

# 词法分析

## (1. 词法分析器生成器 ANTLR v4)

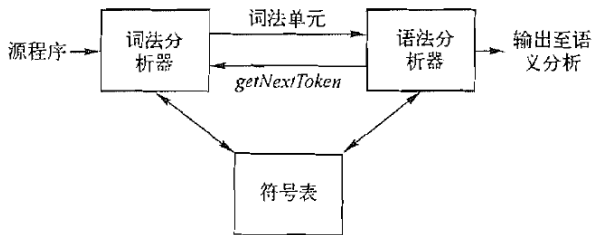
魏恒峰

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2024 年 03 月 06 日 (周三)

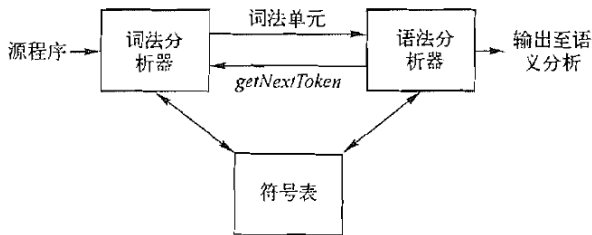


**输入:** 程序文本/字符串  $s$  (CharStream)



**输出:** 词法单元流 (TokenStream)

**输入:** 程序文本/字符串  $s$  (`CharStream`) + **词法单元 (token)** 的规约



**输出:** 词法单元流 (`TokenStream`)

# 词法分析器的三种设计方法 (由易到难)

## 词法分析器的三种设计方法 (由易到难)

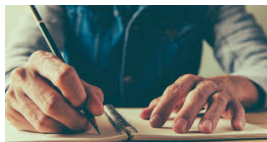


词法分析器生成器

## 词法分析器的三种设计方法 (由易到难)



词法分析器生成器



手写词法分析器

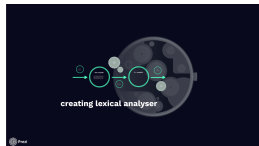
## 词法分析器的三种设计方法 (由易到难)



词法分析器生成器



手写词法分析器

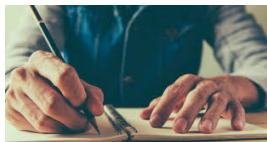


自动化词法分析器

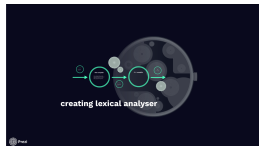
## 词法分析器的三种设计方法 (由易到难)



词法分析器生成器



手写词法分析器



自动化词法分析器

很多生产环境下的编译器 (如 gcc) 仍选择**手写词法分析器**





[gcc / gcc / c-family / c-lex.cc](#)

**jakubjelinek** c: Handle scoped attributes in \_\_has\*attrib

**Code** **Blame** **1785 lines (1612 loc)** · 49.1 KB

[gcc / libcpp / lex.cc](#)

**jakubjelinek** c: Handle scoped attributes in \_\_has\*at

**Code** **Blame** **5717 lines (5073 loc)** · 158 KB



mysql-server / `sql / sql_lex.cc` 



roylyseng and dahlerlend Bug#35889990: Setting

Code

Blame

5266 lines (4560 loc) · 170 KB



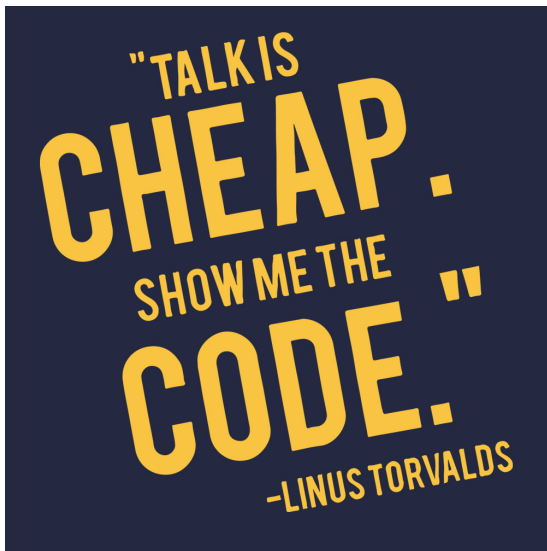
词法分析器生成器

**输入:** 词法单元的规约

`SimpleExpr.g4`

**输出:** 词法分析器

► `SimpleExprLexer.java`



# 命令行式使用 ANTLR v4

## Quick Start

To try ANTLR immediately, jump to the *new* [ANTLR Lab!](#)

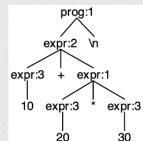
To install locally, use `antlr4-tools`, which installs Java and ANTLR if needed and creates `antlr4` and `antlr4-parse` executables:

```
$ pip install antlr4-tools
```

(Windows must add `.. \LocalCache\local-packages\Python310\Scripts` to the PATH). See the [Getting Started](#) doc. Paste the following grammar into file `Expr.g4` and, from that directory, run the `antlr4-parse` command. Hit control-D on Unix (or control-Z on Windows) to indicate end-of-input. A window showing the parse tree will appear.

