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Developing Mynewt Applications with Visual Studio Code

This guide shows you how to set up Visual Studio Code to develop and debug Mynewt applications. Visual Studio Code is supported on Mac OS, Linux, and Windows. This guide shows you how to:

1. Install Visual Studio Code.
2. Install the C/C++ and debugger extensions.
3. Define task configurations to build Mynewt applications.
4. Define debugger configurations to debug Mynewt applications.
5. Launch the debugger.

Prerequisites:

- Have Internet connectivity to fetch remote Mynewt components.
- Have a computer to build a Mynewt application.
- Perform native installation (../get_started/native_install/index.html) for the Mynewt tools and toolchains. **Note:** For Windows platforms, ensure that the MinGW bash you install is added to your Windows Path. In addition, if you are using Windows 10 WSL, you must have the MinGW bash before

the Windows 10 WSL bash in your Windows Path.

- Read the Mynewt OS Concepts section.
- Create a project space (directory structure) and populate it with the core code repository (apache-mynewt-core) or know how to as explained in Creating Your First Project.
- Complete one of the Blinky Tutorials (../tutorials/blinky/blinky.html#blinky-tutorials).

Notes:

- This guide is not a tutorial for Visual Studio Code. It assumes you are familiar with Visual Studio Code. If this is your first time using Visual Studio Code, we recommend that you read the Visual Studio Code documentation and tutorials (https://code.visualstudio.com/docs) and evaluate whether you would like to use it to develop Mynewt applications.
- This guide uses Visual Studio Code on Windows. Visual Studio Code is supported on Linux and Mac OS but may have some variations in the keyboard shortcuts and command names for these platforms.
- You can also use the Eclipse IDE to develop Mynewt applications. See hacking-mynewt-in-eclipse (https://www.codecoup.pl/blog/hacking-mynewt-in-eclipse) for more details. On Windows platforms, you must also ensure the MinGW bash is set in your Windows Path as described in the prerequisites.

Installing Visual Studio Code

Download and install Visual Studio Code from https://code.visualstudio.com/ (https://code.visualstudio.com/).

Installing the C/C++ and Debugger Extensions

You need to install two extensions:

1. The C/C++ extension from Microsoft. This extension provides language support such as symbol searching, signatuare help, go to definition, and go to declaration.
2. The Native Debug extension from webfreak. This extension provides GDB support.

To install the C/C++ extension:

1. Press `Ctrl-P` to open the search box.
2. Type `ext install cpptools` in the search box and press Enter. You should see the extension at the top of the list.
3. Click `Install` to install the extension.

To install the Native Debugger:

1. Press `Ctrl-P` to open the search box.
2. Type `ext install webfreak.debug` in the search box and press Enter. You should see the Native Debug extension at the top of the list.
3. Click `Install` to install the extension.

Defining Tasks for Mynewt Projects

Two main concepts in Visual Studio Code are workspaces and tasks. A workspace represents a folder that is open. You can open multiple workspaces and switch between workspaces.

Tasks allow you to integrate the external tools and operations that are used to build or test your project into Visual Studio Code. Tasks are run from and the task results can be analyzed in Visual Studio Code. Tasks are defined within the scope of a workspace. This means that the tasks you define for a workspace only apply to the given workspace.

Associating a Mynewt Project to a Workspace

For your Mynewt project, your Visual Studio Code workspace is the Mynewt project base directory. For example, if you create a project named `myproj` under the `~/dev` directory, then you open the `~/dev/myproj` folder for your workspace.

Select **File** > **Open Folder**, and select the `myproj` folder from the `Select Folder` dialog box to open the folder.

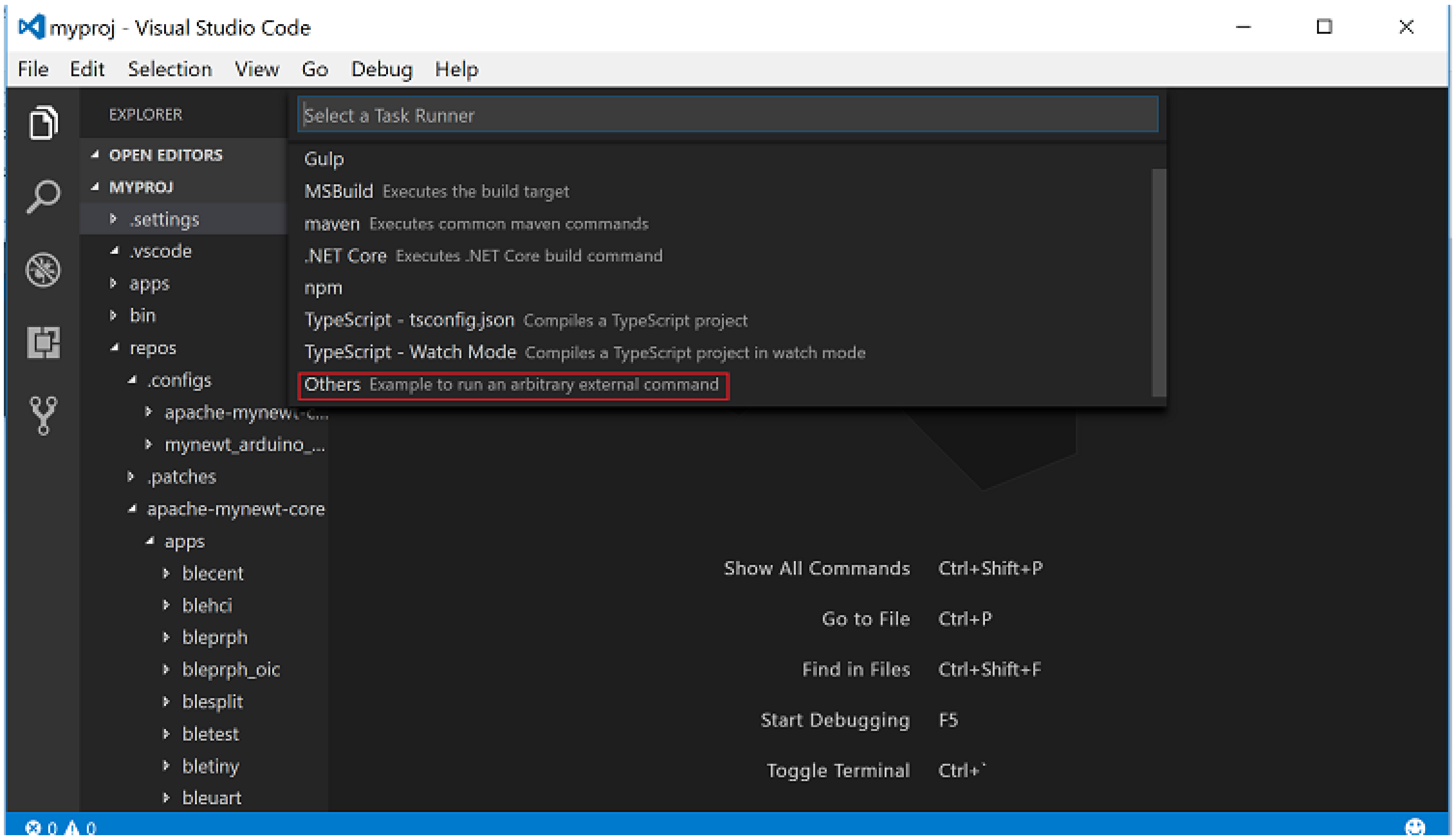
Defining Visual Studio Code Tasks to Build and Debug Mynewt Applications

