



```
if ( $(window).scrollTop() > header1_initialDistance) {  
  if ( parseInt(header1.css('padding-top'), 10) >= header1_initialPadding) {  
    header1.css('padding-top', '' + $(window).scrollTop() - header1_initialPadding);  
  }  
} else {  
  header1.css('padding-top', '' + header1_initialPadding);  
}
```

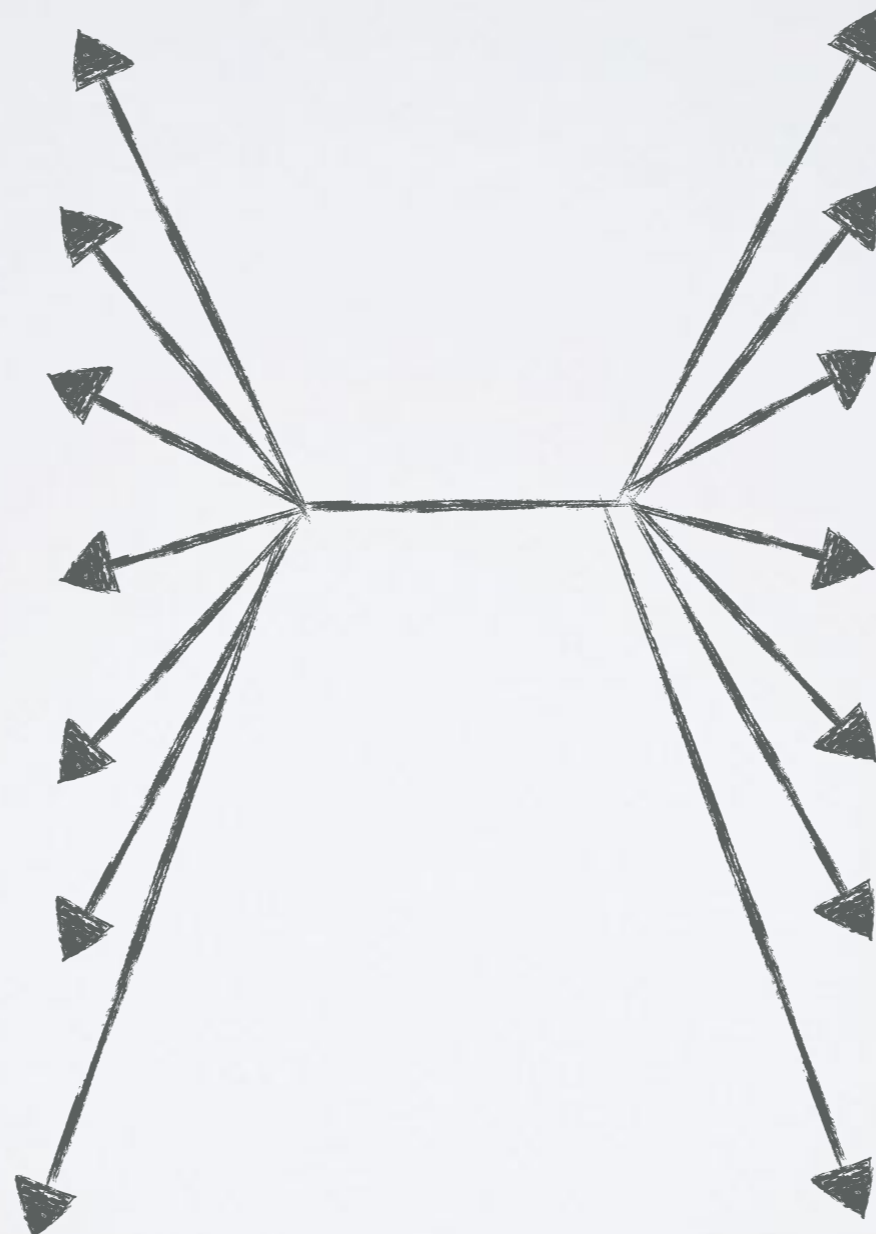
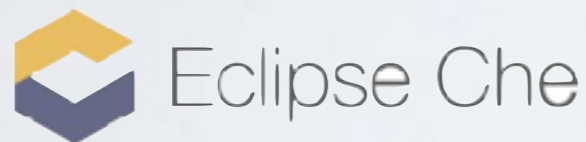
# LANGUAGE SERVERS

