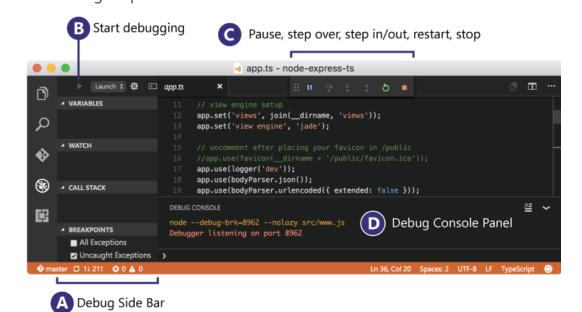


Debugging

One of the key features of Visual Studio Code is its great debugging support. VS Code's built-in debugger helps accelerate your edit, compile and debug loop.



IN THIS ARTICLE

Debugger extensions

Start debugging

Run view

Edit

Run menu

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Platform-specific properties

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Advanced breakpoint topics

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Redirect input/output

Debugger extensions

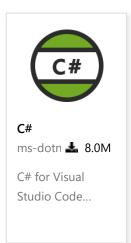
VS Code has built-in debugging support for the Node.js runtime and can debug JavaScript, TypeScript, or any other language that gets transpiled to JavaScript.

For debugging other languages and runtimes (including PHP, Ruby, Go, C#, Python, C++, PowerShell and many others), look for <u>Debuggers</u> extensions in our VS Code Marketplace or select **Install Additional Debuggers** in the top-level Run menu.

Below are several popular extensions which include debugging support:









to/from the debug target

Multi-target debugging

Remote debugging

Automatically open a URI when debugging a server program

Next steps

Common questions

- Tweet this link
- **Subscribe**
- Ask questions
- Follow @code
- Request features
- Report issues
- Watch videos

Tip: The extensions shown above are dynamically queried. Select an

extension tile above to read the description and reviews to decide which extension is best for you.

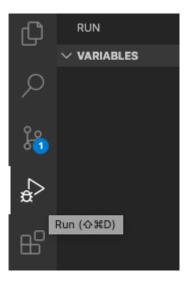
Start debugging

The following documentation is based on the built-in Node.js debugger, but most of the concepts and features are applicable to other debuggers as well.

It is helpful to first create a sample Node.js application before reading about debugging. You can follow the Node.js walkthrough to install Node.js and create a simple "Hello World" JavaScript application (app.js). Once you have a simple application set up, this page will take you through VS Code debugging features.

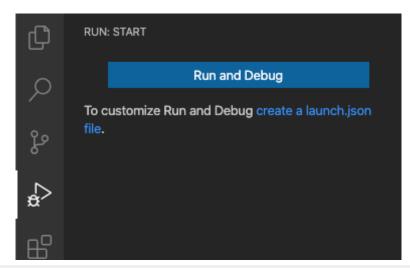
Run view

To bring up the Run view, select the Run icon in the **Activity Bar** on the side of VS Code. You can also use the keyboard shortcut Ctrl+Shift+D.



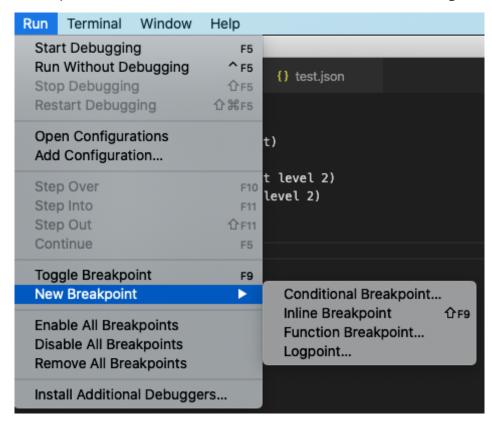
The Run view displays all information related to running and debugging and has a top bar with debugging commands and configuration settings.

If running and debugging is not yet configured (no launch.json has been created) we show the Run start view.