You define Visual Studio Code tasks to build and debug your Mynewt targets in Visual Studio Code. We use the Blinky application for the Arduino Zero board from the Blinky On Arduino Zero Tutorial (../tutorials/blinky/arduino_zero.html) to illustrate how to define the tasks to build and debug the Arduino blinky bootloader and application targets.

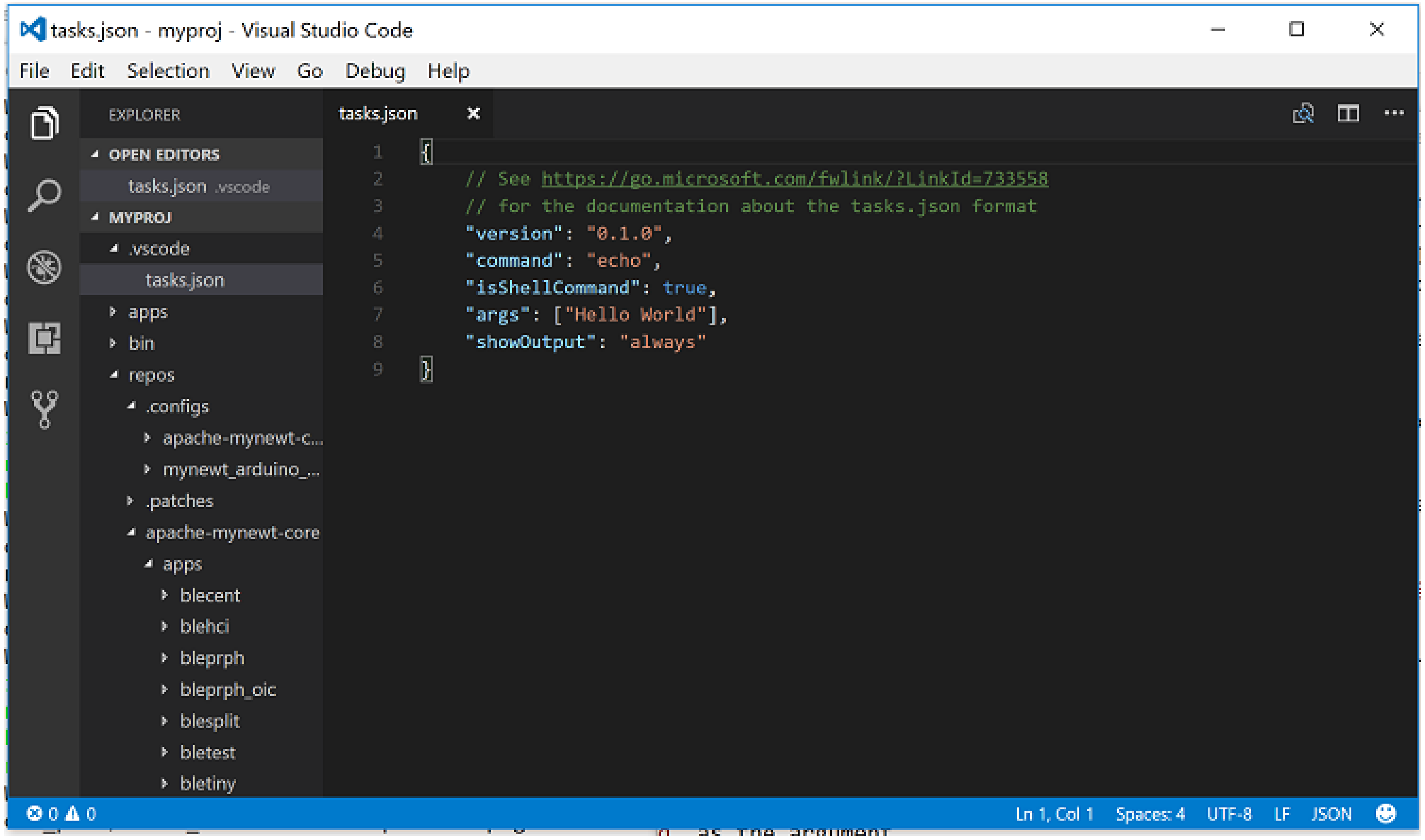
Perform the following steps to create the tasks to build and debug the Arduino blinky bootloader and appliction targets:

Step 1: Press `Ctrl-Shift-P`, type `task`, and select **Tasks:Configure Task Runner** from the search results.

Step 2: Select **Others** (scroll down to the bottom of the list) to create a task runner for external commands.


myproj - Visual Studio Code
File Edit Selection View Go Debug Help
EXPLORER
OPEN EDITORS
MYPROJ
.settings
.vscode
apps
bin
repos
.configs
apache-mynewt-c...
mynewt_arduino_...
.patches
apache-mynewt-core
apps
blecent
blehci
bleprph
bleprph_oic
blesplit
bletest
bletiny
bleuart
Select a Task Runner
Gulp
MSBuild Executes the build target
maven Executes common maven commands
.NET Core Executes .NET Core build command
npm
TypeScript - tsconfig.json Compiles a TypeScript project
TypeScript - Watch Mode Compiles a TypeScript project in watch mode
Others Example to run an arbitrary external command
Show All Commands Ctrl+Shift+P
Go to File Ctrl+P
Find in Files Ctrl+Shift+F
Start Debugging F5
Toggle Terminal Ctrl+`
0 0

Tasks are defined in the `tasks.json` file. You should see the `.vscode` folder created in the `MYPROJ` folder and a `tasks.json` file created in the `.vscode` folder. The `tasks.json` file has the following default values.



```
{
    // See https://go.microsoft.com/fwlink/?LinkId=733558
    // for the documentation about the tasks.json format
    "version": "0.1.0",
    "command": "echo",
    "isShellCommand": true,
    "args": ["Hello World"],
    "showOutput": "always"
}
```

The sample `tasks.json` file defines a simple task that runs the echo command with “Hello World” as the argument.