The promise of any language in any editor

Karsten Thoms / itemis

```
if ( $(window).scrollTop() > header2_initialDistance) {  
  if ( parseInt(header2.css('padding-top'), 10) >= header2_initialPadding) {  
    header2.css('padding-top', '' + $(window).scrollTop() - header2_initialPadding);  
  }  
} else {  
  header2.css('padding-top', '' + header2_initialPadding);  
}
```

# LANGUAGE INTEGRATION IN IDE'S

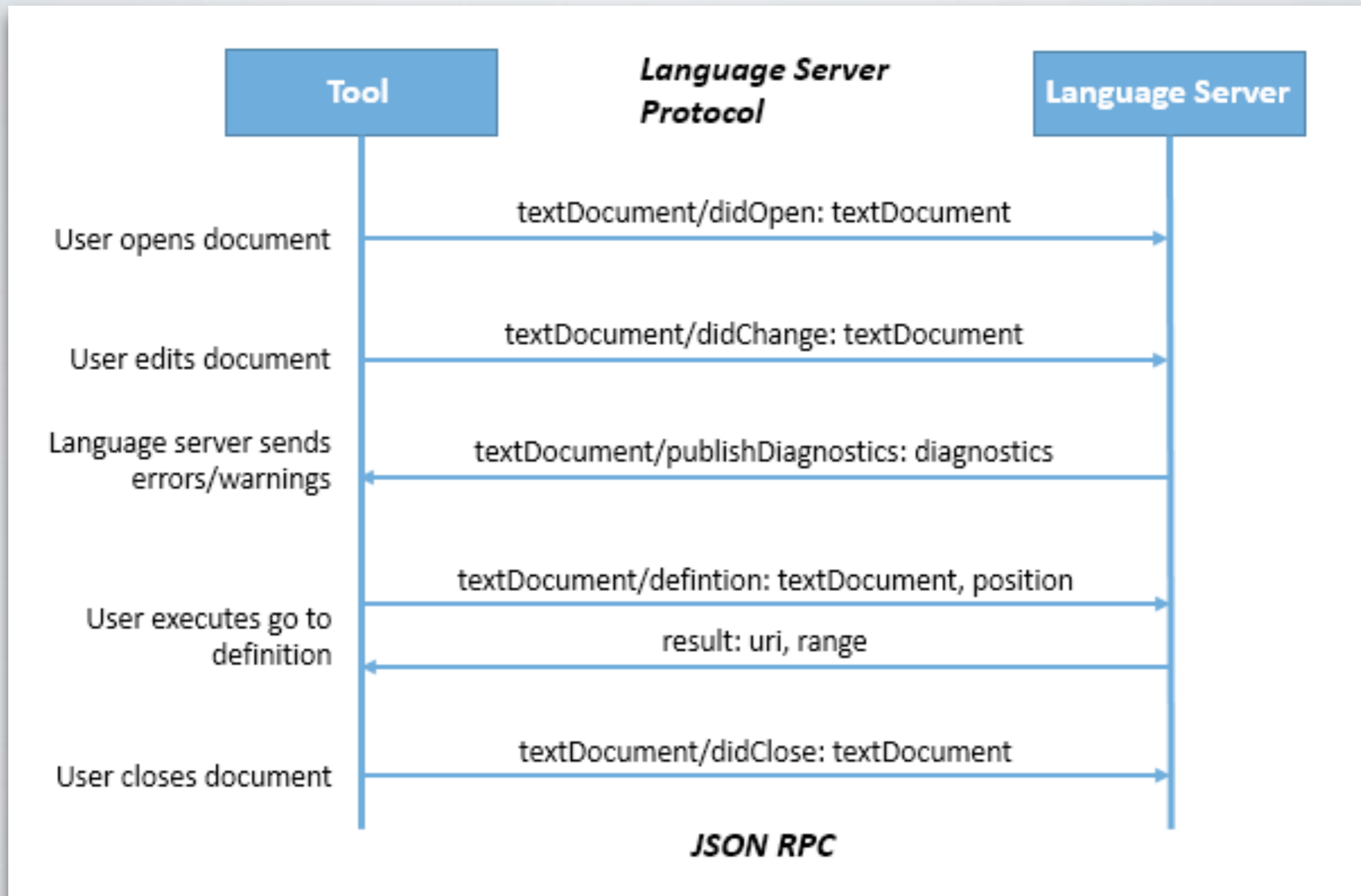


# LANGUAGE SERVER PROTOCOL

# LANGUAGE SERVER PROTOCOL

- Defines a **bidirectional protocol** between a **tool** (Client) and a „language smartness provider“ (**Language Server**)
- Open **de-facto Standard** from Microsoft (Team around Erich Gamma)
- Initially implemented in Microsoft Visual Studio Code (**VS Code**), other IDEs (e.g. **Eclipse Che, Eclipse IDE** ) in progress or already supporting
- Generic integration of language features:  
*Content Assist, Go to definition, Validation, Find references, etc.*
- **JSON-RPC** used to communicate Requests, Responses and Notifications
- Server provides semantics of a program in a certain language
- Client sends messages and requests on interactions: open document, change text...

# LANGUAGE SERVER PROTOCOL



# BASE PROTOCOL

- Message consists of Header and Content Part.
- Header and Content are separated by `,\r\n'`.

Header Field Name	Value Type	Description
Content-Length	number	The length of the content part in bytes. This header is required.
Content-Type	string	The mime type of the content part. Defaults to application/vscode-jsonrpc; charset=utf8

```
Content-Length: ... \r\n
\r\n
{
  "jsonrpc": "2.0",
  "id": 1,
  "method": "textDocument/didOpen",
  "params": {
    ...
  }
}
```

# BASIC PROTOCOL STRUCTURES (1/3)

- **Abstract Message**

A general message as defined by JSON-RPC. The language server protocol always uses "2.0" as the jsonrpc version.

- **RequestMessage**

