三、语义分析
(8. 符号表)

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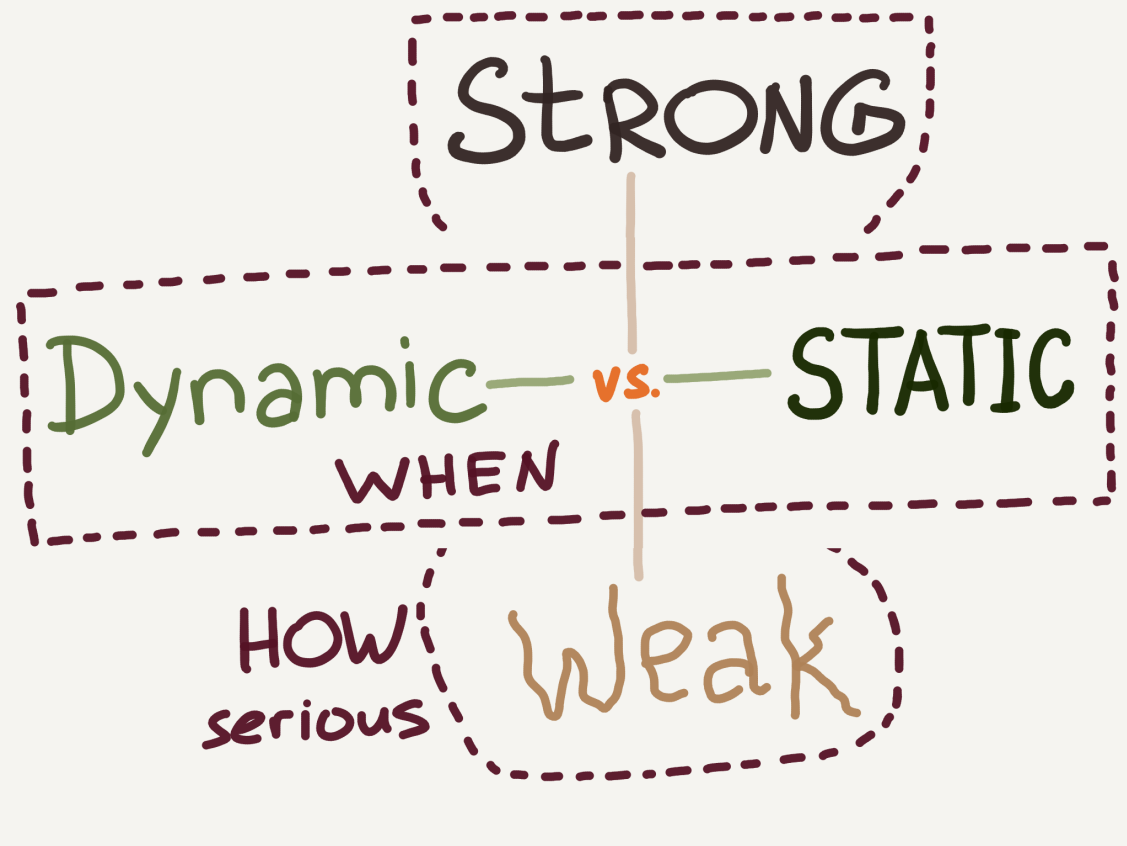
2024 年 04 月 12 日

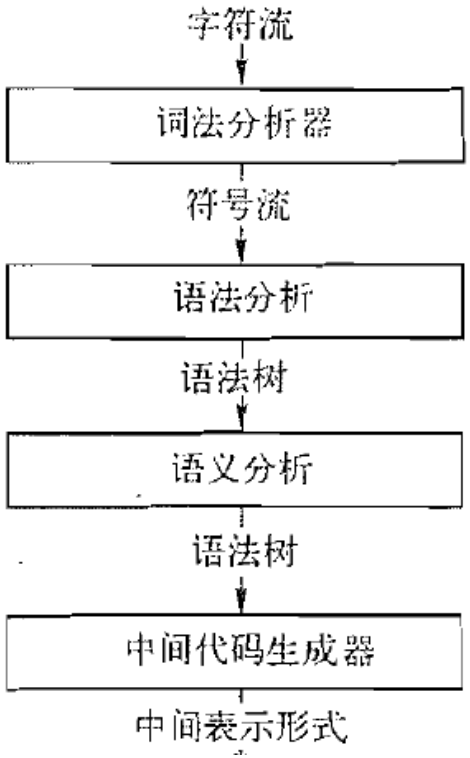

Semantic
Analysis
Explained
KEYWORD
KEYWORD
KEYWORD

类型检查 (Type Checking)

