# 语法分析
# (5. ANTLR 4 语法分析器)

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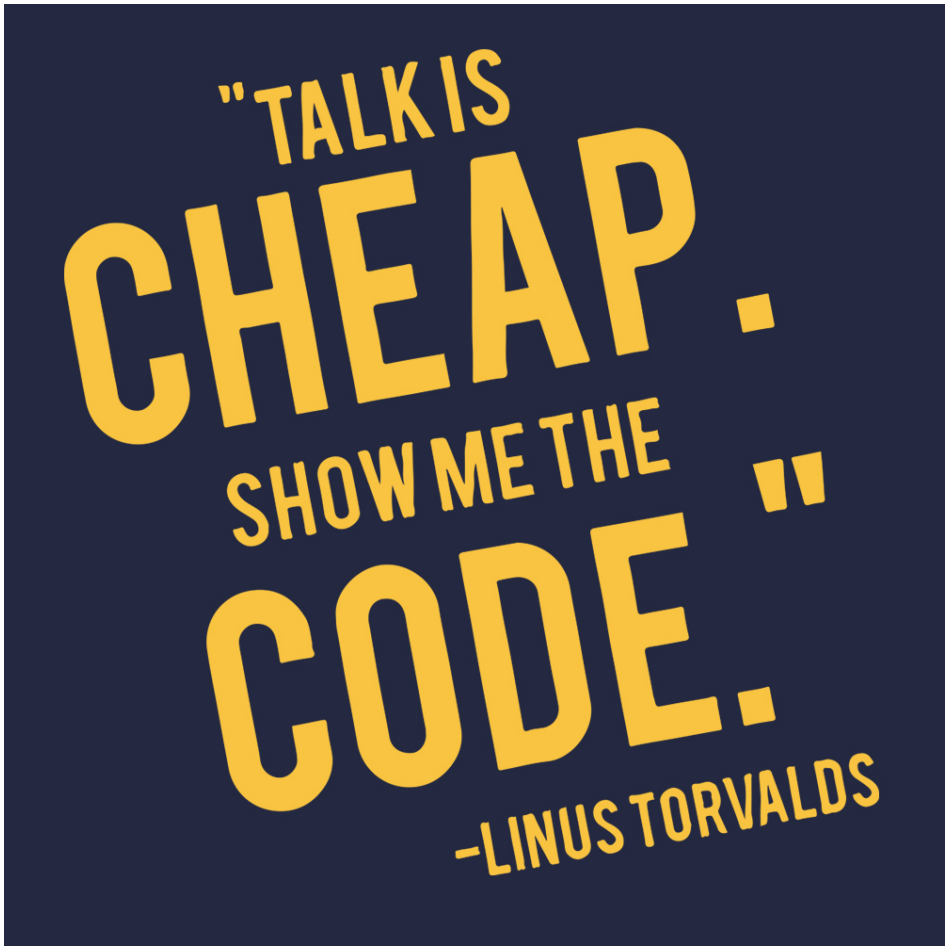
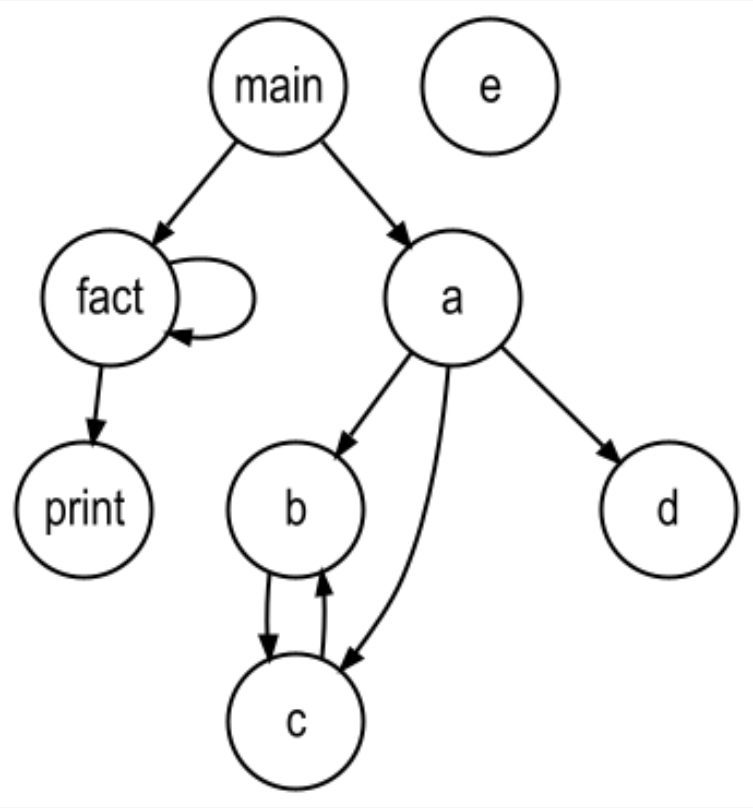

