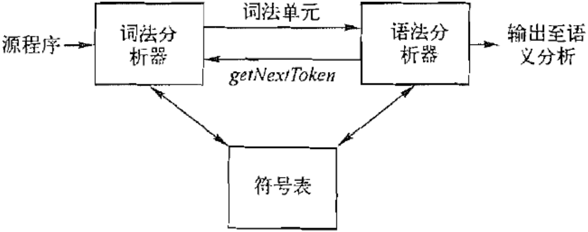
词法分析
(1. 词法分析器生成器 ANTLR v4)

魏恒峰

hfwei@nju.edu.cn

2024 年 03 月 06 日 (周三)

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)

ANTLR

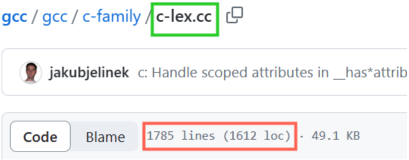
词法分析器生成器

手写词法分析器

creating lexical analyser

自动化词法分析器

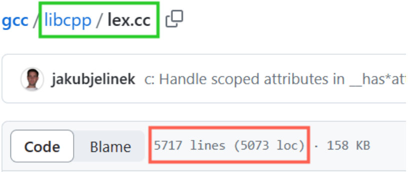
很多生产环境下的编译器 (如 gcc) 仍选择**手写词法分析器**



gcc / gcc / c-family / c-lex.cc

jakubjelinek c: Handle scoped attributes in __has*attrib

Code Blame 1785 lines (1612 loc) · 49.1 KB

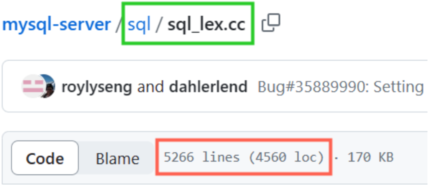


gcc / libcpp / lex.cc

jakubjelinek c: Handle scoped attributes in __has*at

Code Blame 5717 lines (5073 loc) · 158 KB

MySQL®



mysql-server / sql / sql_lex.cc

roylyseng and dahlerlend Bug#35889990: Setting

Code Blame 5266 lines (4560 loc) · 170 KB

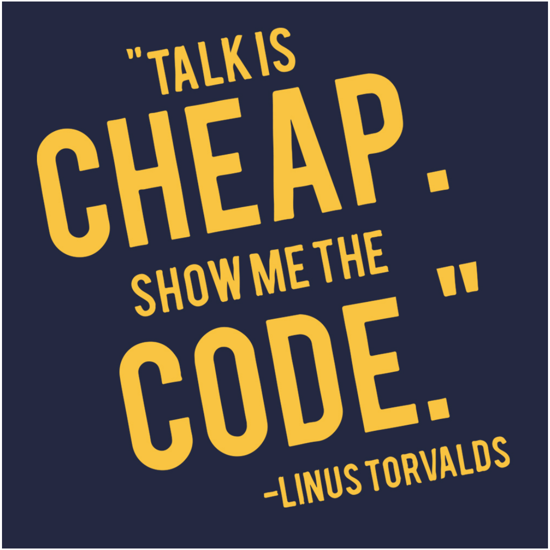
词法分析器生成器

输入： 词法单元的规约

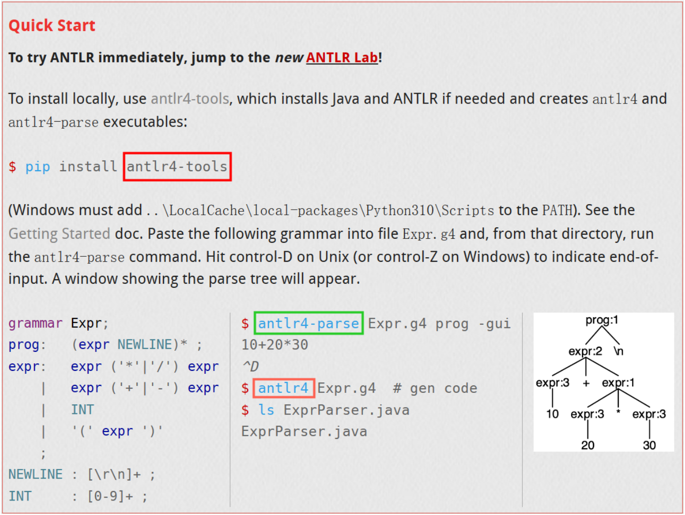
`SimpleExpr.g4`

输出： 词法分析器

- `SimpleExprLexer.java`


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

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
```

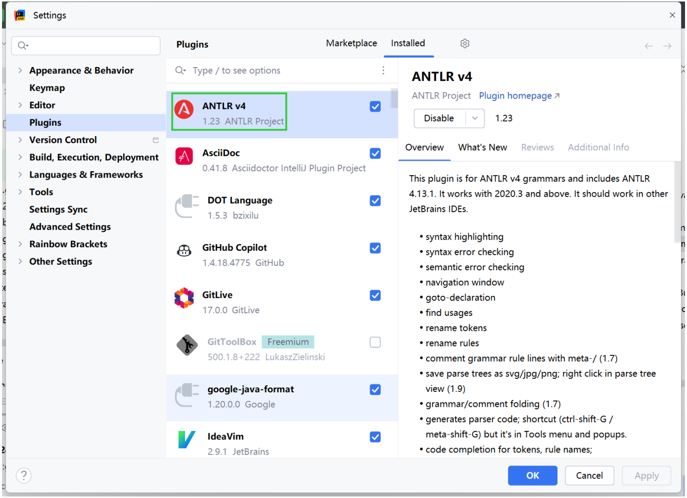
(Windows must add `..\LocalCache\local-packages\Python310\Scripts` to the `PATH`). See the Getting Started doc. Paste the following grammar into file `Expr.g4` and, from that directory, run the `antlr4-parse` command. Hit control-D on Unix (or control-Z on Windows) to indicate end-of-input. A window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



Settings

Plugins Marketplace Installed

- Appearance & Behavior
- Keymap
- Editor
- Plugins
- Version Control
- Build, Execution, Deployment
- Languages & Frameworks
- Tools
- Settings Sync
- Advanced Settings
- Rainbow Brackets
- Other Settings

Type / to see options

Plugin	Version	Vendor	Enabled
ANTLR v4	1.23	ANTLR Project	☑
AsciiDoc	0.41.8	Asciidoctor IntelliJ Plugin Project	☑
DOT Language	1.5.3	bzixilu	☑
GitHub Copilot	1.4.18.4775	GitHub	☑
GitLive	17.0.0	GitLive	☑
GitToolBox Freemium	500.1.8+222	LukaszZielinski	□
google-java-format	1.20.0.0	Google	☑