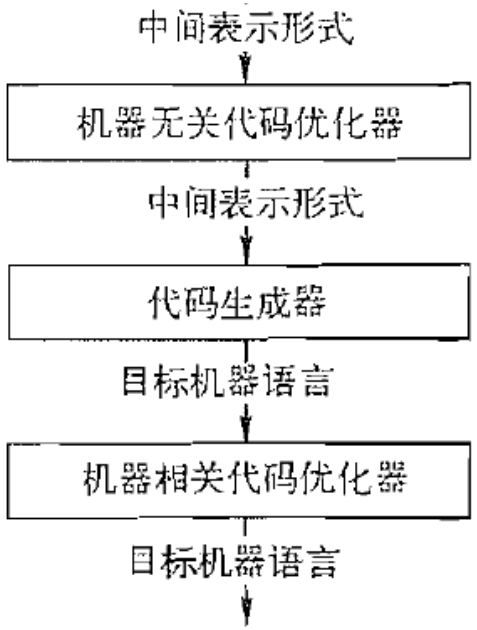


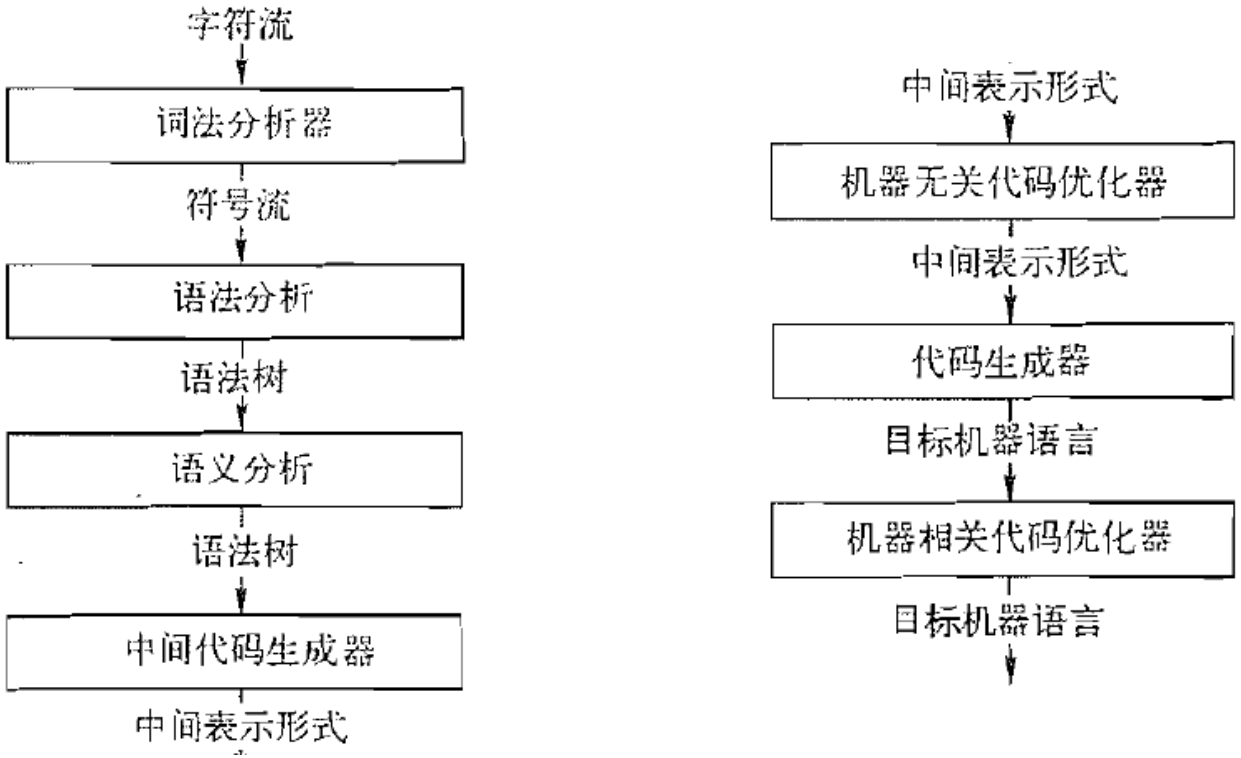
符号 (Symbols) 检查

```
5   int one = 1;
6   int three = one + two;
7   int five = len("Hello");
8
9   int two = one(one);
10  int one = 1;
```


字符流
词法分析器
符号流
语法分析
语法树
语义分析
语法树
中间代码生成器
中间表示形式

符号表


中间表示形式
机器无关代码优化器
中间表示形式
代码生成器
目标机器语言
机器相关代码优化器
目标机器语言



符号: 变量名、函数名、类型名、标签名、...

Definition (符号表 (Symbol Table))

符号表是用于保存**各种信息**的**数据结构**。

Definition (符号表 (Symbol Table))