Run menu

The top-level Run menu has the most common run and debug commands:



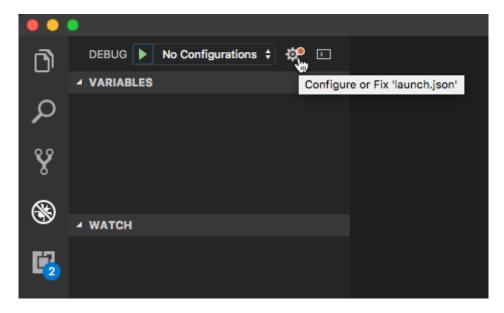
Launch configurations

To run or debug a simple app in VS Code, press F5 and VS Code will try to

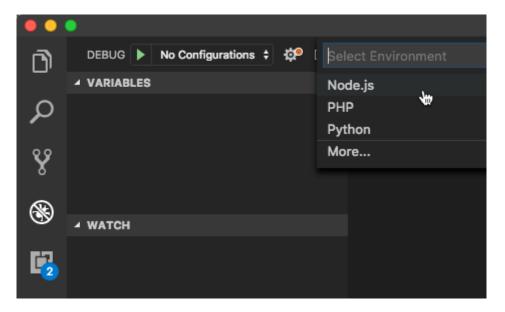
run your currently active file.

However, for most debugging scenarios, creating a launch configuration file is beneficial because it allows you to configure and save debugging setup details. VS Code keeps debugging configuration information in a Launch.json file located in a Located in your workspace (project root folder) or in your user settings or workspace settings.

To create a launch.json file, open your project folder in VS Code (File > Open Folder) and then select the Configure gear icon on the Run view top bar.



VS Code will try to automatically detect your debug environment, but if this fails, you will have to choose it manually:



Here is the launch configuration generated for Node.js debugging:

If you go back to the File Explorer view (Ctrl+Shift+E), you'll see that VS Code has created a .vscode folder and added the launch.json file to your workspace.

EXPLORER

JS app.js

F launch.json .vscode

HELLO

JS app.js

F launch.json .vscode

HELLO

JS app.js

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F launch.json

JS app.js

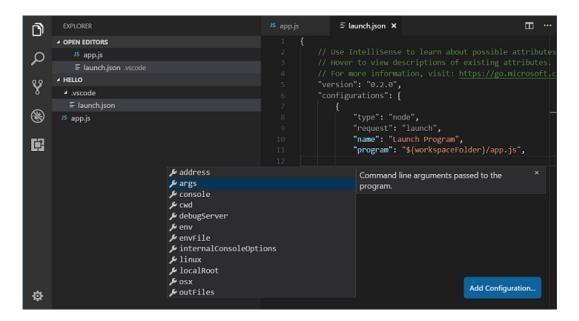
F launch.json

Machine Interpretation in the program of the p

Note: You can debug a simple application even if you don't have a folder open in VS Code, but it is not possible to manage launch configurations and set up advanced debugging. The VS Code Status Bar is purple if you do not have a folder open.

Note that the attributes available in launch configurations vary from debugger to debugger. You can use IntelliSense suggestions (Ctrl+Space) to find out which attributes exist for a specific debugger. Hover help is also available for all attributes.

Do not assume that an attribute that is available for one debugger automatically works for other debuggers too. If you see green squiggles in your launch configuration, hover over them to learn what the problem is and try to fix them before launching a debug session.



Review all automatically generated values and make sure that they make sense for your project and debugging environment.

Launch versus attach configurations

In VS Code, there are two core debugging modes, **Launch** and **Attach**, which handle two different workflows and segments of developers. Depending on your workflow, it can be confusing to know what type of configuration is appropriate for your project.

If you come from a browser Developer Tools background, you might not be used to "launching from your tool," since your browser instance is already open. When you open DevTools, you are simply **attaching** DevTools to your open browser tab. On the other hand, if you come from a

server or desktop background, it's quite normal to have your editor launch

your process for you, and your editor automatically attaches its debugger to the newly launched process.

The best way to explain the difference between **launch** and **attach** is to think of a **launch** configuration as a recipe for how to start your app in debug mode **before** VS Code attaches to it, while an **attach** configuration is a recipe for how to connect VS Code's debugger to an app or process that's **already** running.

VS Code debuggers typically support launching a program in debug mode or attaching to an already running program in debug mode. Depending on the request (attach or launch), different attributes are required, and VS Code's launch.json validation and suggestions should help with that.