"TALK IS
CHEAP.
SHOW ME THE
CODE."
-LINUS TORVALDS

# Cymbol.g4

```
1   int factorial(int n) {
2     if (n == 1)
3     then return 1;
4
5     return n * factorial(n - 1);
6   }
7
8   int main() {
9     factorial(5);
10  }
```




函数调用图 (Function Call Graph)

# IfStat.g4

二义性文法

# IfStat.g4

二义性文法

```
stat : 'if' expr 'then' stat
     | 'if' expr 'then' stat 'else' stat
     | expr
     ;
```

# IfStat.g4

```
stat : 'if' expr 'then' stat
     | 'if' expr 'then' stat 'else' stat
     | expr
     ;
```

# IfStat.g4

```
stat : 'if' expr 'then' stat
     | 'if' expr 'then' stat 'else' stat
     | expr
     ;
```

# IfStatOpenMatched.g4

```
stat : matched_stat | open_stat ;

matched_stat : 'if' expr 'then' matched_stat 'else' matched_stat
             | expr
             ;

open_stat: 'if' expr 'then' stat
         | 'if' expr 'then' matched_stat 'else' open_stat
         ;
```

# Expr.g4

```
expr :
    | expr '*' expr
    | expr '-' expr
    | DIGIT
    ;
```

运算符的**结合性**带来的**二义性**

# ExprAssoc.g4

```
expr: '!' expr
    | <assoc = right> expr '^' expr
    | DIGIT
    ;
```

右结合运算符、前缀运算符与后缀运算符的结合性

# Expr.g4

```
expr :
    | expr '*' expr
    | expr '-' expr
    | DIGIT
    ;
```

运算符的**优先级**带来的**二义性**

```
expr :
    | expr '*' expr
    | expr '-' expr
    | DIGIT
    ;
```

ANTLR 4 可以处理该文法

# ExprLR.g4

```
expr : expr '-' term
     | term
     ;

term : term '*' factor
     | factor
     ;

factor : DIGIT ;
```

左递归 (左结合)

```
expr :
     | expr '*' expr
     | expr '-' expr
     | DIGIT
     ;
```

ANTLR 4 可以处理该文法

```
expr :
   | expr '*' expr
   | expr '-' expr
   | DIGIT
   ;
```

ANTLR 4 可以处理该文法

```
expr :
   | expr '*' expr
   | expr '-' expr
   | DIGIT
   ;
```