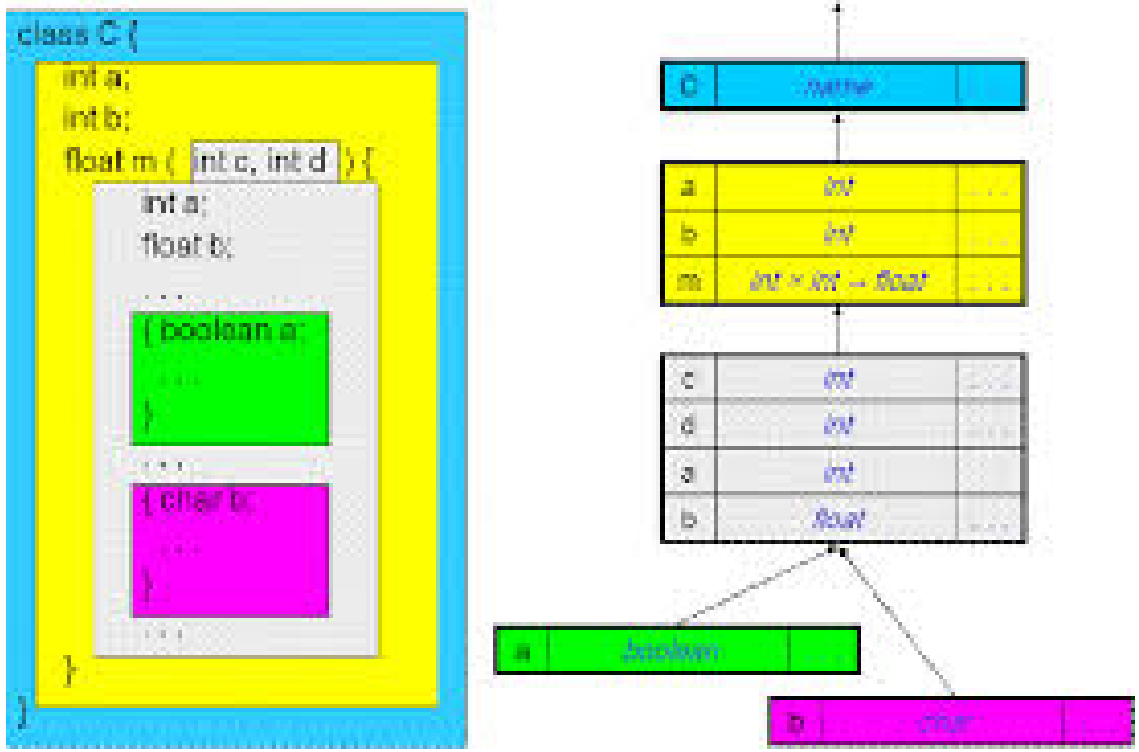
符号表是用于保存**各种信息**的**数据结构**。

Name	**Type**	**Size**	**Dimension**	**Line of Declaration**	**Line of Usage**	**Address**	$\cdots$
count	int	4	0	$\cdots$	$\cdots$	$\cdots$	$\cdots$
str	char[]	5	1	$\cdots$	$\cdots$	$\cdots$	$\cdots$

“领域特定语言” (DSL) 通常只有**单作用域** (全局作用域)

```
host=antlr.org
port=80
webmaster=parrt@antlr.org
```

“通用程序设计语言” (GPL) 通常需要**嵌套作用域**



```
1 int x;
  int y;
2 void a()
3 {
      int x;
      x = 1;
      y = 2;
4     { int y = x; }
  }
5 void b(int z)
6 { }
```

```
1 int x;
  int y;
2 void a()
3 {
      int x;
      x = 1;
      y = 2;
4     { int y = x; }
  }
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```

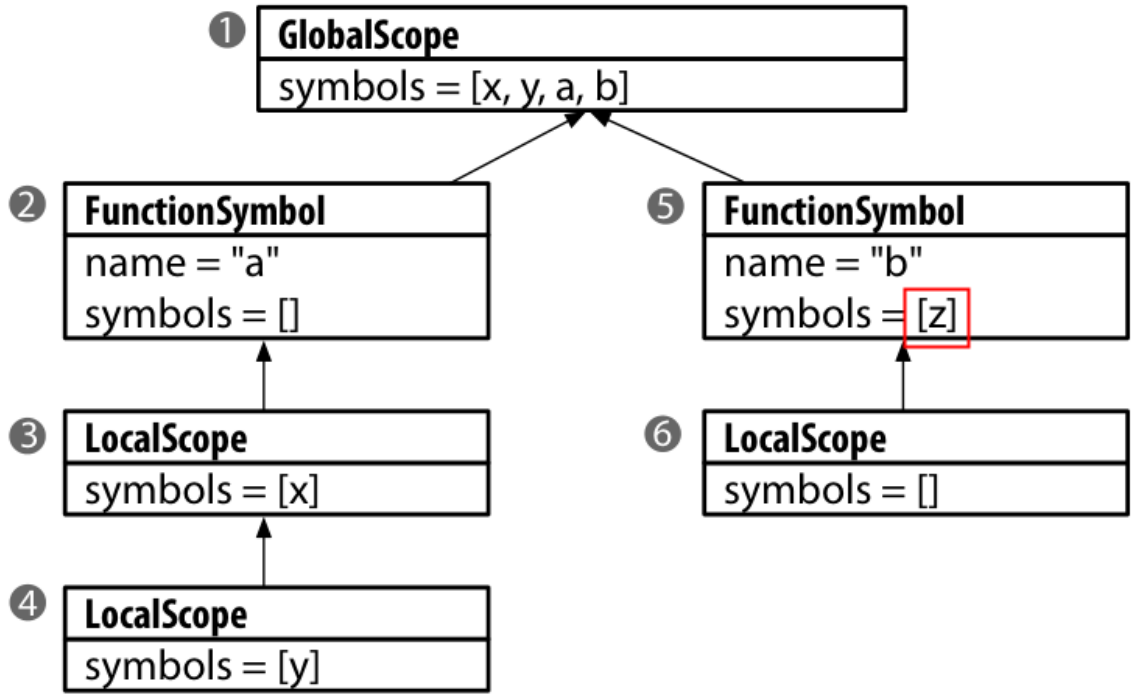

