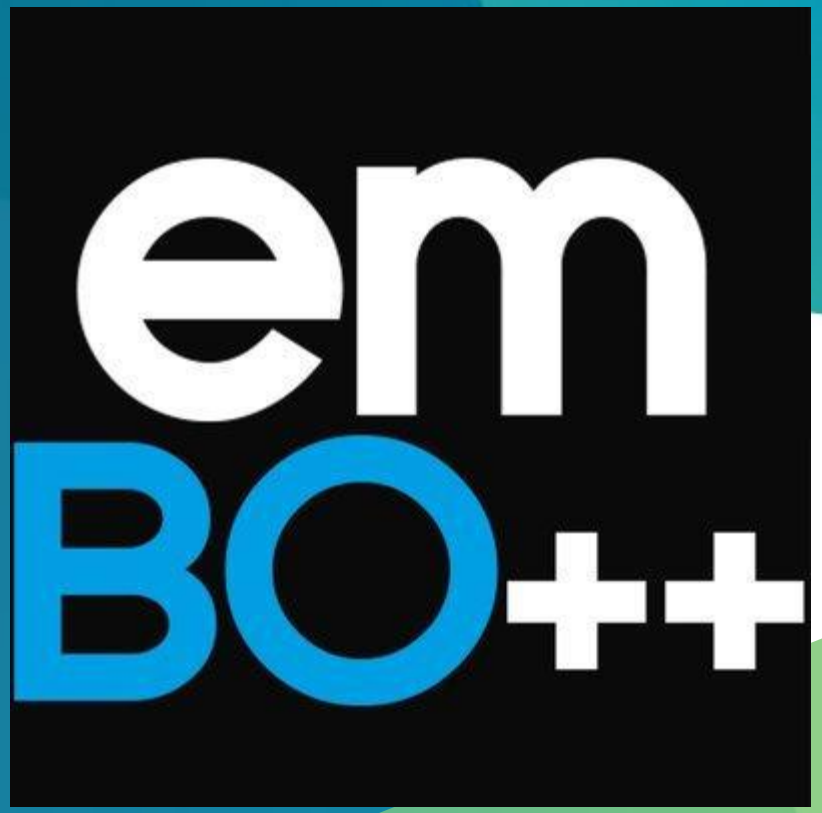

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Hands-on: Molding VS Code into a care-free development environment to develop with Zephyr RTOS

Jonas Nussdorfer

Global leader in **sensor**, **software**,
and **autonomous** technologies committed to

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				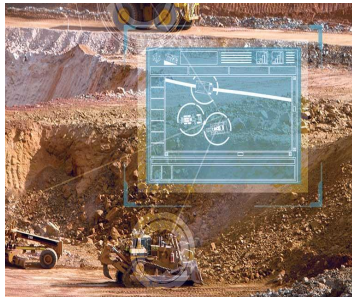

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Agenda

- Overview over Zephyr RTOS
  - Brief introduction
  - Typical project setup workflow
- Our development setup
  - Configuring VS Code
  - Evolution of the setup
- Demo of 1st time setup
- Summary & Outlook

Getting started with Zephyr

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Getting started with Zephyr

What is Zephyr?

From the Zephyr doc pages

- RTOS which is based on a small-footprint kernel
- Designed for resource-constrained and embedded systems

Some key features

- Highly configurable and modular setup (Kconfig)
- Hardware configuration described by devicetree
- Cross-architecture with wide range of supported boards
- Native development on Linux, macOS and Windows
- Native POSIX port, i.e. run your Zephyr application as a Linux application
- …

Getting started with Zephyr

Setting up a workspace

- Install dependencies
  - CMake
  - Python
  - Devicetree compiler
- Install Zephyr SDK
  - Download and install the SDK