A request message to describe a request between the client and the server. Every processed request must send a response back to the sender of the request.

- **Response Message**

Response Message sent as a result of a request.

- **Notification Message**

A notification message. A processed notification message must not send a response back. They work like events.

- **Cancellation Support**

The base protocol now offers support for request cancellation.

```
interface Message {  
  jsonrpc: string  
}
```

```
interface RequestMessage extends Message {  
  id: number | string;  
  method: string;  
  params?: any  
}
```

```
interface ResponseMessage extends Message {  
  id: number | string;  
  result?: any;  
  error?: ResponseError<any>;  
}
```

```
interface NotificationMessage extends Message  
{  
  method: string;  
  params?: any  
}
```

```
interface CancelParams {  
  id: number | string;  
}
```

# BASIC PROTOCOL STRUCTURES (2/3)

- **Position**

Position in a text document expressed as zero-based line and character offset.

- **Range**

A range in a text document expressed as (zero-based) start and end positions.

- **Location**

Represents a location inside a resource, such as a line inside a text file.

- **Diagnostic**

Represents a diagnostic, such as a compiler error or warning. Diagnostic objects are only valid in the scope of a resource.

- **Command**

Represents a reference to a command. Provides a title which will be used to represent a command in the UI and, optionally, an array of arguments which will be passed to the command handler function when invoked.



# BASIC PROTOCOL STRUCTURES (3/3)

- **TextEdit**

A textual edit applicable to a text document.

- **WorkspaceEdit**

A workspace edit represents changes to many resources managed in the workspace.

- **TextDocumentIdentifier**

Text documents are identified using a URI. On the protocol level, URIs are passed as strings.

- **TextDocumentItem**

An item to transfer a text document from the client to the server.