IdeaVim	2.9.1	JetBrains	☑

ANTLR v4

ANTLR Project Plugin homepage ↗

Disable 1.23

Overview What's New Reviews Additional Info

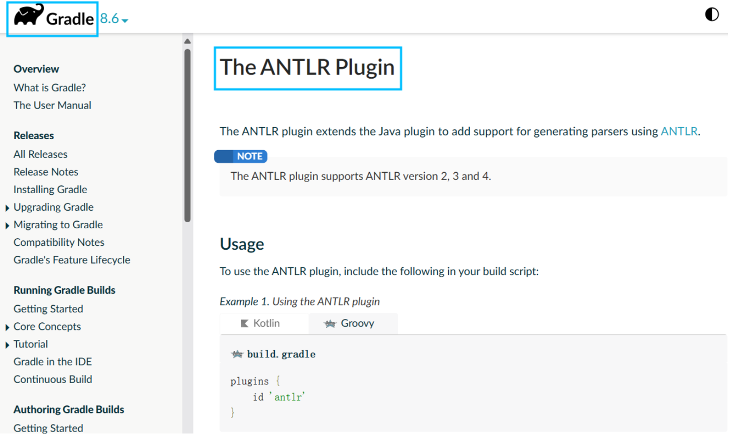
This plugin is for ANTLR v4 grammars and includes ANTLR 4.13.1. It works with 2020.3 and above. It should work in other JetBrains IDEs.

- syntax highlighting
- syntax error checking
- semantic error checking
- navigation window
- goto-declaration
- find usages
- rename tokens
- rename rules
- comment grammar rule lines with meta-/ (1.7)
- save parse trees as svg/jpg/png; right click in parse tree view (1.9)
- grammar/comment folding (1.7)
- generates parser code; shortcut (ctrl-shift-G / meta-shift-G) but it's in Tools menu and popups.
- code completion for tokens, rule names;

OK Cancel Apply

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

编程式使用 ANTLR v4



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

build.gradle

```
plugins {
    id 'antlr'
}
```

https://docs.gradle.org/current/userguide/antlr_plugin.html

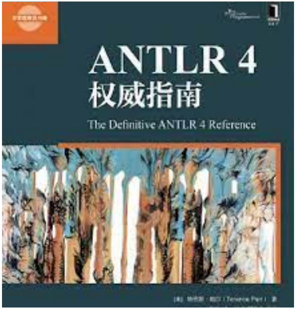
ANTLR v4 中的**冲突解决**规则

最前优先匹配: 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: `()??`, `()*?`, `()+?`



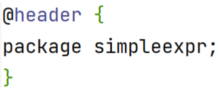
5.5: 识别常见的语法结构

15.5: 词法规则

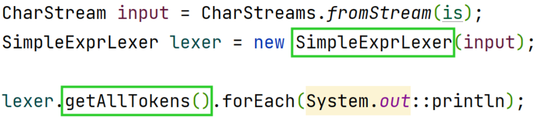
15.6: 通配符与非贪婪子规则

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`



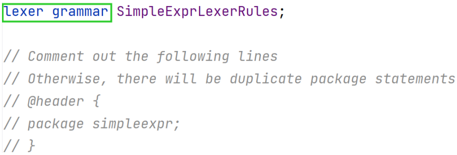
```
@header {
package simpleexpr;
}
```



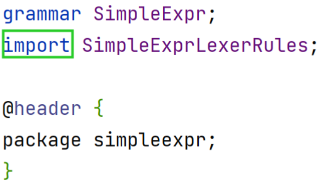
```
CharStream input = CharStreams.fromStream(is);
SimpleExprLexer lexer = new SimpleExprLexer(input);

lexer.getAllTokens().forEach(System.out::println);
```

lexer grammar

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

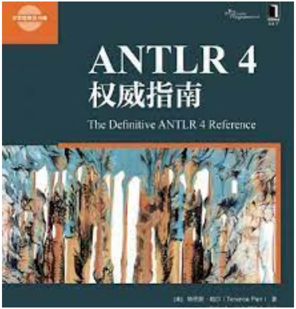


```
lexer grammar SimpleExprLexerRules;

// 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.



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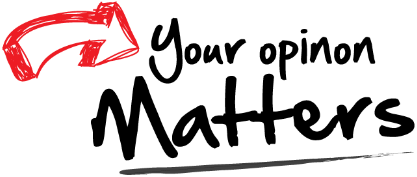
Thank You!



Office 926

hfwei@nju.edu.cn