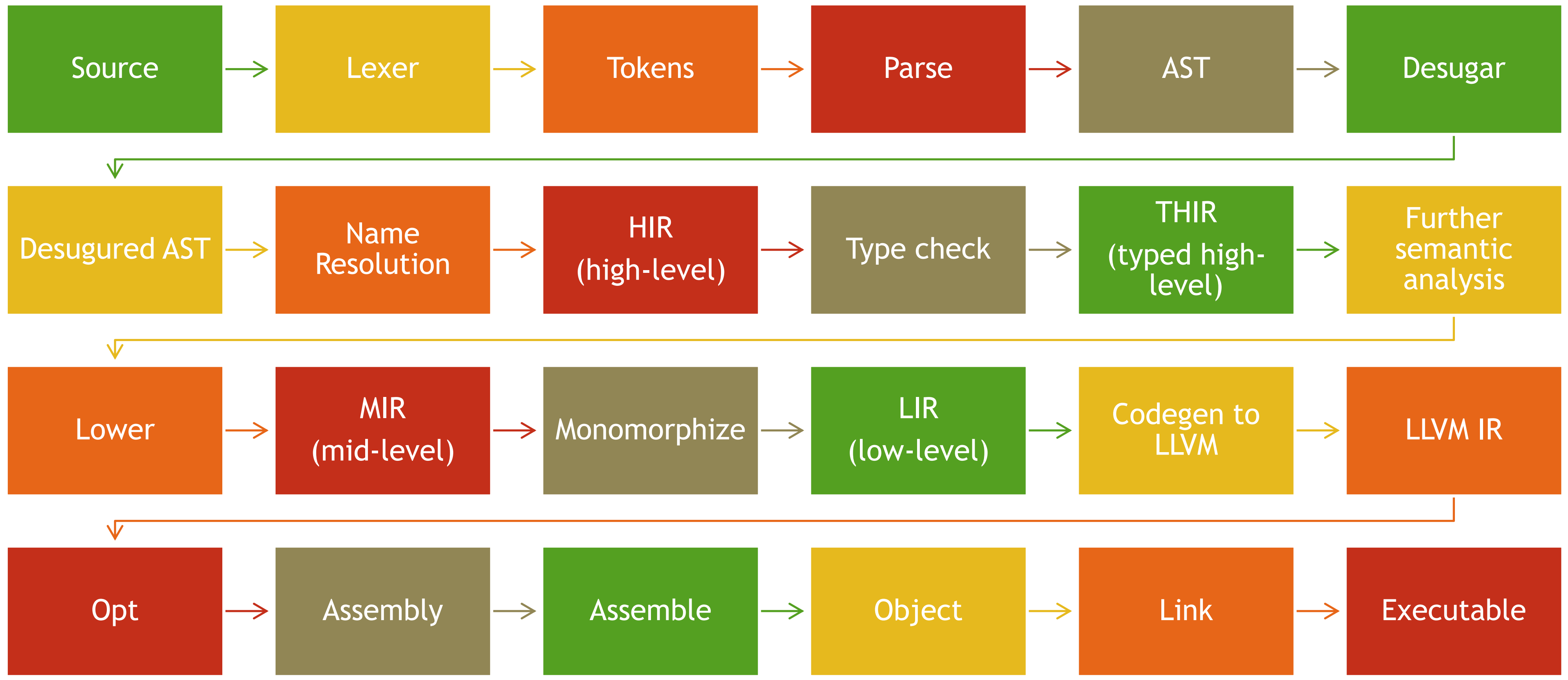
Major Features of C*

- Algebraic data types: struct and enum
- Pattern matching
- Monadic error handling with the try ? Operator, Option<T>, and Result<T, E>
- Simple methods that are syntactic-sugar
- Defer for resource cleanup
- Slices
- Monomorphized, unchecked (in C++ style) generics

Compiler Architecture

- Split into separable and serializable stages
  - Allows you to develop and test each stage in isolation
- Top-level driver CLI splits a compile command into each stage and runs them, similar to clang
- Development environment:
  - dune
  - opam
  - esy

Compiler Stages



Desugaring

Many features of C* can be desugared into others

- method call => function call
- for Loop => while loop + Option + try ?
- try ? => match
- if, if else => match
- closures => struct + method
- tuples => struct
- defer => closure on stack

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