



Reactor

Extending VSCode: Write Your Own
Language Server for Visual Studio Code

With Lex Li

Aug 20 | 7PM ET | 4pM PT |

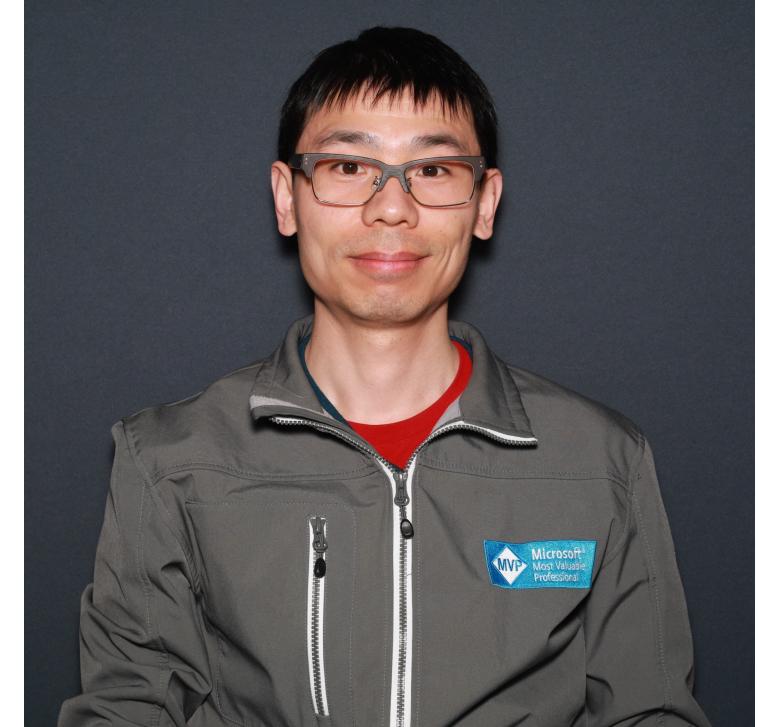
Livestream event



meetup.com/Microsoft-Reactor-Toronto

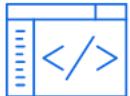
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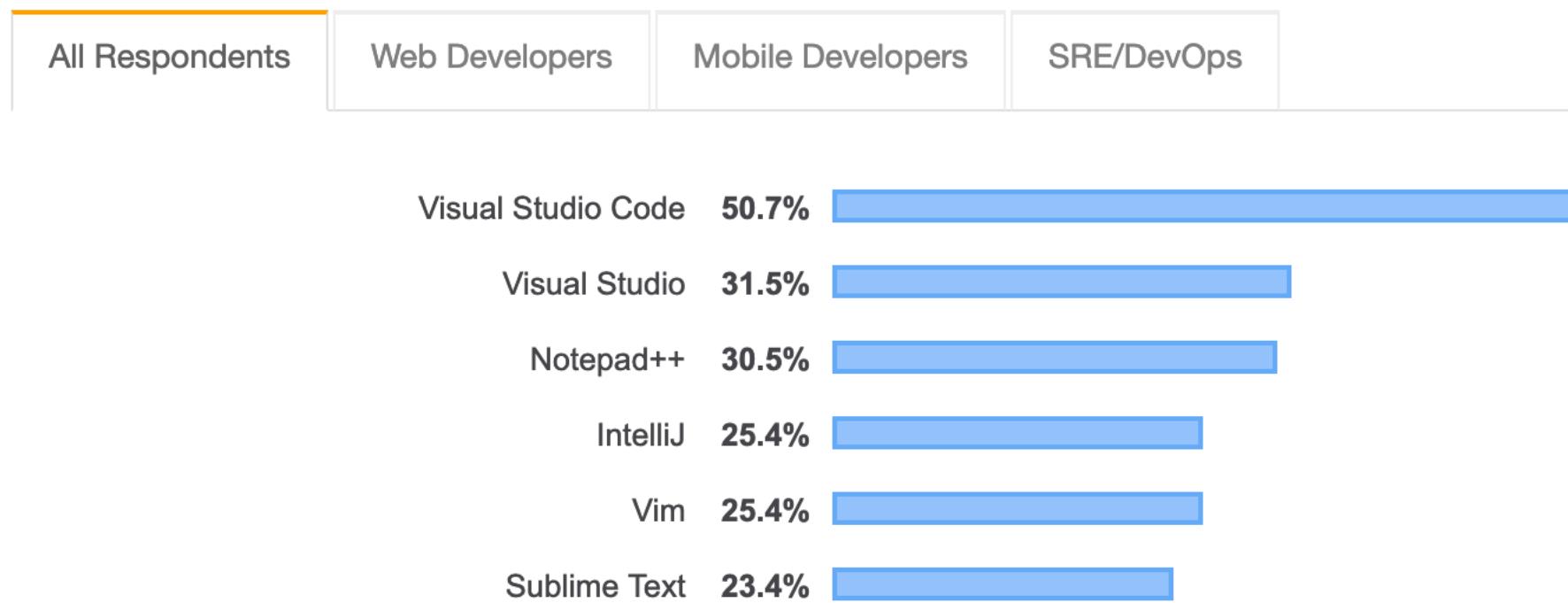
Agenda