ANTLR 4 可以处理该文法

## ExprRR.g4

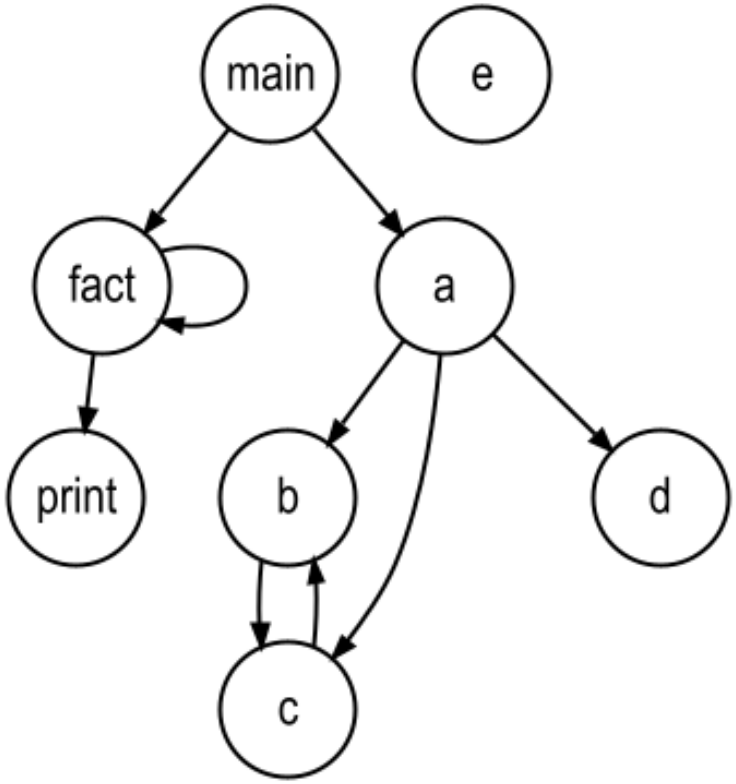
```
expr : term expr_prime ;
expr_prime : '-' term expr_prime
      |
      ;

term : factor term_prime ;
term_prime : '*' factor term_prime
      |
      ;

factor : DIGIT ;
```

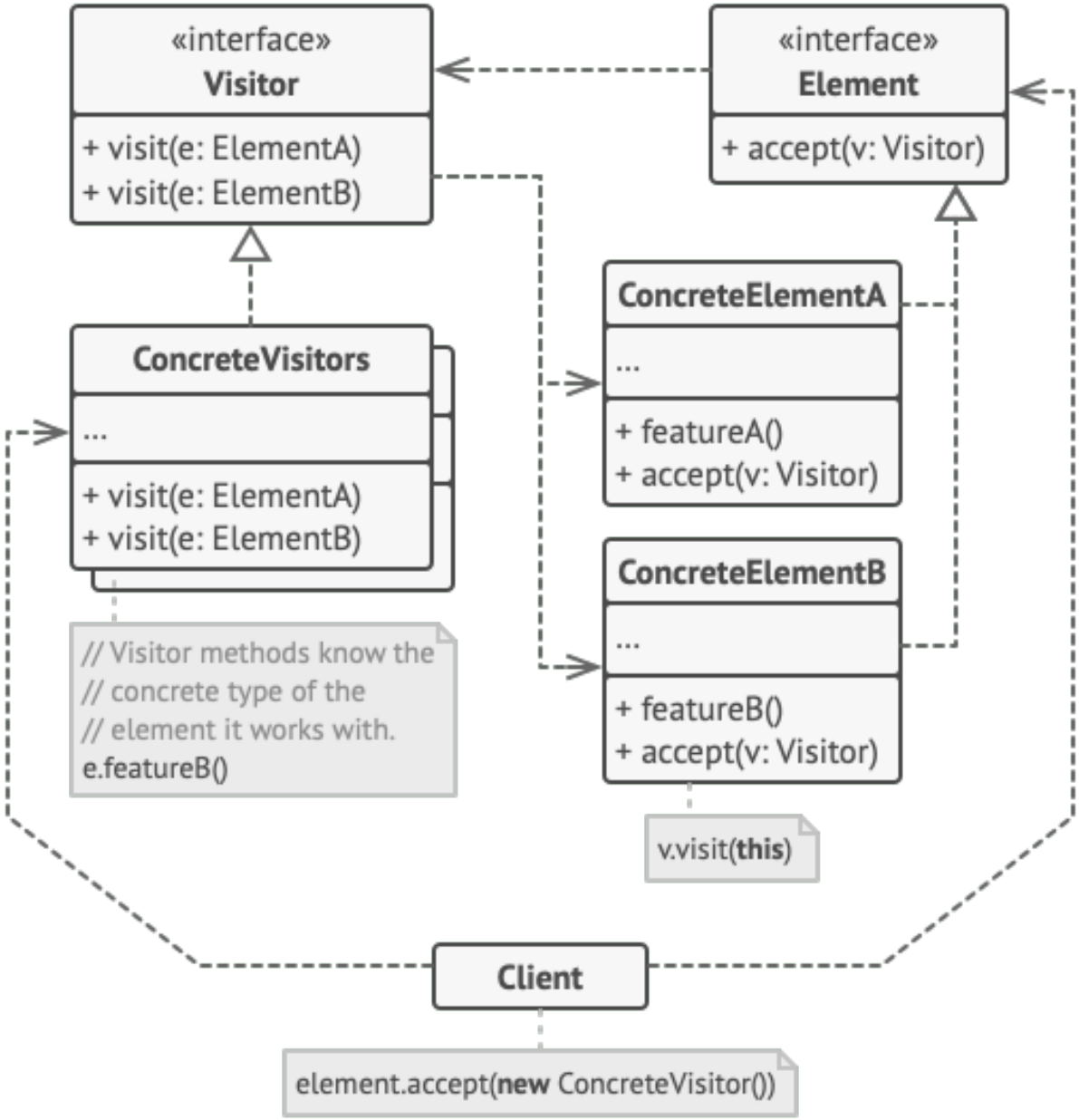
右递归 (右结合)

