

Contextual Analysis

YEGOR BUGAYENKO

Lecture #3 out of 10

80 minutes

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Concrete vs. Abstract

Identification

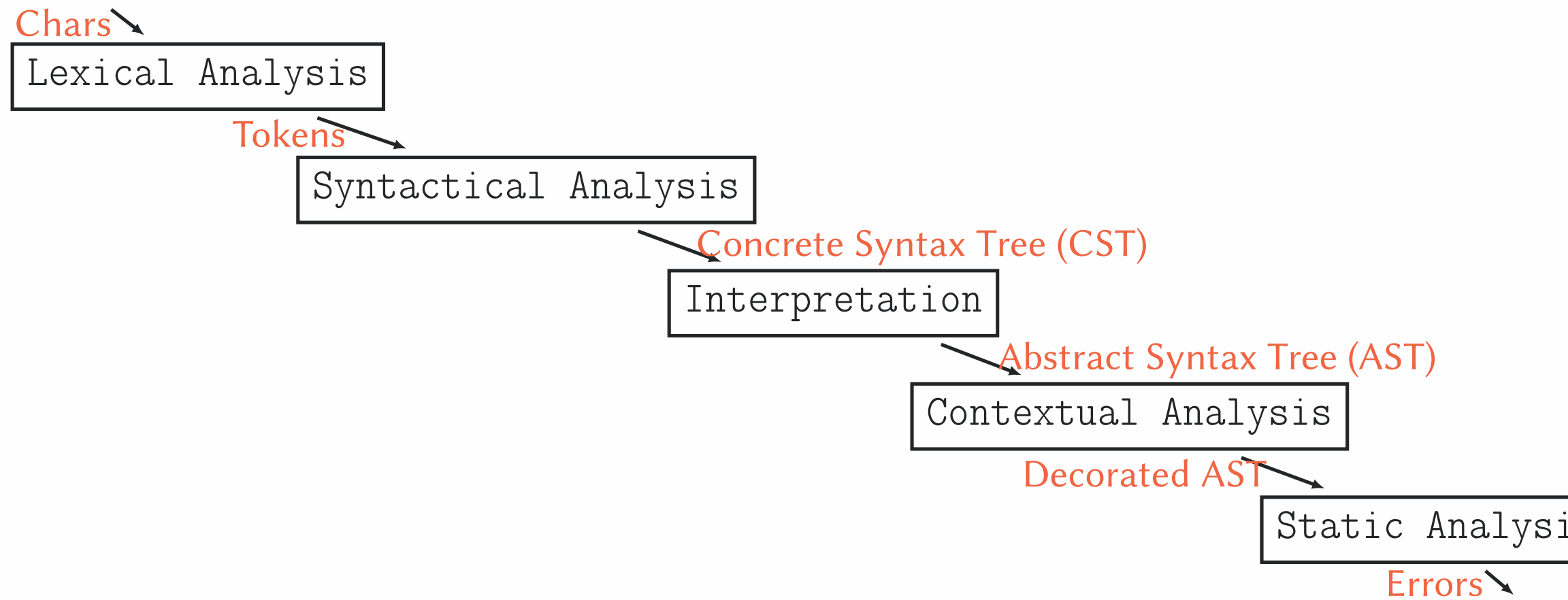
Static Type Checking

AST Visitor

Decorated AST

Control Flow Graph

Code Understanding Pipeline



Chapter #1:

