COMP 430 Lecture 1

Kyle Dewey

About Me

- My research:
  - Novel programming language development, in collaboration with JPL
  - Automated test case generation, particularly on testing compilers
- Third time teaching this course

About this Class

- Roughly same version of the course taught Spring 2020
- See something wrong? Want something improved? Email me about it! (kyle.dewey@csun.edu)
- I generally operate based on feedback

Bad Feedback

- This guy sucks.
- This class is boring.
- This material is useless.

Good Feedback

- This guy sucks, *I can’t read his writing.*
- This class is boring, *it’s way too slow.*
- This material is useless, *I don’t see how it relates to anything in reality.*

- I can’t fix anything if I don’t know what’s wrong

Motivation

When will I implement a compiler?

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Probably never.

- *When will I need to reuse my own code?*
- *When will I need to understand how a language works?*
- *When will I need to work on a team?*
- *When will I need to understand why a language was designed a certain way?*

- *When will I need to reuse my own code?*
- *When will I need to understand how a language works?*
- *When will I need to work on a team?*
- *When will I need to understand why a language was designed a certain way?*

Basically always.

Understanding Language Behavior

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```
int i = 0;
i = i++ + i++;
// what is i? (Java)
```

Understanding Language Behavior

```
int i = 0;
i = i++ + i++;
// what is i? (Java)
// what is i? (C)
```

Understanding Language Behavior