- What is a Language Server
 - Why You Need It
- Creating a New Language Server
 - Introduction
 - Define the Language Grammar
 - Create the Language Parser
 - Build the Language Server Upon the Parser
- Summary
- Q&A



Development Environments and Tools

Most Popular Development Environments



Visual Studio

Visual Studio Code

Azure DevOps

Subscriptions

Build your own

Search Visual Studio Code extensions



4003 Results

Showing: Programming Languages ▾

Python

Microsoft ⬇️ 23.6M

Linting, Debugging (multi-threaded, remote), Intellisense, Jupyter...

★★★★★ FREE

C/C++

Microsoft ⬇️ 13.2M

C/C++ IntelliSense, debugging, and code browsing.

★★★★☆ FREE

ESLint

Dirk Baeumer ⬇️ 10.4M

Integrates ESLint JavaScript into VS Code.

★★★★★ FREE

C#

Microsoft ⬇️ 8.4M

C# for Visual Studio Code (powered by OmniSharp).

★★★★☆ FREE

Language Support for Java

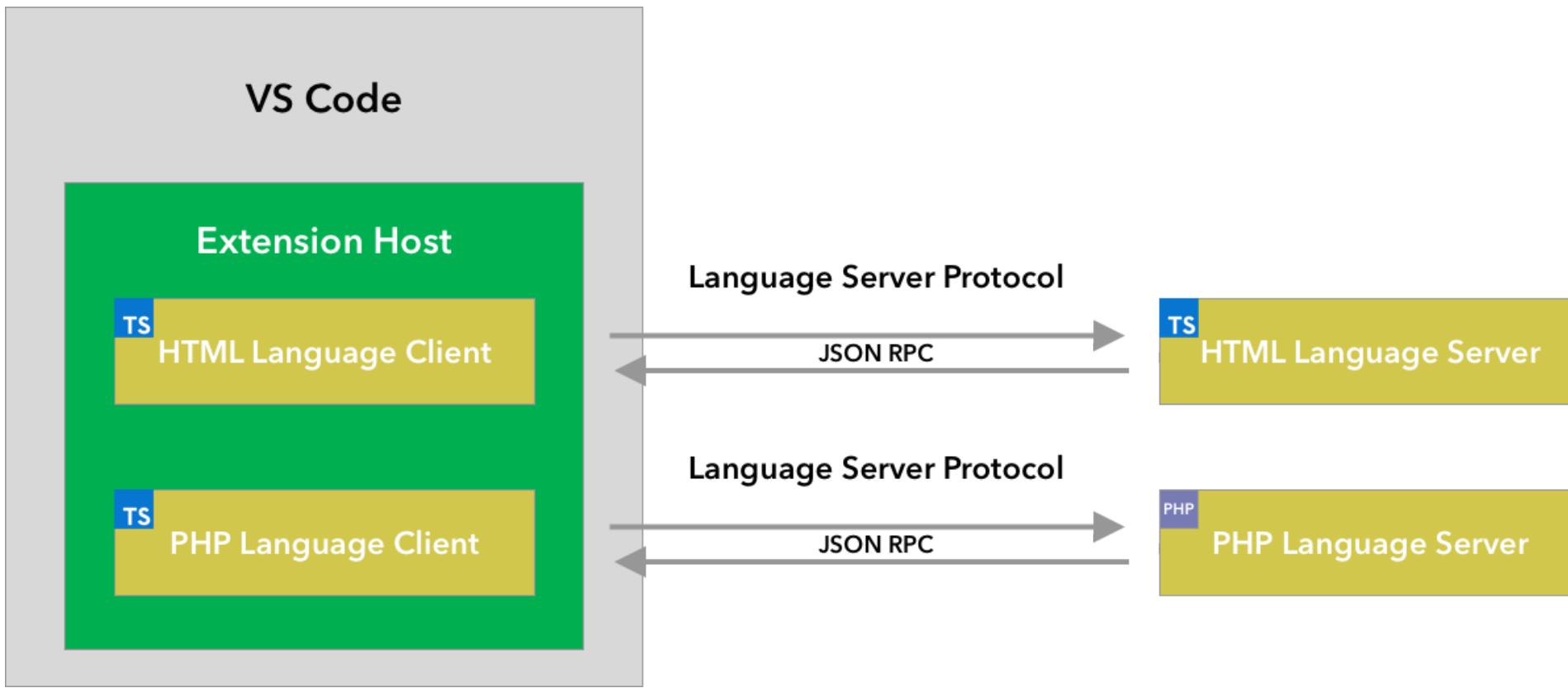
Red Hat ⬇️ 6.7M

Java Linting, Intellisense, formatting, refactoring, Maven/Gradle support and...

★★★★☆ FREE

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Demo

- Review a language server and its extension in action.

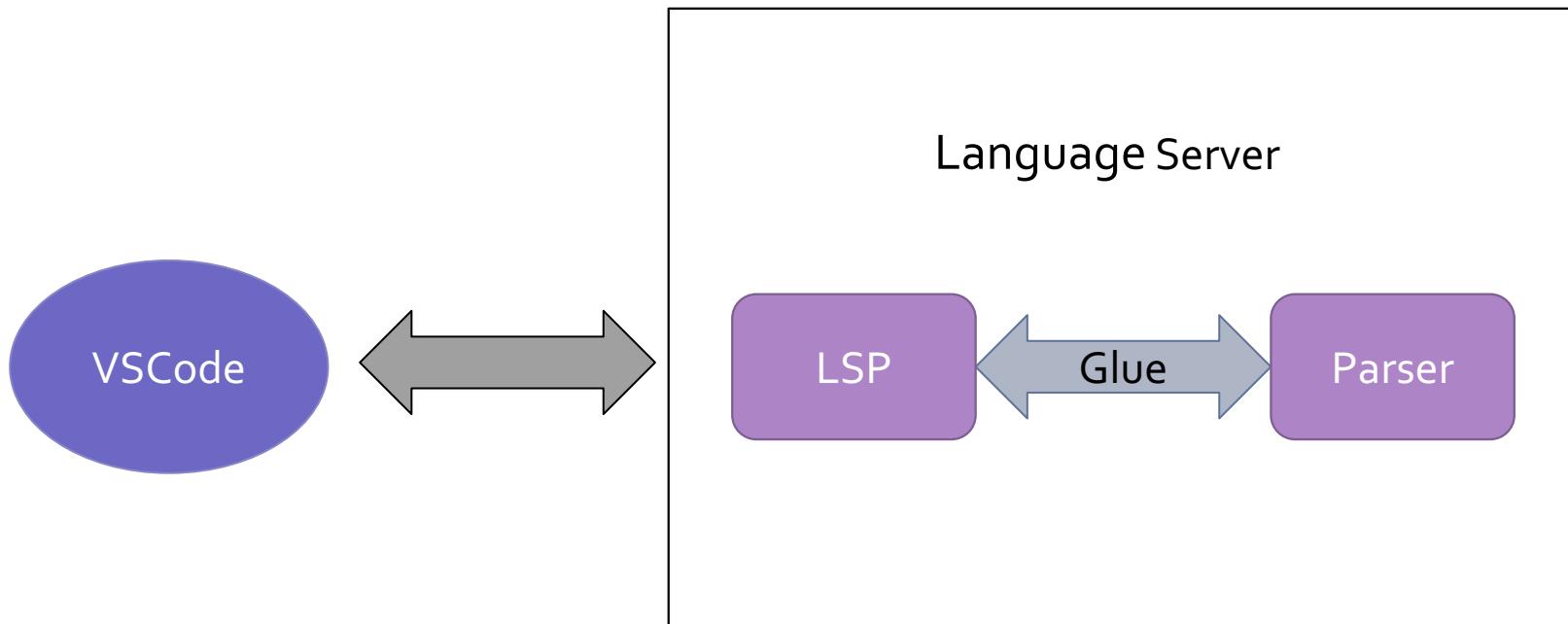
What is A Language Server

- A console application that analyzes the source code in real time.
- It can be written in any language, but usually in the same language it analyzes (eg. TypeScript language server is written in TypeScript).