- **VersionedTextDocumentIdentifier**

An identifier to denote a specific version of a text document.

- **TextDocumentPositionParams**

A parameter literal used in requests to pass a text document and a position inside that document.

# ACTUAL PROTOCOL (1/7)

- **Initialize Request**

The initialize request is sent as the first request from the client to the server.

- **Shutdown Request**

The shutdown request is sent from the client to the server. It asks the server to shut down, but to not exit (otherwise the response might not be delivered correctly to the client). There is a separate exit notification that asks the server to exit.

# ACTUAL PROTOCOL (2/7)

- **ShowMessage Notification**

The show message notification is sent from a server to a client to ask the client to display a particular message in the user interface.

- **ShowMessage Request**

The show message request is sent from a server to a client to ask the client to display a particular message in the user interface. In addition to the show message notification the request allows to pass actions and to wait for an answer from the client.

- **LogMessage Notification**

The log message notification is sent from the server to the client to ask the client to log a particular message.

# ACTUAL PROTOCOL (3/7)

- **DidChangeConfiguration Notification**

A notification sent from the client to the server to signal the change of configuration settings.

- **DidOpenTextDocument Notification**

The document open notification is sent from the client to the server to signal newly opened text documents. The document's truth is now managed by the client and the server must not try to read the document's truth using the document's uri.

- **DidChangeTextDocument Notification**

The document change notification is sent from the client to the server to signal changes to a text document. In 2.0 the shape of the params has changed to include proper version numbers and language ids.

- **DidCloseTextDocument Notification**

The document close notification is sent from the client to the server when the document got closed in the client. The document's truth now exists where the document's uri points to (e.g. if the document's uri is a file uri the truth now exists on disk).

# ACTUAL PROTOCOL (4/7)

- **DidSaveTextDocument Notification**

The document save notification is sent from the client to the server when the document was saved in the client.

- **DidChangeWatchedFiles Notification**

The watched files notification is sent from the client to the server when the client detects changes to files watched by the language client.

- **PublishDiagnostics Notification**

Diagnostics notification are sent from the server to the client to signal results of validation runs.

- **Completion Request**

The Completion request is sent from the client to the server to compute completion items at a given cursor position. Completion items are presented in the IntelliSense user interface. If computing full completion items is expensive, servers can additionally provide a handler for the completion item resolve request. This request is sent when a completion item is selected in the user interface.

- **Completion Item Resolve Request**

The request is sent from the client to the server to resolve additional information for a given completion item.

# ACTUAL PROTOCOL (5/7)

- **Hover Request**

The hover request is sent from the client to the server to request hover information at a given text document position.

- **Signature Help Request**

The signature help request is sent from the client to the server to request signature information at a given cursor position.

- **Goto Definition Request**

The goto definition request is sent from the client to the server to resolve the definition location of a symbol at a given text document position.

- **Find References Request**

The references request is sent from the client to the server to resolve project-wide references for the symbol denoted by the given text document position.

- **Document Highlight Request**

The document highlight request is sent from the client to the server to resolve a document highlights for a given text document position.

# ACTUAL PROTOCOL (6/7)

- **Document Symbols Request**

The document symbol request is sent from the client to the server to list all symbols found in a given text document.

- **Workspace Symbols Request**

The workspace symbol request is sent from the client to the server to list project-wide symbols matching the query string.

- **Code Action Request**

The code action request is sent from the client to the server to compute commands for a given text document and range. The request is triggered when the user moves the cursor into a problem marker in the editor or presses the lightbulb associated with a marker.

- **Code Lens Request**

The code lens request is sent from the client to the server to compute code lenses for a given text document.

- **Code Lens Resolve Request**

The code lens resolve request is sent from the client to the server to resolve the command for a given code lens item.

# ACTUAL PROTOCOL (7/7)

- **Document Formatting Request**

The document formatting request is sent from the server to the client to format a whole document.

- **Document Range Formatting Request**

The document range formatting request is sent from the client to the server to format a given range in a document.