Docker Container

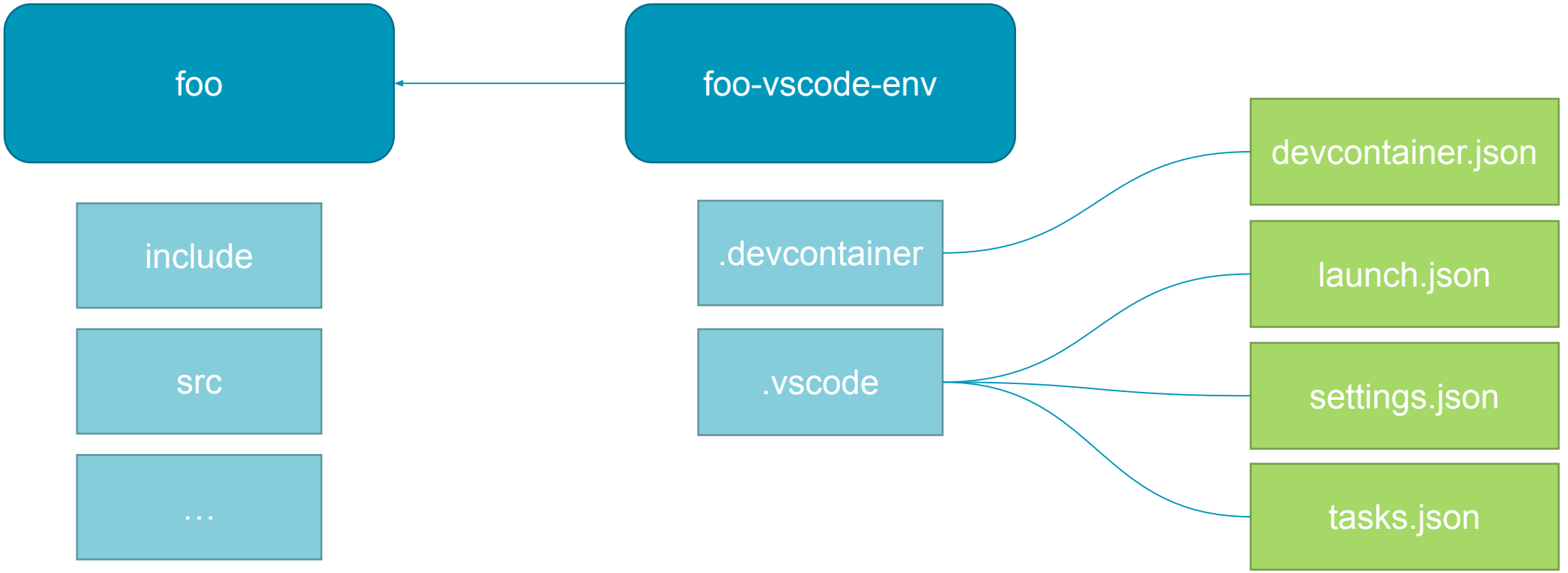
- Set up Zephyr
  - Install west (Zephyr build tool)
  - Initialize project directory via west and update
  - Export Zephyr CMake package
  - Install additional Python dependencies via pip

Custom Steps

Setting up the development environment

Setting up the development environment

First approach



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Development Containers

Docker container configuration with devcontainer.json

Configure what the container needs to run:

- Name
- Image specification or reference to Dockerfile from which to build
- Mounted folders
- Run arguments
- Container environment variables (alternatively via environment file)
- VS Code extensions

devcontainer.json

root > .devcontainer > devcontainer.json > ...

Jonas, 2 days ago | 2 authors (Jonas and others)

```
{
    "name": "Zephyr VS Code Template",
    "build": {
        "dockerfile": "Dockerfile"
    },
    "mounts": [
        "type=bind,source=${env:HOME}/.ssh,target=/home/zephyr/.ssh"
    ],
    "runArgs": [
        "--cap-add=SYS_PTRACE",
        "--security-opt",
        "seccomp=unconfined"
    ],
    "customizations": {
        "vscode": {
            "extensions": [
                "ms-vscode.cpptools",
                "ms-vscode.cmake-tools",
                "matepek.vscode-catch2-test-adapter",
                "actboy168.tasks",
                "eamodio.gitlens",
                "twxs.cmake",
                "asciidoctor.asciidoctor-vscode",
                "jebbs.plantuml"
            ]
        }
    }
}
```