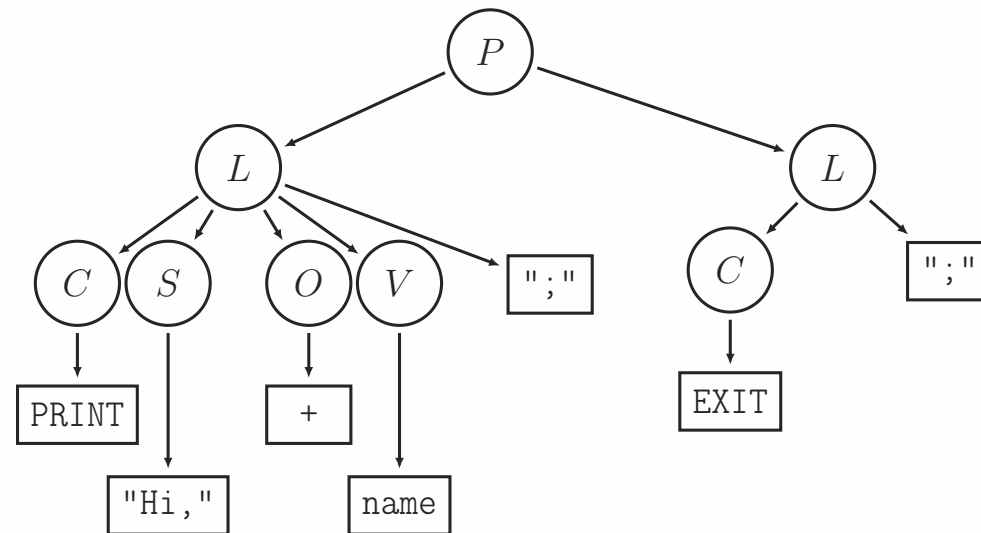
Concrete vs. Abstract

The *concrete syntax* of a programming language is defined by a context free grammar (CFG). The *abstract syntax* of an implementation is the set of trees used to represent programs in the implementation.

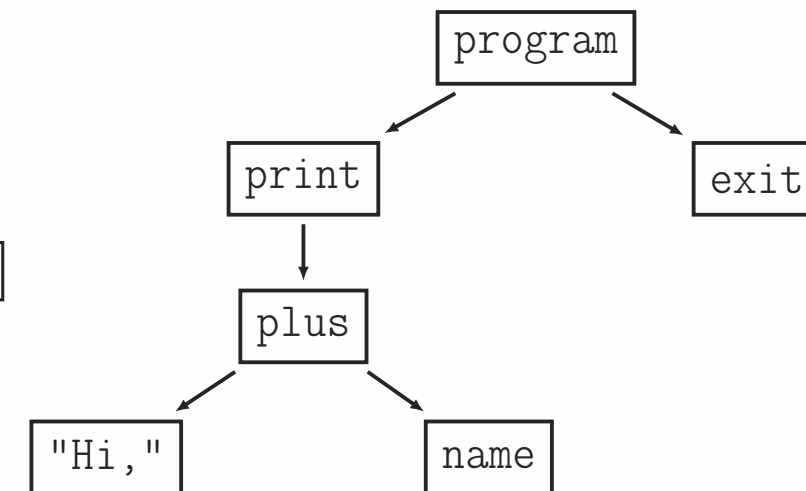
Simple program:

```
1 | PRINT "Hi," + name;  
2 | EXIT;
```

Concrete Syntax Tree:



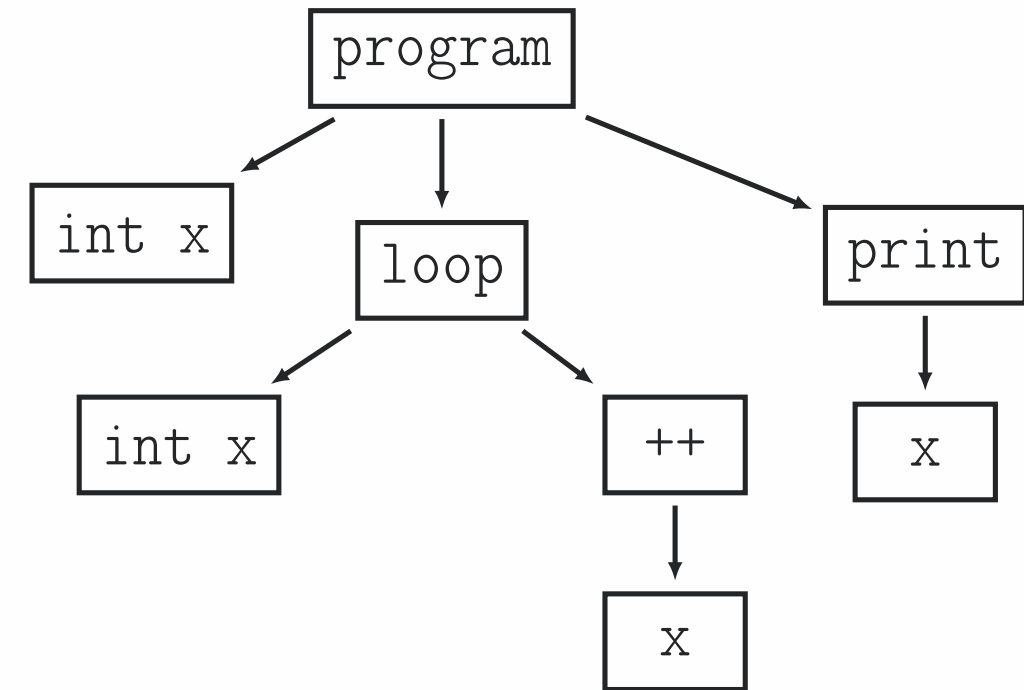
Abstract Syntax Tree:



Chapter #2:

Identification

```
int x;  
loop { int x; x++; };  
print x;
```



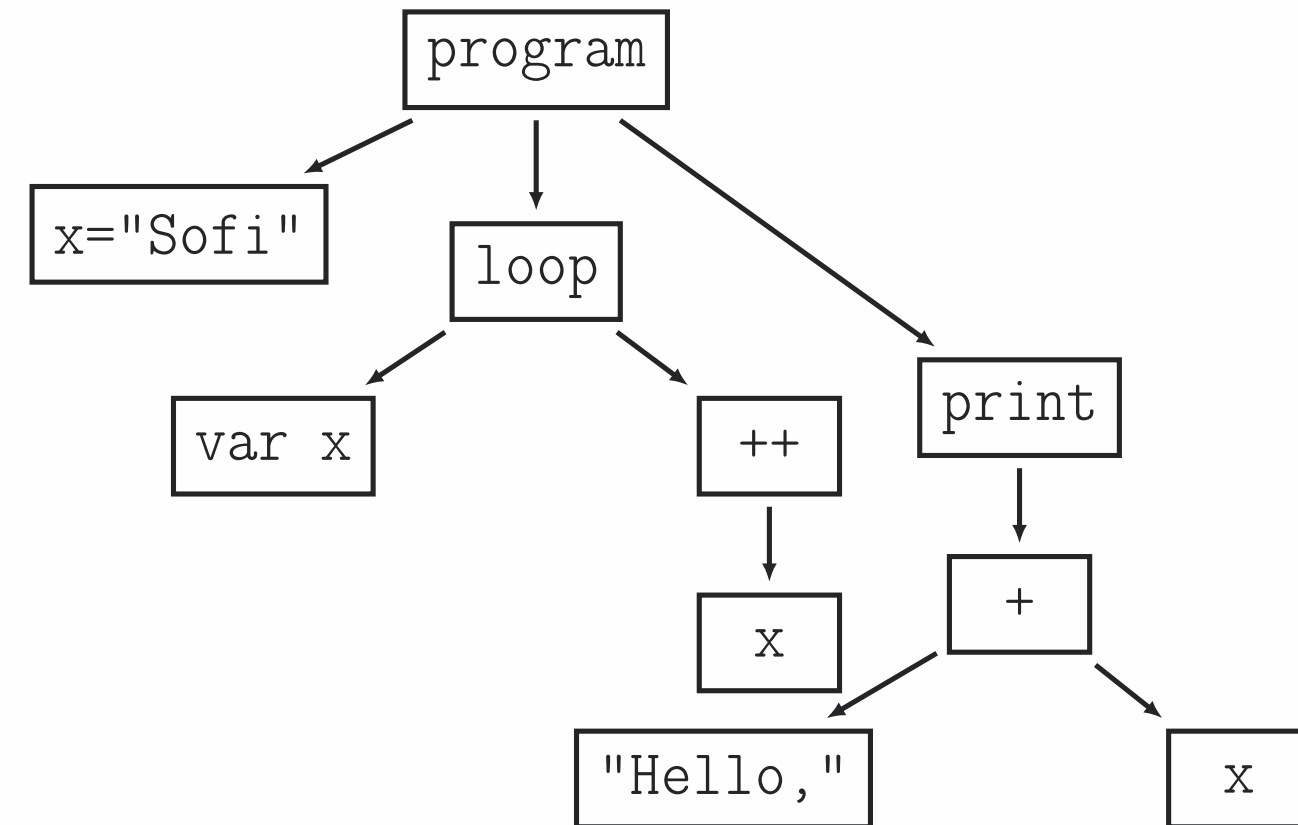
Somehow we must *link* different x to different places, where they are *declared*, maybe with the help of "*Identification Table*," or by attaching attributes to AST nodes, or both. We may want to track their *indentation levels*.

Chapter #3:

Static Type Checking

Dynamically-typed languages perform *type checking at runtime*, while statically typed languages perform type checking at *compile time*.

```
var x = "Sofi";  
loop { var x; x++; };  
print "Hello," + x;
```



Chapter #4:

AST Visitor

ANTLR4 lets us implement the following interface:

```
1 public interface ParseTreeListener {  
2     void visitTerminal(TerminalNode var1);  
3     void visitErrorNode(ErrorNode var1);  
4     void enterEveryRule(ParserRuleContext var1);  
5     void exitEveryRule(ParserRuleContext var1);  
6 }
```