Step 3: Delete the content from the `tasks.json` file, add the following definitions, and press `Ctrl-S` to save the file.

```
{
    "version": "0.1.0",
    "command": "newt",
    "echoCommand": true,
    "isShellCommand": true,

    "tasks":[
        {
            "taskName": "build_arduino_boot",
            "args": ["build", "arduino_boot"],
            "suppressTaskName": true
        },
        {
            "taskName": "build_arduino_blinky",
            "args": ["build", "arduino_blinky"],
            "isBuildCommand": true,
            "suppressTaskName": true
        },
        {
            "taskName": "create_arduino_blinky",
            "args": ["create-image", "arduino_blinky", "1.0.0"],
            "suppressTaskName":true
        },
        {
            "taskName": "debug_arduino_blinky",
            "args": ["debug", "arduino_blinky", "-n"],
            "suppressTaskName": true
        }
    ]
}
```

The `tasks.json` file specifies the tasks that are run to build and debug the Arduino blinky targets. Each task runs a `newt` command. The `newt` command to run and the arguments for the `newt` command are passed in the `args` property for each task.

The following tasks are defined in this example:

1. **build_arduino_boot**: Runs the `newt build arduino_boot` command to build the arduino_boot target.
2. **build_arduino_blinky**: Runs the `newt build arduino_blinky` command to build the arduino_blinky target.

   Note: This task sets the `isBuildCommand` property to `true`. This is an optional property that, when set to true, allows you to run the **Tasks: Run Build Task**(`Ctrl-Shift-B`) command to start the task.
3. **create_arduino_blinky**: Runs the `newt create-image arduino_blinky` command to create the image file.

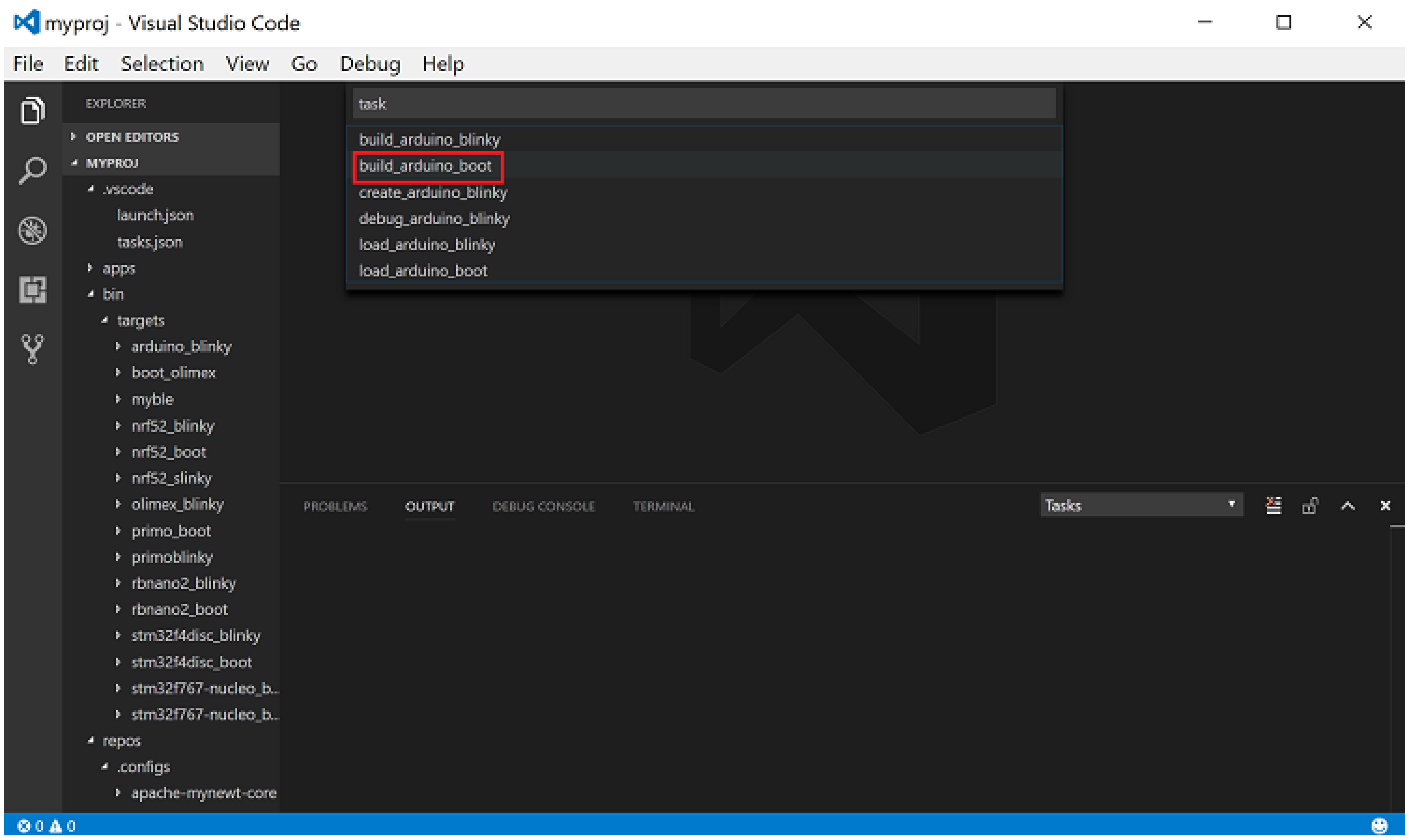
4. **debug_arduino_blinky**: Runs the `newt build arduino_blinky -n` command to debug the arduino_blinky target. The `-n` flag is specified to start only the GDB server and not the GDB client. We will launch the GDB client from Visual Studio Code.