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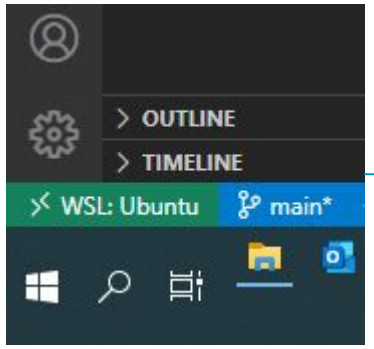
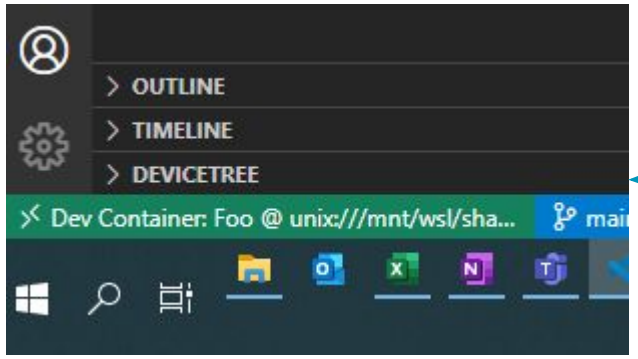
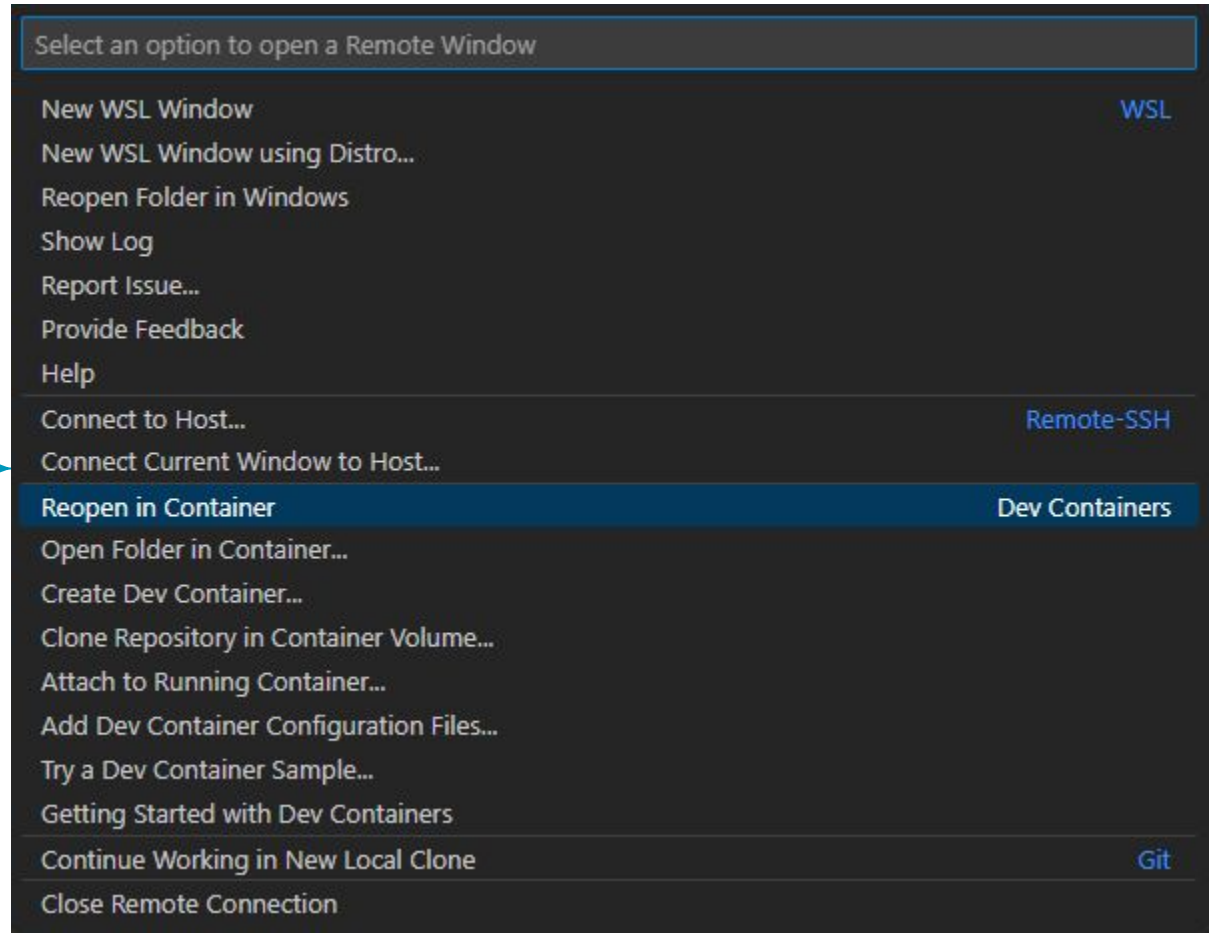
Development Containers

Setting up VS Code with devcontainer.json (1st time)







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Development Containers

Dev containers in VS Code wrapped up

Required extensions

- Docker
- Dev Containers
- WSL (if on Windows)

No extensions specific to development required

Remarks for Windows

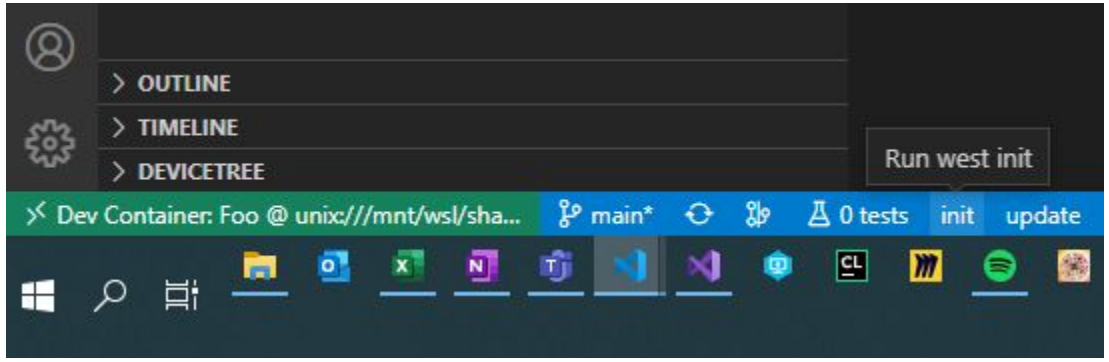
- Docker requires **WSL2** (Docker Desktop for Windows can be used, but WSL2 variant is free)
- Remember to pay attention to potential line ending conversions
- Code should be «hosted» in WSL for better performance (inside virtual hard disk/vhdx)

VS Code Configuration

Customizing Zephyr setup steps with tasks.json

Recall from Zephyr introduction:

- Initialize project with west (Zephyr meta-tool)
- Install some additional dependencies via pip
- Flash your device
- …



