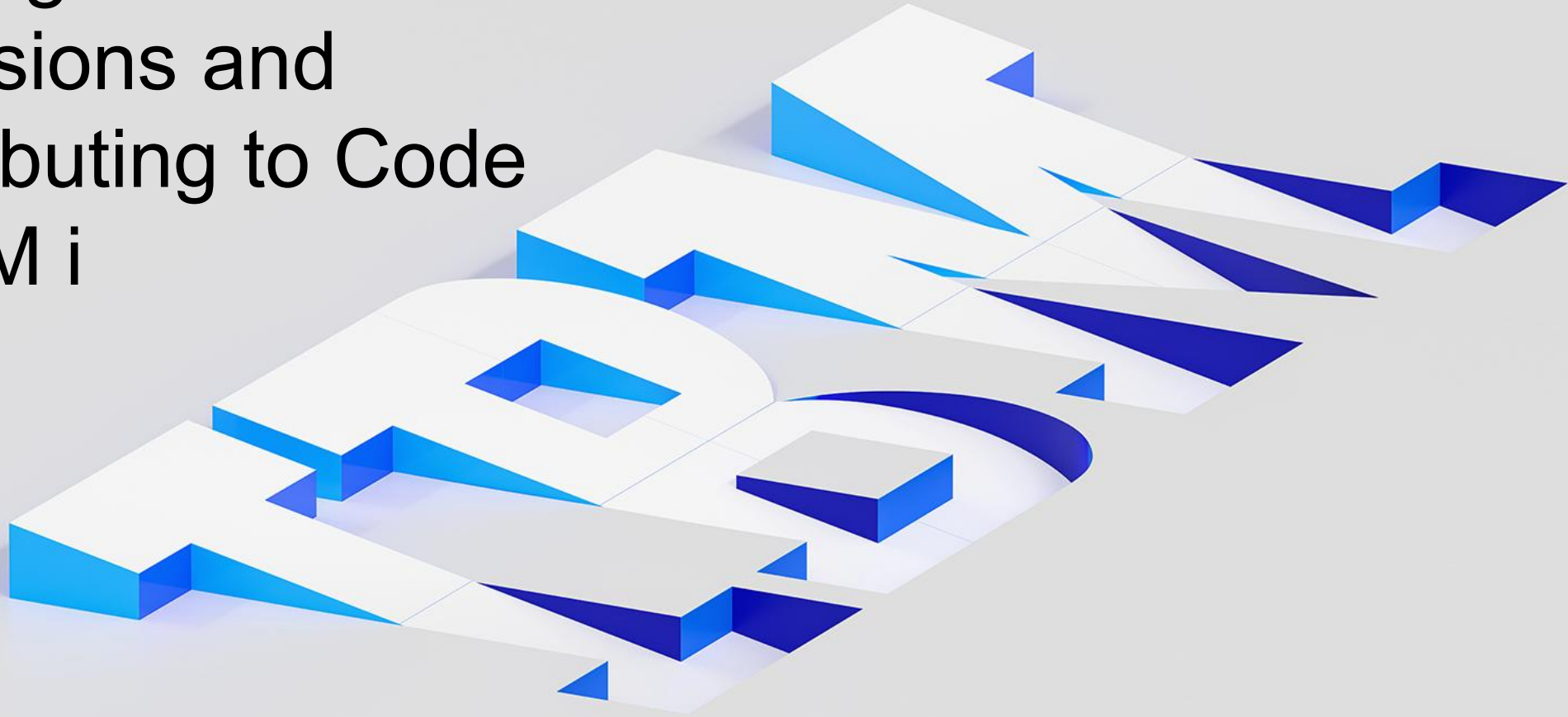


# Building VS Code Extensions and Contributing to Code for IBM i

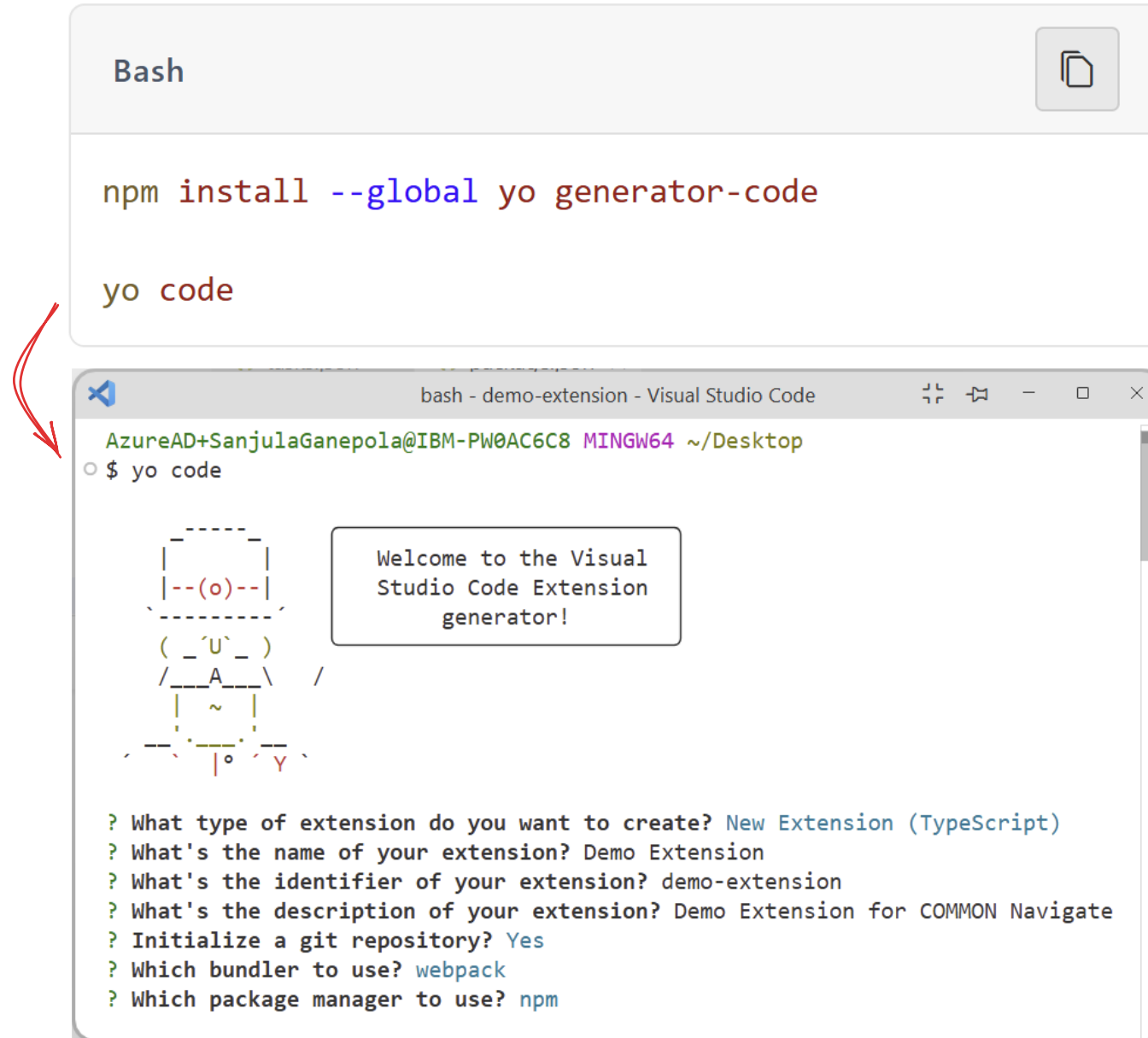


# Agenda

- Building VS Code Extensions
  - Extension anatomy
  - Extension manifest
  - VS Code API
  - Language extensions
- Contributing to Code for IBM i
  - Extension structure
  - Core logic
  - Integration with your own extension

# **Building VS Code Extensions**

# Let's create a new extension



```
Bash

npm install --global yo generator-code

yo code
```

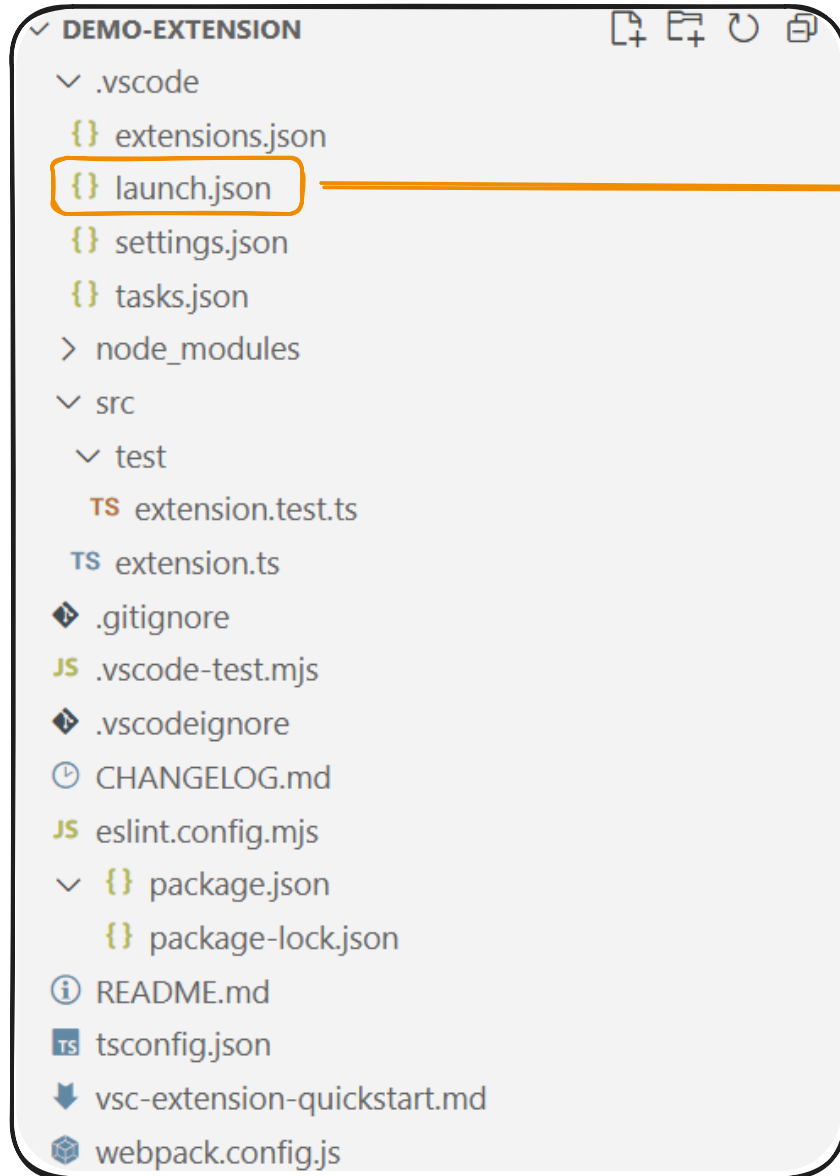
Visual Studio Code window: bash - demo-extension - Visual Studio Code

```
AzureAD+SanjulaGanepola@IBM-PW0AC6C8 MINGW64 ~/Desktop
$ yo code

Welcome to the Visual
Studio Code Extension
generator!

? What type of extension do you want to create? New Extension (TypeScript)
? What's the name of your extension? Demo Extension
? What's the identifier of your extension? demo-extension
? What's the description of your extension? Demo Extension for COMMON Navigate
? Initialize a git repository? Yes
? Which bundler to use? webpack
? Which package manager to use? npm
```