```
1 int x;
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      int x;
      x = 1;
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4     { int y = x; }
  }
5 void b(int z)
6 { }
```
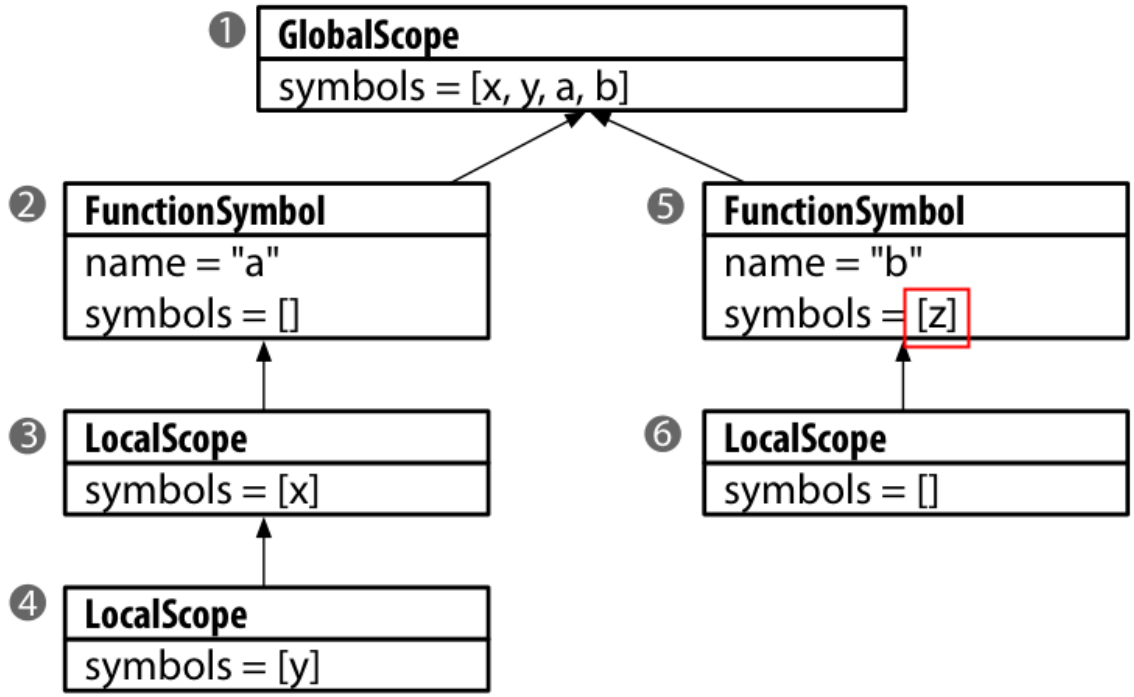
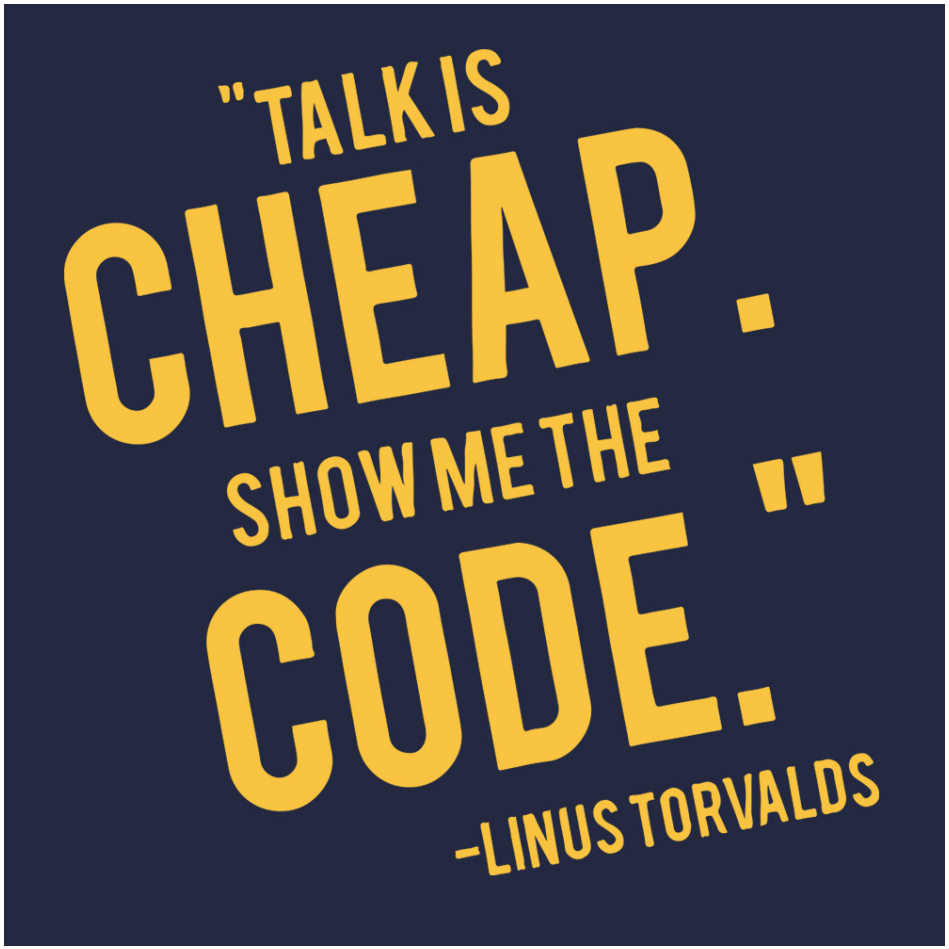



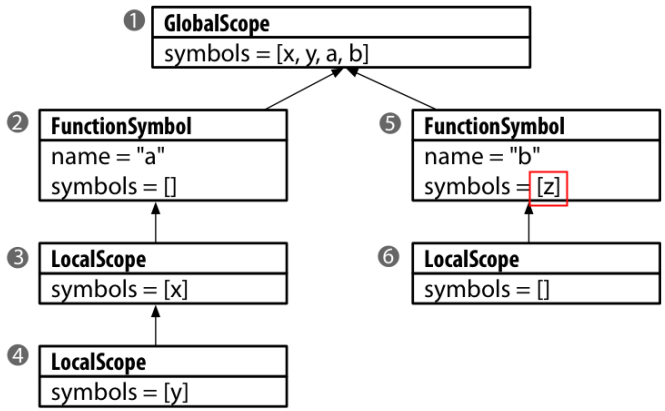
We take a **WRONG** assumption here about `FunctionSymbol`'s scope.

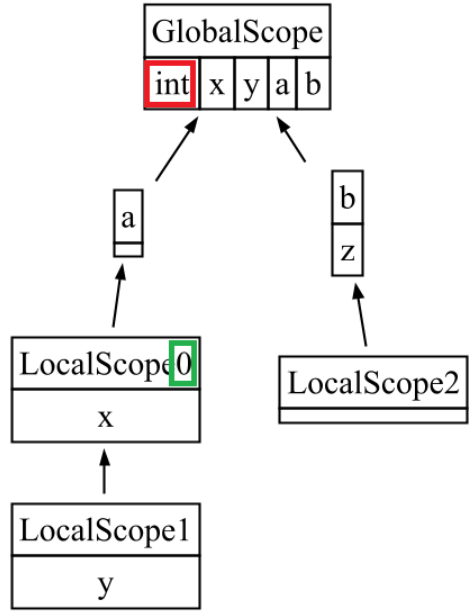
```
public interface Scope {
    public String getScopeName();          // 有名称吗?