Add a new configuration

To add a new configuration to an existing launch.json, use one of the
following techniques:

- Use IntelliSense if your cursor is located inside the configurations array.
- Press the **Add Configuration** button to invoke snippet IntelliSense at the start of the array.
- Choose Add Configuration option in the Run menu.

```
settings.json User
                    settings.json .vscode
                                            launch.json x ind 🔯 🖽 …
      // Use IntelliSense to learn about possible Node.js debug attribute
      // Hover to view descriptions of existing attributes.
      // For more information, visit: https://go.microsoft.com/fwlink/?li
      "version": "0.2.0",
      "configurations". [
               Type of configuration.
              "type": "node",
              "request": "launch",
              "name": "Launch Program",
              "program": "${workspaceRoot}/bin/www",
              "cwd": "${workspaceRoot}"
          },
              "type": "node",
              "request": "attach",
              "name": "Attach to Process",
              "port": 5858
                                                       Add Configuration
```

VS Code also supports compound launch configurations for starting multiple configurations at the same time; for more details, please read this section.

In order to start a debug session, first select the configuration named

Launch Program using the Configuration drop-down in the Run view.

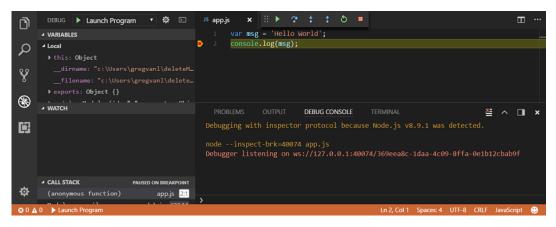
Once you have your launch configuration set, start your debug session with F5.

Alternatively you can run your configuration through the Command

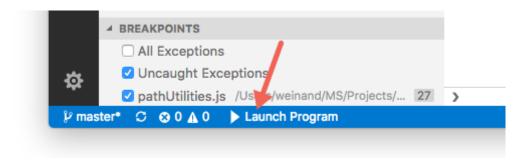
Palette (Ctrl+Shift+P), by filtering on Debug: Select and Start

Debugging or typing 'debug', and selecting the configuration you want to debug.

As soon as a debugging session starts, the **DEBUG CONSOLE** panel is displayed and shows debugging output, and the Status Bar changes color (orange for default color themes):



In addition, the **debug status** appears in the Status Bar showing the active debug configuration. By selecting the debug status, a user can change the active launch configuration and start debugging without needing to open the Run view.



Debug actions

Once a debug session starts, the **Debug toolbar** will appear on the top of the editor.



- Continue / Pause F5
- Step Over F10
- Step Into F11
- Step Out Shift+F11
- Restart Ctrl+Shift+F5
- Stop Shift+F5

Tip: Use the setting debug.toolBarLocation to control the location of the debug toolbar. It can either be the default floating, docked to the Run view or hidden. A floating debug toolbar can be dragged horizontally and also down to the editor area.

Run mode

In addition to debugging a program, VS Code supports **running** the program. The **Debug: Run (Start Without Debugging)** action is triggered with ctrl+F5 and uses the currently selected launch configuration. Many of the launch configuration attributes are supported in 'Run' mode. VS Code maintains a debug session while the program is running, and pressing the **Stop** button terminates the program.

Tip: The **Run** action is always available, but not all debugger extensions support 'Run'. In this case, 'Run' will be the same as 'Debug'.

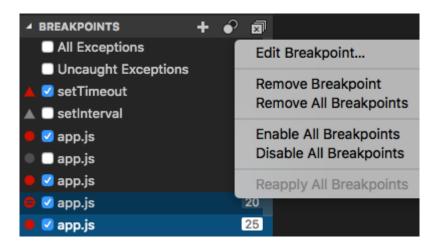
Breakpoints

Breakpoints can be toggled by clicking on the **editor margin** or using F9 on the current line. Finer breakpoint control (enable/disable/reapply) can be done in the Run view's **BREAKPOINTS** section.

- Breakpoints in the editor margin are normally shown as red filled circles.
- Disabled breakpoints have a filled gray circle.
- When a debugging session starts, breakpoints that cannot be registered with the debugger change to a gray hollow circle. The same might happen if the source is edited while a debug session without live-edit support is running.

The Reapply All Breakpoints command sets all breakpoints again to their original location. This is helpful if your debug environment is "lazy" and

"misplaces" breakpoints in source code that has not yet been executed.