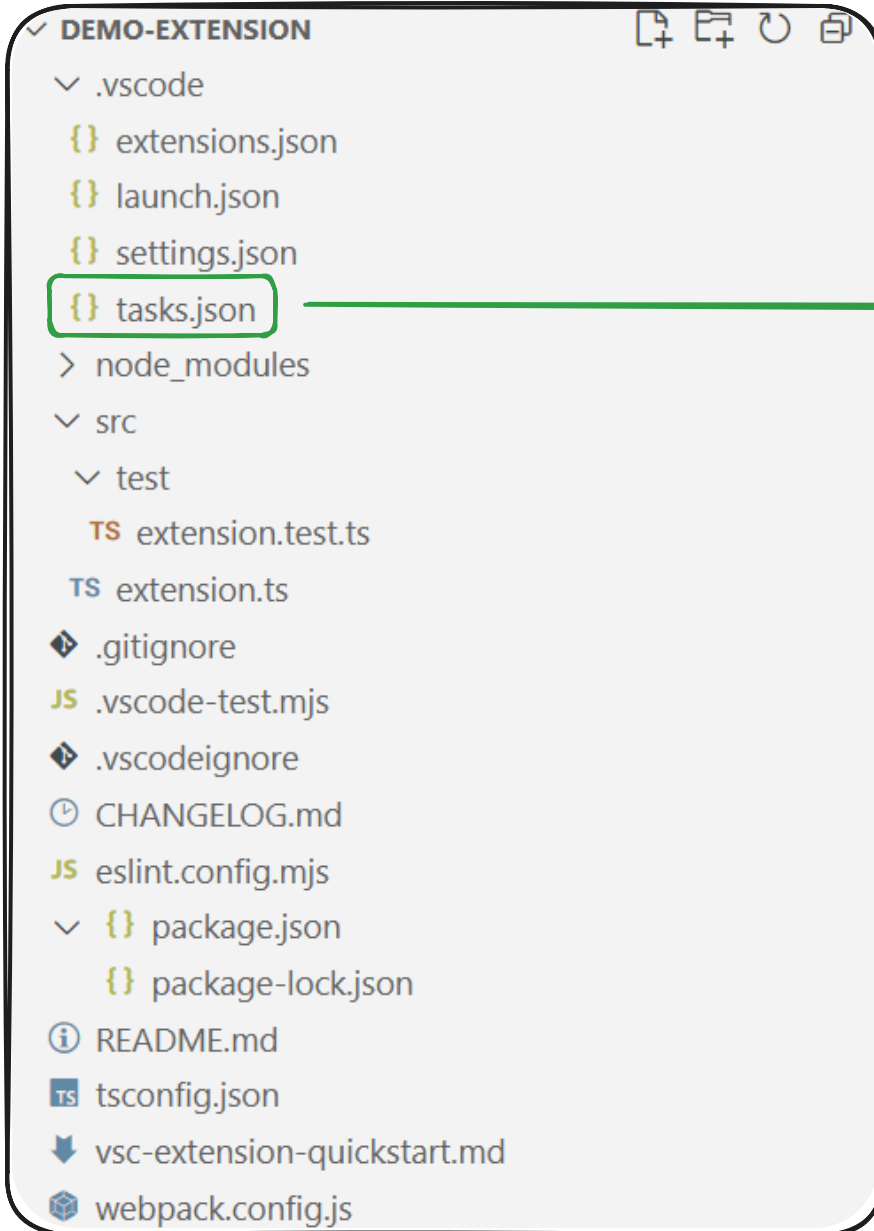
# File Structure – *launch.json*



➤ Config for launching and debugging the extension

```
{} launch.json X
.vscode > {} launch.json > ...
1  {
2      "version": "0.2.0",
3      "configurations": [
4          {
5              "name": "Run Extension",
6              "type": "extensionHost",
7              "request": "launch",
8              "args": [
9                  "--extensionDevelopmentPath=${workspaceFolder}"
10             ],
11             "outFiles": [
12                 "${workspaceFolder}/dist/**/*.js"
13             ],
14             "preLaunchTask": "${defaultBuildTask}"
15         }
16     ]
17 }
```

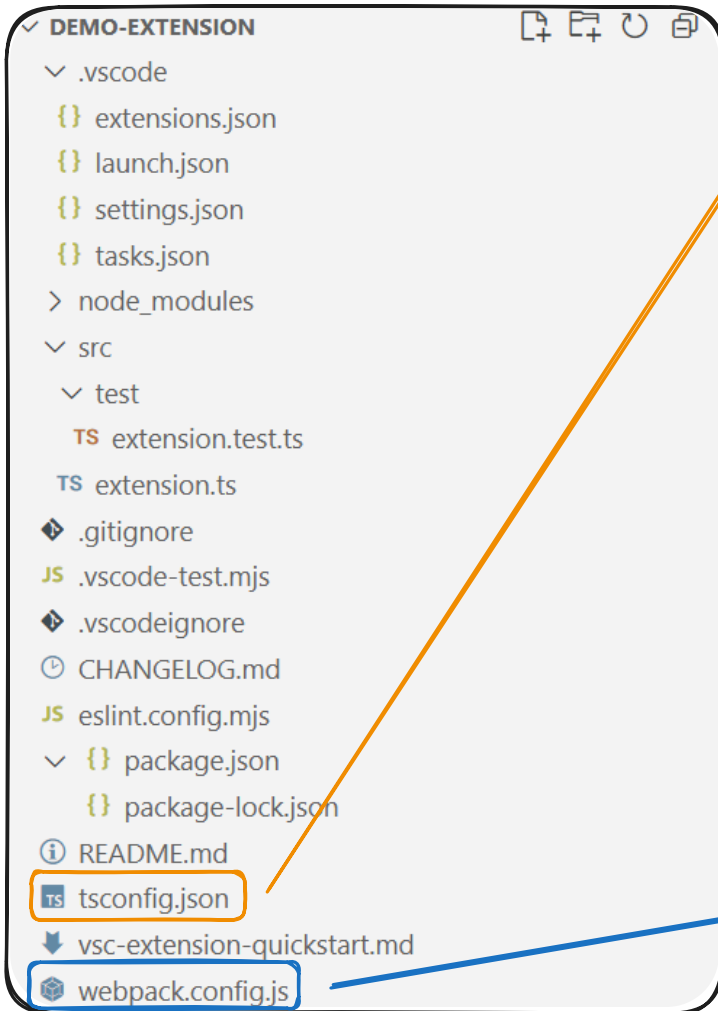
# File Structure – *task.json*



Config for build task that compiles Typescript

```
.vscode > { } tasks.json > [ ] tasks > { } 1
1 // See https://go.microsoft.com/fwlink/?LinkId=733558
2 // for the documentation about the tasks.json format
3 {
4     "version": "2.0.0",
5     "tasks": [
6         {
7             "type": "npm",
8             "script": "watch",
9             "problemMatcher": "$ts-webpack-watch",
10            "isBackground": true,
11            "presentation": {
12                "reveal": "never",
13                "group": "watchers"
14            },
15            "group": {
16                "kind": "build",
17                "isDefault": true
18            }
19        },
20    ]
21 }
```

# File Structure – *tsconfig.json* and *webpack.config.js*



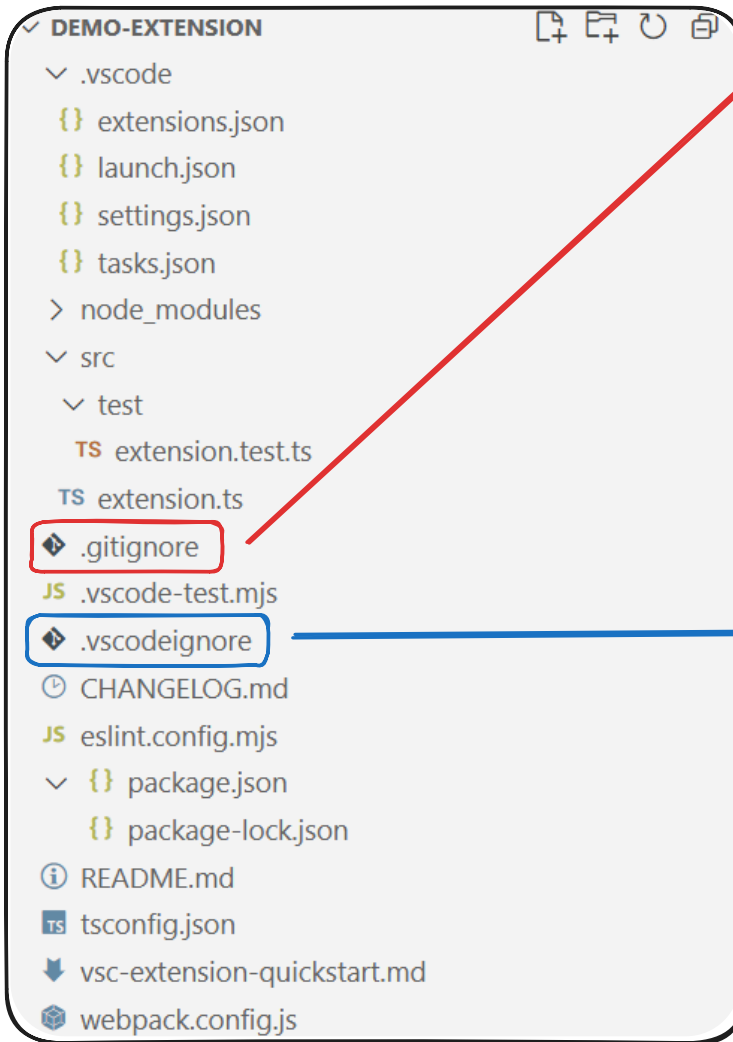
TypeScript configuration

```
tsconfig.json X
tsconfig.json > ...
1  {
2    "compilerOptions": {
3      "module": "Node16",
4      "target": "ES2022",
5      "lib": [
6        "ES2022"
7      ],
8      "sourceMap": true,
9      "rootDir": "src",
10     "strict": true
11   }
12 }
```