# Call Graphs

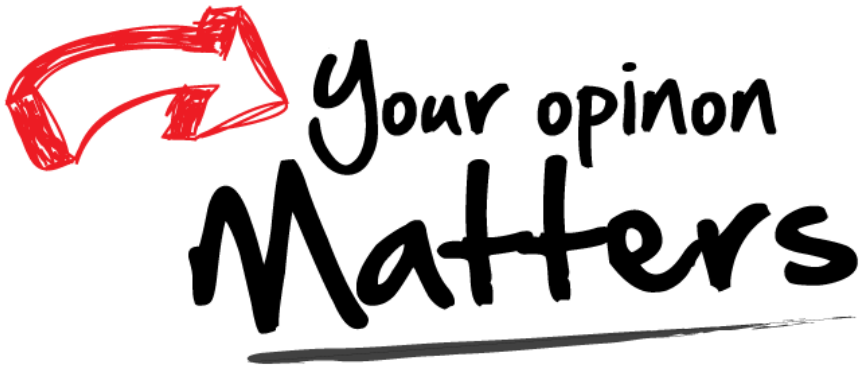


# ParseTreeWalker 与 Listener

```
23  public void walk(ParseTreeListener listener, ParseTree t) {
24    if ( t instanceof ErrorNode) {
25      listener.visitErrorNode((ErrorNode)t);
26      return;
27    }
28    else if ( t instanceof TerminalNode) {
29      listener.visitTerminal((TerminalNode)t);
30      return;
31    }
32    RuleNode r = (RuleNode)t;
33        enterRule(listener, r);
34        int n = r.getChildCount();
35        for (int i = 0; i<n; i++) {
36            walk(listener, r.getChild(i));
37        }
38    exitRule(listener, r);
39    }
```


«interface»
Visitor
+ visit(e: ElementA)
+ visit(e: ElementB)
«interface»
Element
+ accept(v: Visitor)
ConcreteVisitors
...
+ visit(e: ElementA)
+ visit(e: ElementB)
// Visitor methods know the
// concrete type of the
// element it works with.
e.featureB()
ConcreteElementA
...
+ featureA()
+ accept(v: Visitor)
ConcreteElementB
...
+ featureB()
+ accept(v: Visitor)
v.visit(this)
Client
element.accept(new ConcreteVisitor())


Thank
You!

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