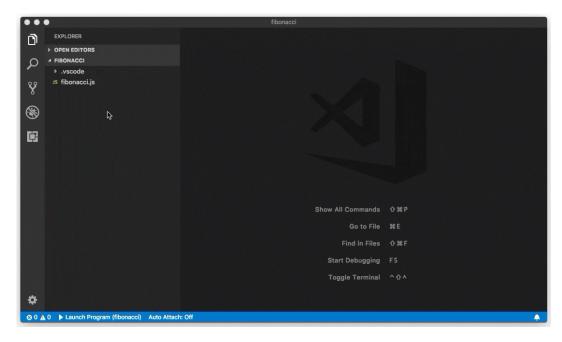


Optionally breakpoints can be shown in the editor's overview ruler by enabling the setting debug.showBreakpointsInOverviewRuler:

Logpoints

A Logpoint is a variant of a breakpoint that does not "break" into the debugger but instead logs a message to the console. Logpoints are especially useful for injecting logging while debugging production servers that cannot be paused or stopped.

A Logpoint is represented by a "diamond" shaped icon. Log messages are plain text but can include expressions to be evaluated within curly braces ('{}').



Just like regular breakpoints, Logpoints can be enabled or disabled and can also be controlled by a condition and/or hit count.

Note: Logpoints are supported by VS Code's built-in Node.js debugger, but can be implemented by other debug extensions. The Python and Java extensions, for example, support Logpoints.

Data inspection

Variables can be inspected in the VARIABLES section of the Run view or by

hovering over their source in the editor. Variable values and expression

evaluation are relative to the selected stack frame in the **CALL STACK** section.

Variable values can be modified with the **Set Value** action from the variable's context menu.

Variables and expressions can also be evaluated and watched in the Run view's **WATCH** section.

```
enabled false
port 8888

i 3

range Object
endColumn 150
endLineNumber 8
startColumn 123
startLineNumber 7
```

Variable names and values can be filtered by typing while the focus is on the **VARIABLES** section

```
VARIABLES

Local

-_dirname: "/Users/samuelrae/dev/debugging-in-vscode/hello"
-_filename: "/Users/samuelrae/dev/debugging-in-vscode/hello/app.js"

module: Module {id: ".", exports: Object, parent: null, ...}

filename: "/Users/samuelrae/dev/debugging-in-vscode/hello/app.js"

paths: Array(6) ["/Users/samuelrae/dev/debugging-in-vscode/hello/nod...
msg: "Hello World"
```

Launch.json attributes

There are many launch.json attributes to help support different debuggers and debugging scenarios. As mentioned above, you can use IntelliSense (Ctrl+Space) to see the list of available attributes once you have specified a value for the type attribute.

```
{} launch.json ×
         ·// Use hover for the description of the existing attributes.
         // For further information visit https://go.microsoft.com/fwlink/?linkid=830387
          "version": "0.2.0",
          "configurations": [
                  "type": "node",
             ····"request": "launch",
              "name": "Launch Program",
                 "program": "${workspaceRoot}/app.js",
            "cwd": "${workspaceRoot}"
                    TCP/IP address of debug port (for Node.js >= 5.0 only). Defa...
                  ℱ args
                  № console
                  ℱ env
                  ✗ externalConsole
         🔑 linux
                  ℱ osx
                  ℱ outDir

№ outFiles

                  🔑 port
                  ✗ preLaunchTask
```

The following attributes are mandatory for every launch configuration:

- type the type of debugger to use for this launch configuration. Every installed debug extension introduces a type: node for the built-in Node debugger, for example, or php and go for the PHP and Go extensions.
- request the request type of this launch configuration. Currently,
 launch and attach are supported.
- name the reader-friendly name to appear in the Debug launch configuration drop-down.

Here are some optional attributes available to all launch configurations:

- presentation using the order, group, and hidden attributes in the presentation object you can sort, group, and hide configurations and compounds in the Debug configuration dropdown and in the Debug quick pick.
- preLaunchTask to launch a task before the start of a debug session, set this attribute to the name of a task specified in tasks.json (in the workspace's .vscode folder). Or, this can be set to
 \${defaultBuildTask} to use your default build task.
- postDebugTask to launch a task at the very end of a debug session, set this attribute to the name of a task specified in tasks.json (in the workspace's .vscode folder).
- <u>internalConsoleOptions</u> this attribute controls the visibility of the Debug Console panel during a debugging session.
- debugServer for debug extension authors only: this attribute

- allows you to connect to a specified port instead of launching the debug adapter.
- serverReadyAction if you want to open a URL in a web browser whenever the program under debugging outputs a specific message to the debug console or integrated terminal. For details see section Automatically open a URI when debugging a server program below.

