

CI/CD with OpenModelica for Library and Tool developers

Andreas Heuermann

Hochschule Bielefeld - University of Applied Sciences and Arts

Institute for Data Science Solutions

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AGENDA

1. **CI/CD in OpenModelica eco-system**
2. **GitHub Workflows**
 - ┆ **setup-openmodelica action**
 - ┆ **openmodelica-library-testing action**
3. **VS Code Extension**
 - ┆ **Modelica language server**

CI/CD IN A NUTSHELL

- ┃ Continuous Integration & Continuous Delivery (*or Development*)
 - ┃ CI: Frequent merging of small changes
 - ┃ CD: Release software at any time

Basic Idea

- ┃ Test before you break stuff!
- ┃ Fast release cycles

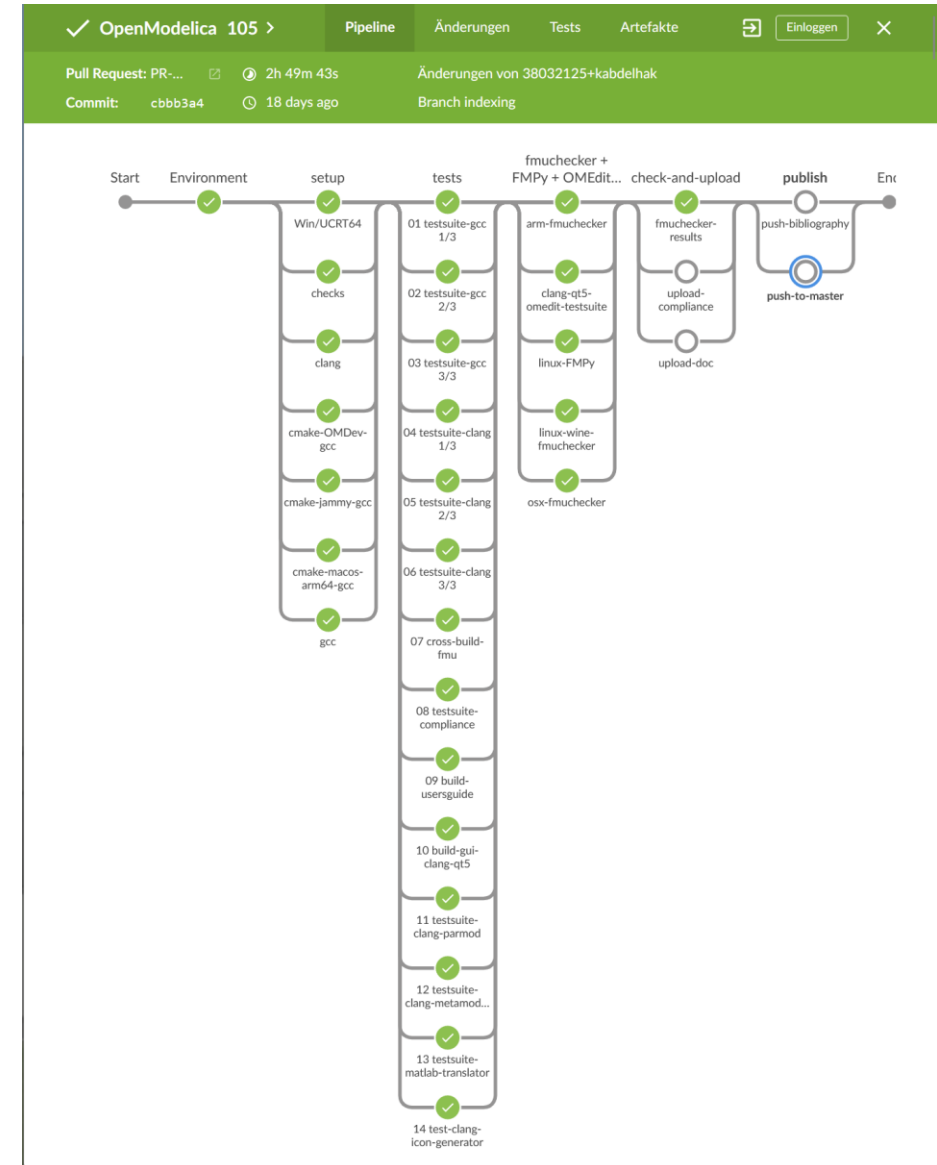
CI/CD AND OPENMODELICA

Git + GitHub + Jenkins + Docker

Testing Pull Requests

MSYS2 change MINGW64 to UCRT64
[#10939](#)

- Unit test on Windows / Linux / Mac with different toolchains.
- Ensure I wrack less havoc.