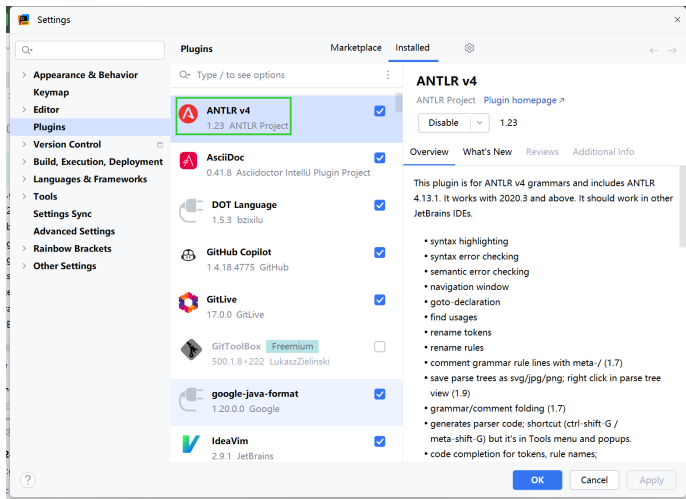
```
grammar Expr;
prog:  (expr NEWLINE)* ;
expr:  expr ('*' | '/') expr
      | expr ('+' | '-') expr
      | INT
      | '(' expr ')'
      ;
NEWLINE : [\r\n]+ ;
INT      : [0-9]+ ;

$ antlr4-parse Expr.g4 prog -gui
10+20*30
^D
$ antlr4 Expr.g4 # gen code
$ ls ExprParser.java
ExprParser.java
```



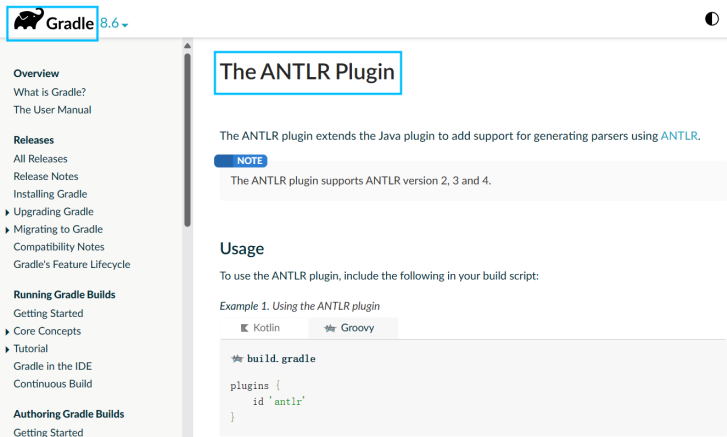
<https://www.antlr.org/>

# 交互式使用 ANTLR v4



<https://www.antlr.org/tools.html>

# 编程式使用 ANTLR v4



The screenshot shows the Gradle 8.6 documentation page for the ANTLR plugin. The left sidebar contains a navigation menu with sections: Overview, Releases, Running Gradle Builds, and Authoring Gradle Builds. The main content area is titled "The ANTLR Plugin" and includes a description, a note about ANTLR version support, and a usage section with a code example.

**Gradle 8.6**

**The ANTLR Plugin**

The ANTLR plugin extends the Java plugin to add support for generating parsers using [ANTLR](#).

**NOTE**

The ANTLR plugin supports ANTLR version 2, 3 and 4.

**Usage**

To use the ANTLR plugin, include the following in your build script:

*Example 1. Using the ANTLR plugin*

☒ Kotlin ☐ Groovy

```
build.gradle

plugins {
    id 'antlr'
}
```

[https://docs.gradle.org/current/userguide/antlr\\_plugin.html](https://docs.gradle.org/current/userguide/antlr_plugin.html)



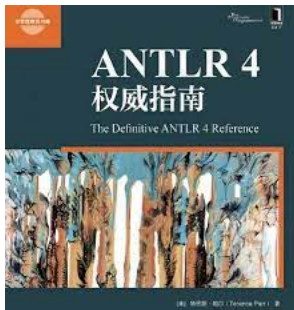
## ANTLR v4 中的冲突解决规则

最优先匹配: 关键字 *vs.* 标识符

ML\_COMMENT *vs.* DOC\_COMMENT

最长优先匹配: 1.23, >=, ifhappy

非贪婪匹配:  $()??$ ,  $()*?$ ,  $()+?$



5.5: 识别常见的语法结构

15.5: 词法规则

15.6: 通配符与非贪婪子规则

12: 掌握词法分析的“黑魔法”

以编程的方式使用 ANTLR 4 生成的 xxxLexer.java

以**编程的方式**使用 ANTLR 4 生成的 xxxLexer.java

```
@header {  
package simpleexpr;  
}
```

## 以编程的方式使用 ANTLR 4 生成的 xxxLexer.java

```
@header {  
package simpleexpr;  
}  
  
CharStream input = CharStreams.fromStream(is);  
SimpleExprLexer lexer = new SimpleExprLexer(input);  
  
lexer.getAllTokens().forEach(System.out::println);
```

## lexer grammar

### Section 4.1 (1. 语法导入) of 《ANTLR 4 权威指南》

```
lexer grammar SimpleExprLexerRules;
```

```
// Comment out the following lines  
// Otherwise, there will be duplicate package statements  
// @header {  
// package simpleexpr;  
// }
```

```
grammar SimpleExpr;  
import SimpleExprLexerRules;
```

```
@header {  
package simpleexpr;  
}
```

You can learn a lot from [grammars-v4/c](#).





Thank  
You!



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