Webpack configuration

```
webpack.config.js X
webpack.config.js > extensionConfig > module > rules
10  /** @type WebpackConfig */
11  const extensionConfig = {
12    target: 'node',
13    mode: 'none',
14
15    entry: './src/extension.ts',
16    output: {
17      path: path.resolve(__dirname, 'dist'),
18      filename: 'extension.js',
19      libraryTarget: 'commonjs2'
20    },
21    externals: {
22      vscode: 'commonjs vscode'
23    },
24    resolve: {
25      extensions: ['.ts', '.js']
26    },
27  }
```

# File Structure – *.gitignore* and *.vscodeignore*



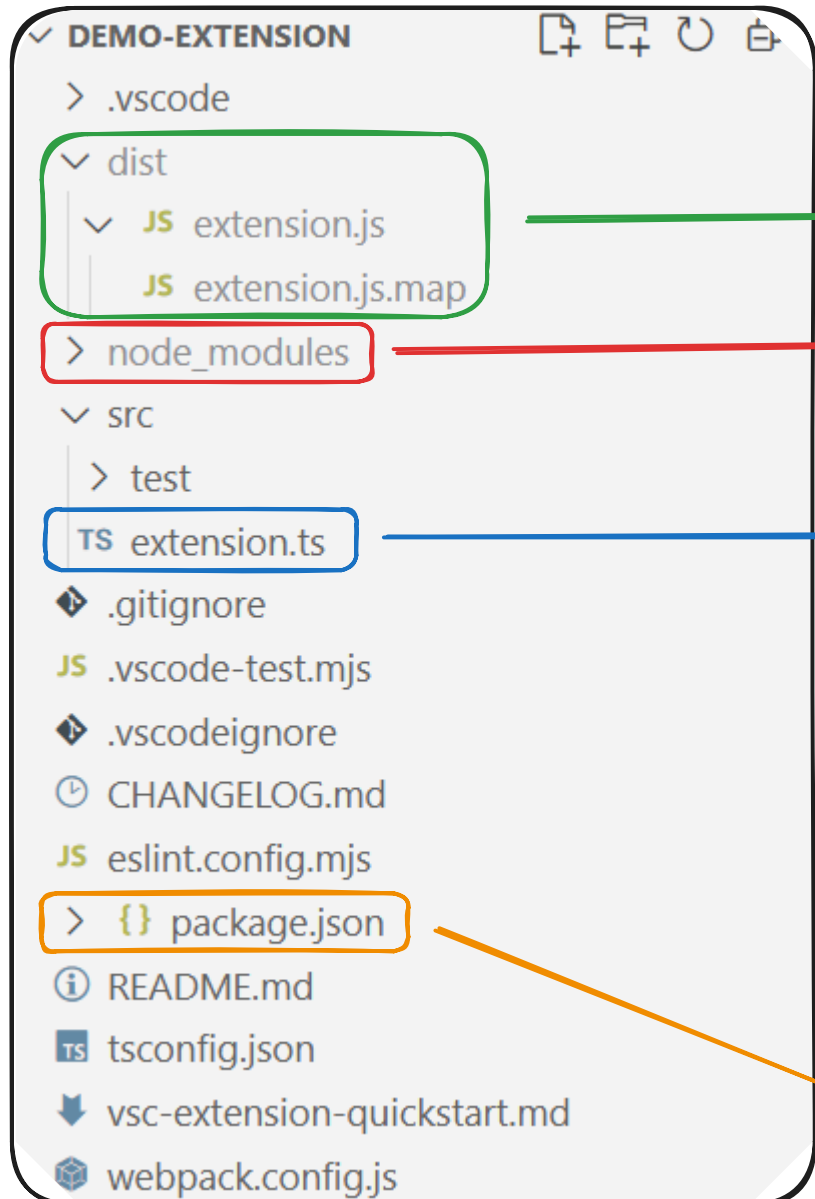
Ignore build output and node\_modules Prevent files from being included in your extension's package.

```
◆ .gitignore X
◆ .gitignore
1  out
2  dist
3  node_modules
4  .vscode-test/
5  *.vsix
```

```
◆ .vscodeignore X
◆ .vscodeignore
1  .vscode/**
2  .vscode-test/**
3  out/**
4  node_modules/**
5  src/**
6  .gitignore
7  .yarnrc
8  webpack.config.js
9  vsc-extension-quickstart.md
10 **/tsconfig.json
11 **/eslint.config.mjs
12 **/*.map
13 **/*.ts
14 **/.vscode-test.*
```



# File Structure – Source code, extension manifest, and more



Compiled and bundled source

Installed node dependencies

Extension source code

```
TS extension.ts X
src > TS extension.ts > ...
1  import * as vscode from 'vscode';
2
3  export function activate(context: vscode.ExtensionContext) {
4      // Called when your extension is activated
5  }
6
7  export function deactivate() {
8      // Called when your extension is deactivated
9  }
```

Extension Manifest

# File Structure – package.json

```
{ } package.json X
{ } package.json > { } scripts
1  {
2    "name": "demo-extension",
3    "displayName": "Demo Extension",
4    "description": "Demo extension for COMMON Navigate",
5    "version": "0.0.1",
6    "engines": {
7      "vscode": "^1.103.0"
8    },
9    "categories": [
10     "Other"
11   ],
12   "activationEvents": [],
13   "main": "./dist/extension.js",
```

"onStartupFinished"  
is commonly used

↓  
contributes

```
22   "scripts": {
23     "vscode:prepublish": "npm run package",
24     "compile": "webpack",
25     "watch": "webpack --watch",
26     "package": "webpack --mode production --devtool hidden-source-map",
27     "compile-tests": "tsc -p . --outDir out",
28     "watch-tests": "tsc -p . -w --outDir out",
29     "pretest": "npm run compile-tests && npm run compile && npm run lint",
30     "lint": "eslint src",
31     "test": "vscode-test"
32   },
33   "dependencies": {},
34   "devDependencies": {
35     "@types/vscode": "^1.103.0",
36     "@types/mocha": "^10.0.10",
37     "@types/node": "22.x",
38     "@typescript-eslint/eslint-plugin": "^8.39.0",
39     "@typescript-eslint/parser": "^8.39.0",
40     "eslint": "^9.32.0",
41     "typescript": "^5.9.2",
42     "ts-loader": "^9.5.2",
43     "webpack": "^5.101.0",
44     "webpack-cli": "^6.0.1",
45     "@vscode/test-cli": "^0.0.11",
46     "@vscode/test-electron": "^2.5.2"
47   }
48 }
```

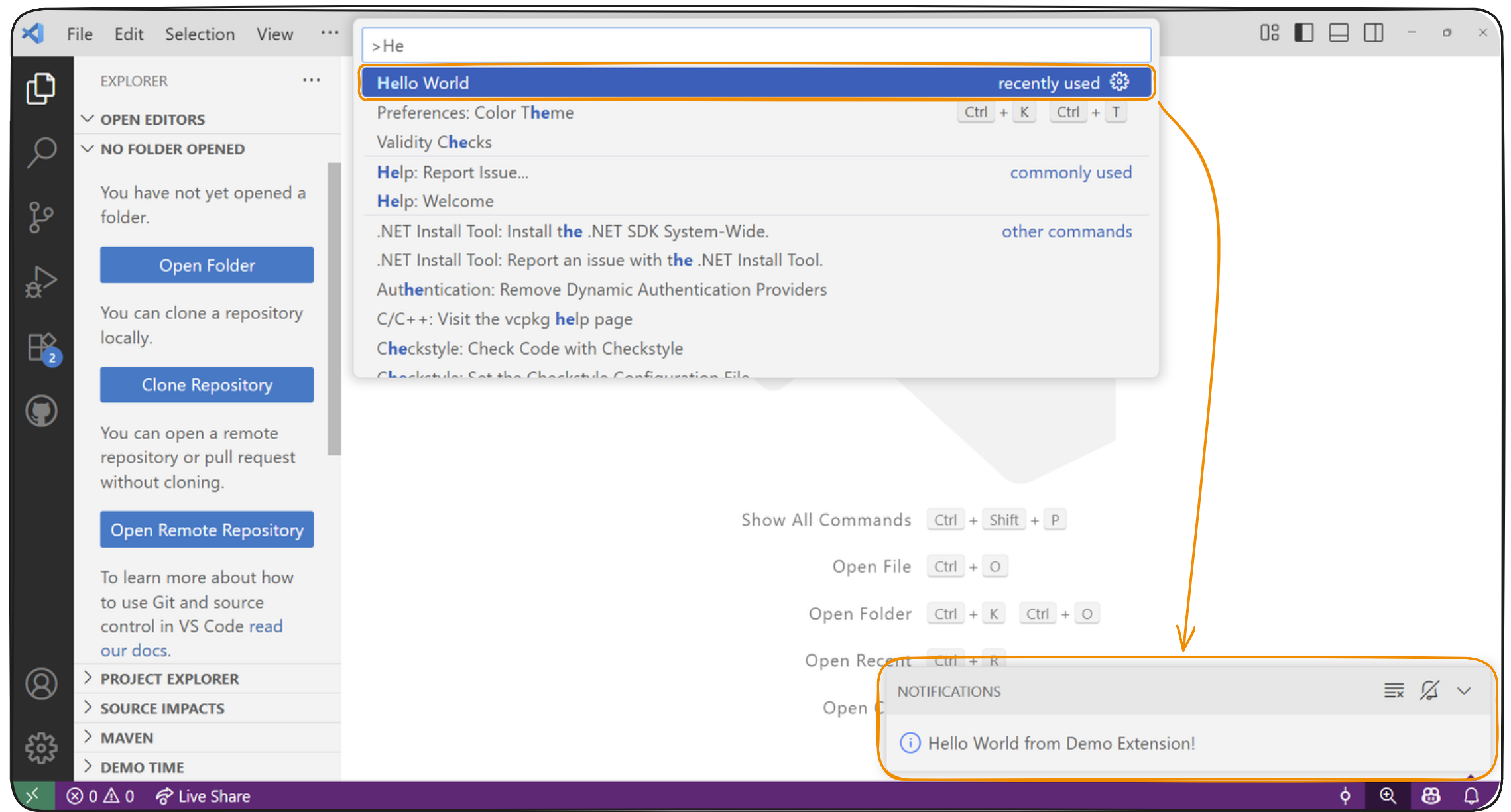
# Extension Manifest - Contributions

```
14 |   "contributes": {  
15 |     "commands": [  
16 |       {  
17 |         "command": "demo-extension.helloWorld",  
18 |         "title": "Hello World"  
19 |       }  
20 |     ]  
21 |   },
```