Why You Need It

- It provides VSCode users with features including:
 - Autocomplete
 - Error-checking
 - Jump-to-definition

Creating a New Language Server



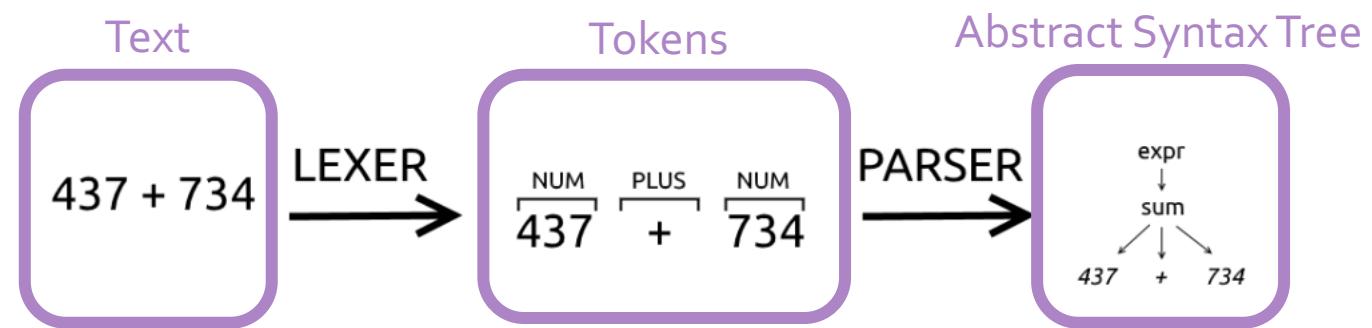
Existing LSP

Existing language servers provide LSP implementations in the following languages:

- Java
- TypeScript
- C#
- Go
- C++
- Swift
- Rust
- Python
- ...

<https://microsoft.github.io/language-server-protocol/implementors/servers/>

What is a Parser?



Parser Generators

The Definitive **ANTLR 4** Reference



Terence Parr

Edited by Susannah Davidson Pfalzer

Image source: ANTLR.org

Define the Language

- Write a grammar file (.g4) to define the programming language (variables/methods/types).
- Validate the grammar against test files.

Hint: Reuse an existing grammar to get started more quickly.

<https://github.com/antlr/grammars-v4>

```
27  /** C 2011 grammar built from the C11 Spec */
28  parser grammar CParser;
29
30  options { tokenVocab = CLexer; }
31
32  primaryExpression
33      : Identifier
34      | Constant
35      | StringLiteral+
36      | '(' expression ')'
37      | genericSelection
38      | EXTENSION? '(' compoundStatement ')' // Blocks (GCC extension)
39      | BUILTIN_VA_ARG '(' unaryExpression ',' typeName ')'
40      | BUILTIN_OFFSETOF '(' typeName ',' unaryExpression ')'
41      ;
```

Generate the Parser

- Run ANTLR command line to generate the parser skeleton (lexer and parser).
 - `$ antlr4 mylanguage.g4`
- Alternatively, use a more suitable ANTLR tooling for the target language. For example, ANTLR 4 C# tooling seamlessly integrates with MSBuild.

How to Glue Up

- VSCode sends a request for autocomplete,
 - File name
 - Line number
 - Column number
- LSP component receives and understands the request.
- The target file as well as its dependencies (such as files included) is analyzed by the parser to generate Abstract Syntax Tree.
- Autocompletion items such as function names are built from AST.

Recap

Component	Reuse/New
LSP	Reuse
Grammar/Parser	Reuse
Glue	New

References

- VSCode official site

<https://code.visualstudio.com/api/language-extensions/language-server-extension-guide>

- ANSI C language server sample

<https://github.com/lextm/ansi-c-antlr>

<https://github.com/lextm/vscode-ansic>

Further questions about the sample can be posted to its Issues section on GitHub.

My Advice

- Start with a minimal set of features.
- Gradually add more features.
- Periodically release to users.

Summary

- What is a Language Server
- Creating a New Language Server

Q&A

- Further questions about the sample can be posted to its Issues section on GitHub.
- Business inquiry on custom language server development can be sent to support@lexstudio.com.
- Fill the survey for this session and leave your feedback.

Reactor

T O R O N T O

We are constantly striving to create excellent content
and would appreciate if you could take this brief survey.

Survey Link: <https://aka.ms/Reactor/Survey>

Please enter the event code <**8150**> at the start of survey



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