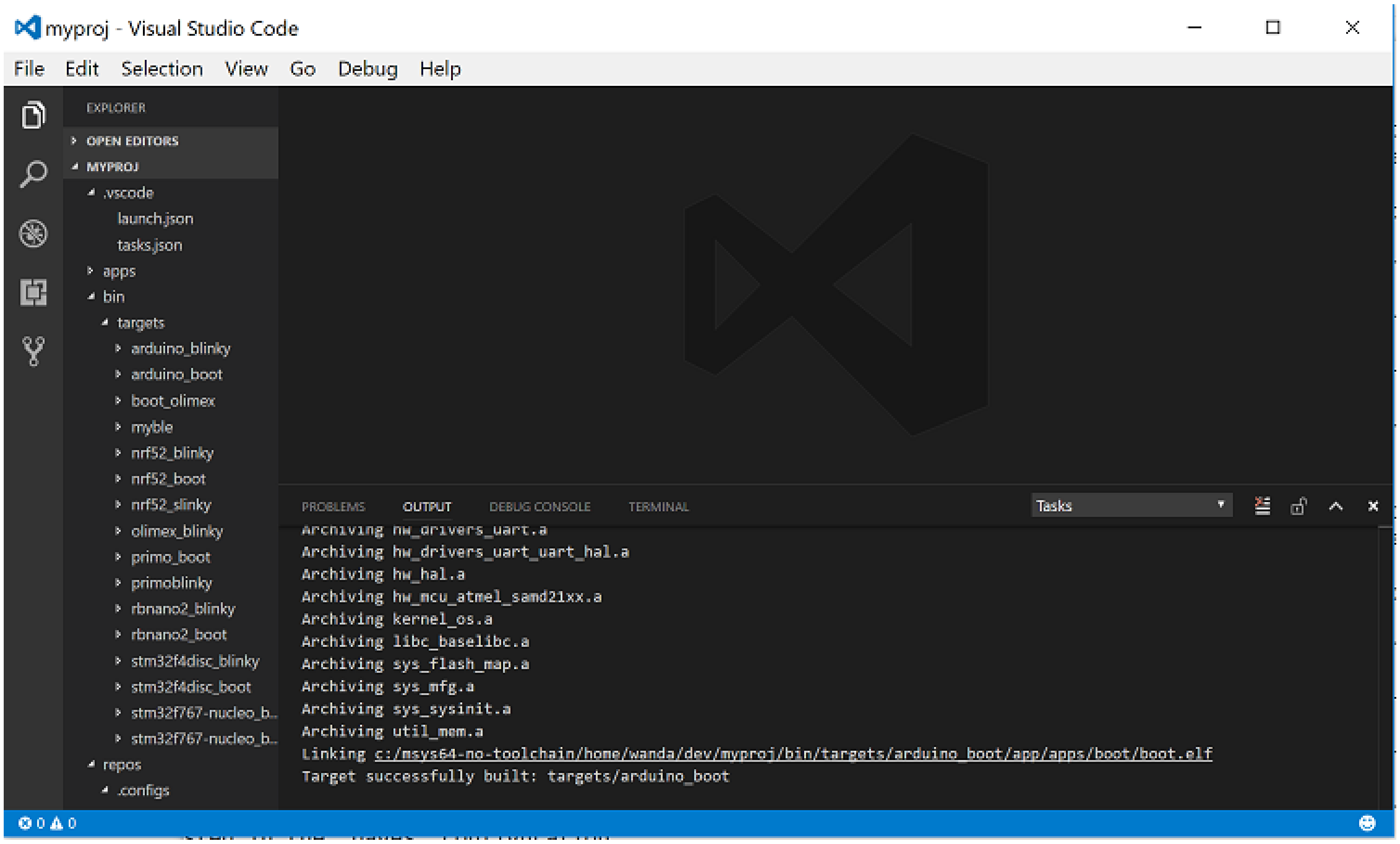
For more information on tasks and all supported properties, see the Visual Studio Code Task documentation (https://code.visualstudio.com/docs/editor/tasks).

Running a Task

To run a task, press `Ctrl-Shift-P`, type `task` on the search box, and select **Tasks: Run Task**. The tasks that you define in the `tasks.json` file are listed. Select the task to run.

The following is an example of running the `build_arduino_boot` task:





```
Archiving hw_drivers_uart.a
Archiving hw_drivers_uart_uart_hal.a
Archiving hw_hal.a
Archiving hw_mcu_atmel_samd21xx.a
Archiving kernel_os.a
Archiving libc_baselibc.a
Archiving sys_flash_map.a
Archiving sys_mfg.a
Archiving sys_sysinit.a
Archiving util_mem.a
Linking c:/msys64-no-toolchain/home/wanda/dev/myproj/bin/targets/arduino_boot/app/apps/boot/boot.elf
Target successfully built: targets/arduino_boot
```

Note: To run the `build_arduino_blinky` task, you can use the keyboard shortcut `Ctrl-Shift-B` because the task has the property `isBuildCommand` set to true.

