

Contextual Analysis

AST, Interpretation, CFG


YEGOR BUGAYENKO

Lecture #3 out of 10

80 minutes

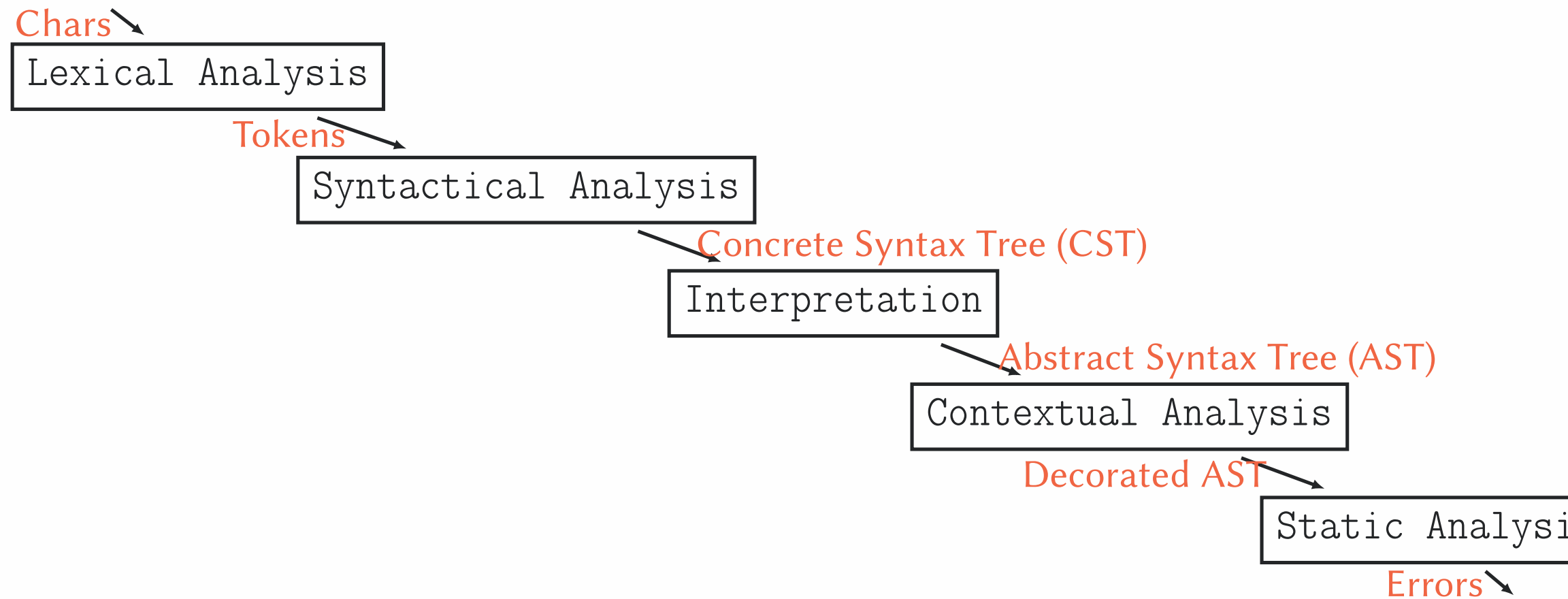
The slidedeck was presented by the author in this [YouTube Video](#)

All visual and text materials presented in this slidedeck are either originally made by the author or taken from public Internet sources, such as web sites. Copyright belongs to their respected authors.



Concrete vs. Abstract
Identification
Static Type Checking
AST Visitor
Decorated AST
Control Flow Graph

Code Understanding Pipeline



Chapter #1:

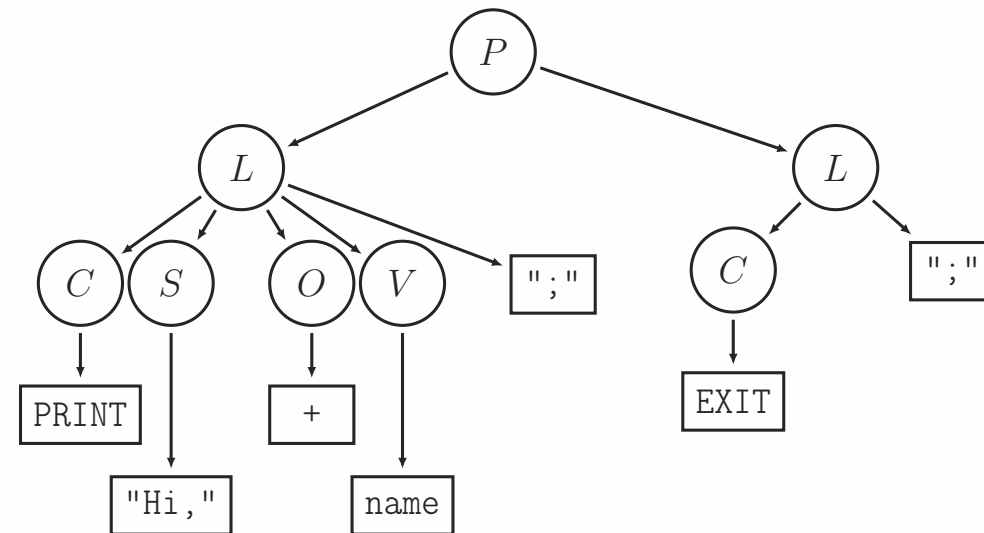
Concrete vs. Abstract

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.

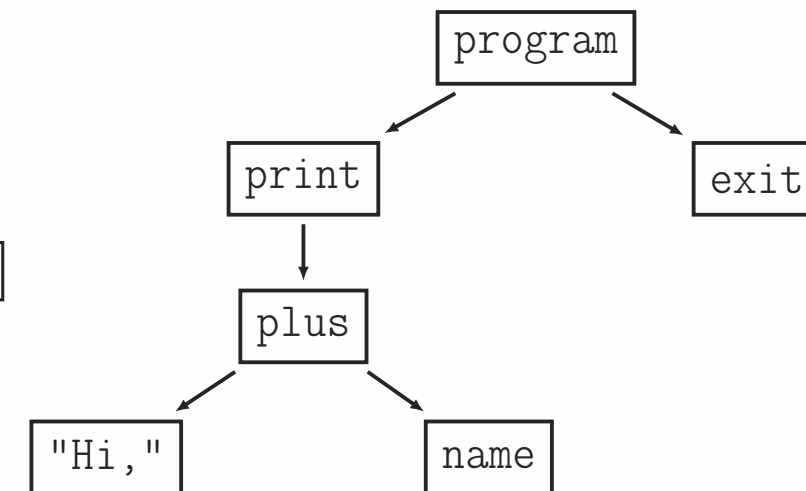
Simple program:

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

Concrete Syntax Tree:



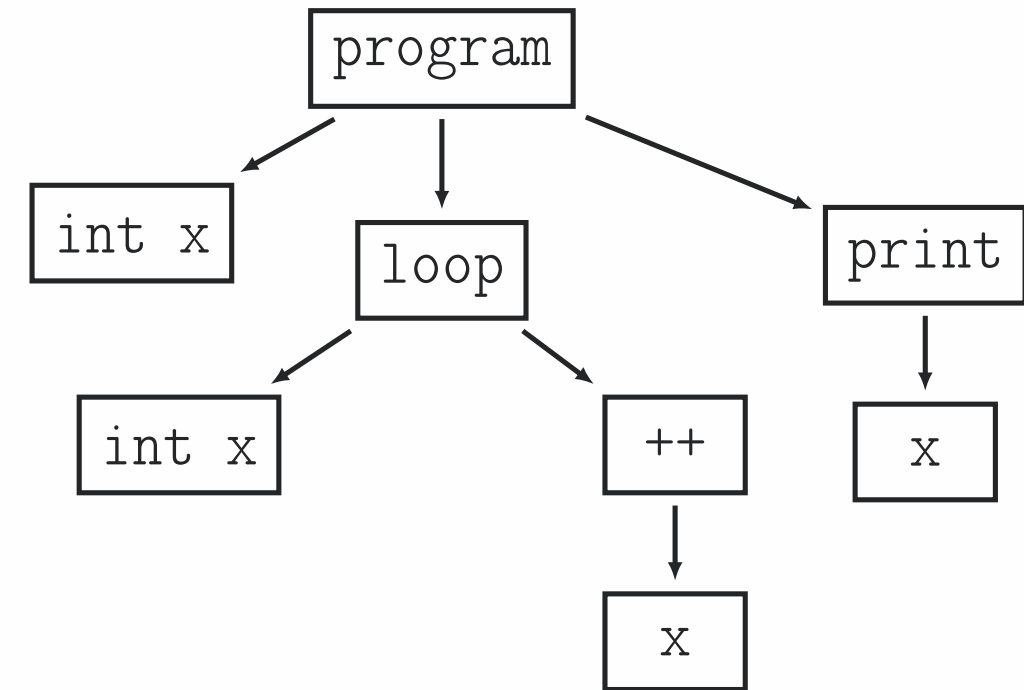
Abstract Syntax Tree:



Chapter #2:

Identification

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



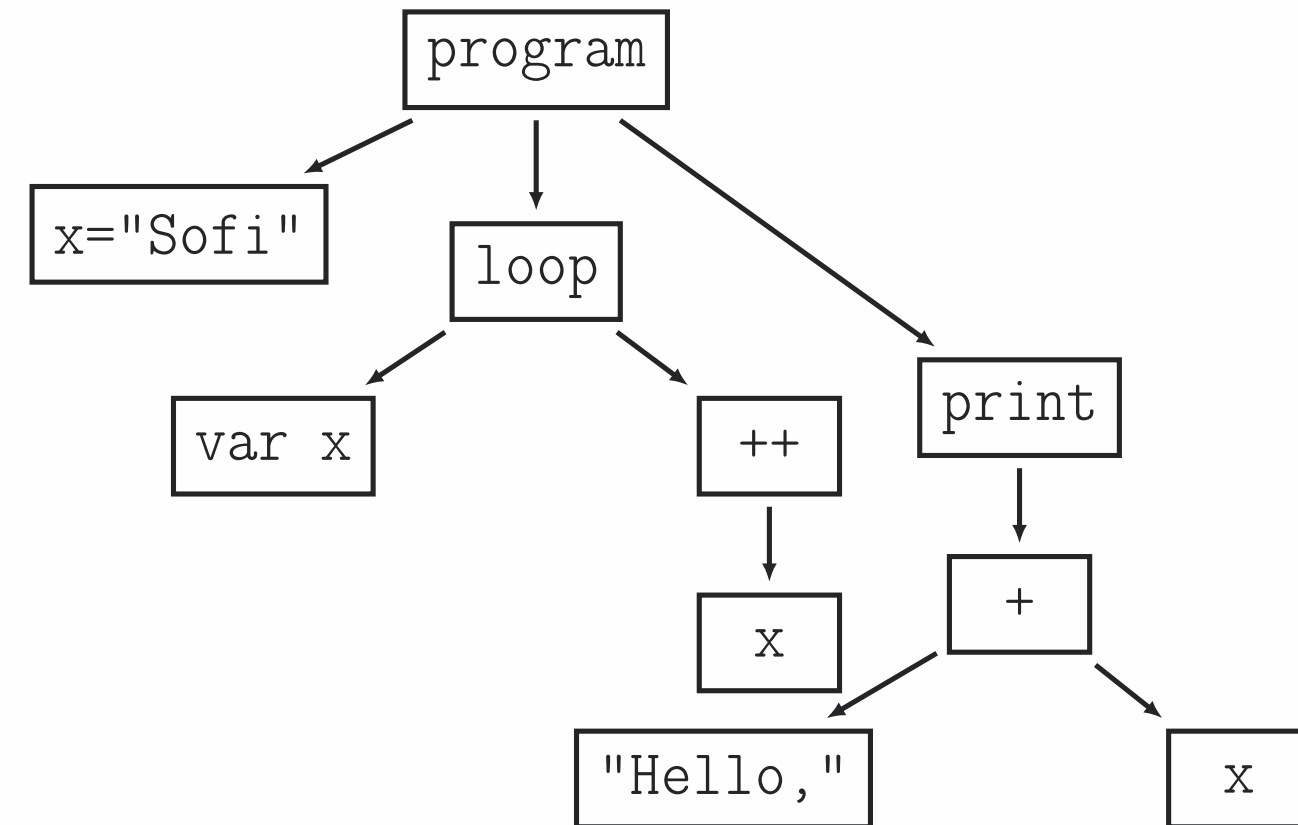
Somehow we must *link* different x to different places, where they are *declared*, maybe with the help of "*Identification Table*," or by attaching attributes to AST nodes, or both. We may want to track their *indentation levels*.