Many debuggers support some of the following attributes:

- program executable or file to run when launching the debugger
- args arguments passed to the program to debug
- env environment variables (the value null can be used to "undefine" a variable)
- cwd current working directory for finding dependencies and other files
- port port when attaching to a running process
- stopOnEntry break immediately when the program launches
- console what kind of console to use, for example, internalConsole, integratedTerminal, or externalTerminal

Variable substitution

VS Code makes commonly used paths and other values available as variables and supports variable substitution inside strings in launch.json. This means that you do not have to use absolute paths in debug configurations. For example, \${workspaceFolder} gives the root path of a workspace folder, \${file} the file open in the active editor, and \${env:Name} the environment variable 'Name'. You can see a full list of

predefined variables in the Variables Reference or by invoking IntelliSense inside the launch.json string attributes.

```
"type": "node",
  "request": "launch",
  "name": "Launch Program",
  "program": "${workspaceFolder}/app.js",
  "cwd": "${workspaceFolder}",
  "args": ["${env:USERNAME}"]
}
```

Platform-specific properties

Launch.json supports defining values (for example, arguments to be passed to the program) that depend on the operating system where the debugger is running. To do so, put a platform-specific literal into the launch.json file and specify the corresponding properties inside that literal.

Below is an example that passes "args" to the program differently on Windows:

Valid operating properties are "windows" for Windows, "linux" for Linux and "osx" for macOS. Properties defined in an operating system specific scope override properties defined in the global scope.

In the example below debugging the program always **stops on entry** except on macOS:

Global launch configuration

VS Code supports adding a "launch" object inside your User settings.

This "launch" configuration will then be shared across your workspaces.

For example:

```
"launch": {
    "version": "0.2.0",
    "configurations": [{
        "type": "node",
        "request": "launch",
        "name": "Launch Program",
        "program": "${file}"
    }]
}
```

Tip: If a workspace contains a "launch.json", the global launch configuration is ignored.

Advanced breakpoint topics

Conditional breakpoints

A powerful VS Code debugging feature is the ability to set conditions based on expressions, hit counts, or a combination of both.

- **Expression condition**: The breakpoint will be hit whenever the expression evaluates to true.
- Hit count: The 'hit count' controls how many times a breakpoint needs to be hit before it will 'break' execution Whether a 'hit count'

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is respected and the exact syntax of the expression vary among debugger extensions.

You can add a condition and/or hit count when creating the breakpoint (with the Add Conditional Breakpoint action) or when modifying an existing one (with the Edit Breakpoint action). In both cases, an inline text box with a drop-down menu opens where you can enter expressions:

```
extension.ts sn
    import * as vscode from 'vscode';
   // this method is called when your extension is activated
 8 export function activate(context: vscode.ExtensionContext) {
      // This line of code will only be executed once when your extension is activated
       console.log('Congratulations, your extension "new-ts-extension" is now active!');
       // The command has been defined in the package.json file
       // Now provide the implementation of the command with registerCommand
       let disposable = vscode.commands.registerCommand('extension.sayHello', () ⇒ {
                               ode.window.createOutputChannel('myoutput');
  Add Breakpoint
                                nformationMessage('Hello World!');
  Add Conditional Breakpoint...
                               tConfiguration()
       });
        context.subscriptions.push(disposable);
26 // this method is called when your extension is deactivated
27 export function deactivate() {
```

If a debugger does not support conditional breakpoints, the **Add Conditional Breakpoint** action will be missing.

Inline breakpoints

Inline breakpoints will only be hit when the execution reaches the column associated with the inline breakpoint. This is particularly useful when

abbounded and broakpoints to particularly aboun

debugging minified code which contains multiple statements in a single line.

An inline breakpoint can be set using Shift+F9 or through the context menu during a debug session. Inline breakpoints are shown inline in the editor.