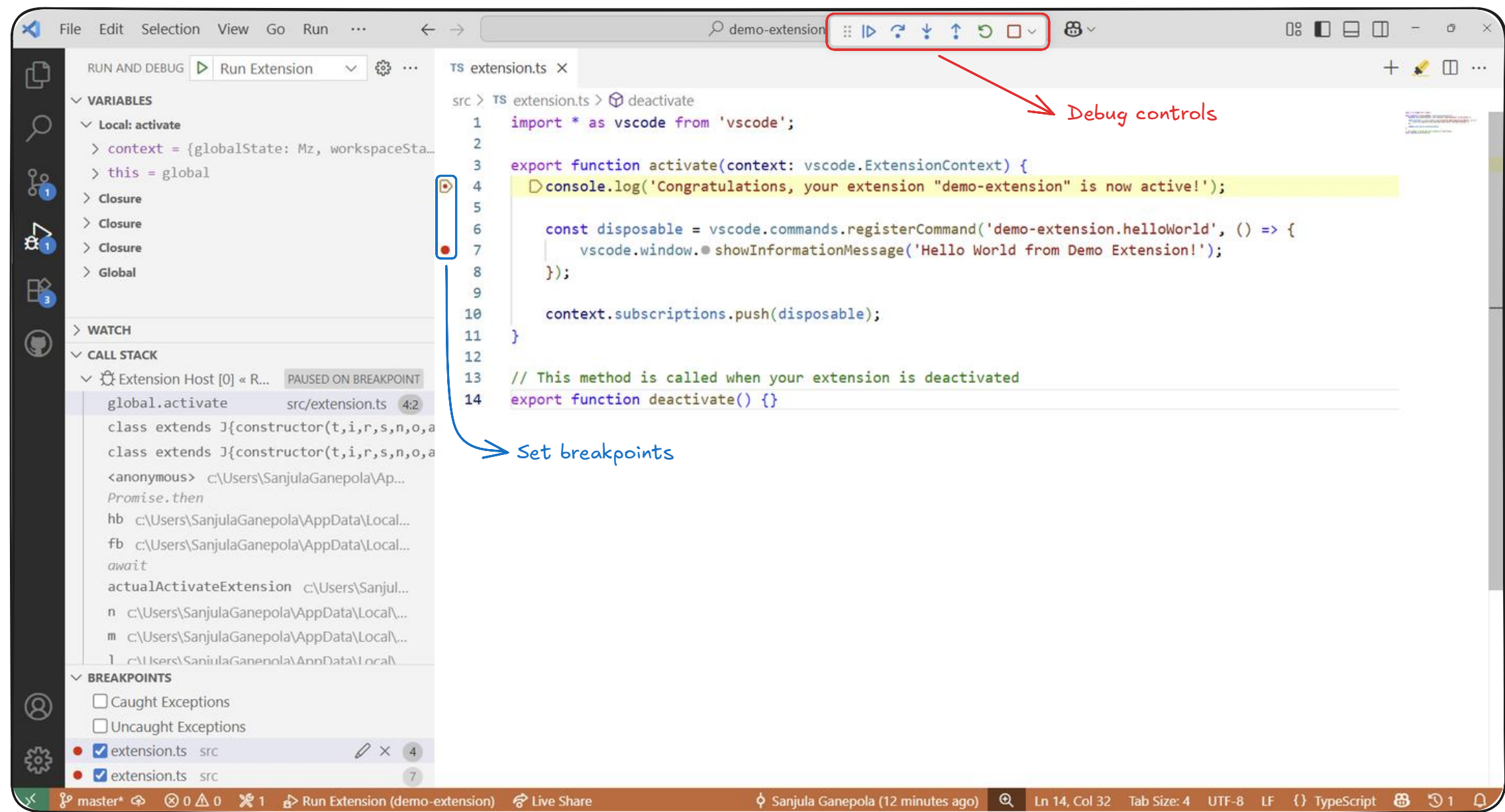


```
TS extension.ts ×  
src > TS extension.ts > ...  
1  import * as vscode from 'vscode';  
2  
3  export function activate(context: vscode.ExtensionContext) {  
4    console.log('Congratulations, your extension "demo-extension" is now active!');  
5  
6    const disposable = vscode.commands.registerCommand('demo-extension.helloWorld', () => {  
7      vscode.window.showInformationMessage('Hello World from Demo Extension!');  
8    });  
9  
10   context.subscriptions.push(disposable);  
11 }  
12  
13 // This method is called when your extension is deactivated  
14 export function deactivate() {}
```

# Let's run our extension



# Let's debug our extension



# Contribution Points - Keybindings

```
{} package.json 9 X
{} package.json > {} contributes > [ ] keybindings > {} 2
43    "contributes": {
1448      "keybindings": [
1449        {
1450          "command": "vscode-db2i.runEditorStatement",
1451          "key": "ctrl+r",
1452          "mac": "cmd+r",
1453          "when": "editorLangId == sql && resourceExtname != .inb"
1454        },
1455        {
1456          "command": "vscode-db2i.runEditorStatement.inView",
1457          "key": "ctrl+alt+r",
1458          "mac": "cmd+ctrl+r",
1459          "when": "editorLangId == sql"
1460        },

```

Keyboard Shortcuts X

vscode-db2i.runEditorStatement

Command	Keybinding	When
Db2 for i: Run statement vscode-db2i.runEditorStatement	Ctrl + R	editorLangId == 'sql' && resourceExtname != '.inb'
Db2 for i: Run statement in new view vscode-db2i.runEditorStatement.inView	Ctrl + Alt + R	editorLangId == 'sql'

# Contribution Points - Configurations

{} package.json 9+, M X

{} package.json > {} contributes > {} configuration > {} properties > {} code-for-ibmi.ObjectBrowser.showNam

41 "contributes": {

55 "configuration": {

57 "properties": {

422 "code-for-ibmi.autoOpenFile": {

423 "type": "boolean",

424 "default": true,

425 "description": "When enabled, files will automatically be

426 },

Code for IBM i

CodeSnap

> CSS Language Features

> Db2 for IBM i

Code for IBM i

Auto Open File

☒ When enabled, files will automatically be opened when copied or moved/renamed



# Contribution Points – JSON Validation

```
{ } package.json 9+, M X
{ } package.json > { } contributes > { } configuration > { } properties > {
41   "contributes": {
47     "jsonValidation": [
48       {
49         "fileMatch": [
50           ".vscode/actions.json"
51         ],
52         "url": "./schemas/actions.json"
53       }
54     ],
```

```
{ } actions.json 1, M X
.vscode > { } actions.json > { } 0
1  [
2    {
3      "name": "Create DSPF",
4      "command": "CRTDSPF FILE(&CURLIB/&NAME) SRCFILE(&SRCFILE) RSTDSP(*NO) OPTION(*EVENTF)",
5      "environment": "ile",
6      "deployFirst": true,
7      "extensions": [
8        "dspf"
9      ],
10   }
11 ]
12
13
```

- 🔑 action
- 🔑 outputToFile
- 🔑 postDownload
- 🔑 required

Remote files/folders to download when the Action is complete. Using `evfevent` in combination with a build tool will populate the Problems view.



# Contribution Points – View Containers

{} package.json 9+, M X

{} package.json > {} contributes

41 "contributes": {

1785 "viewsContainers": {

1786 "activitybar": [

1787 {

1788 "id": "ibmi-explorer",

1789 "title": "IBM i",

1790 "icon": "\$(server-environment)"

1791 },



# Contribution Points – Views

```
{} package.json 9+, M X
{} package.json > {} contributes
41      "contributes": {
1799      "views": {
1800      "ibmi-explorer": [
1810      ],
1817      {
1818      "id": "libraryListView",
1819      "name": "User Library List",
1820      "when": "code-for-ibmi:connected && code-for-ibmi:libraryListDisabled !== true"
1821      },

```

✓ USER LIBRARY LIST

+

📄

↺

⋮

SANJULA (current library) SANJULA.GANEPOLA@IBM.COM (\*TEST)

TESTTOOLS Test Tool Library (\*PROD)

QTEMP (\*TEST)

QDEVTOOLS (\*PROD)

RPGUNIT iRPGUnit Utility - v5.1.0.r (12.07.2025) (\*PROD)

RPGUTILS (\*PROD)

CMPSYS (\*PROD)