```
int i = 0;
i = i++ + i++;
// what is i? (Java)
// what is i? (C)
```

The point: understanding compilers can aid language understanding.

Course Design

- Emphasis on modern compilers
    - Minimal parsing
    - Minimal ultra low-level stuff

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- It's about writing code
- It's about teamwork

Choose Your Own Adventure

- Design your own language with certain kinds of features
- Incrementally implement those features
- By the end, you'll have a compiler

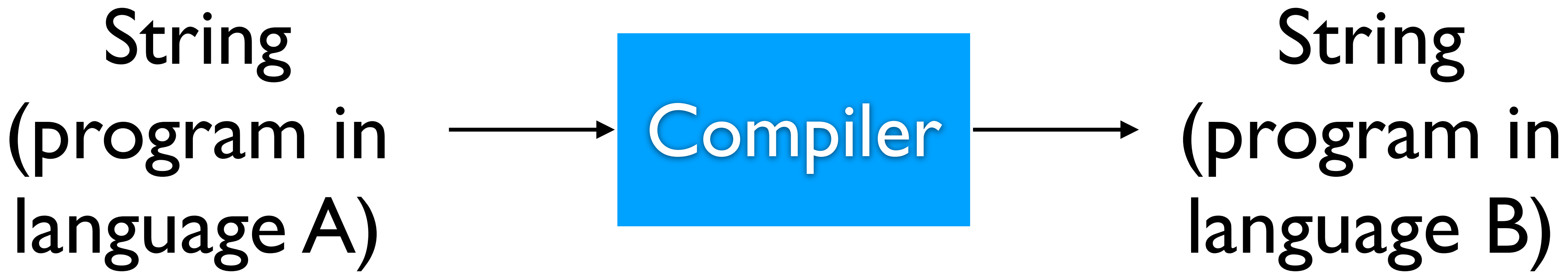
Fair Warning

- This is a **lot** of work
- I will try to give you effectively lab time in class, when possible