tasks.json U

tasks.json > ...

```
{
    "version": "2.0.0",
    "problemMatcher": [],
    "tasks": [
        {
            "label": "init",
            "detail": "Run west init",
            "type": "shell",
            "command": "west init --local firmware",
            "options": {
                "cwd": "${workspaceFolder:root}",
                "statusbar": {
                    "hide": false
                }
            }
        },
        {
            "label": "update",
            "detail": "Run west update",
            "type": "shell",
            "command": "west update",
            "options": {
                "cwd": "${workspaceFolder:root}",
                "statusbar": {
                    "hide": false
                }
            }
        }
    ]
}
```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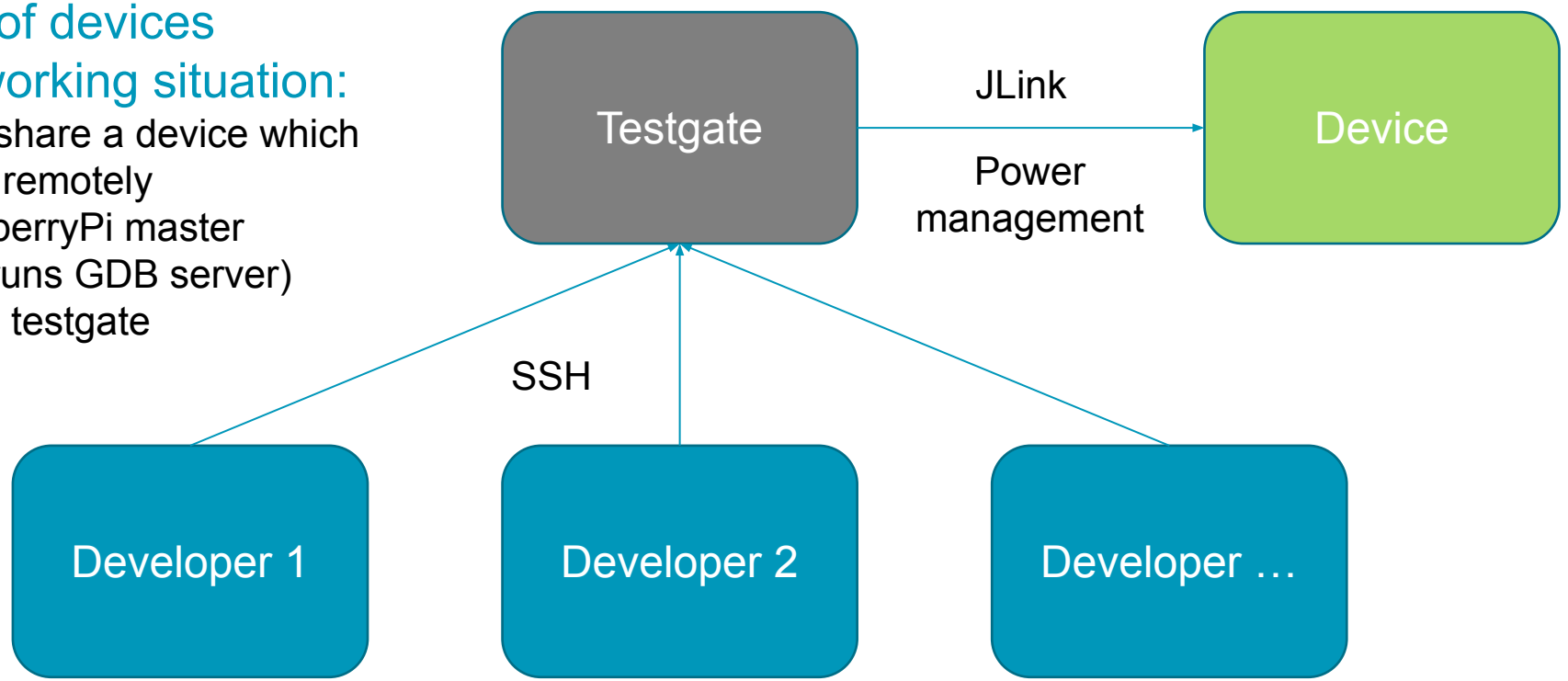
VS Code Configuration

Remote debugging

Due to limited number of devices available and remote working situation:

- Multiple developers share a device which has to be debugged remotely
- Connection to RaspberryPi master (testgate) via SSH (runs GDB server)
- Device connected to testgate



VS Code Configuration

Houston, we have liftoff with launch.json

Define launch configurations:

- Name
- Executable
- Device
- GDB settings
- Tasks to execute before launch
- …

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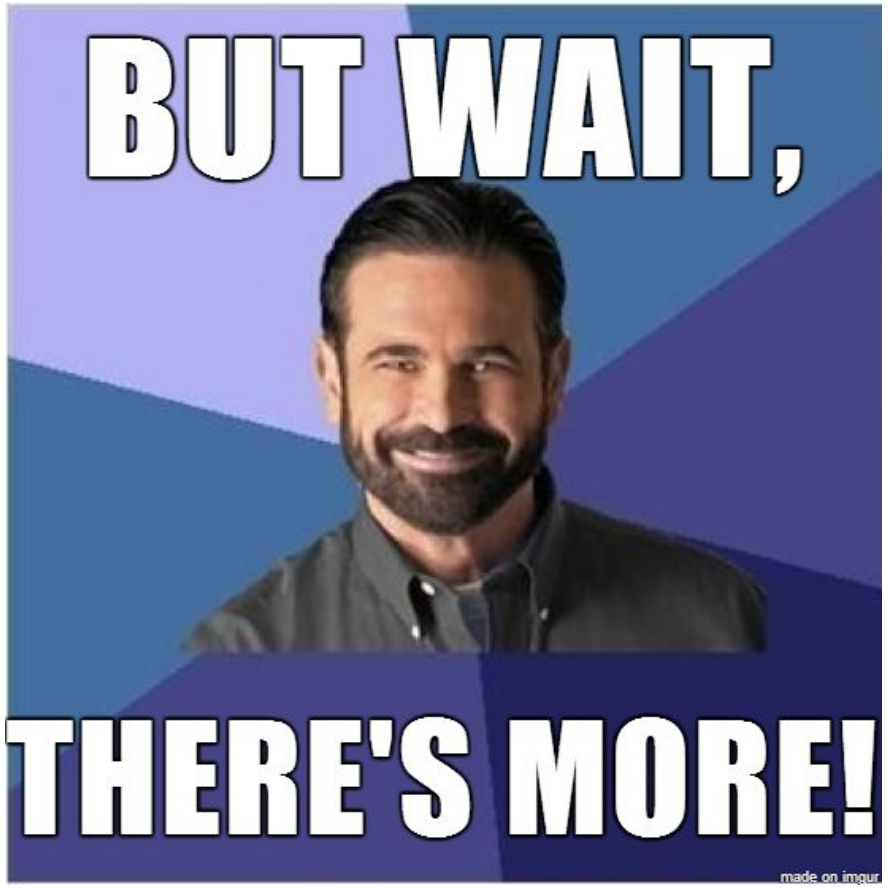
VS Code Dev Setup