    public Scope getEnclosingScope();      // 有外部作用域吗?
    public void define(Symbol sym);        // 在作用域中定义符号
    public Symbol resolve(String name);    // 根据名称查找
}
```

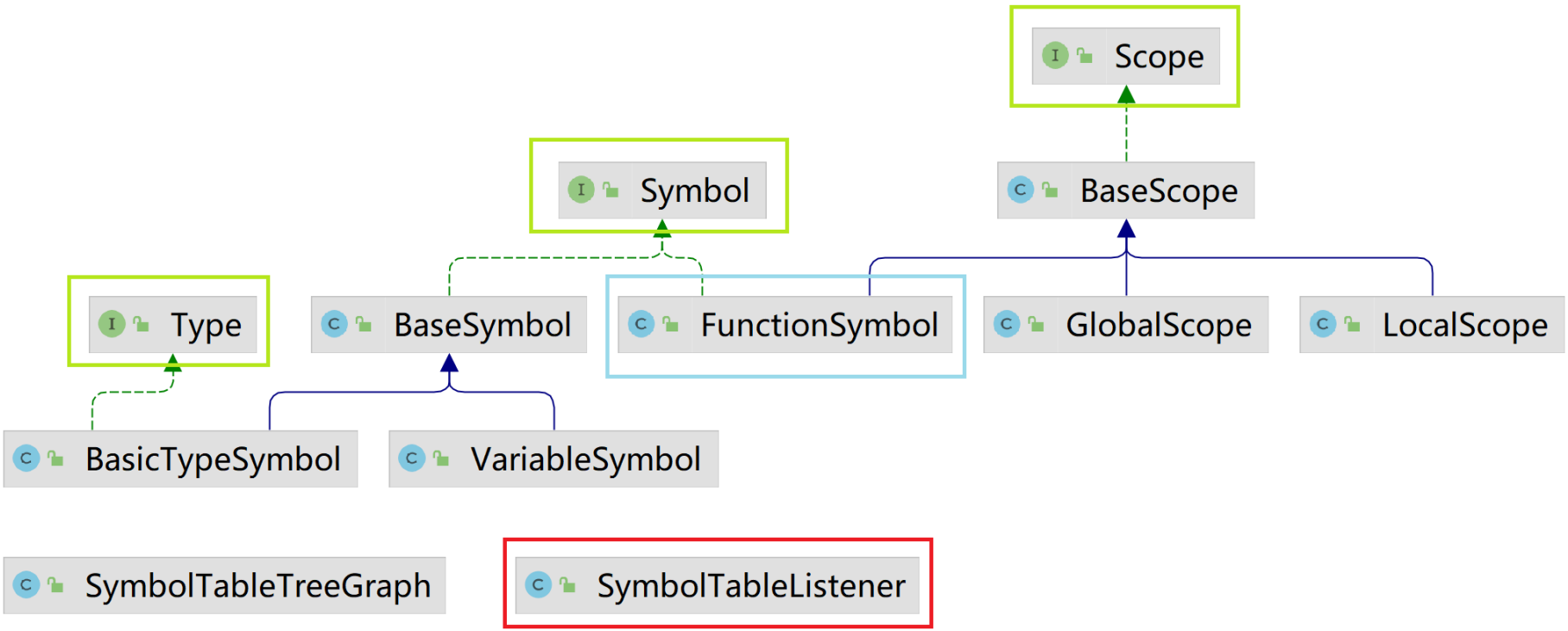
全局作用域、函数/方法作用域、局部作用域

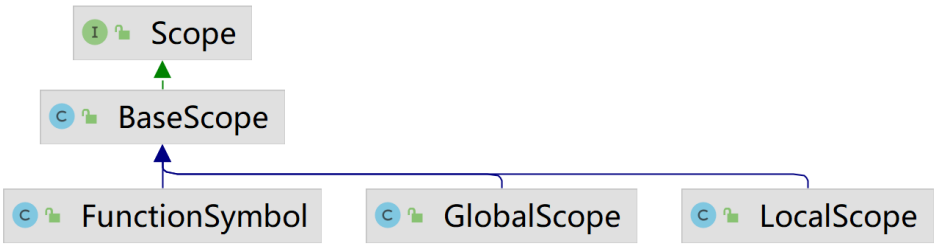

"TALK IS
CHEAP.
SHOW ME THE
CODE."
-LINUS TORVALDS

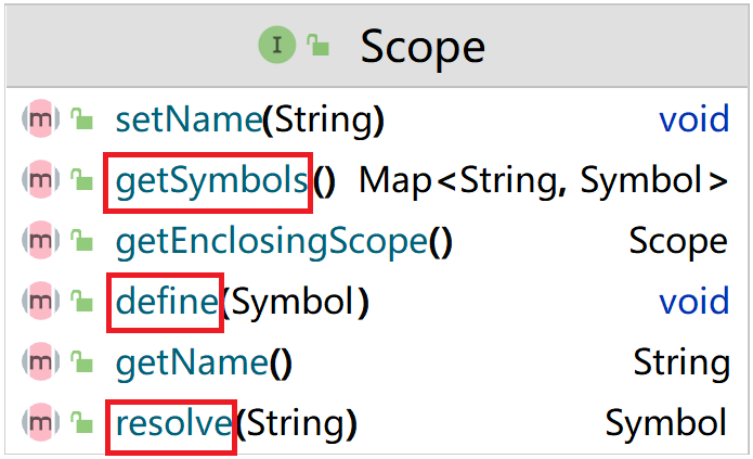
```
1 int x;
  int y;
2 void a()
3 {
      int x;
      x = 1;
      y = 2;
4     { int y = x; }
  }
5 void b(int z)
6 { }
```



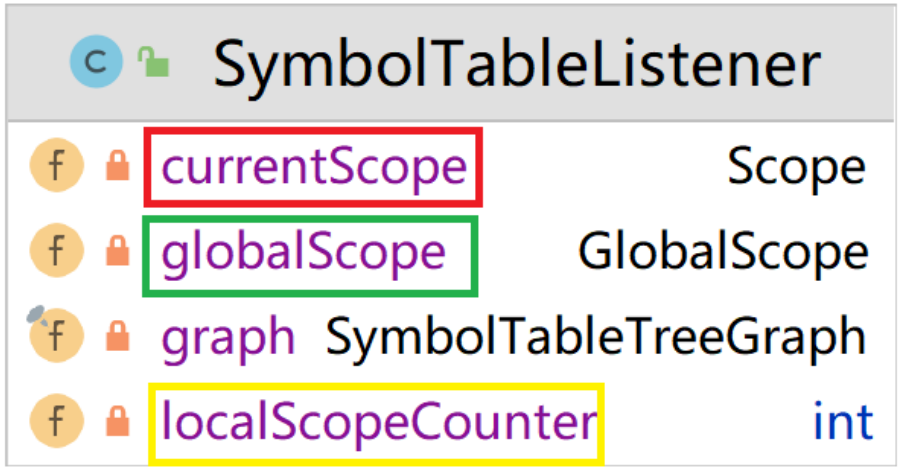