- As we progress, lectures may get more specialized (depends on you)

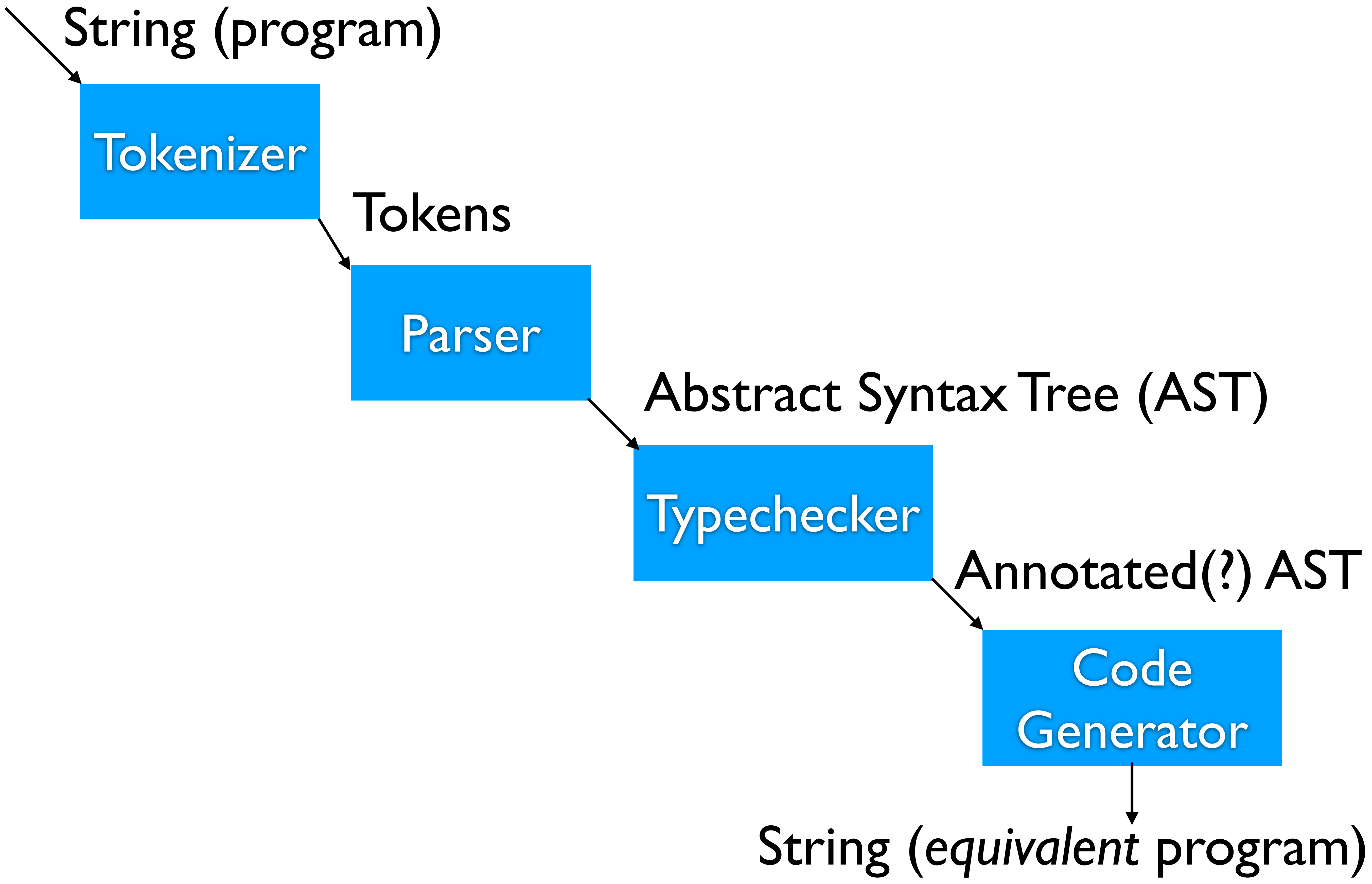
Syllabus

Birds-eye View

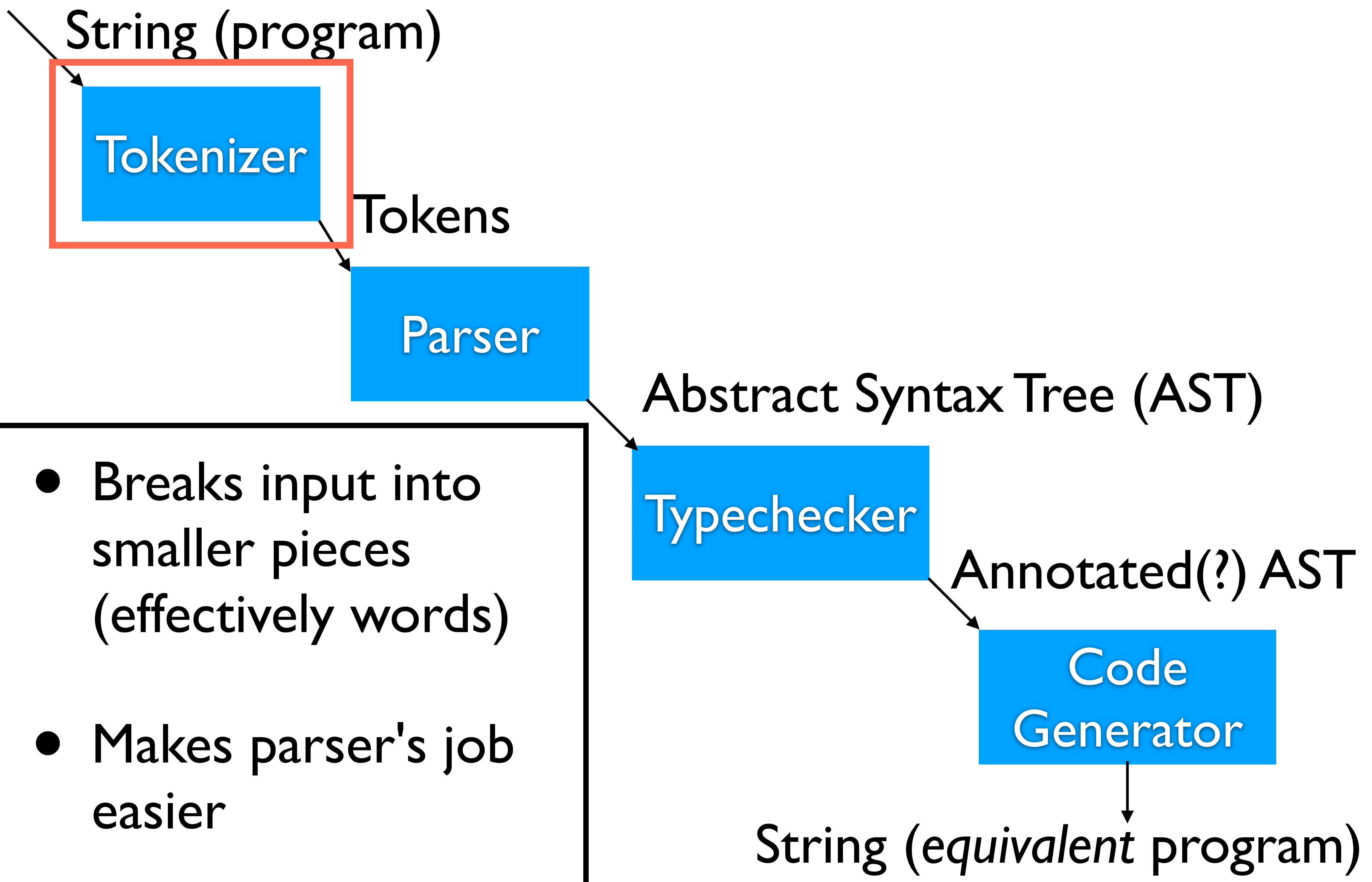
Compiler


String (program in language A)
Compiler
String (program in language B)

Compiler Architecture