- **Document on Type Formatting Request**

The document on type formatting request is sent from the client to the server to format parts of the document during typing.

- **Rename Request**

The rename request is sent from the client to the server to perform a workspace-wide rename of a symbol.



# ECLIPSE LSP4J

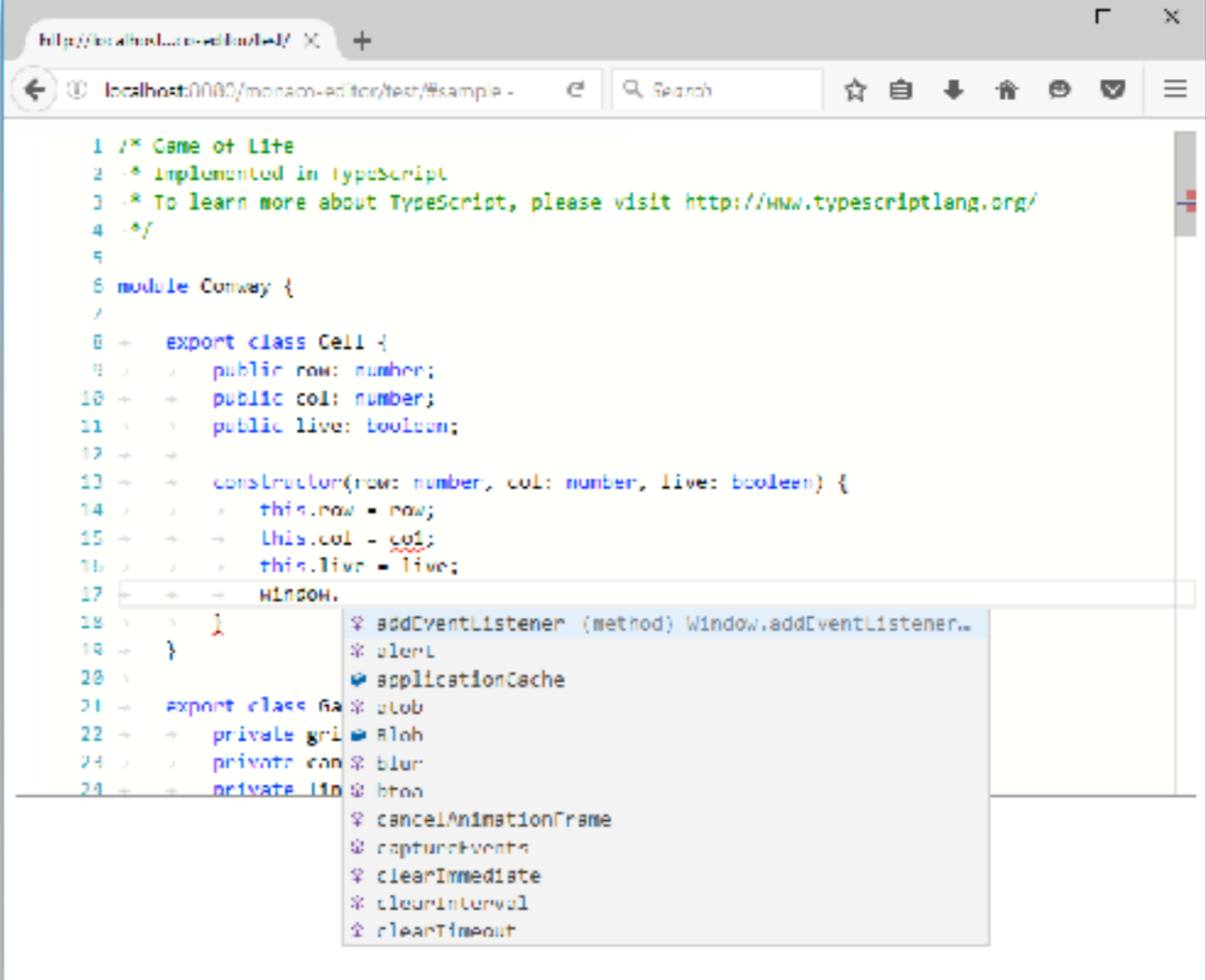
- **Java Binding** for the Language Server Protocol
- Initially used by **Xtext**
- Provides support for **Client and Server side** of the protocol
- Current version 0.2.0 released 2017-05-26, **part of Eclipse Oxygen**
- <https://projects.eclipse.org/projects/technology.lsp4j>