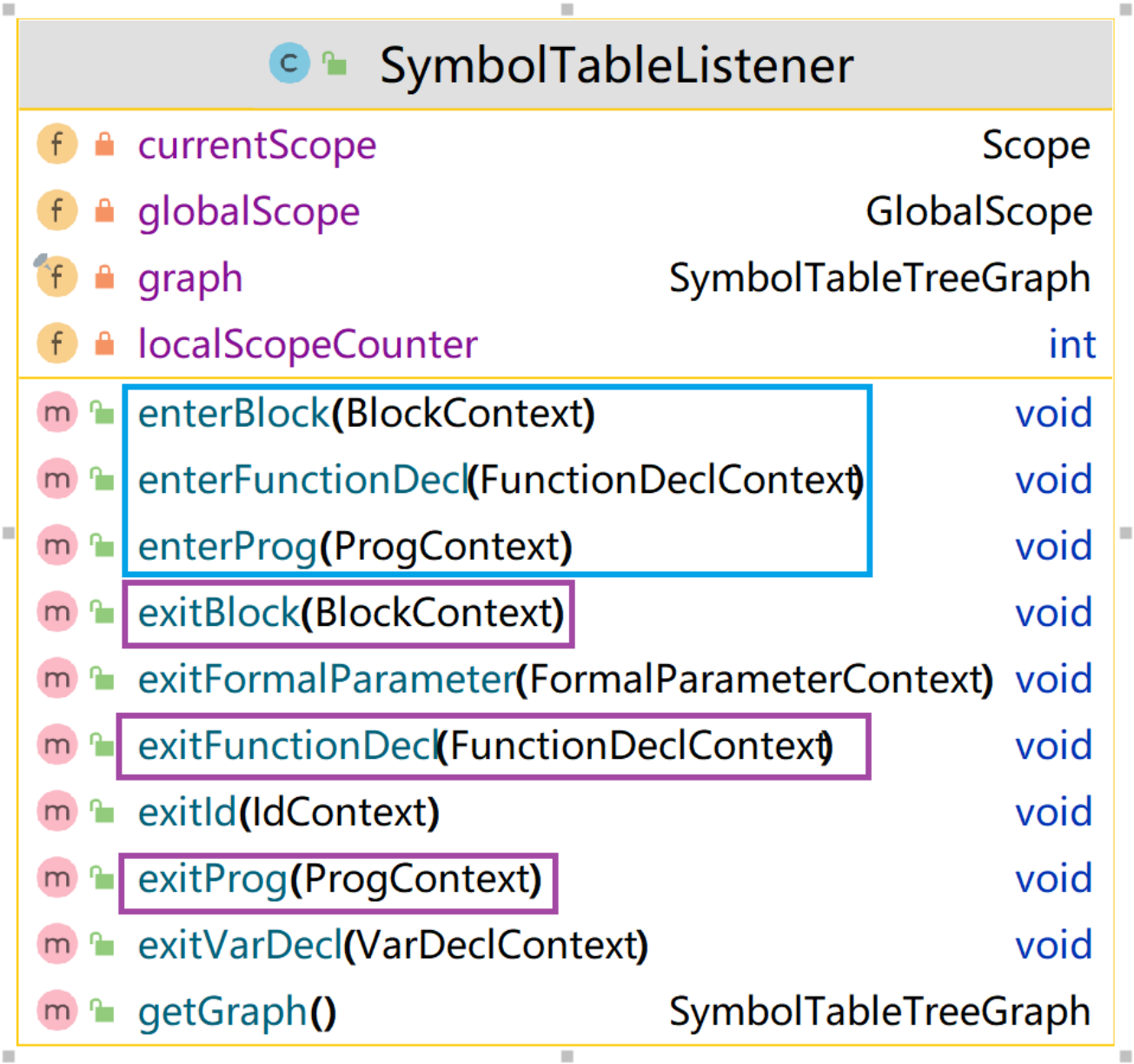

Scope
Symbol
BaseScope
Type
BaseSymbol
FunctionSymbol
GlobalScope
LocalScope
BasicTypeSymbol
VariableSymbol
SymbolTableTreeGraph
SymbolTableListener


Scope
BaseScope
FunctionSymbol
GlobalScope
LocalScope


Scope
setName(String) void
getSymbols() Map<String, Symbol>
getEnclosingScope() Scope
define(Symbol) void
getName() String
resolve(String) Symbol

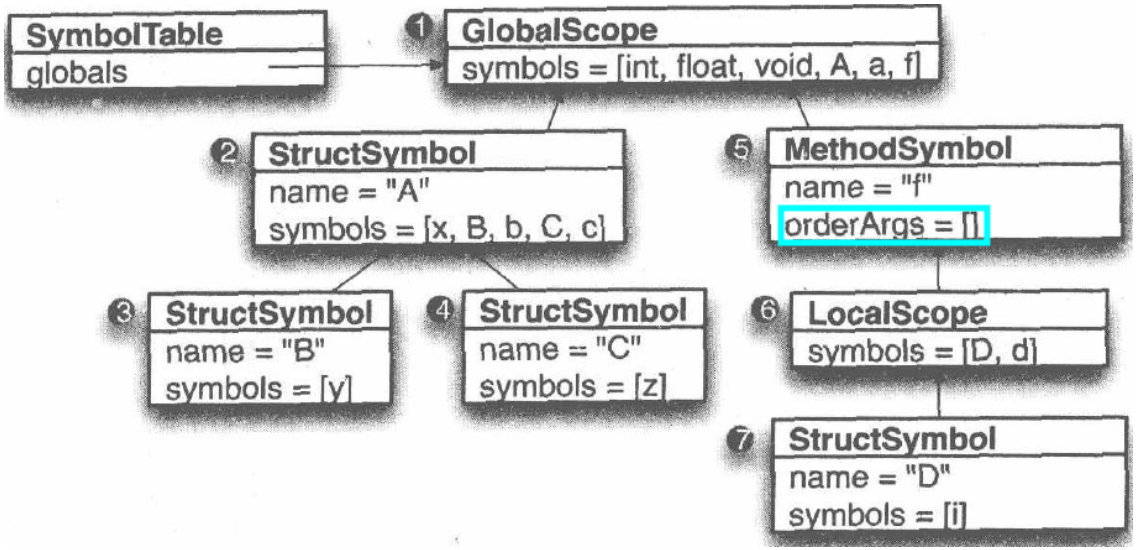

SymbolTableListener


SymbolTableListener
currentScope
Scope
globalScope
GlobalScope
graph
SymbolTableTreeGraph