OPENMODELICA LIBRARY COVERAGE TESTS

Modelica_4.0.0 test using OpenModelica

Total	Frontend	Backend	SimCode	Templates	Compilation	Simulation	Verification
514	514	514	514	514	513	504	486

Test started: 2024-01-24 00:52:58

Total time taken: 1:07:43

System info: AMD Ryzen 9 5950X 16-Core Processor, 63 GB RAM, Ubuntu 22.04.3 LTS

OpenModelica Version: OMCompiler v1.23.0-dev.241+g00dc99398b

OpenModelicaLibraryTesting Changes

Commit	Date	Author	Summary
e188a42	2024-01-22 14:42:30	+0100 Andreas	Adding CI (#53)

Modelica_4.0.0

Version	v1.12					v1.13			
	4.0.0+maint.om (74d056ef1b4a89463408ba70fc4ea4db83a6296f)					4.0.0+maint.om (74d056ef1b4a89463408ba70fc4ea4db83a6296f)			
Branch	Total	Parsing	Frontend	Backend	SimCode	Templates	Compilation	Simulation	Verification
v1.12	514	514	509	497	497	497	479	469	437
v1.13	514	514	512	504	504	504	504	491	455
v1.14	514	514	512	509	509	509	508	499	463
v1.16	514	514	512	509	509	509	477	464	428
v1.17	514	514	514	512	512	511	507	494	451
v1.18	514	514	514	511	511	510	506	497	456
v1.19	514	514	514	512	512	512	512	504	484
v1.20	514	514	512	512	512	512	512	504	484
v1.21	514	514	514	512	512	512	512	504	484
v1.22	514	514	514	514	514	514	513	505	484
master	514	514	514	514	514	514	513	504	486
Branch	Total	Parsing	Frontend	Backend	SimCode	Templates	Compilation	Simulation	Verification
v1.12	1:11:10	0:12:31	0:09:01	0:02:50	0:01:26	48.48	0:21:17	0:18:06	0:01:21
v1.13	1:13:19	0:14:36	0:11:32	0:03:17	0:02:08	0:01:00	0:18:54	0:16:11	0:01:36
v1.14	1:14:57	0:14:06	0:11:42	0:03:55	0:02:00	0:01:00	0:19:36	0:16:48	0:01:34
v1.16	1:13:58	0:14:16	0:10:16	0:04:12	0:02:22	59.25	0:18:46	0:17:17	0:01:25
v1.17	1:07:15	0:12:56	0:01:54	0:03:44	0:02:15	48.71	0:20:36	0:18:31	0:01:34
v1.18	1:07:30	0:13:01	0:02:00	0:03:36	0:02:12	49.01	0:21:10	0:18:23	0:01:34
v1.19	1:10:39	0:13:53	0:02:18	0:03:57	0:01:09	55.87	0:22:09	0:20:32	0:01:35
v1.20	1:08:00	0:13:07	0:02:05	0:03:42	59.39	51.00	0:21:31	0:20:13	0:01:32
v1.21	1:11:24	0:13:44	0:02:22	0:04:33	0:01:11	55.39	0:22:56	0:19:54	0:01:37
v1.22	1:10:26	0:13:51	0:02:16	0:04:04	0:01:12	56.07	0:23:03	0:18:47	0:01:42
master	1:07:43	0:13:12	0:02:08	0:03:50	0:01:02	53.73	0:22:20	0:18:21	0:01:34