Recap until now

How mature is the setup?

- ✔ Custom steps can be represented by a task, grouping tasks also possible
- ✔ Everything that is needed to develop (dependencies, tooling, etc…) is inside the docker container
- ✔ Remote debugging is set up and configured by a launch file
- ✔ Developer only needs a minimal setup (Docker, VS Code + some extensions, git)

At this point anyone can clone the repo and collaborate right away without being plagued by a complex development environment setup



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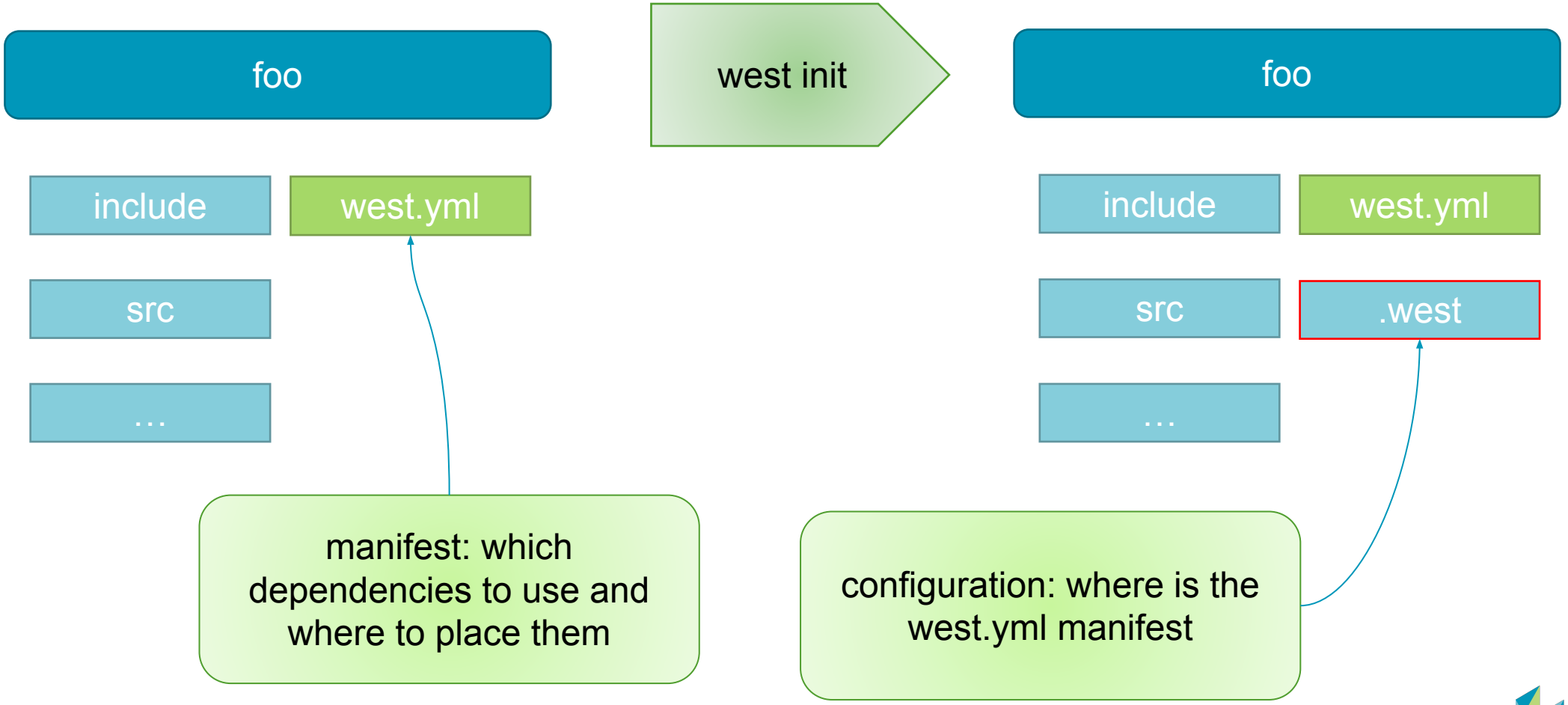
Zephyr Project Structure