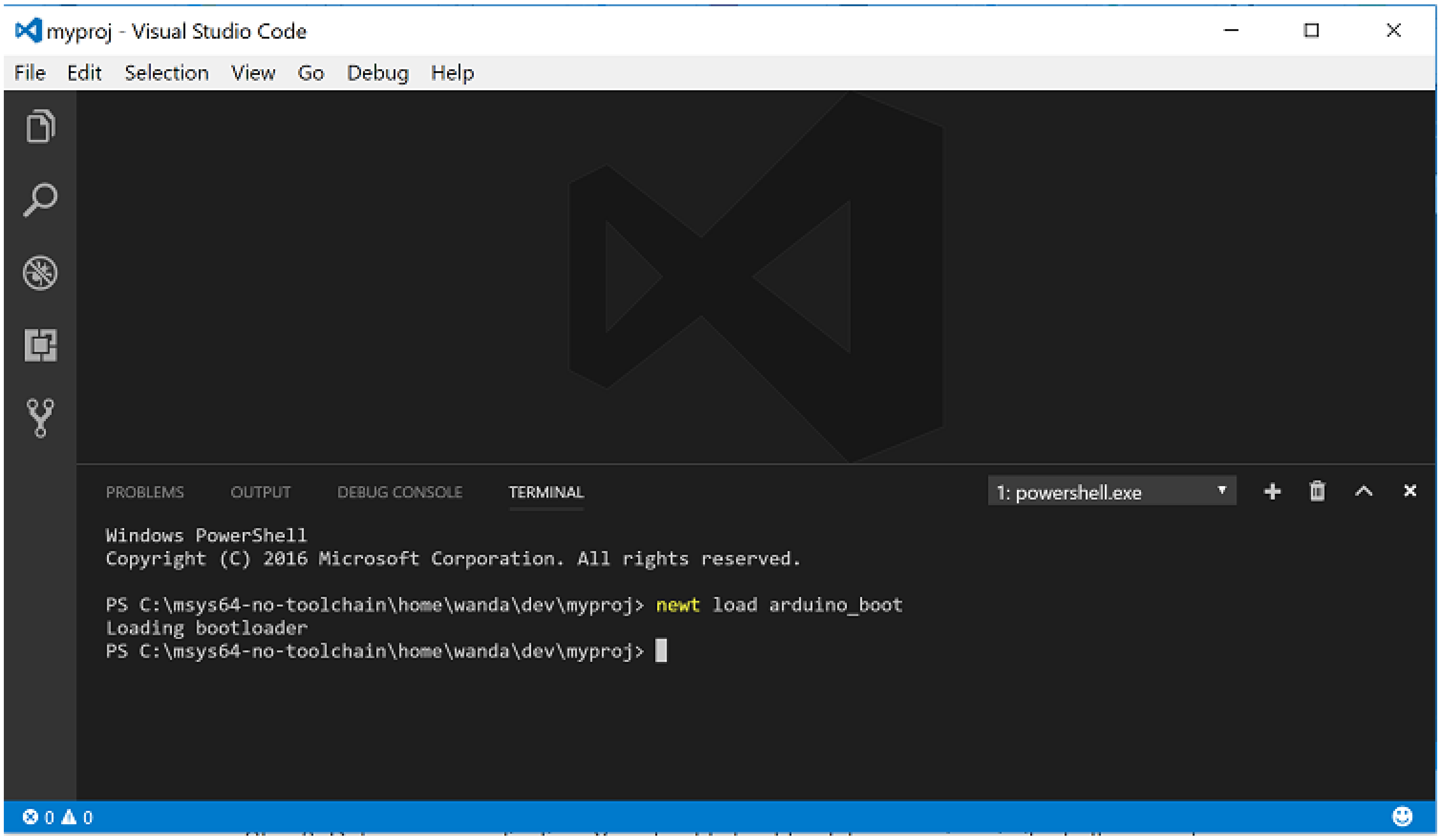
Defining Tasks for Other Newt Commands

Other newt commands, such as the `newt load` command, do not need to run from within Visual Studio Code. You can define a task for each command as a convenience and run the command as a task, or you can run the newt command on the command line from the Visual Studio Code integrated terminal or an external terminal.

To create the tasks for the `newt load arduino_boot` and `newt load arduino_blinky` commands, add the following definitions to the `tasks.json` file:

```
[
        {
            "taskName": "load_arduino_boot",
            "args": ["load", "arduino_boot"],
            "suppressTaskName":true
        },
        {
            "taskName": "load_arduino_blinky",
            "args": ["load", "arduino_blinky"],
            "suppressTaskName":true
        },
]
```

To run a command from the Visual Studio integrated terminal, instead of starting a task, press `Ctrl-`` to launch the integrated terminal and enter the command on the prompt:


myproj - Visual Studio Code
File Edit Selection View Go Debug Help
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
1: powershell.exe
0 0

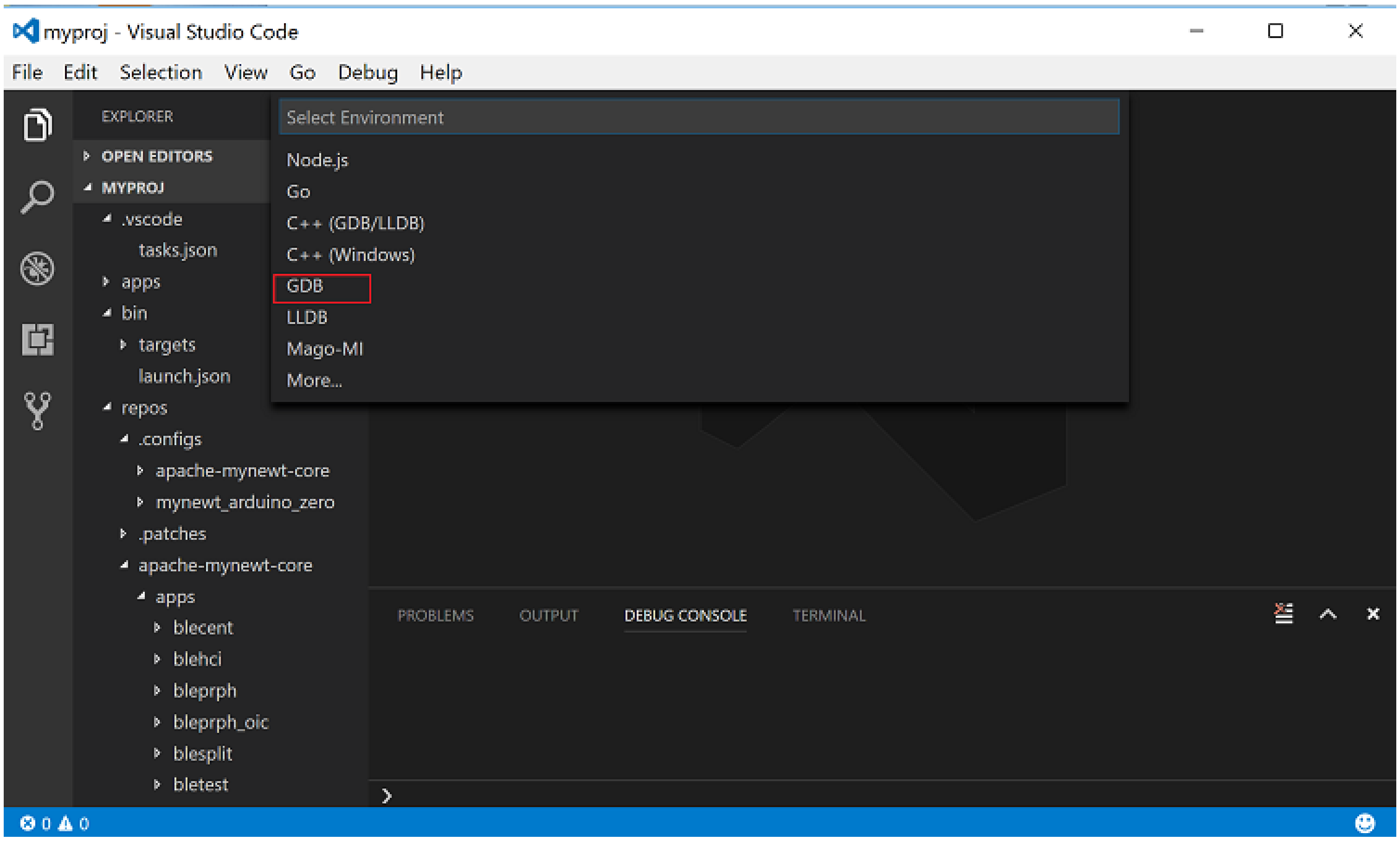
```
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\msys64-no-toolchain\home\wanda\dev\myproj> newt load arduino_boot
Loading bootloader
PS C:\msys64-no-toolchain\home\wanda\dev\myproj>
```