localScopeCounter
int


SymbolTableListener
currentScope Scope
globalScope GlobalScope
graph SymbolTableTreeGraph
localScopeCounter int
enterBlock(BlockContext) void
enterFunctionDecl(FunctionDeclContext) void
enterProg(ProgContext) void
exitBlock(BlockContext) void
exitFormalParameter(FormalParameterContext) void
exitFunctionDecl(FunctionDeclContext) void
exitId(IdContext) void
exitProg(ProgContext) void
exitVarDecl(VarDeclContext) void
getGraph() SymbolTableTreeGraph

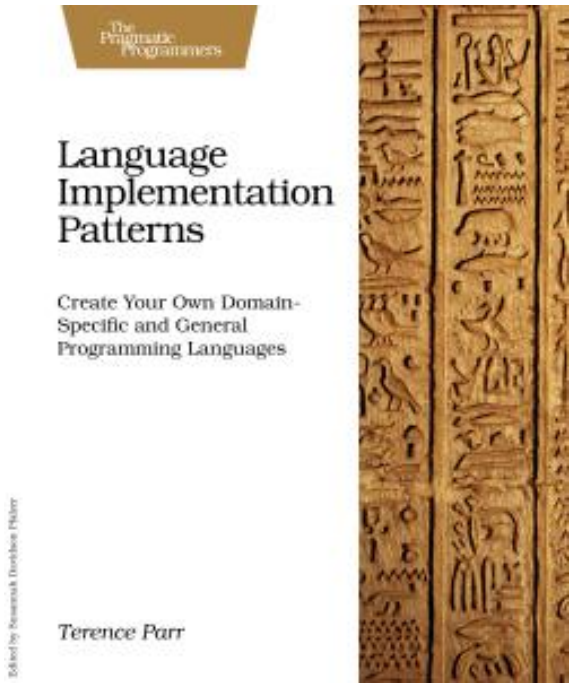
struct/class: 类型作用域