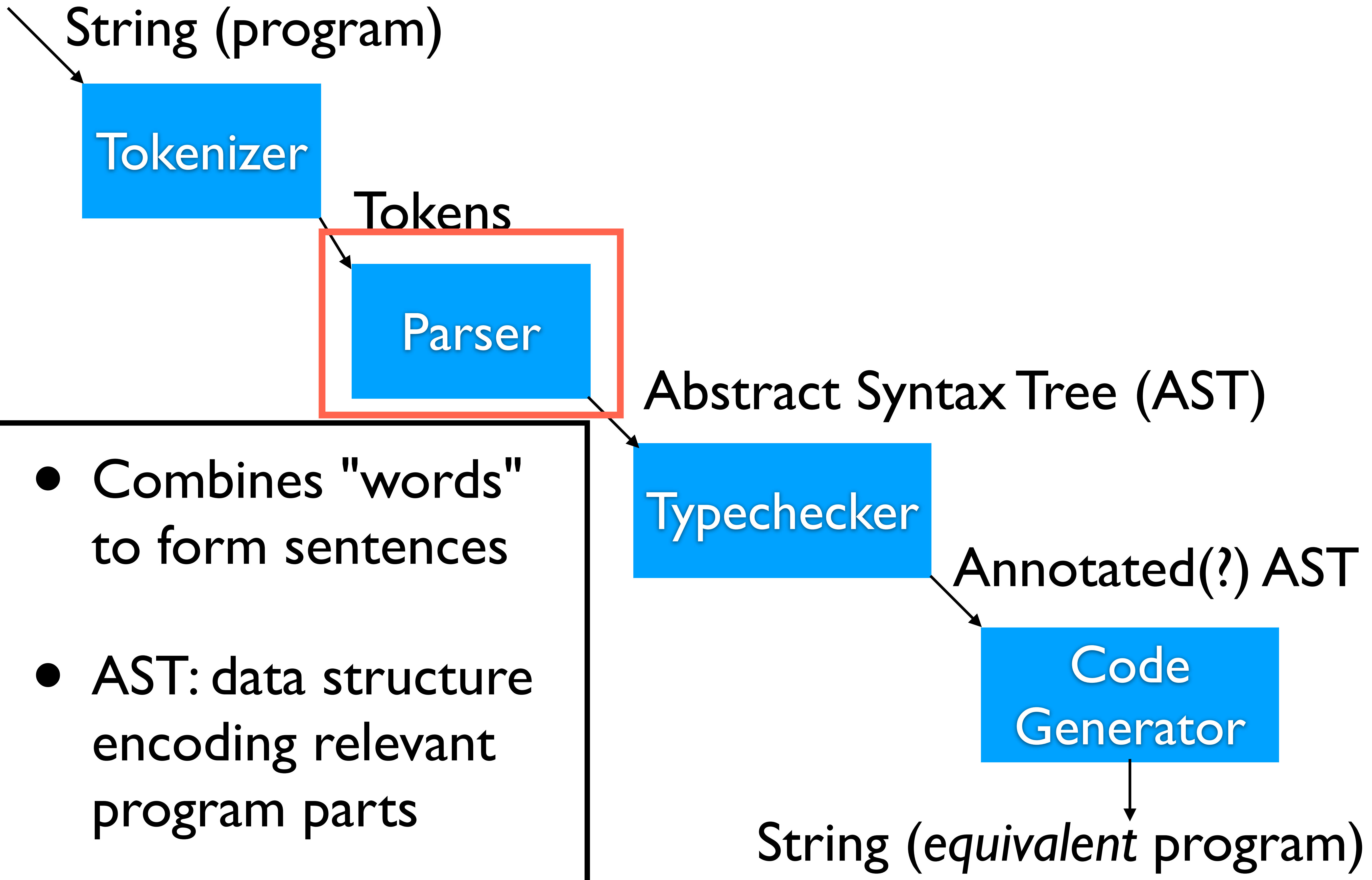


Compiler Architecture



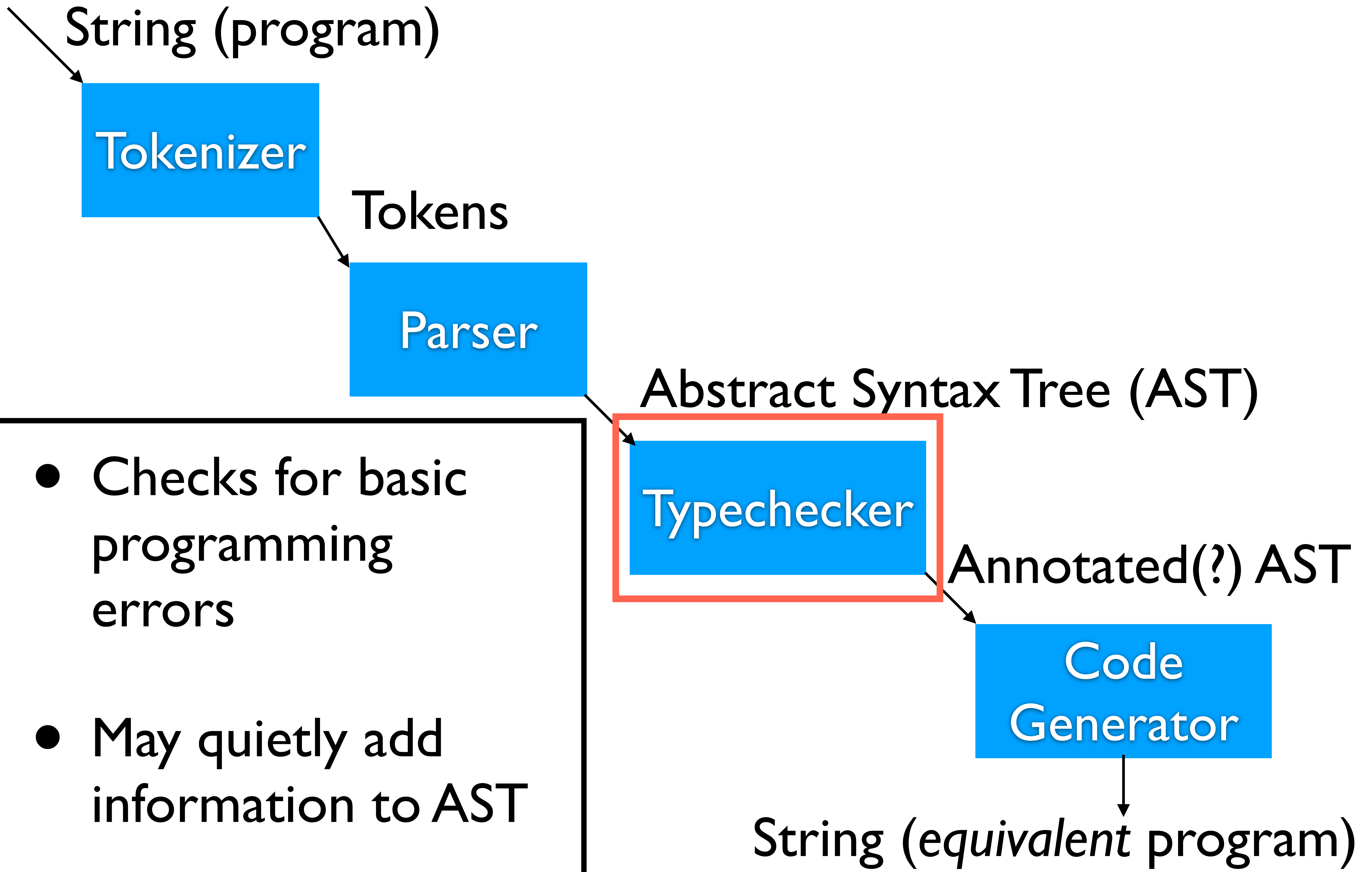
- Breaks input into smaller pieces (effectively words)
- Makes parser's job easier

Compiler Architecture



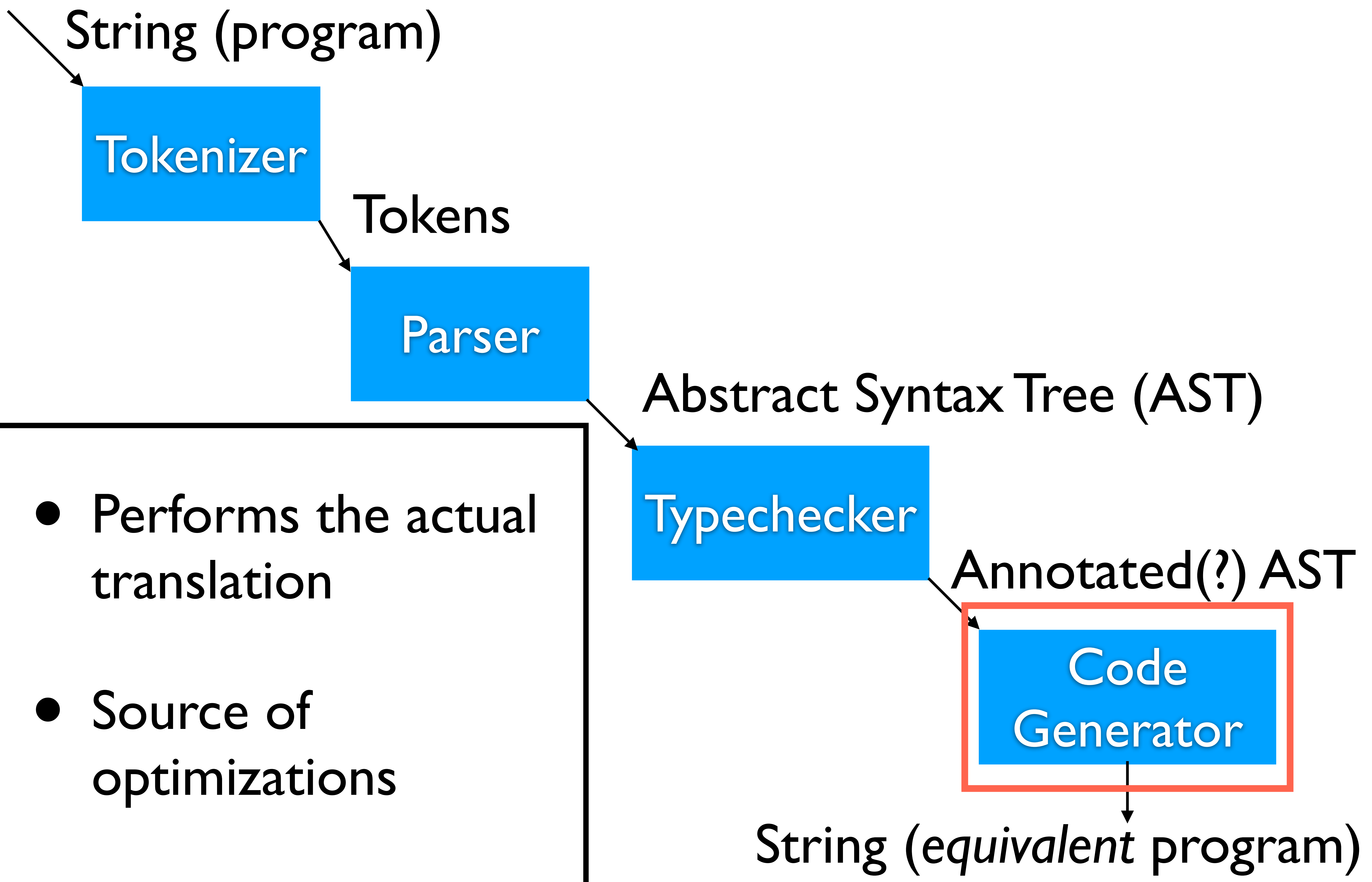
- Combines "words" to form sentences