# Contribution Points – View title menu

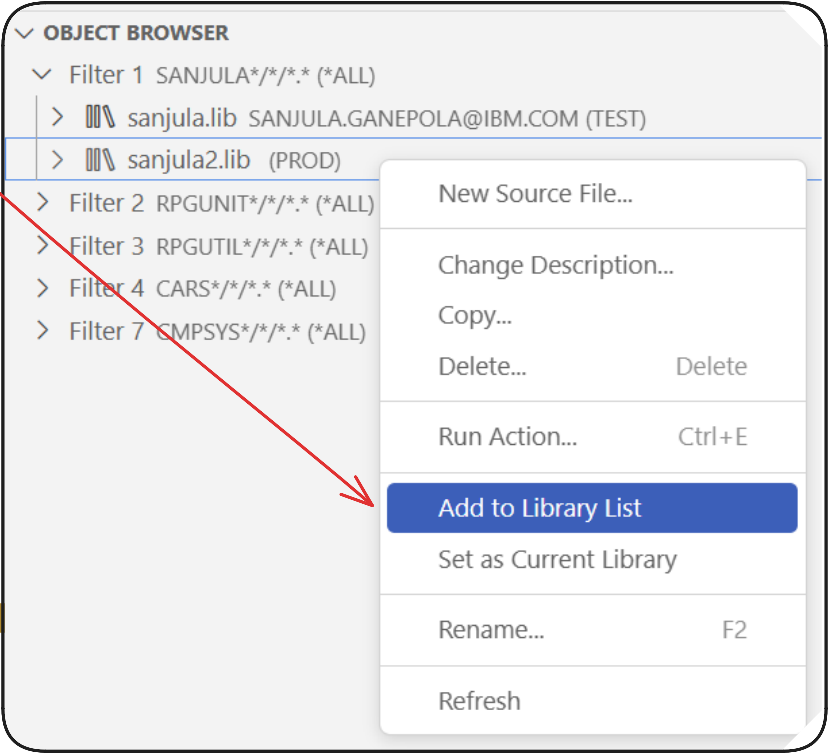
```
{} package.json 9+, M X
{} package.json > {} contributes > {} menus > [ ] view/title > {} 7 > [abc] group
41      "contributes": {
1891      "menus": {
2365      "view/title": [
2381      {
2382          "command": "code-for-ibmi.connectToPrevious",
2383          "group": "navigation@4",
2384          "when": "view == connectionBrowser && code-for-ibmi:hasPreviousConnection"
2385      },
```



# Contribution Points – View item context menu

```
{} package.json 9+, M ×
{} package.json > {} contributes > {} menus > [ ] view/item/context > {} 40
41      "contributes": {
1891        "menus": {
2534          "view/item/context": [
2725            {
2726              "command": "code-for-ibmi.addToLibraryList",
2727              "when": "!code-for-ibmi:libraryListDisabled && view == objectBrowser && viewItem =~ /library/",
2728              "group": "2_library@1"
2729            },

```



# Contribution Points – Languages

```
{} package.json X
{} package.json > {} contributes > [ ] languages > {} 1 > [ ] aliases
16   "contributes": {
17     "languages": [
149       {
150         "id": "rpgle",
151         "aliases": [
152           "RPGLE",
153           "SQLRPGLE",
154           "RPGLEINC"
155         ],
156         "extensions": [
157           ".rpgle",
158           ".sqlrpgle",
159           ".rpgleinc"
160         ],
161         "configuration": "./configurations/rpgle.language-configuration.json"
162       }
163     ],
  },
```

```
{} rpgle.language-configuration.json 1 X
configurations > {} rpgle.language-configuration.json > ...
1  {
2    // symbols used as brackets
3    "brackets": [
4      ["{", "}"],
5      ["[", "]"],
6      ["(", ")"],
7
8      ["IF", "ENDIF"],
9      ["IF", "END"],
10     ["IFEQ", "ENDIF"],
11     ["IFEQ", "END"],
```

```
26  ✓  if (sqlcode = 0);
27      detail_found = *on;
28  ✓  else;
29      employee_detail_found = *off;
30      endif;
```

Click to collapse the range.

# Contribution Points – Grammars

```
{ } package.json X
{ } package.json > { } contributes
16     "contributes": {
164         "grammars": [
220             {
221                 "language": "rpgle",
222                 "scopeName": "source.rpgle",
223                 "path": "./syntaxes/rpgle.tmLanguage.json"
224             }
        ]
    }
```

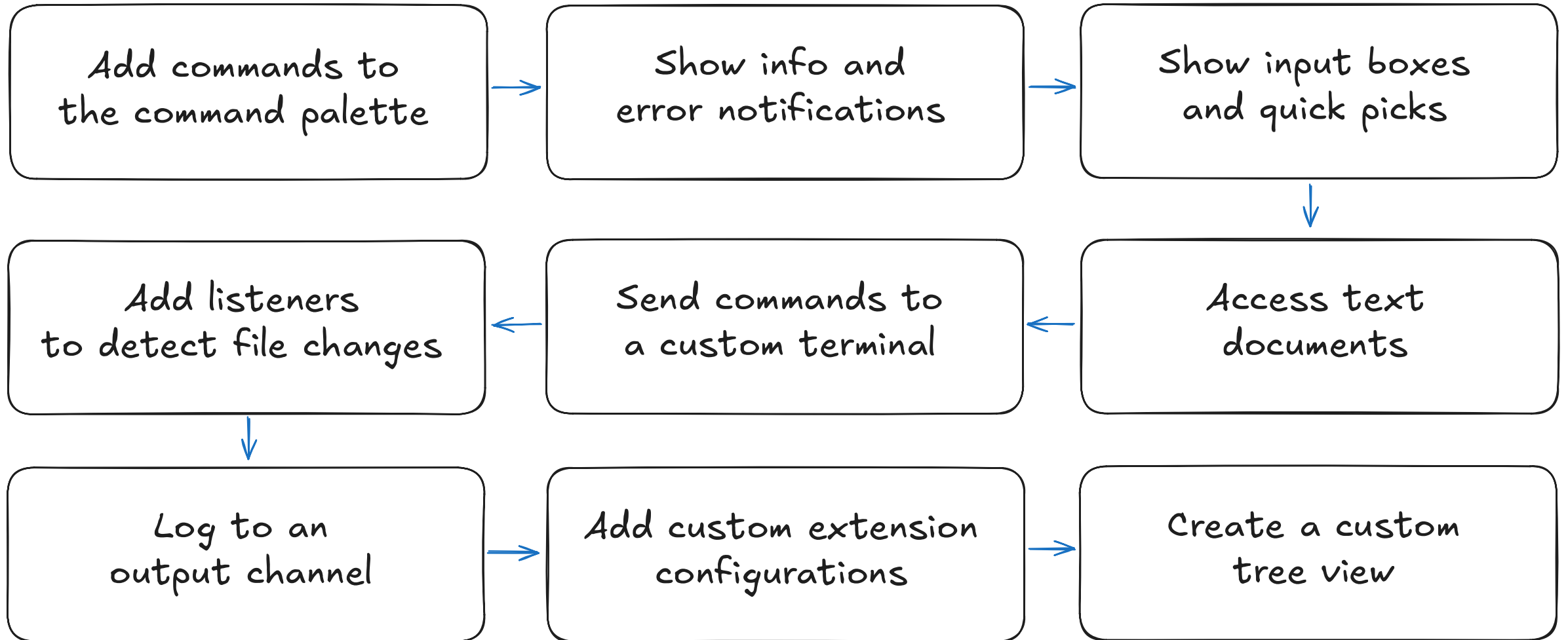
```
{ } rpgle.tmLanguage.json X
syntaxes > { } rpgle.tmLanguage.json > ...
61     "repository": {
179         "freeformat": {
180             "patterns": [
260                 {
261                     "name": "rpgle.free.definition.complex",
262                     "begin": "(?i)(?=(\\b(DCL\\-)(DS|ENUM|PROC|PR|PI)\\b))",
263                     "end": "\\n",
264                     "patterns": [
265                         {
266                             "name": "storage.type.rpgle.free.definition.complex.dcl",
267                             "match": "(?i)\\b(DCL\\-)(DS|ENUM|PROC|PR|PI)\\b"
268                         }
                    ]
                }
            ]
        }
    }
```

```
7  dcl-proc getEmployeeDetail export;
8  dcl-pi *n like(employee_detail_t);
9      empno char(6) const;
10 end-pi;
11
12 dcl-ds employee_detail likes(employee_detail_t);
```

# Contribution Points – Check the docs for more

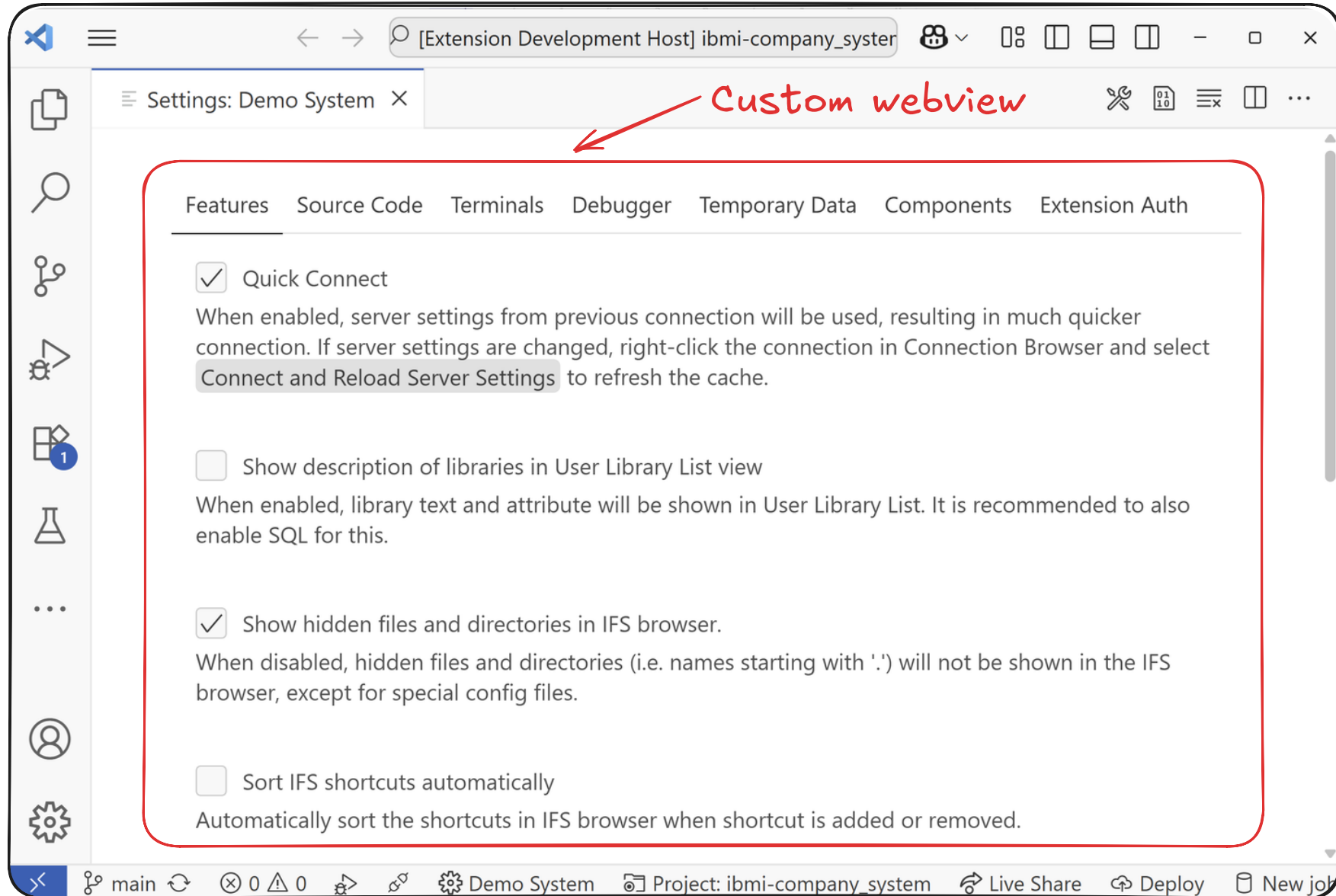
<https://code.visualstudio.com/api/references/contribution-points>