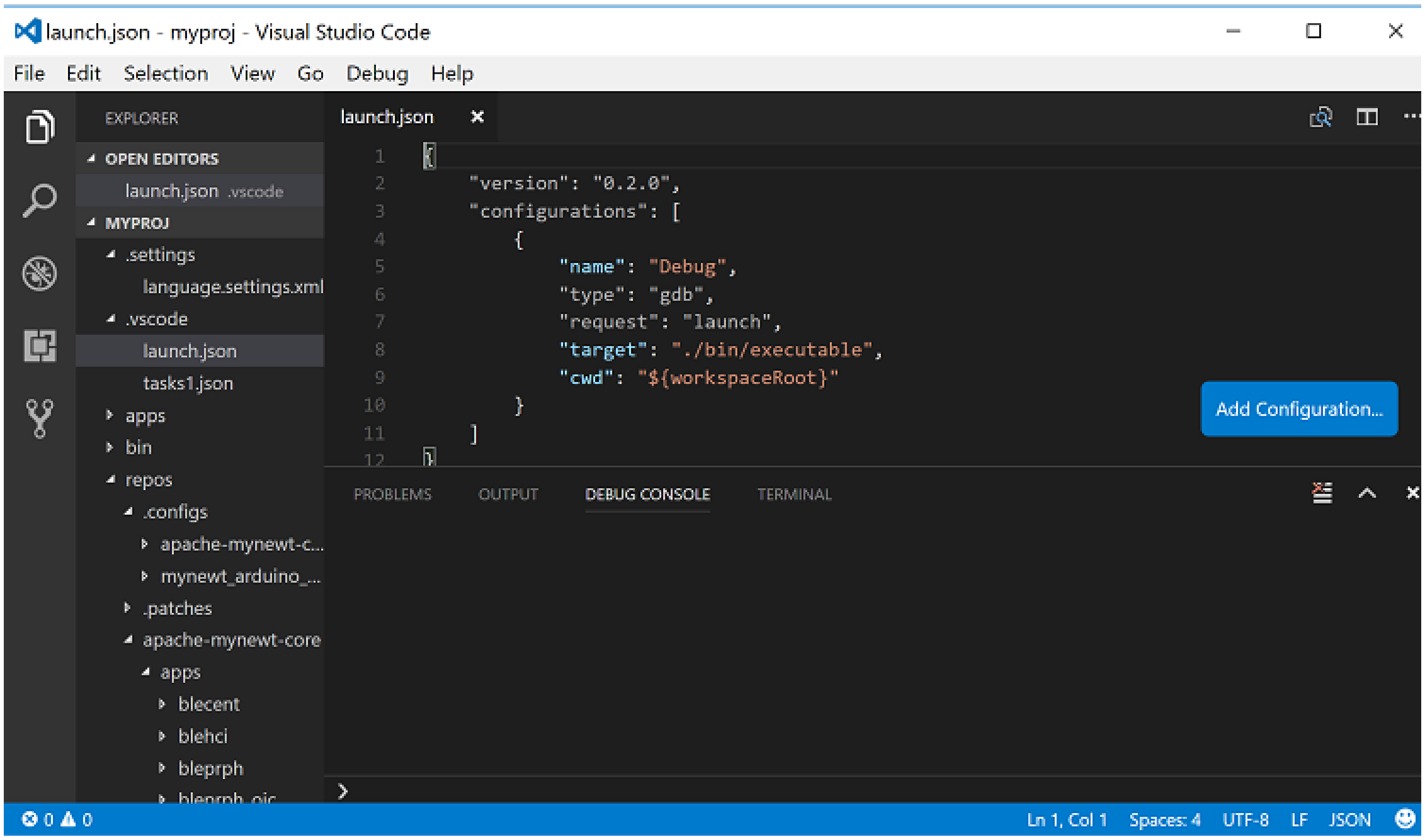
Defining Debugger Configurations

You need to define a debugger configuration to launch the GDB debugger from within Visual Studio Code:

Step 1: Select **Debug** > **Open Configuration**, and select the **GDB** environment.



You should see a default `launch.json` file created in the `.vscode` folder.



```
{
    "version": "0.2.0",
    "configurations": [
        {
            "name": "Debug",
            "type": "gdb",
            "request": "launch",
            "target": "./bin/executable",
            "cwd": "${workspaceRoot}"
        }
    ]
}
```

Step 2: Delete the content from the `launch.json` file, add the following definitions, and press ‘Ctrl-S’ to save the file.

```
{
    "version": "0.2.0",
    "configurations": [
        {
            "name": "gdb_arduino_blinky",
            "type": "gdb",
            "request": "attach",
            "executable": "${workspaceRoot}\\bin\\targets\\arduino_blinky\\app\\apps\\blinky\\blinky.elf",
            "target": ":3333",
            "cwd": "${workspaceRoot}",
            "gdbpath": "C:\\Program Files (x86)\\GNU Tools ARM Embedded\\4.9 2015q2\\bin\\arm-none-eabi-gdb.e
xe",
            "remote": true

        }
    ]
}
```

This defines a `gdb_arduino_blinky` debugger configuration. It specifies:

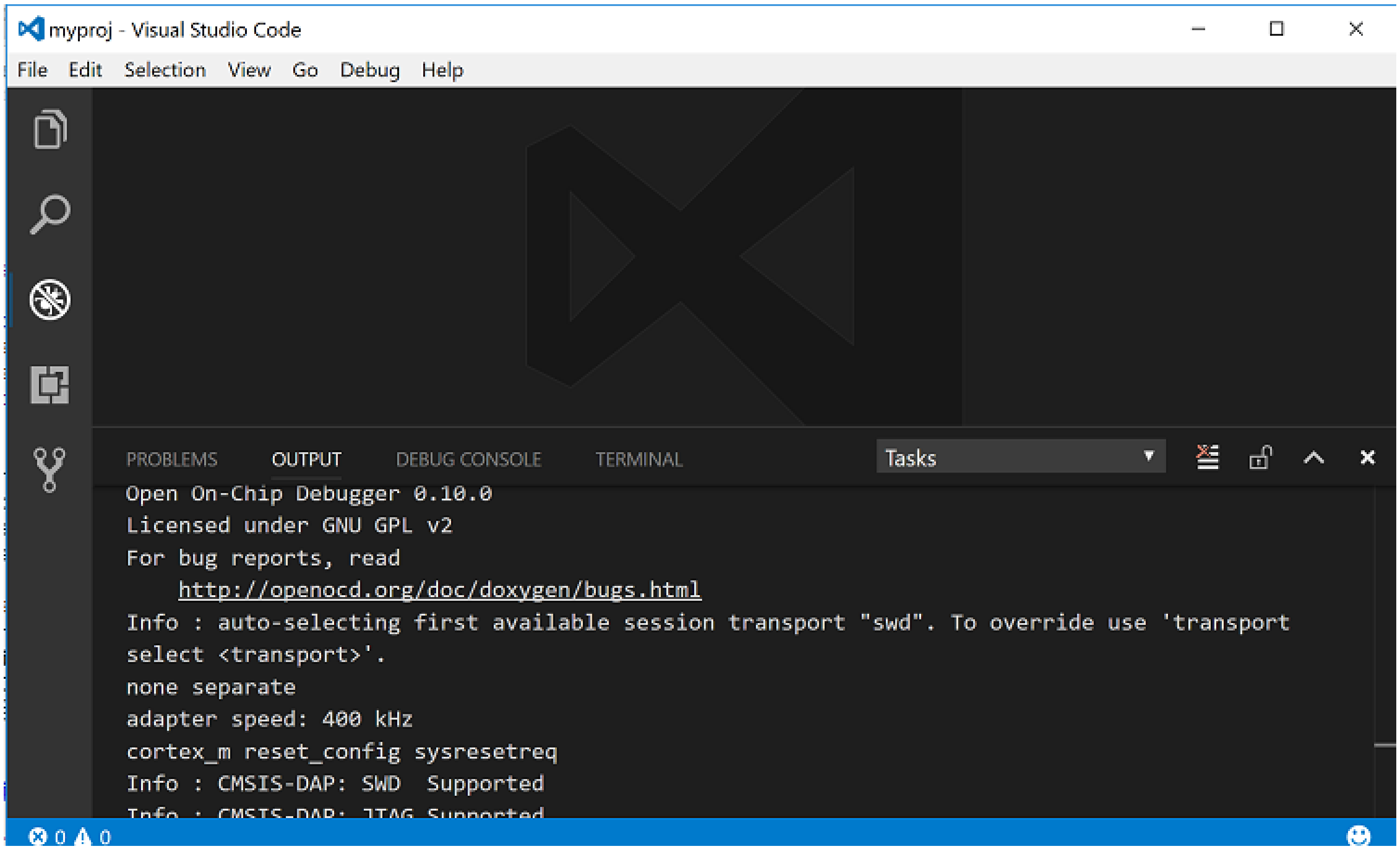
- The debugger is type **gdb**.
- To use the `blinky.elf` file for the executable.
- To use port 3333 to connect with the remote target.
- To use arm-none-eabi-gdb for the GDB program.

Debugging Your Application

To debug your application, start the GDB server and launch the GDB session from Visual Studio Code. For the the arduino blinky example, perform the following:

Step 1: Run the debug_arduino_blinky task to start the GDB server. Perform the following:

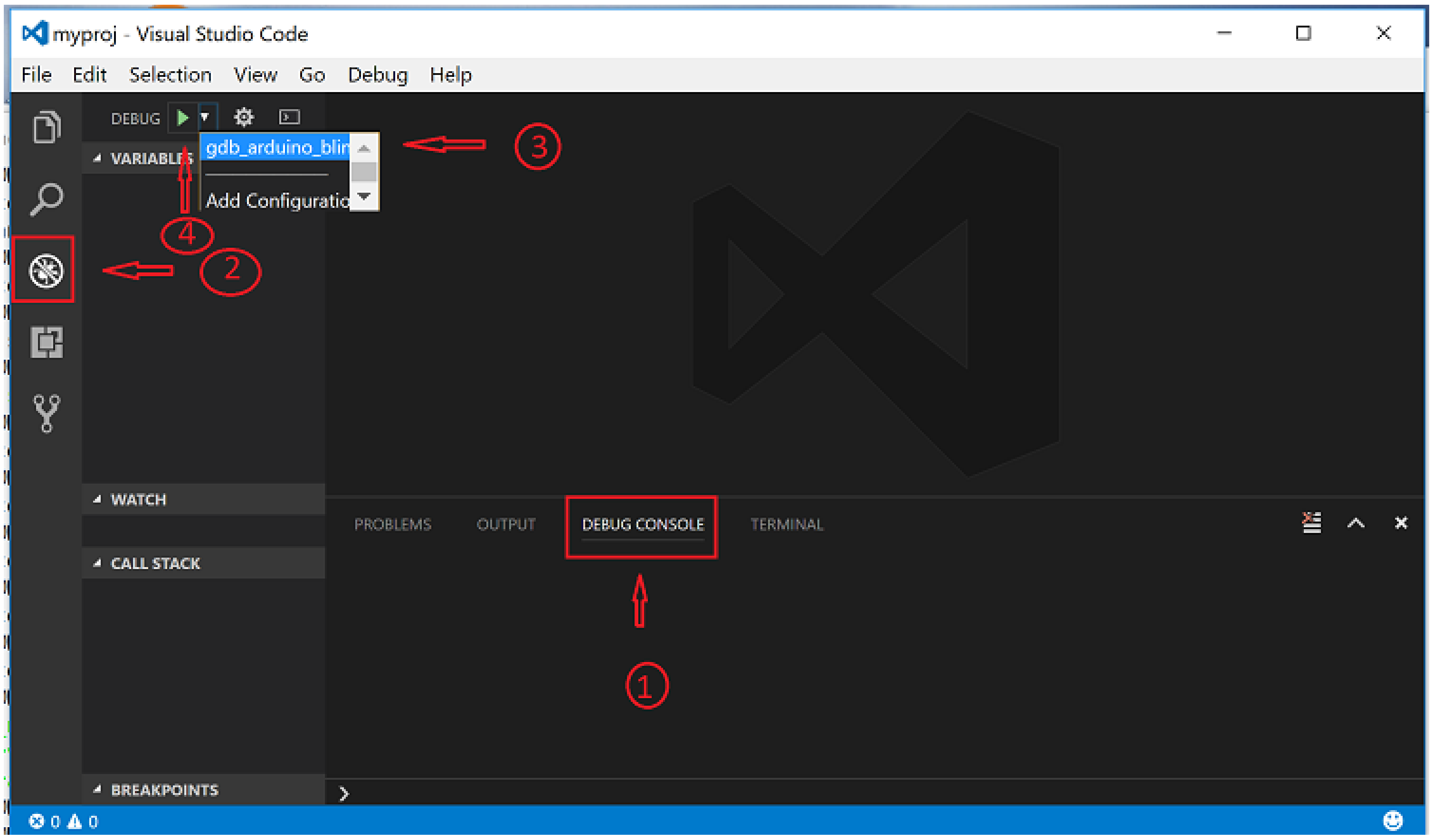
1. Press `Ctrl-Shift-P` and type `task` in the search box.
2. Select **Tasks:Run Task** > **debug_arduinoblinky**.
3. Press `Ctrl-Shift-U` to open the Output Panel and see the OpenOCD GDB Server output.


myproj - Visual Studio Code
File Edit Selection View Go Debug Help
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Tasks
0 0