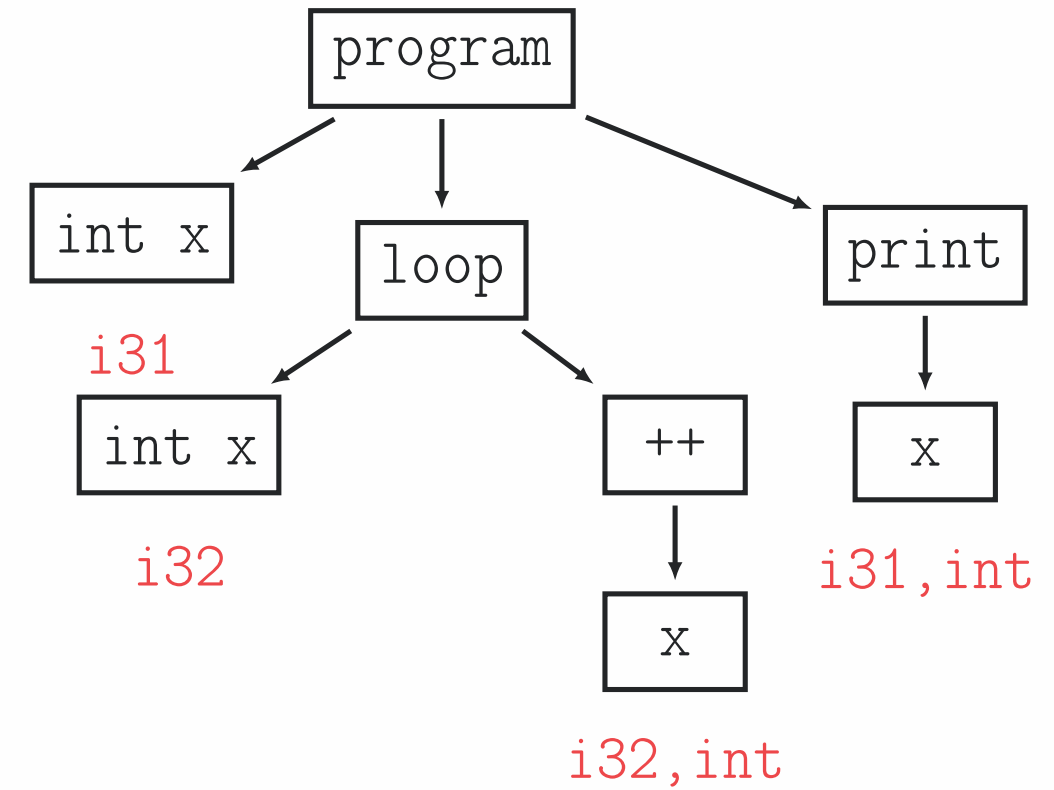
Then:

```
1 MyLexer lexer = new MyLexer(text); // Lexer
2 MyParser parser = new MyParser(
3     new CommonTokenStream(lexer) // Parser
4 );
5 MyListener lsr = new MyListener(); // ParseTreeListener
6 new ParseTreeWalker().walk(lsr, parser.program());
```

Chapter #5:

Decorated AST

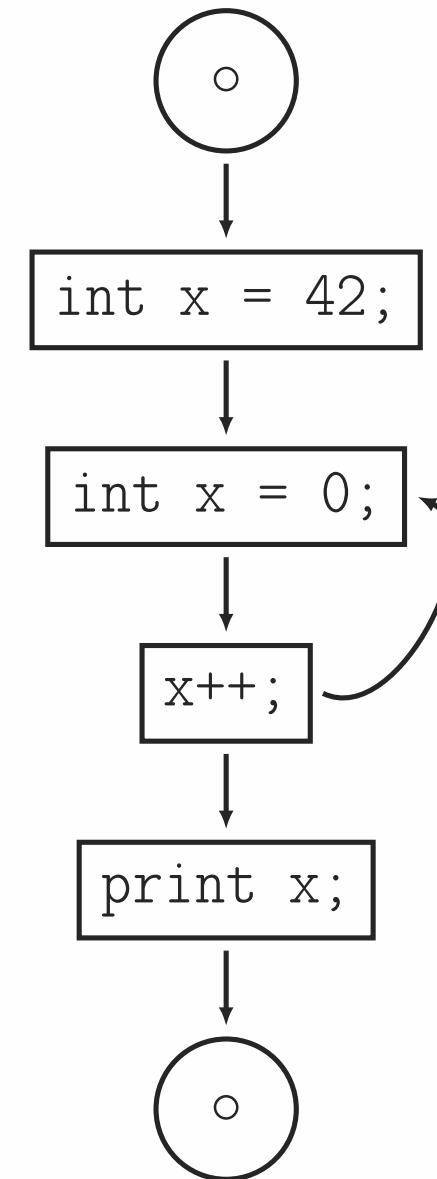

```
int x;  
loop { int x; x++; };  
print x;
```



Chapter #6:

Control Flow Graph

```
int x = 42;  
loop { int x = 0; x++; };  
print x;
```



References