Initializing



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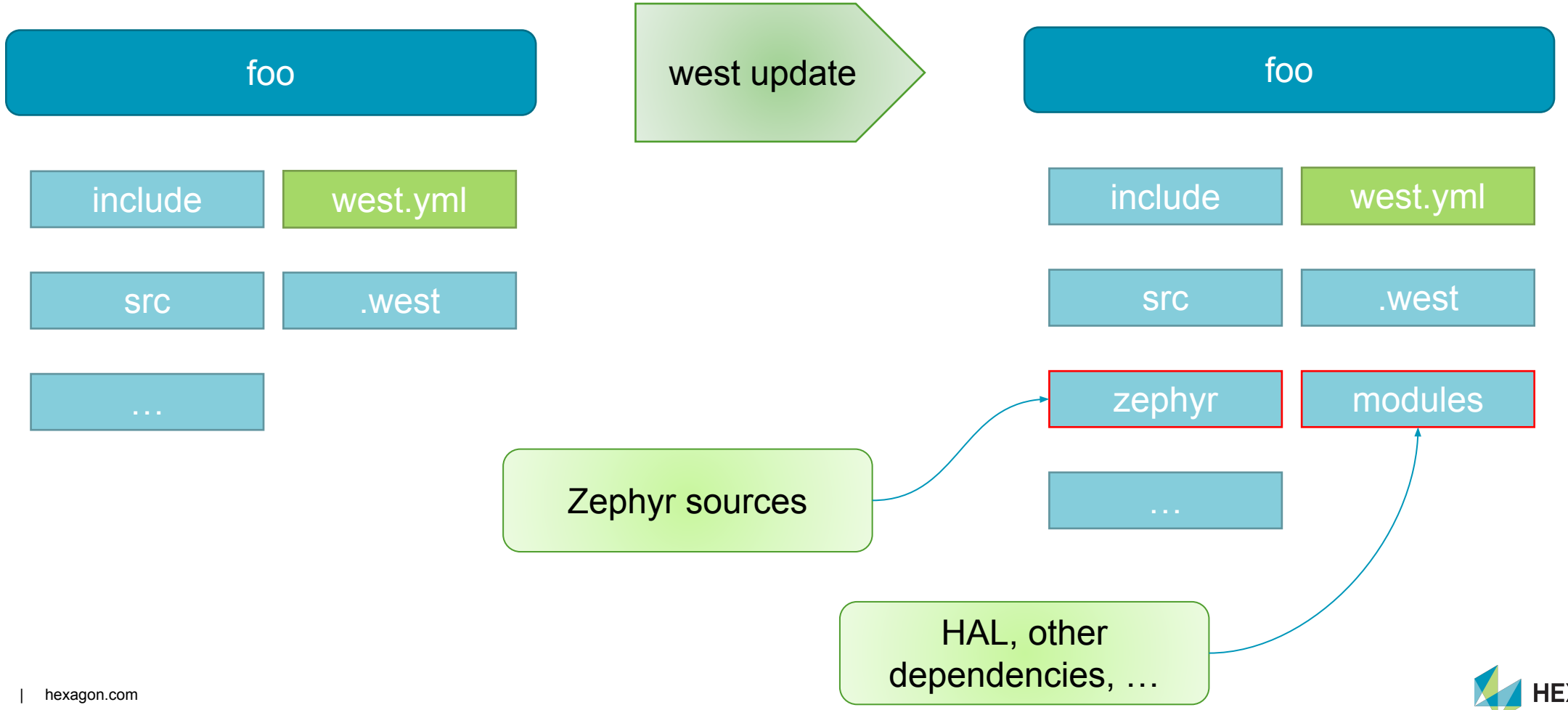
Zephyr Project Structure