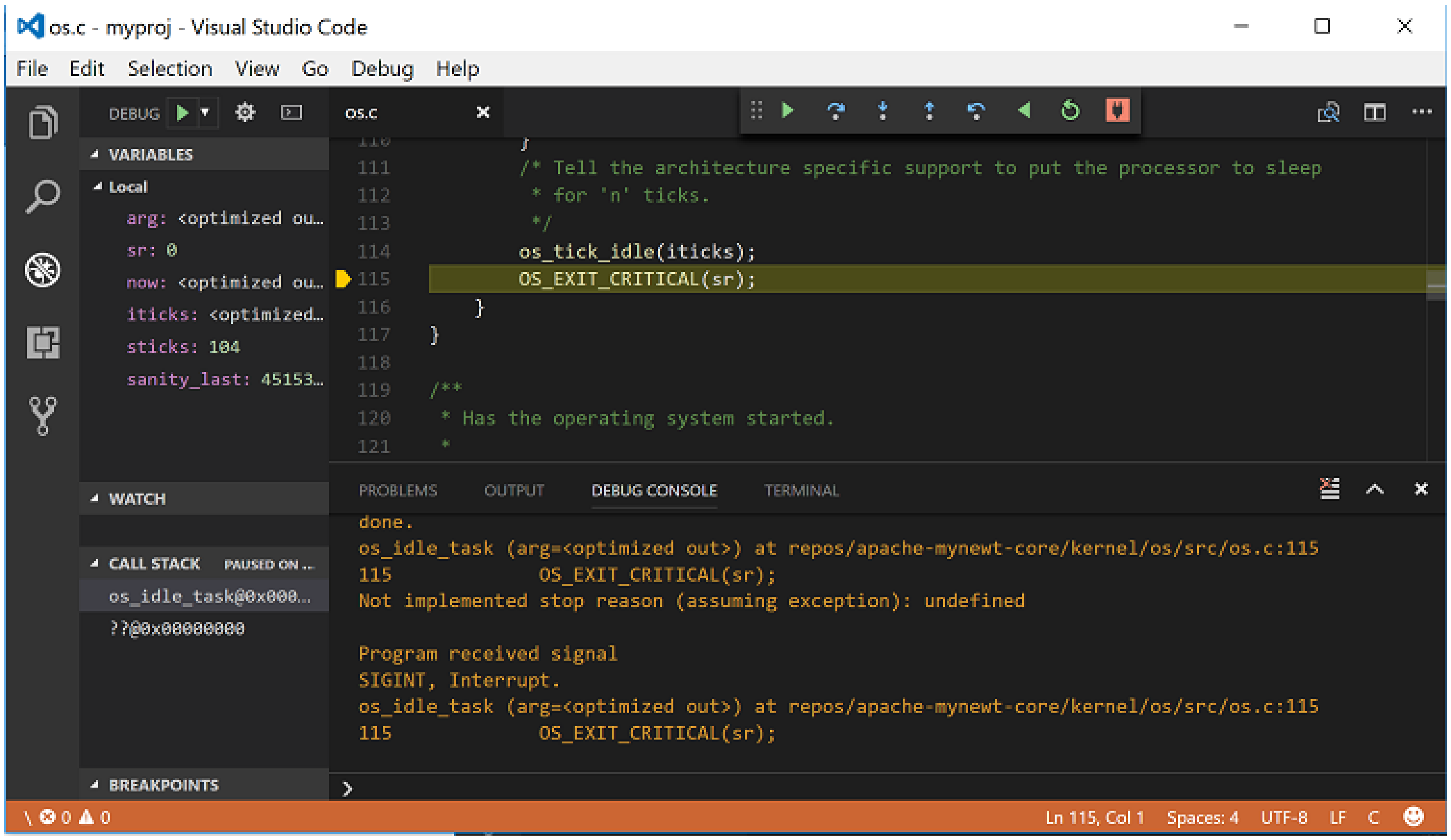
```
Open On-Chip Debugger 0.10.0
Licensed under GNU GPL v2
For bug reports, read
    http://openocd.org/doc/doxygen/bugs.html
Info : auto-selecting first available session transport "swd". To override use 'transport
select <transport>'.
none separate
adapter speed: 400 kHz
cortex_m reset_config sysresetreq
Info : CMSIS-DAP: SWD  Supported
Info : CMSIS-DAP: JTAG Supported
```

Step 2: Start the GDB session. Perform the following:

1. Press `Ctrl-Shift-Y` to view the Debug Console.
2. Press the Debugging icon on the activity bar (Ctrl-Shift-D) to bring up the Debug Side Bar.
3. Select `gdb_arduino_blinky` from the DEBUG drop down menu.
4. Press the green play button to start the gdb session.



Step 3: Debug your application. You should see a debug session similar to the one shown below:


os.c - myproj - Visual Studio Code
File Edit Selection View Go Debug Help
DEBUG
os.c
VARIABLES
Local
WATCH
CALL STACK PAUSED ON ...
BREAKPOINTS
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Ln 115, Col 1 Spaces: 4 UTF-8 LF C

```
arg: <optimized ou…
sr: 0
now: <optimized ou…
iticks: <optimized…
sticks: 104
sanity_last: 45153…
```

```
os_idle_task@0x000…
??@0x00000000
```

```
111         /* Tell the architecture specific support to put the processor to sleep
112          * for 'n' ticks.
113          */
114         os_tick_idle(iticks);
115         OS_EXIT_CRITICAL(sr);
116     }
117 }
118
119 /**
120  * Has the operating system started.
121  *
```

```
done.
os_idle_task (arg=<optimized out>) at repos/apache-mynewt-core/kernel/os/src/os.c:115
115             OS_EXIT_CRITICAL(sr);
Not implemented stop reason (assuming exception): undefined

Program received signal
SIGINT, Interrupt.
os_idle_task (arg=<optimized out>) at repos/apache-mynewt-core/kernel/os/src/os.c:115
115             OS_EXIT_CRITICAL(sr);
```

For more information on how to use the Visual Studio Code Debugger, see the Visual Studio Code debugging documentation (https://code.visualstudio.com/docs/editor/debugging).

Working with Multiple Mynewt Applications

As mentioned previously, each mynewt project corresponds to a Visual Studio Code workspace. If you have multiple Mynewt application targets defined in same project, you will need to define build and debug tasks for each target in the `tasks.json` file and debugger configurations for the targets in the `launch.json` file for the workspace. If you have a different Mynewt project for each mynewt application, you will need to define build and debug tasks in the `tasks.json` file and the debugger configuration in the `launch.json` file for each workspace.

Previous: Contributing to Newt or Newtmgr Tools (go_env.html)