Inline breakpoints can also have conditions. Editing multiple breakpoints on a line is possible through the context menu in the editor's left margin.

Function breakpoints

Instead of placing breakpoints directly in source code, a debugger can support creating breakpoints by specifying a function name. This is useful in situations where source is not available but a function name is known.

A function breakpoint is created by pressing the + button in the **BREAKPOINTS** section header and entering the function name. Function breakpoints are shown with a red triangle in the **BREAKPOINTS** section.

Data breakpoints

If a debugger supports data breakpoints they can be set from the **VARIABLES** view and will get hit when the value of the underlying variable changes. Data breakpoints are shown with a red hexagon in the **BREAKPOINTS** section.

Debug Console REPL

Expressions can be evaluated with the **Debug Console** REPL (Read-Eval-Print Loop) feature. To open the Debug Console, use the **Debug Console** action at the top of the Debug pane or use the **View: Debug Console** command (Ctrl+Shift+Y). Expressions are evaluated after you press

Enter and the Debug Console REPL shows suggestions as you type. If you need to enter multiple lines, use Shift+Enter between the lines and then send all lines for evaluation with Enter. Debug Console input uses the mode of the active editor, which means that the Debug Console input supports syntax coloring, indentation, auto closing of quotes, and other language features.

```
DEBUG CONSOLE
 node --debug-brk=43743 --nolazy fib.js
 Debugger listening on port 43743
 enabled
 7 + 8
 15
 range
⊿ Object 🕕
▶ child: Object
  endLineNumber: 8
  startColumn: 123
  startLineNumber: 7
  te: "11"
  te6: "11"
 text: "lineContext.getTokenEndIndex(tokenIndex) + 1"
 fib(15)
 987
```

Note: You must be in a running debug session to use the Debug Console REPL.

Redirect input/output to/from the debug target

Redirecting input/output is debugger/runtime specific, so VS Code does not have a built-in solution that works for all debuggers.

Here are two approaches you might want to consider:

- 1. Launch the program to debug ("debug target") manually in a terminal or command prompt and redirect input/output as needed. Make sure to pass the appropriate command line options to the debug target so that a debugger can attach to it. Create and run an "attach" debug configuration that attaches to the debug target.
- 2. If the debugger extension you are using can run the debug target in VS Code's Integrated Terminal (or an external terminal), you can try to pass the shell redirect syntax (for example "<" or ">") as arguments.

Here's an example launch.json configuration:

```
"name": "launch program that reads a file from stdin",
  "type": "node",
  "request": "launch",
  "program": "program.js",
  "console": "integratedTerminal",
  "args": ["<", "in.txt"]</pre>
```

}

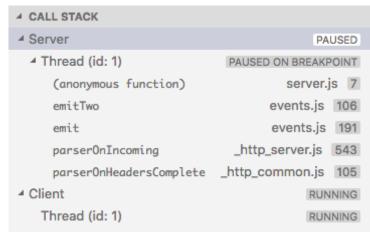
This approach requires that the "<" syntax is passed through the debugger extension and ends up unmodified in the Integrated Terminal.

Multi-target debugging

For complex scenarios involving more than one process (for example, a client and a server), VS Code supports multi-target debugging.

Using multi-target debugging is simple: after you've started a first debug session, you can just launch another session. As soon as a second session is up and running, the VS Code UI switches to *multi-target mode*:

 The individual sessions now show up as top-level elements in the CALL STACK view.



• The debug toolbar shows the currently active session (and all other sessions are available in a drop-down menu).



 Debug actions (for example, all actions in the debug toolbar) are performed on the active session. The active session can be changed either by using the drop-down menu in the debug toolbar or by selecting a different element in the CALL STACK view.

Compound launch configurations

An alternative way to start multiple debug sessions is by using a **compound** launch configuration. A compound launch configuration lists the names of two or more launch configurations that should be launched in parallel. Optionally a **prelaunchTask** can be specified that is run before the individual debug sessions are started.

```
"name": "Server/Client",
    "configurations": ["Server", "Client"],
    "preLaunchTask": "${defaultBuildTask}"
    }
]
]
```

Compound launch configurations are displayed in the launch configuration drop-down menu.

Remote debugging

VS Code does not itself support remote debugging: this is a feature of the debug extension you are using, and you should consult the extension's page in the Marketplace for support and details.