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 }
```

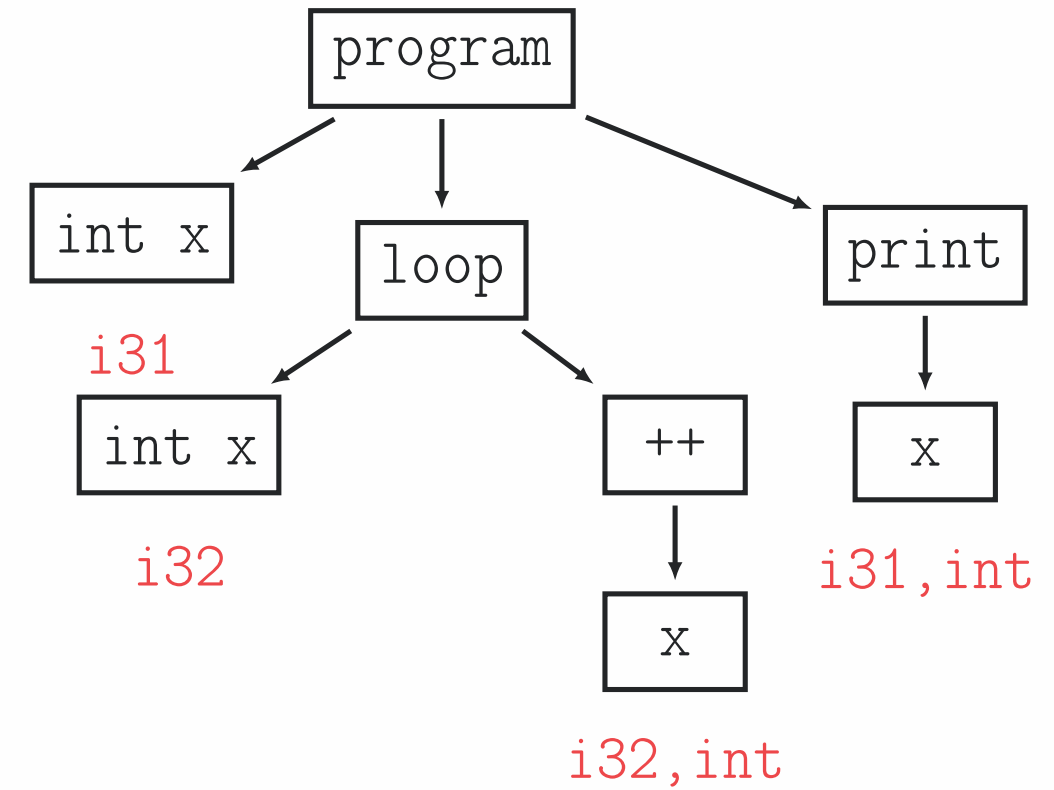
Then:

```
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

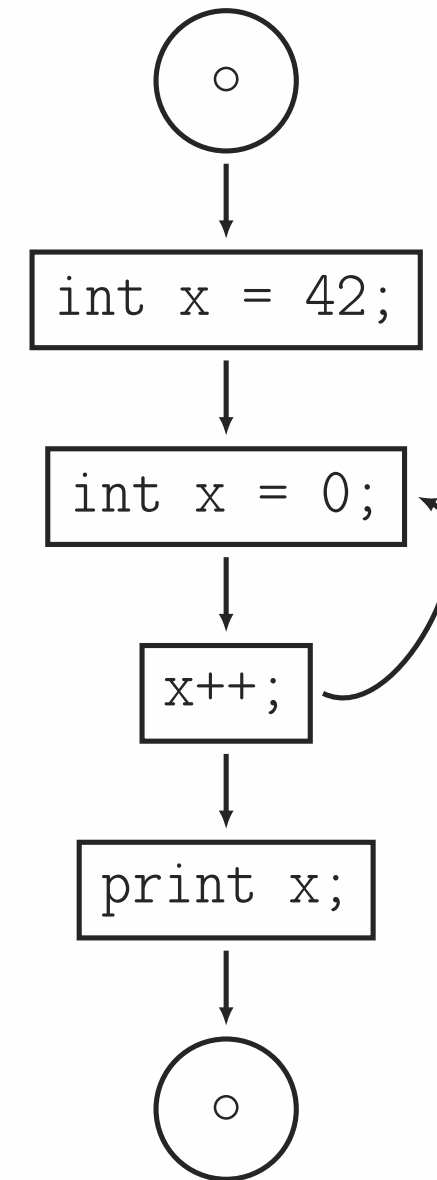

```
int x;  
loop { int x; x++; };  
print x;
```



Chapter #6:

Control Flow Graph

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



Bibliography