Retrieving Zephyr sources and dependencies



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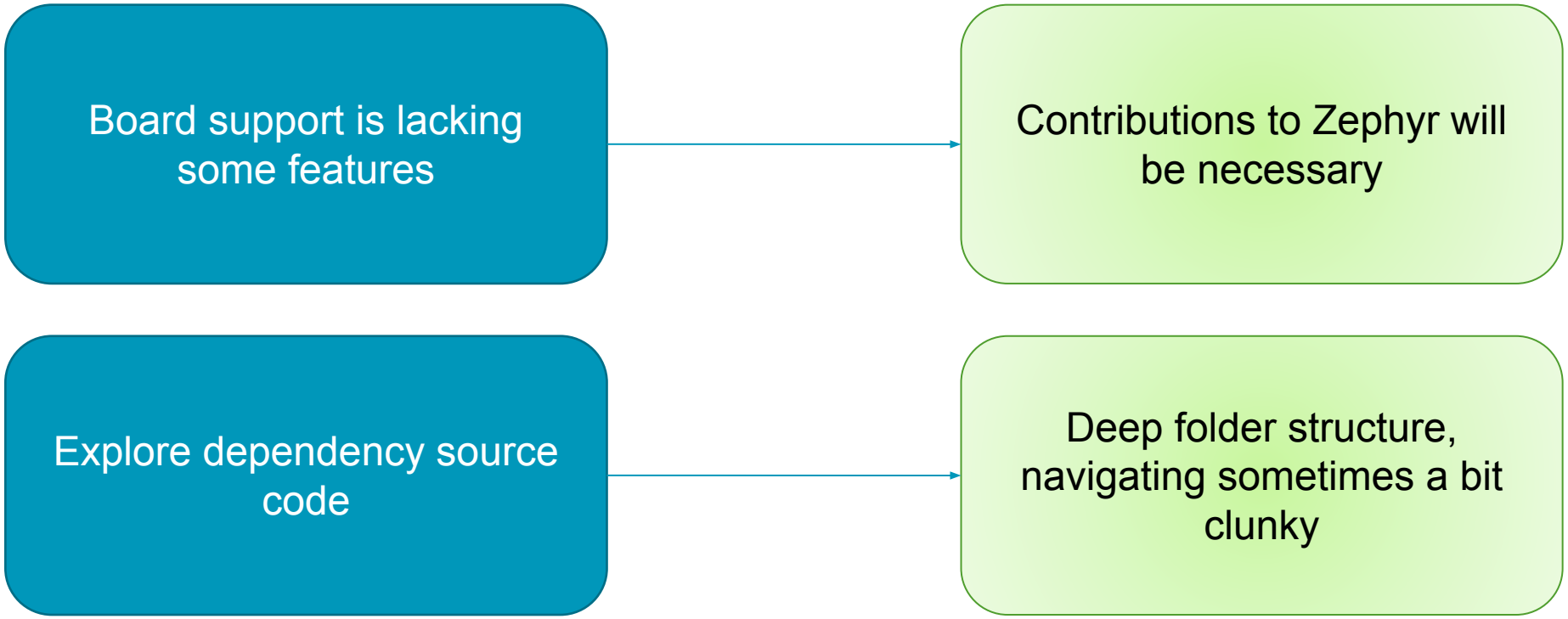
Development Pains

Interlude



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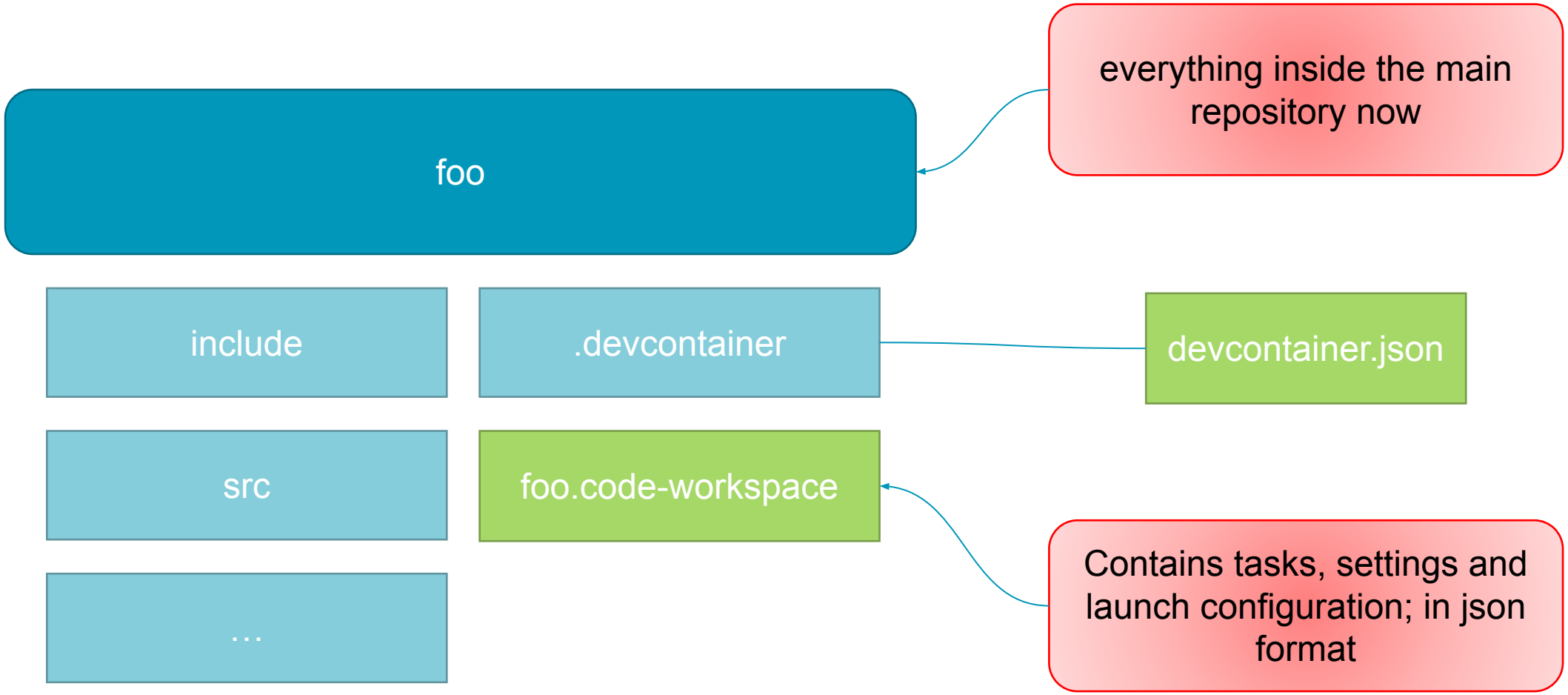
VS Code Workspaces