```
❶
❷ struct A {
    int x;
❸   struct B { int y; };
    B b;
❹   struct C {int z; };
    C c;
  };
  A a;

❺ void f()
❻ {
❼   struct D {
      int i;
    };
    D d;
    d.i = a.b.y;
  }
```

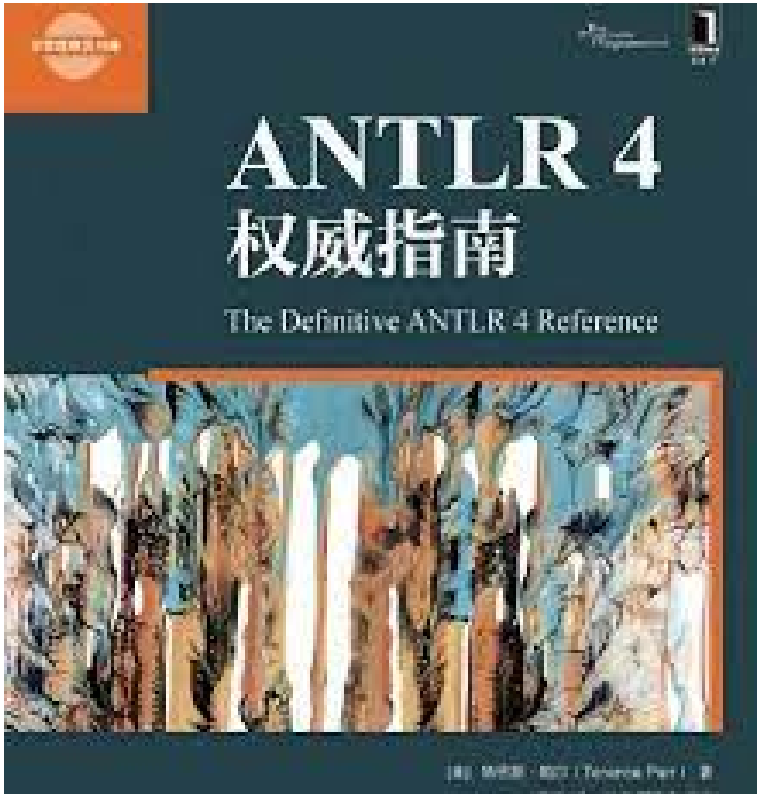


$d.i$ $a.b.y$

第 6 章: 记录并识别程序中的符号



第 7 章: 管理数据聚集的符号表

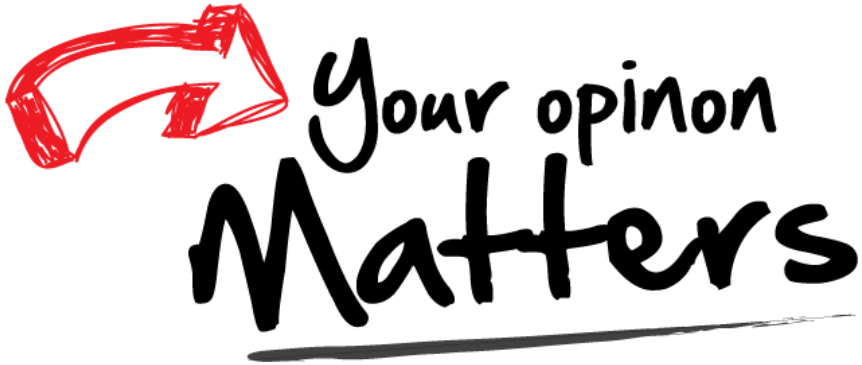


第 8.4 节: 验证程序中符号的使用

symtab @ antlr by parrt

symtab @ cs652 by parrt


Thank
You!



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