# ECLIPSE LSP4E

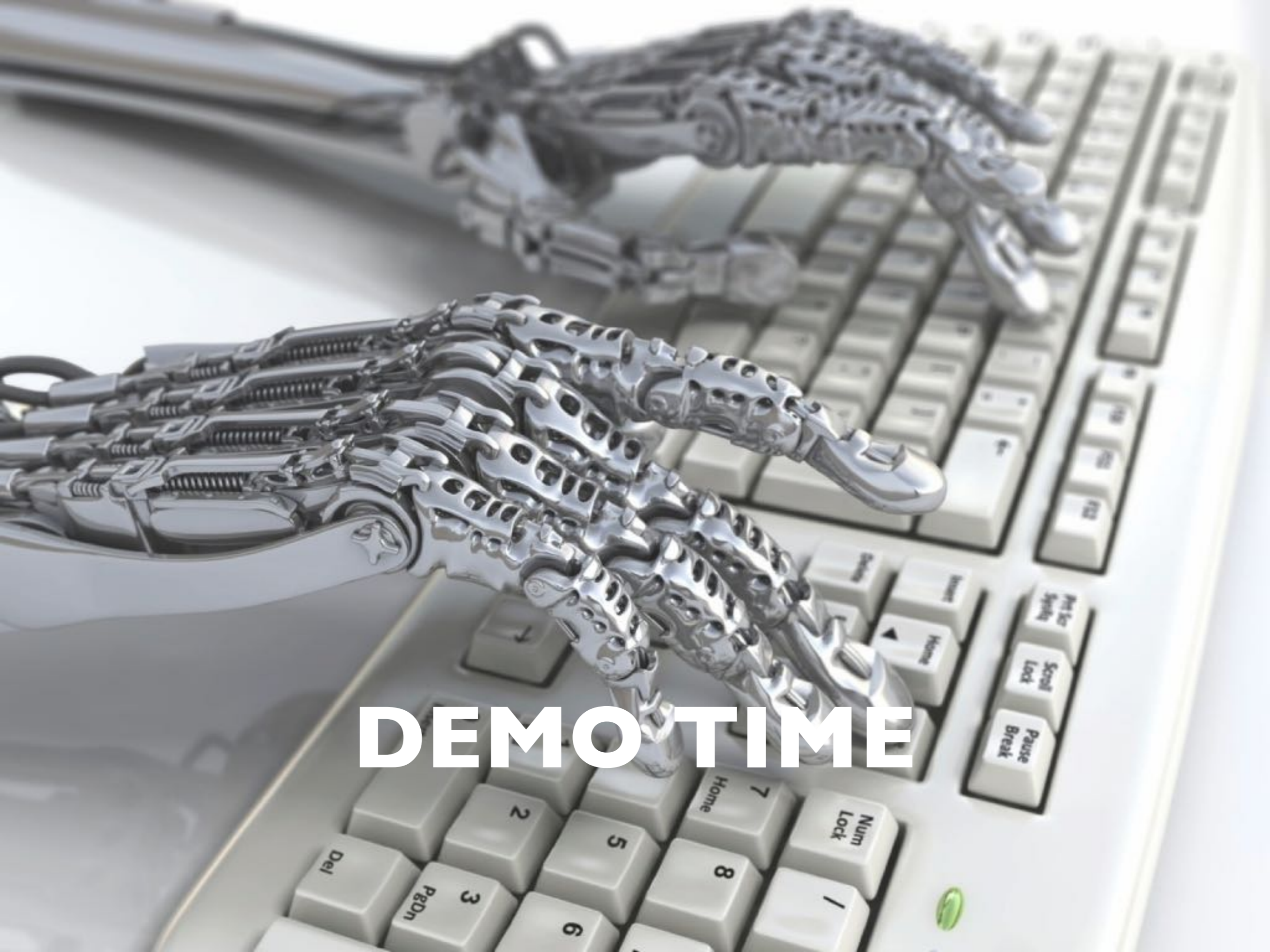
- Allows **integration** of language servers **into Eclipse IDE**
- Integrates with Eclipse's new **Generic Editor**
- <https://projects.eclipse.org/projects/technology.lsp4e>