There is, however, one exception: the Node.js debugger included in VS Code supports remote debugging. See the Node.js Debugging topic to learn how to configure this.

Automatically open a URI when debugging a server program

Developing a web program typically requires opening a specific URL in a web browser in order to hit the server code in the debugger. VS Code has a built-in feature "serverReadyAction" to automate this task.

Here is an example of a simple Node.js Express application:

```
var express = require('express');
var app = express();
```

```
app.get('/', function(req, res) {
   res.send('Hello World!');
});

app.listen(3000, function() {
   console.log('Example app listening on port 3000!');
});
```

This application first installs a "Hello World" handler for the "/" URL and then starts to listen for HTTP connections on port 3000. The port is announced in the Debug Console and typically the developer would now type http://localhost:3000 into their browser application.

The **serverReadyAction** feature makes it possible to add a structured property **serverReadyAction** to any launch config and select an "action" to be performed:

```
"type": "node",
  "request": "launch",
  "name": "Launch Program",
  "program": "${workspaceFolder}/app.js",

"serverReadyAction": {
    "pattern": "listening on port ([0-9]+)",
    "uriFormat": "http://localhost:%s",
    "action": "openExternally"
  }
}
```

Here the pattern property describes the regular expression for matching the program's output string that announces the port. The pattern for the

port number is put into parenthesis so that it is available as a regular

expression capture group. In this example, we are extracting only the port number, but it is also possible to extract a full URI.

The uriFormat property describes how the port number is turned into a URI. The first %s is substituted by the first capture group of the matching pattern.

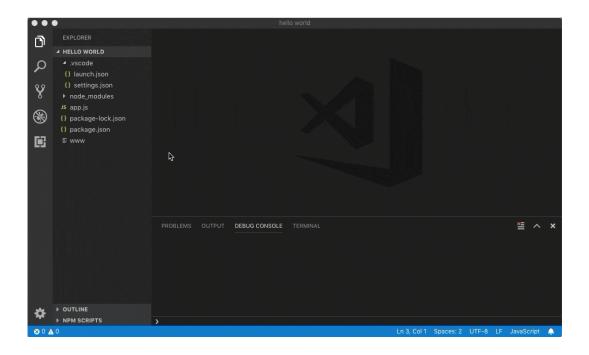
The resulting URI is then opened outside of VS Code ("externally") with the standard application configured for the URI's scheme.

Alternatively, the action can be set to debugWithChrome. In this case, VS Code starts a Chrome debug session for the URI (which requires that the Debugger for Chrome extension is installed). In this mode, a webRoot property can be added that is passed to the Chrome debug session.

To simplify things a bit, most properties are optional and we use the following fallback values:

- pattern: "listening on.* (https?://\\S+|[0-9]+)" which matches the commonly used messages "listening on port 3000" or "Now listening on: https://localhost:5001".
- uriFormat: "http://localhost:%s"
- webRoot: "\${workspaceFolder}"

And here the **serverReadyAction** feature in action:



Next steps

To learn about VS Code's Node.js debugging support, take a look at:

 Node.js - Describes the Node.js debugger, which is included in VS Code.

To see tutorials on the basics of Node.js debugging, check out these videos:

- Intro Video Debugging Showcases the basics of debugging.
- Getting started with Node.js debugging Shows how to attach a debugger to a running Node.js process.

To learn about VS Code's task running support, go to:

 Tasks - Describes how to run tasks with Gulp, Grunt and Jake, and how to show errors and warnings.

To write your own debugger extension, visit:

• Debugger Extension - Uses a mock sample to illustrate the steps required to create a VS Code debug extension.

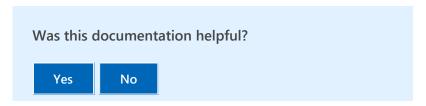
Common questions

What are the supported debugging scenarios?

Debugging of Node.js-based applications is supported on Linux, macOS, and Windows out of the box with VS Code. Many other scenarios are supported by VS Code extensions available in the Marketplace.

I do not see any launch configurations in the Run view dropdown. What is wrong?

The most common problem is that you did not set up launch.json or there is a syntax error in that file. Alternatively, you might need to open a folder, since no-folder debugging does not support launch configurations.



6/10/2020

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