- AST: data structure encoding relevant program parts

Compiler Architecture



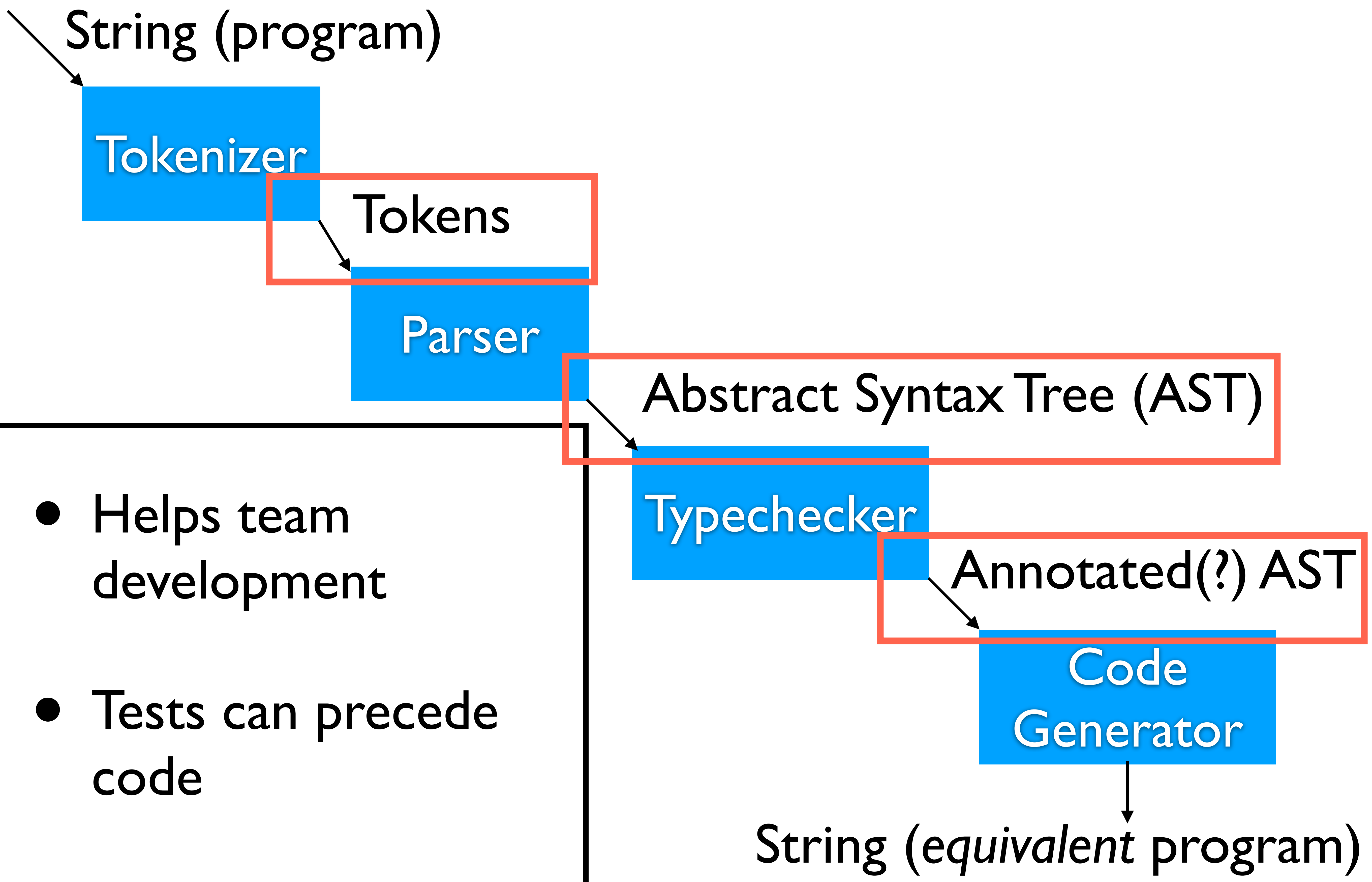
- Checks for basic programming errors
- May quietly add information to AST

Compiler Architecture



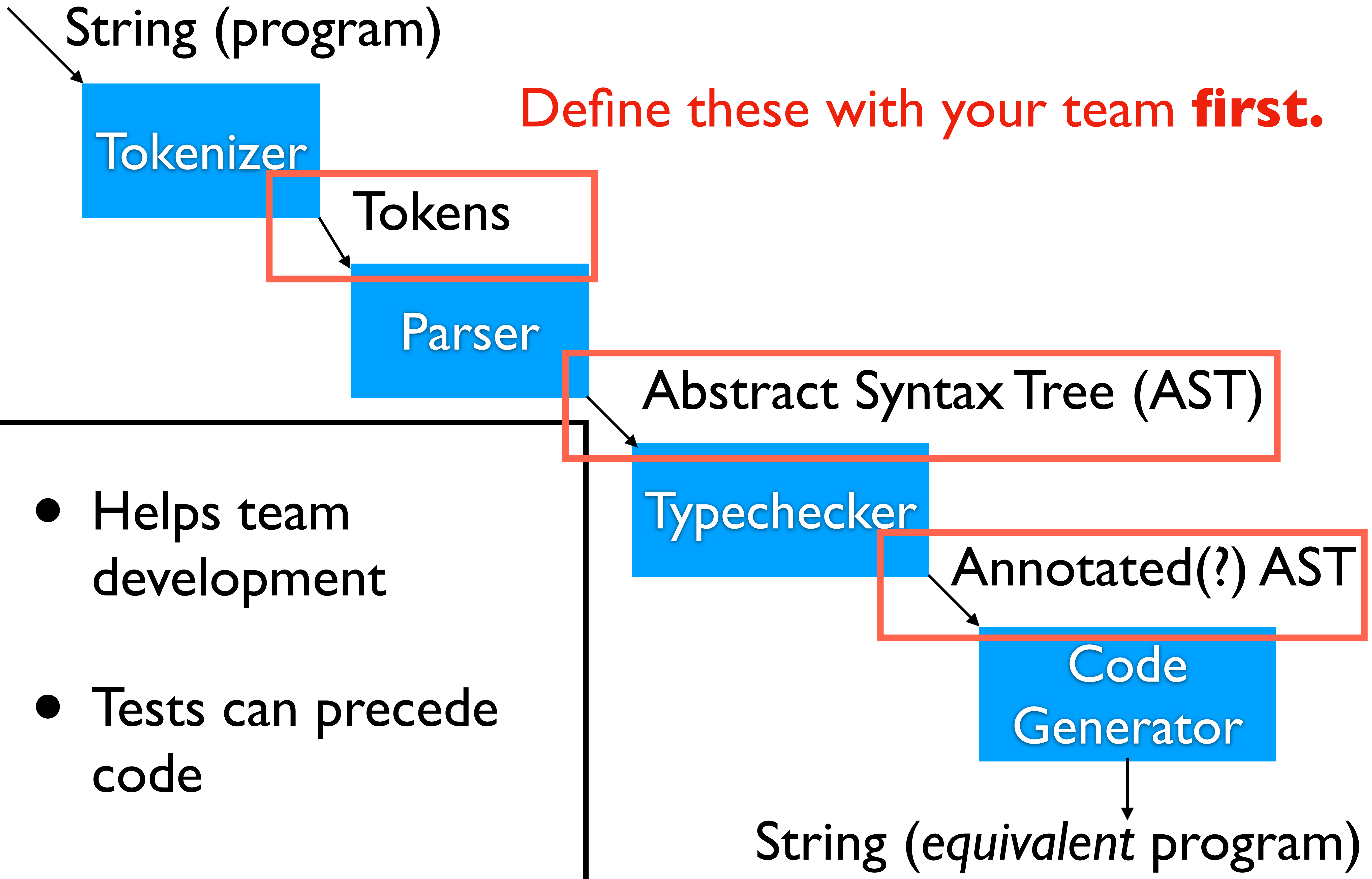
- Performs the actual translation
- Source of optimizations

Well-Defined Interfaces



- Helps team development
- Tests can precede code

Well-Defined Interfaces



Define these with your team **first.**

- Helps team development
- Tests can precede code

Project Information

Into the Lexer / Tokenizer

Basic Idea

- Break input into words, called "tokens"
- Every language has its own specific set of tokens

Example

```
if (x < 7) {
  y = true;
} else {
  y = false;
}
```

Example

```
if (x < 7) {
  y = true;
} else {
  y = false;
}
```

`if`	`(`	`var("x")`	`<`
`int(7)`	`)`	`{`	`var("y")`
`=`	`true`	`;`	`}`
`else`	`{`	`var("y")`	`=`
`false`	`;`	`}`	

Tokenization Handout

Livecoded Tokenizer