# Let's experiment with the VS Code API





# VS Code API – Example webview in Code for IBM i



# VS Code API – Example webview in Db2 for IBM i

VS Code Editor

1

SELECT \* FROM SAMPLE.EMPLOYEE

Custom webview

PROBLEMS

DB2 FOR I

DEBUG CONSOLE

OUTPUT

TERMINAL

IBM I JOB LOG

EMPNO	FIRSTNME	MIDINIT	LASTNAME	WORKDEPT	PHONENO	HIREDATE	JOB
000010	CHRISTINE	I	HAAS	A00	3978	1965-01-01	PRES
000020	MICHAEL	L	THOMPSON	B01	3476	1973-10-10	MANAGER
000030	SALLY	A	KWAN	C01	4738	1975-04-05	MANAGER
000050	JOHN	B	GEYER	E01	6789	1949-08-17	MANAGER
000060	IRVING	F	STERN	D11	6423	1973-09-14	MANAGER
000070	EVA	D	PULASKI	D21	7831	1980-09-30	MANAGER
000090	EILEEN	W	HENDERSON	E11	5498	1970-08-15	MANAGER
000100	THEODORE	Q	SPENSER	E21	0972	1980-06-19	MANAGER
000110	VINCENZO	G	LUCCHESSI	A00	3490	1958-05-16	SALESREP
000120	SEAN		O'CONNELL	A00	2167	1963-12-05	CLERK

Loaded 41 rows in 324ms. End of data.

599339/QUSER/QZDASOINIT

main

0 0

Demo System

Project: ibmi-company\_system

Live Share

Deploy

New

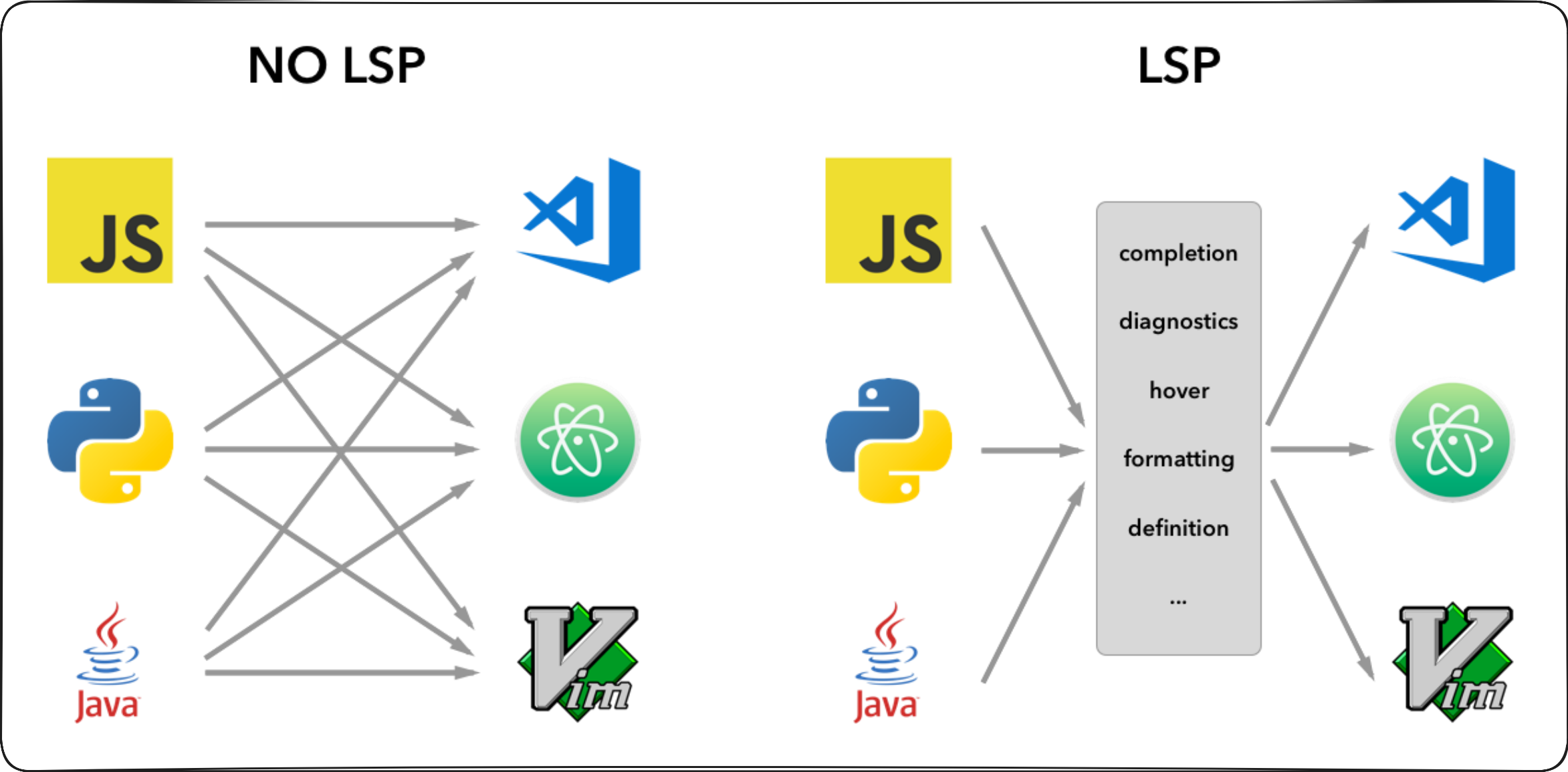
# Language Extensions – 3 core problems

Language servers are usually implemented in their native programming languages, but VS Code has a Node.js runtime.

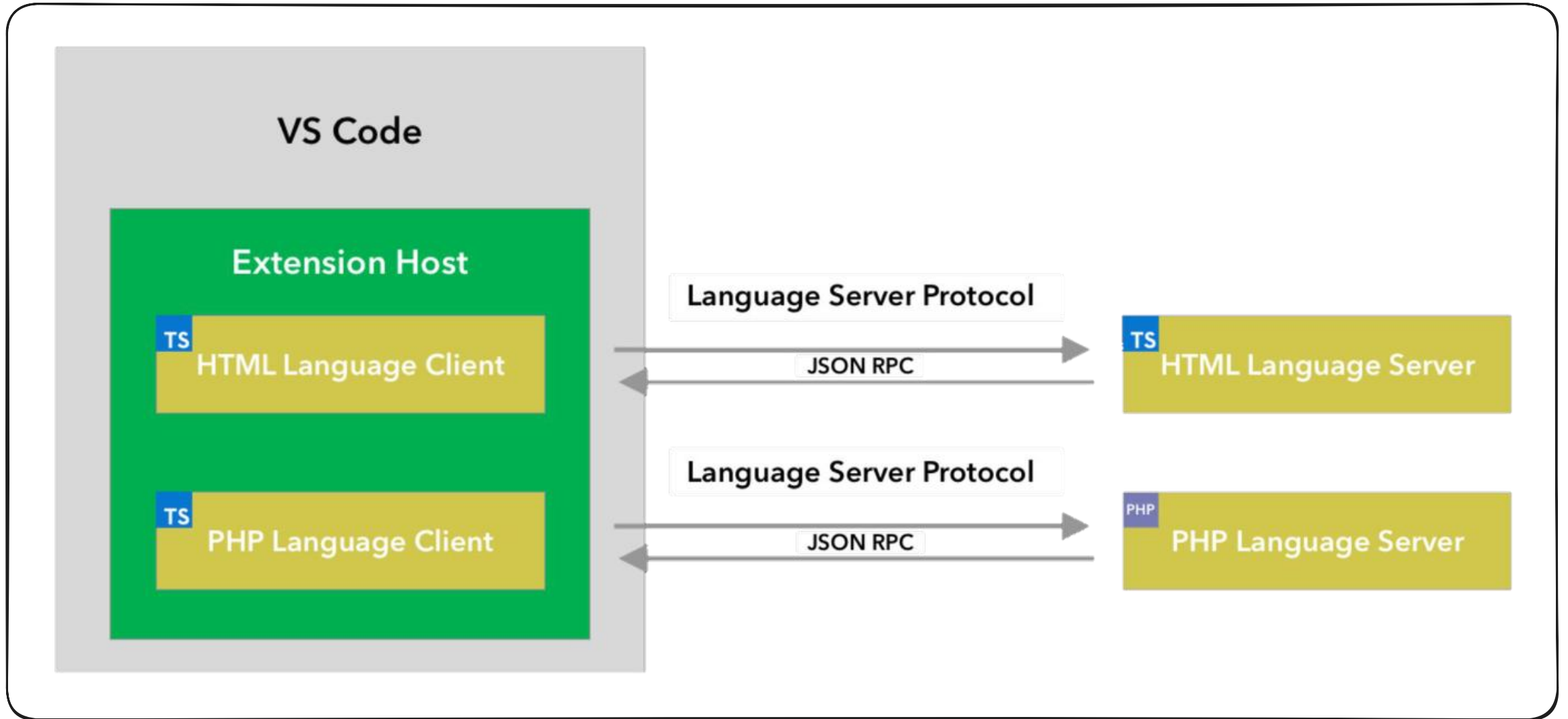
Language features can be resource intensive (building a Abstract Syntax Tree, performing static analysis, etc.).  
Need VS Code's performance to be unaffected.