# MONACO

- Code editor originally developed Visual Studio Code
- Based on web technologies
- Extracted into a separate GitHub project  
<https://github.com/Microsoft/monaco-editor>
- Fully supports LSP



```
1 /* Game of Life
2  * Implemented in TypeScript
3  * To learn more about TypeScript, please visit http://www.typescriptlang.org/
4  */
5
6 module Conway {
7
8     export class Cell {
9         public row: number;
10        public col: number;
11        public live: boolean;
12
13        constructor(row: number, col: number, live: boolean) {
14            this.row = row;
15            this.col = col;
16            this.live = live;
17        }
18        WINDOW.
19    }
20
21    export class Game {
22        private grid: Cell[];
23        private canvas: Canvas;
24        private live: boolean;
25    }
26 }
```



**DEMO TIME**

# AVAILABLE LSP SERVERS

Language	Maintainer	Repository	Code completion	Hover	Jump to def	Find references	Workspace symbols	VFS extension <sup>1</sup>	Isolated <sup>2</sup>	Parallel <sup>3</sup>
C#	OmniSharp	<a href="https://github.com/OmniSharp/omnisharp-node-client/blob/master/language-server">github.com/OmniSharp/omnisharp-node-client/blob/master/language-server</a>	✓	✓	✓	✓	✓			
C#	CXuesong	<a href="https://github.com/CXuesong/Language-Server.NET">github.com/CXuesong/Language-Server.NET</a>	✓	✓	✓	✓	✓			
CSS	Microsoft	<a href="https://github.com/Microsoft/vscode/tree/master/extensions/css">github.com/Microsoft/vscode/tree/master/extensions/css</a>	✓	✓	✓	✓				
Go	Sourcegraph	<a href="https://github.com/sourcegraph/go-language-server">github.com/sourcegraph/go-language-server</a>		✓	✓	✓	✓	✓	✓	✓
GraphQL	Facebook GraphQL	<a href="https://github.com/graphql/graphql-language-service">github.com/graphql/graphql-language-service</a>	✓	✓	✓					
Groovy	Palantir	<a href="https://github.com/palantir/groovy-language-server">github.com/palantir/groovy-language-server</a>	✓		✓	✓	✓			
Haxe	Dan Korostelev	<a href="https://github.com/vshaxe/haxe-language-server">github.com/vshaxe/haxe-language-server</a>	✓	✓	✓	✓	✓			
Java	Gorkem Ercan Red Hat	<a href="https://github.com/gorkem/java-language-server">github.com/gorkem/java-language-server</a>	✓	✓	✓	✓	✓			
Java	georgewfraser	<a href="https://github.com/georgewfraser/vscode-javac">github.com/georgewfraser/vscode-javac</a>	✓	✓	✓	✓	✓			
JavaScript	Sourcegraph	<a href="https://github.com/sourcegraph/javascript-typescript-langserver">github.com/sourcegraph/javascript-typescript-langserver</a>		✓	✓	✓	✓	✓	✓	✓
JSON	Microsoft	<a href="https://github.com/Microsoft/vscode/tree/master/extensions/json">github.com/Microsoft/vscode/tree/master/extensions/json</a>	✓	✓						