Redux of the development setup



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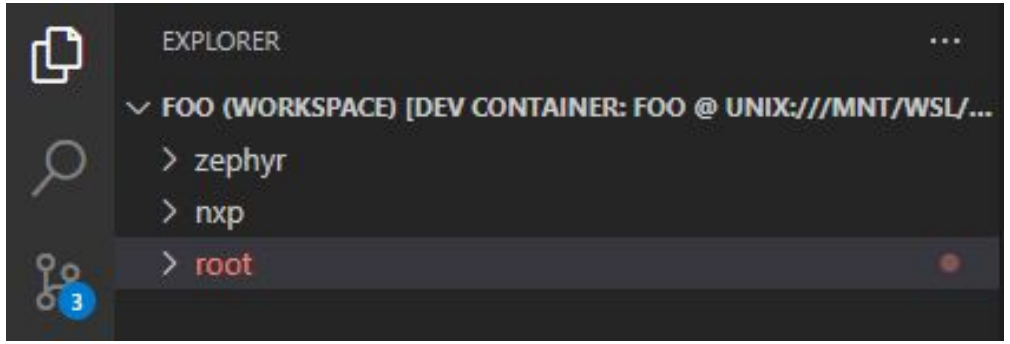
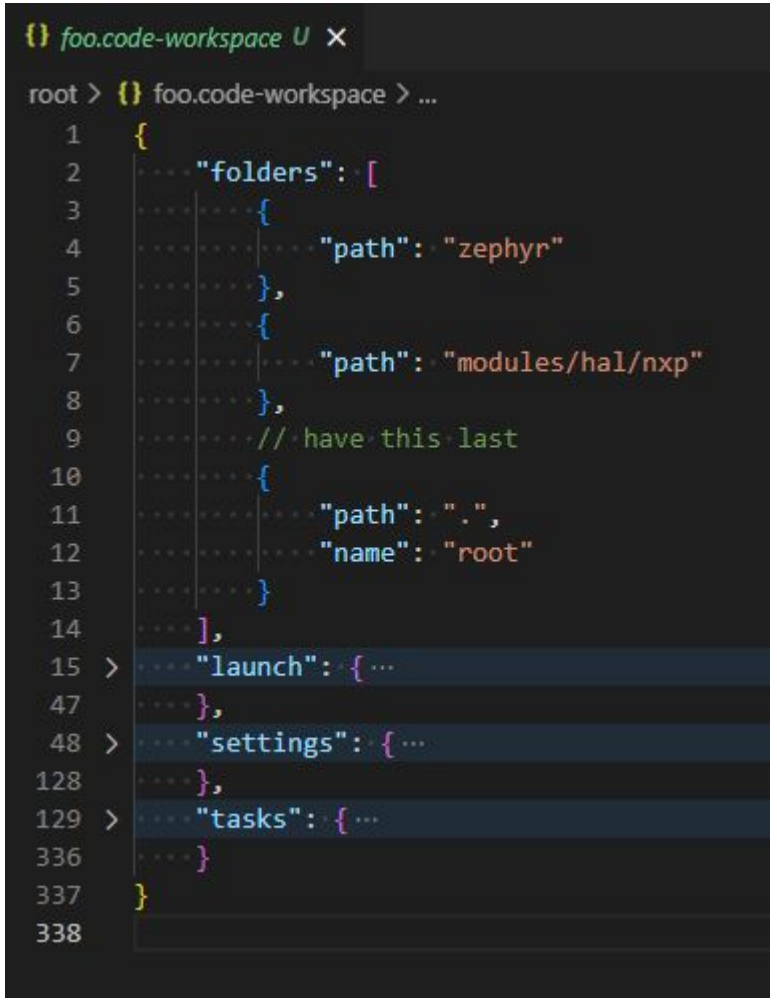
VS Code Workspaces

Multiple repositories/folders

- Workspace files enable working on multiple projects in the same VS Code instance
- Folders that used to be buried deeper in the project are now made more accessible
- Note: Child nodes for launch, settings and tasks are now absorbed in the workspace file





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Demo

Select nuj@AHERDSKNUJ01: ~/Projects/embo

```
nuj@AHERDSKNUJ01:~/Projects/embo$
```

Outlook

Summary

Looking beyond

Some success stories after 1 year:

- Used by our team and a few other teams working on Zephyr projects
- New colleagues had a much easier time getting started
- Other teams working on Windows but developing inside a docker container have also started using this setup pattern (different container and extensions)
- Recently we ported a legacy project to cmake where we also introduced this setup (Freescale/NXP MQX based embedded project)

Link to GitHub repository:

We’re hiring!

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Thank you!

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Extra Slides

Additional Tools and Frameworks

Things we picked up along the way

- CMakePresets.json
  - Predefined configurations to build (e.g. build type, cache variables, toolchain, etc…)
- AsciiDoc
  - Extension for VS Code so we can edit the project documentation
- PlantUML
  - Installed in container, enhance documentation with UML
- Dotnet
  - System automation tests are C#-based
  - Installed in docker container + VS Code extension
  - Possible to execute in container AND debug simultaneously with embedded application
- Puncover
  - tool that allows to see which parts of the code base are expensive with respect to size