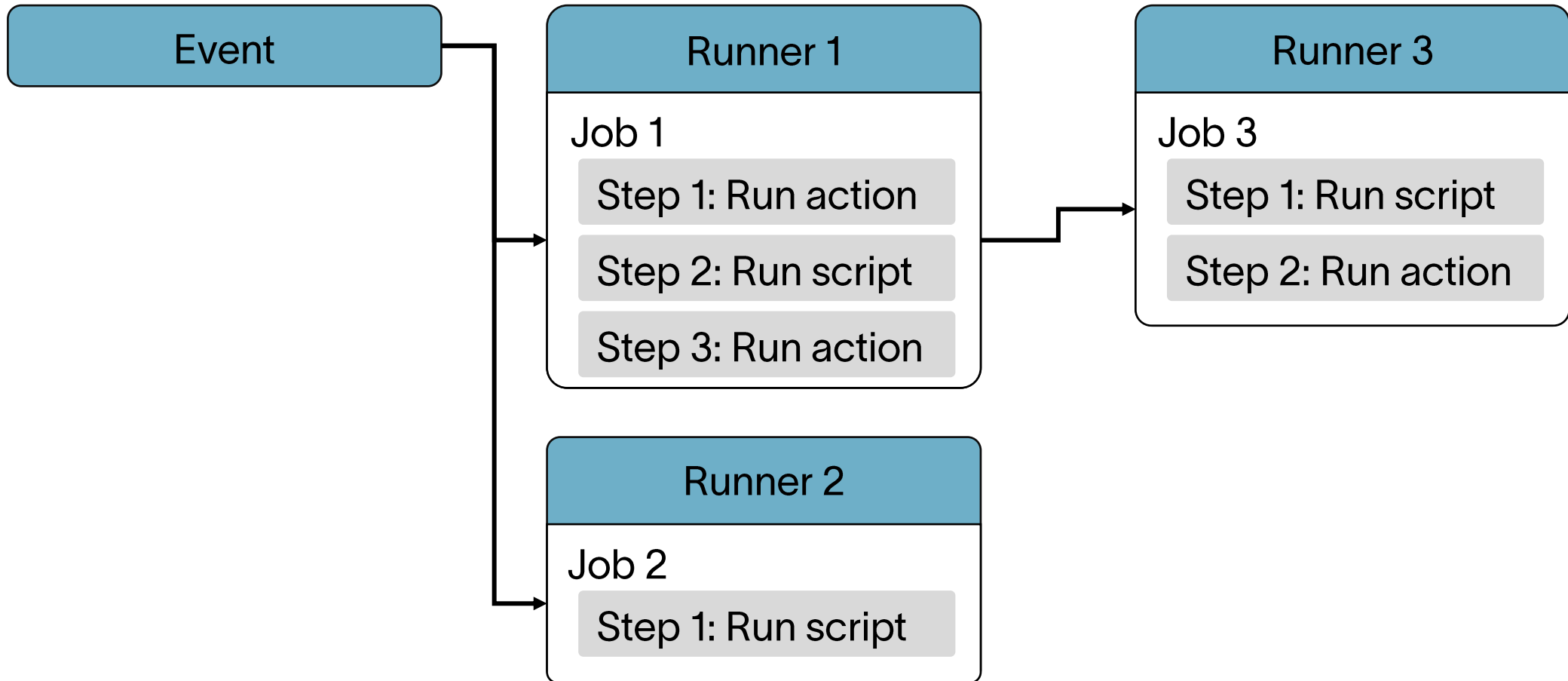
OTHER OPENMODELICA TOOLS

- ┆ Testing OpenModelica APIs
 - ┆ OMPython Python scripting interface
 - ┆ OMJulia.jl Julia scripting interface
- ┆ Testing compatibility with 3rd party tools
 - ┆ FMI export and import

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WORKFLOWS



A workflow is a configurable automated process that will run one or more jobs. Workflows are defined by a YAML file checked in to your repository and will run when triggered by an event in your repository, or they can be triggered manually, or at a defined schedule.