# AVAILABLE LSP SERVERS

Language	Maintainer	Repository	Code completion	Hover	Jump to def	Find references	Workspace symbols	VFS extension <sup>1</sup>	Isolated <sup>2</sup>	Parallel <sup>3</sup>
<b>Julia</b>	David Anthoff	<a href="https://github.com/JuliaEditorSupport/LanguageServer.jl">github.com/JuliaEditorSupport/LanguageServer.jl</a>	✓	✓	✓					
<b>O'Caml + ReasonML</b>	Darin Morrison	<a href="https://github.com/freebroccolo/ocaml-language-server">github.com/freebroccolo/ocaml-language-server</a>	✓	✓	✓	✓	✓			
<b>PHP</b>	Felix Becker	<a href="https://github.com/felixfbecker/php-language-server">github.com/felixfbecker/php-language-server</a>	✓	✓	✓	✓	✓			
<b>PHP</b>	HvyIndustries	<a href="https://github.com/HvyIndustries/crane/blob/master/server">github.com/HvyIndustries/crane/blob/master/server</a>	✓							
<b>Python</b>	Palantir	<a href="https://github.com/palantir/python-language-server">github.com/palantir/python-language-server</a>	✓	✓	✓	✓	✓		✓	
<b>Rust</b>	Jonathan Turner Mozilla	<a href="https://github.com/jonathandturner/rls">github.com/jonathandturner/rls</a>	✓	✓	✓	✓	✓			
<b>Scala</b>	Iulian Dragos	<a href="https://github.com/dragos/dragos-vscode-scala">github.com/dragos/dragos-vscode-scala</a>	✓							
<b>Swift</b>	Ryan Lovelett	<a href="https://github.com/riovelett/langserver-swift">github.com/riovelett/langserver-swift</a>			✓					
<b>TypeScript</b>	Sourcegraph	<a href="https://github.com/sourcegraph/javascript-typescript-language-server">github.com/sourcegraph/javascript-typescript-language-server</a>		✓	✓	✓	✓	✓	✓	✓

# AVAILABLE LSP CLIENTS

Editor/client	Maintainer	Repository	Code completion	Hover	Jump to def	Find references	Symbol search	Diagnostics
Eclipse LSP4E	Eclipse	<a href="https://git.eclipse.org/c/lsp4e/lsp4e.git">git.eclipse.org/c/lsp4e/lsp4e.git</a>	✓	✓	✓	✓	✓	✓
Eclipse Che	Eclipse, Codenvy	<a href="https://github.com/eclipse/che/">github.com/eclipse/che/</a>	✓	✓	✓	✓	✓	✓
VSCoDe	Microsoft	<a href="https://github.com/Microsoft/VSCoDe">github.com/Microsoft/VSCoDe</a>	✓	✓	✓	✓	✓	✓
neovim	Junfeng Li	<a href="https://github.com/autozimu/LanguageClient-neovim">github.com/autozimu/LanguageClient-neovim</a>	✓	✓	✓	✓	✓	✓
<b>Works in progress</b>								
Emacs	Corey Richardson	<a href="https://github.com/sourcegraph/emacs-lsp">github.com/sourcegraph/emacs-lsp</a>						
Sublime	Sourcegraph	<a href="https://github.com/sourcegraph/sublime-lsp">github.com/sourcegraph/sublime-lsp</a>						
Vim	TJ DeVries	<a href="https://github.com/tjdevries/nvim-langserver-shim">github.com/tjdevries/nvim-langserver-shim</a>						
Atom	Damien Guard	<a href="https://github.com/atom/atom-languageclient">github.com/atom/atom-languageclient</a>	✓	✓	✓	✓		✓

# OUTLOOK





# RESOURCES

- <https://github.com/Microsoft/language-server-protocol>
- <https://github.com/Microsoft/vscode>
- <https://github.com/Microsoft/monaco-editor>
- <https://electron.atom.io/>
- <http://langserver.org/>
- <https://projects.eclipse.org/projects/technology.lsp4j>
- <https://projects.eclipse.org/projects/technology.lsp4e>
- <https://blogs.itemis.com/en/how-to-get-started-with-xtext-language-servers-and-che>
- <https://blogs.itemis.com/en/integrating-xtext-language-support-in-visual-studio-code>