Integrating multiple language toolings with multiple code editors could involve significant effort.

# Language Extensions – Benefit of using an LSP

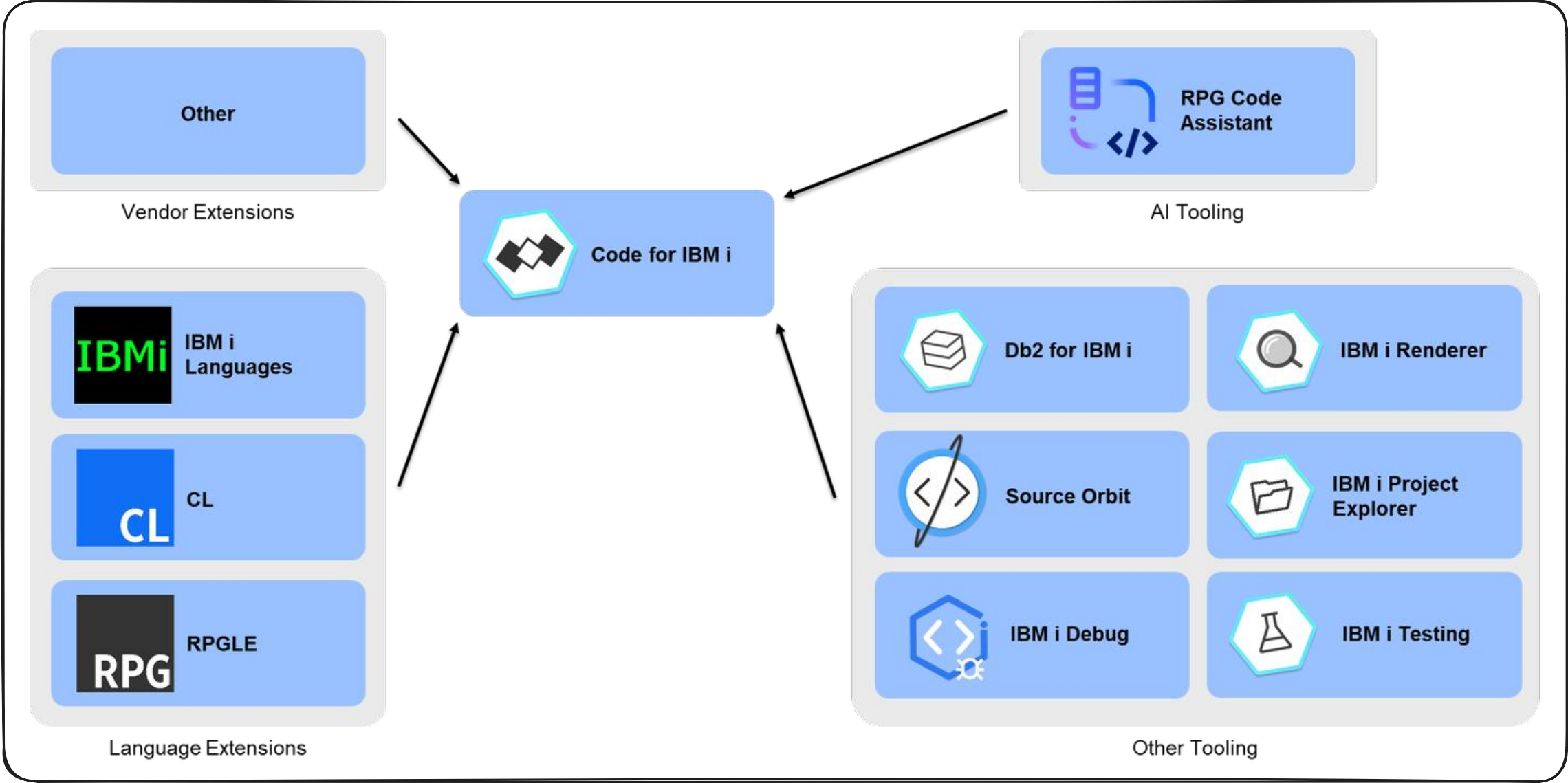


# Language Extensions – How does an LSP work?



# **Contributing to Code for IBM i**

# Family of extensions



# The core team

We help steer the ship!



## Core

## About

Core developers. Used for PRs and discussion

Find a member...

6 members 0 child team members



LJ worksofliam



Sébastien Julliand sebjulliand



Christian Jorgensen chrjorgensen



Julia Yan julesyan



Sanjula Ganepola SanjulaGanepola



Joseph Wright Wright4i



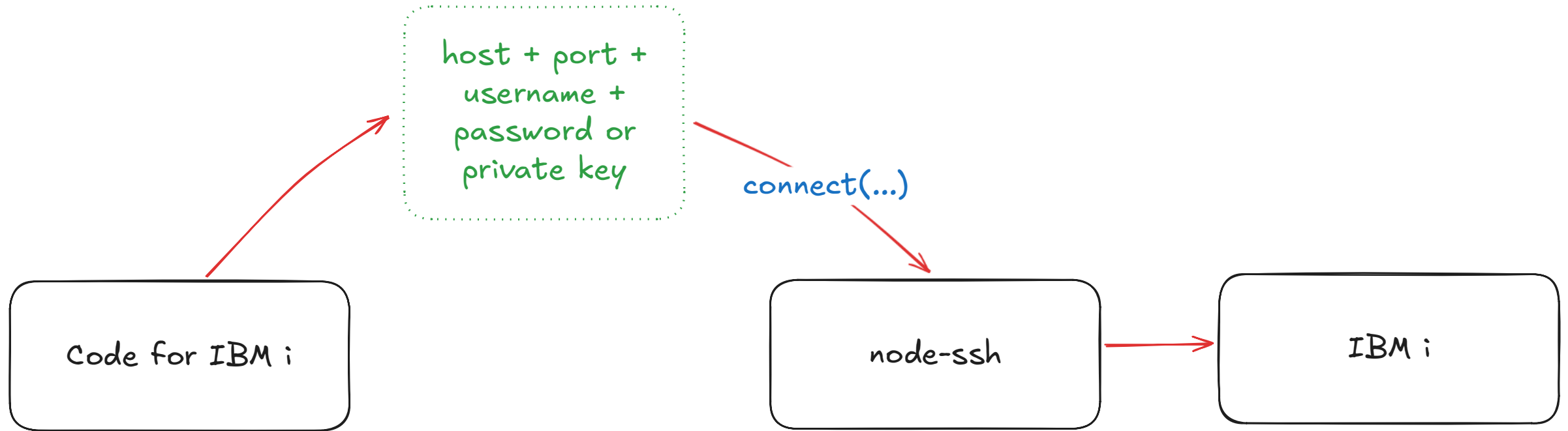
## Community collaboration!

57 total contributors to Code for IBM :!!



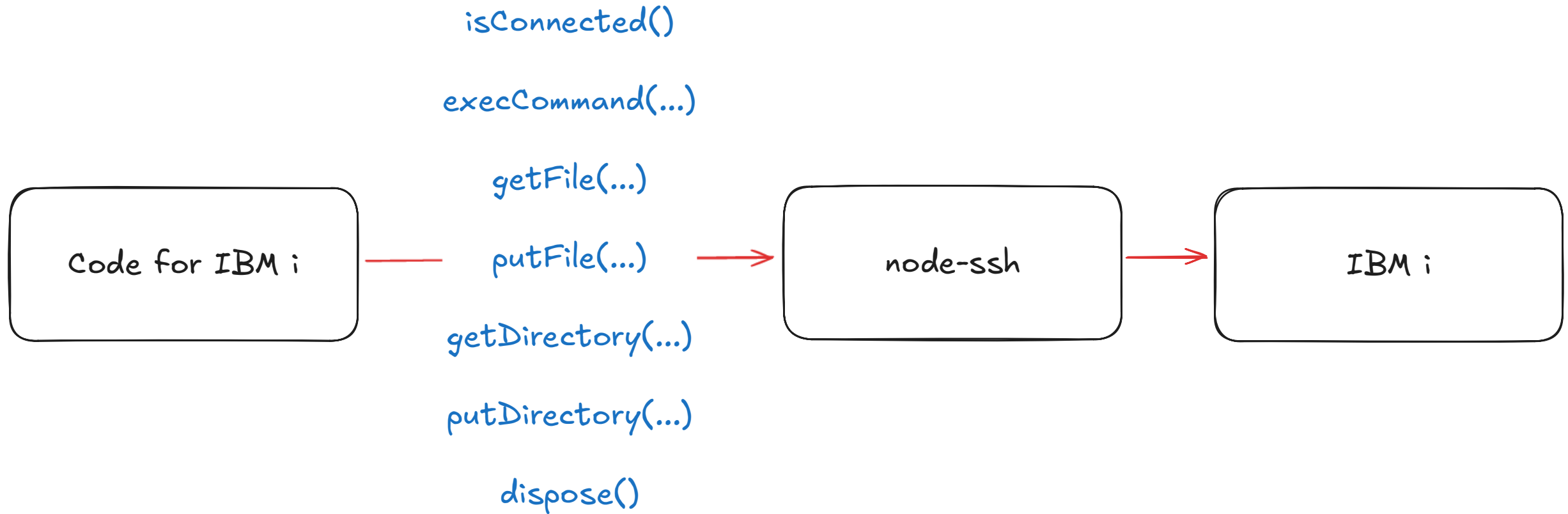
# How does Code for IBM i connect to an IBM i?

<https://github.com/codefori/vscode-ibmi/blob/master/src/api/IBMi.ts#L254>



# How does it use Node-SSH?

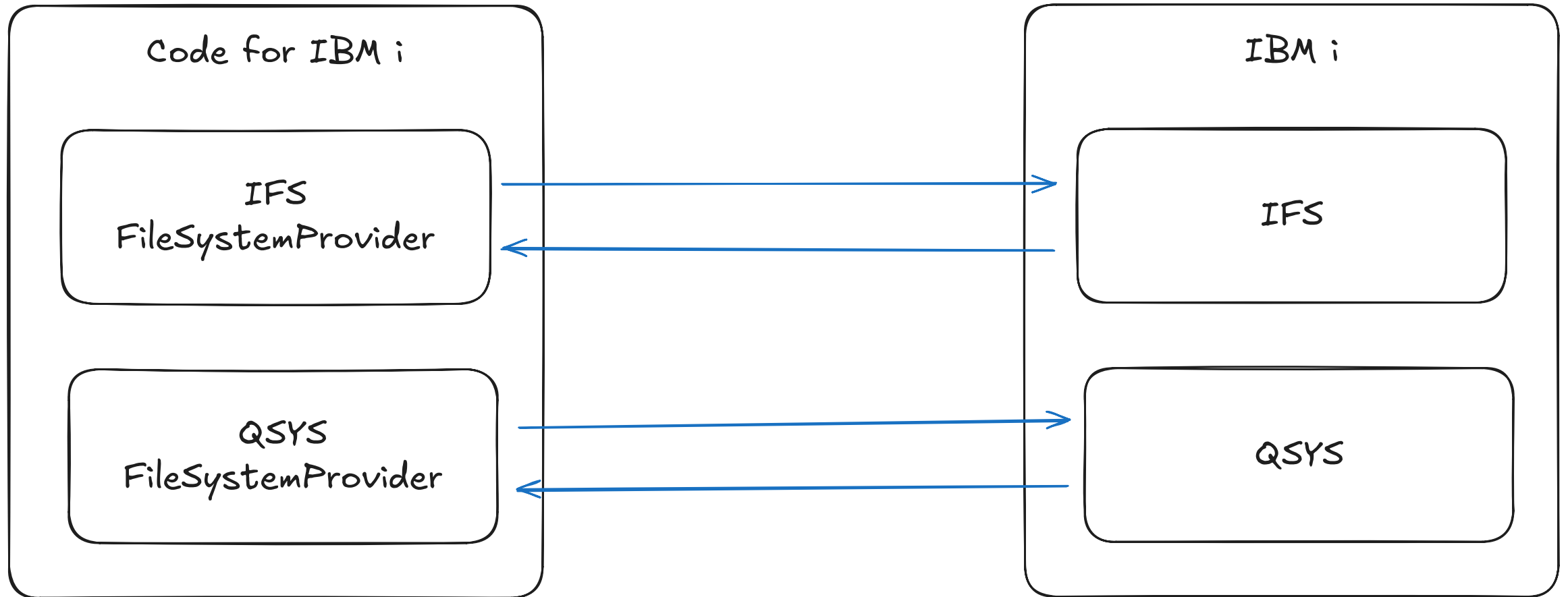
<https://github.com/codefori/vscode-ibmi/blob/master/src/api/IBMi.ts#L317>



# File system providers

<https://github.com/codefori/vscode-ibmi/blob/master/src/filesystems/ifsFs.ts>

<https://github.com/codefori/vscode-ibmi/blob/master/src/filesystems/qsys/QSysFs.ts>



# Internal storage

Internal Storage - Key values stored in extension's globalState

<connection\_name> →

```
export type CachedServerSettings = {  
  lastCheckedOnVersion: string | undefined;  
  iAspInfo: AspInfo[];  
  qccsid: number | null;  
  jobCcsid: number | null;  
  remoteFeatures: { [name: string]: string | undefined }  
  installedComponents: ComponentInstallState[],  
  remoteFeaturesKeys: string | null  
  badDataAreasChecked: boolean | null  
  libraryListValidated: boolean | null  
  pathChecked?: boolean  
  userDefaultCCSID: number | null  
  debugConfigLoaded: boolean  
  maximumArgsLength: number  
} | undefined;
```

lastConnections →

```
export type LastConnection = {  
  name: string  
  timestamp: number  
}  
  
export type LastConnections = LastConnection[];
```

# Secret storage

Secret Storage - Secrets stored in extension's secret storage utility

<connection\_name>\_password →

.....

# Connection settings

Connection Settings - Configurations for different connections

```
{} settings.json X
C: > Users > SanjulaGanepola > AppData > Roaming > Code > User > {} settings.json > [ ] code-for-ibmi.connectionSettings
14  "code-for-ibmi.connectionSettings": [
15      {
16          "commandFor5250": [],
100         "ifsShortcuts": [
101             "/home/SANJULA"
102         ],
103         "autoSortIFSShortcuts": false,
104         "homeDirectory": "/home/SANJULA",
105         "tempLibrary": "ILEEDITOR",
106         "tempDir": "/tmp",
107         "currentLibrary": "SANJULA",
108         "sourceFileCCSID": "*FILE",
109         "autoConvertIFScsid": false,
110         "hideCompileErrors": [],
111         "enableSourceDates": false,
112         "sourceDateGutter": false,
113         "encodingFor5250": "default",
114         "terminalFor5250": "default",
115         "setDeviceNameFor5250": false,
116         "connectingStringFor5250": "+uninhibited localhost",
117         "autoSaveBeforeAction": false,
118         "showDescInLibList": false,
```

# Tree views

<https://github.com/codefori/vscode-ibmi/blob/master/src/ui/views>

Servers

Object Browser

IFS Browser

User Library List

Profiles

Results

Help and Support

IBM i debugger



# Exported API

<https://github.com/IBM/vscode-ibmi-testing/blob/main/src/extension.ts#L22>

```
41  export async function activate(context: ExtensionContext): Promise<CodeForIBMi> {  
131      return {  
132          instance, customUI: () => new CustomUI(),  
133          deployTools: DeployTools,  
134          evfeventParser: parseErrors,  
135          tools: VscodeTools,  
136          componentRegistry: extensionComponentRegistry  
137      };  
138  }
```

Exported API in  
Code for IBM i

RPGLE

CL

Db2 for IBM i

IBM i Testing

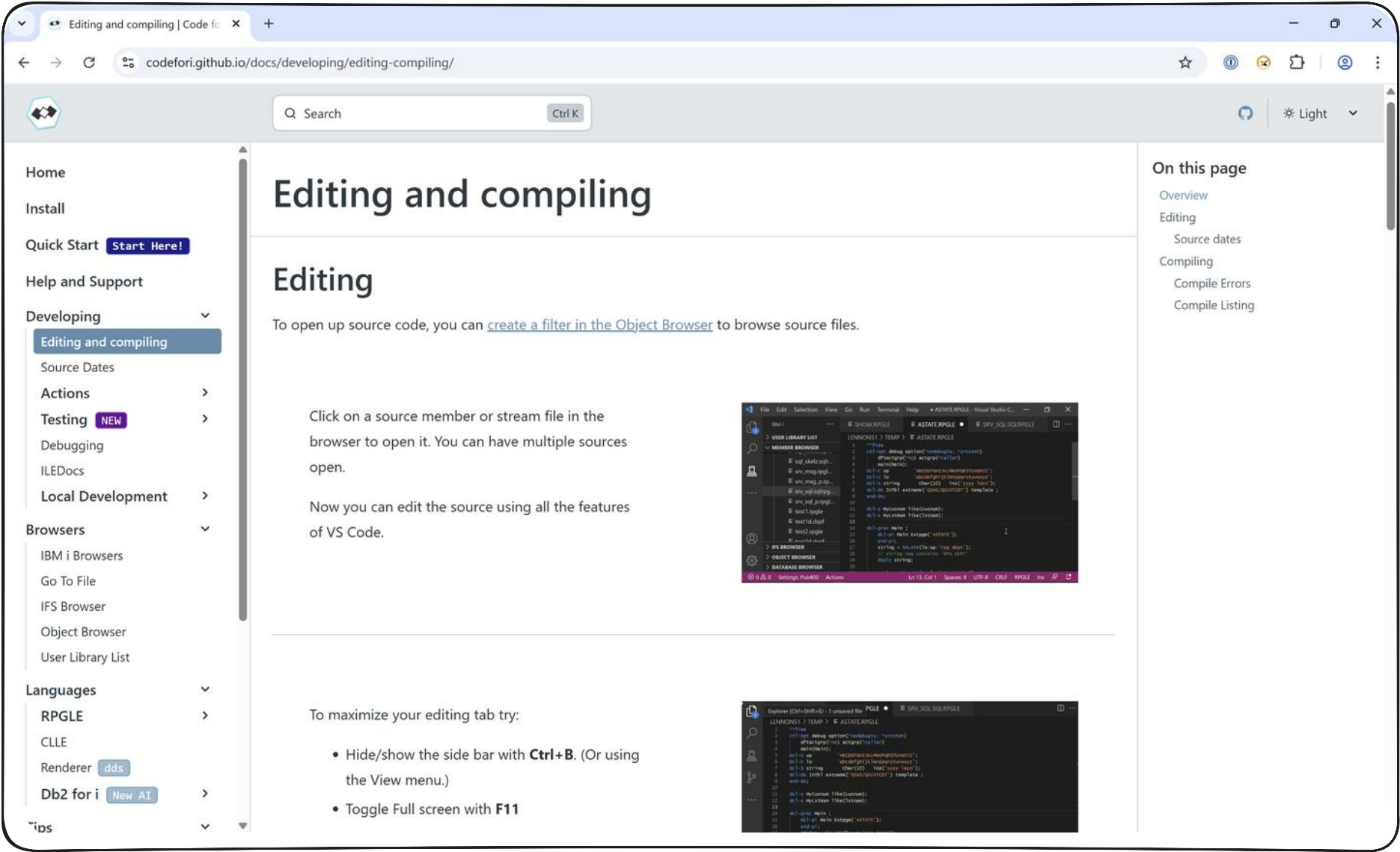
IBM i Project Explorer

```
const baseExtension: Extension<CodeForIBMi> = extensions.getExtension('halcyontechltd.code-for-ibmi');  
let importedApi = baseExtension.exports;
```

Imported API in  
other extensions

# Documentation

<https://github.com/codefori/docs>



# **Any Questions?**

# Important Links

## **VS Code**

API

<https://code.visualstudio.com/api/references/vscode-api>

Extension Guides

<https://code.visualstudio.com/api/extension-guides/overview>

Language Extensions

<https://code.visualstudio.com/api/language-extensions/overview>

Sample Extensions

<https://github.com/microsoft/vscode-extension-samples/tree/main>

## **Code for IBM i**

API

<https://codefori.github.io/docs/dev/api/>

GitHub Repository

<https://github.com/codefori/vscode-ibmi>

# Sanjula Ganepola - Building VS Code Extensions and Contributing to Code for IBM i

Please take the last minute of this session to complete the evaluation. A direct link to the evaluation can be found using the QR code to the right.



**COMMON**

**IBM i**