From: <https://docs.github.com/en/actions/using-workflows/about-workflows#about-workflows>

GITHUB WORKFLOWS AND ACTIONS

- ┆ Workflows: Easy-to-integrate CI/CD pipelines on GitHub
- ┆ Actions: Reusable packages to perform specific tasks in your workflows.

```
name: Test
on: [push]
jobs:
  unit-test:
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v4
      - uses: OpenModelica/setup-openmodelica@v1
      - run: omc --version
```

`.github/workflows/test.yml`

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SETTING UP OPENMODELICA

- ┃ Get OpenModelica into your environment

Scripts

- ┃ OS dependent
- ┃ Easy to set up
- ┃ Difficult to maintain

Docker

- ┃ Fast
- ┃ Linux only
- ┃ Keep up-to-date

Actions

- ┃ Combine with scripts or Docker images
- ┃ Reusable

SETUP-OPENMODELICA

GitHub Action: [OpenModelica/setup-openmodelica](https://github.com/OpenModelica/setup-openmodelica)

```
- uses: OpenModelica/setup-openmodelica@v1
  with:
    version: '1.22.1'
    packages: |
      'omc'
      'omsimulator'
    libraries: |
      'Modelica 4.0.0'
      'Modelica 3.2.3+maint.om'
    omc-diff: true
```

CURRENTLY SUPPORTED

┆ Linux

- ┆ Advanced Packaging Tool (APT)

- ┆ Most non-GUI OM packages

 - ┆ OpenModelica Compiler, OMSimulator, omc-diff, ...

┆ Windows

- ┆ Full installer

- ┆ Most OpenModelica versions

PLANNED

- | Mac support
- | Optional Docker container
- | Archive libraries

The screenshot shows a diff view of a GitHub Actions workflow file named `.github/workflows/test.yml`. The diff highlights a change in the `uses` field of a job step. The original code (left) uses `AnHeuermann/setup-openmodelica@v0.7`, while the updated code (right) uses `OpenModelica/setup-openmodelica@v1`. The diff also shows the `with` block containing `version: ${{ matrix.omc-version }}` and `packages: |`.

```

@@ -22,7 +22,7 @@ jobs:
  22     uses: actions/checkout@v4
  23
  24     - name: Setup OpenModelica
  25     - uses: AnHeuermann/setup-openmodelica@v0.7
  26       with:
  27         version: ${{ matrix.omc-version }}
  28         packages: |
  22     uses: actions/checkout@v4
  23
  24     - name: Setup OpenModelica
  25     + uses: OpenModelica/setup-openmodelica@v1
  26       with:
  27         version: ${{ matrix.omc-version }}
  28         packages: |
  
```

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OPENMODELICA-LIBRARY-TESTING

GitHub Action: [OpenModelica/openmodelica-library-testing-action](#)

```
- uses: OpenModelica/openmodelica-library-testing@v0.1
  with:
    library: 'MyLibrary'
    library-version: '2.2.0'
    modelica-file: 'MyLibrary/package.mo'
    omc-version: 'stable'
    reference-files-dir: 'ReferenceFiles'
    reference-files-extension: 'mat'
    reference-files-delimiter: '.'
    pages-root-url: 'https://USERNAME.github.io/REPOSITORY/'
```

OPENMODELICA-LIBRARY-TESTING

- Easy way to use OpenModelicaLibraryTesting

- <https://github.com/OpenModelica/OpenModelicaLibraryTesting>



- Automated conf.json generation

- Setup and run Python scripts

- Test all modles with experiment annotation

- Compare simulation results to reference

- Generate HTML coverage report

- Collect and archive results

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PNLIB DEMO

test (stable) summary ...

Summary

Total	Frontend	Backend	SimCode	Templates	Compilation	Simulation	Verification
92	92	92	92	92	92	92	92

Results

Model	Verified	Simulate	Total buildModel	Parsing	Frontend	Backend	SimCode	Template:
PNlib.Examples.ConTest.Conflict (sim)	0.01 (13 verified)	0.05	3.90	2.02	0.11	0.40	0.03	0.09
PNlib.Examples.ConTest.ConflictLoop (sim)	0.01 (13 verified)	0.35	4.53	2.00	0.11	0.61	0.05	0.12

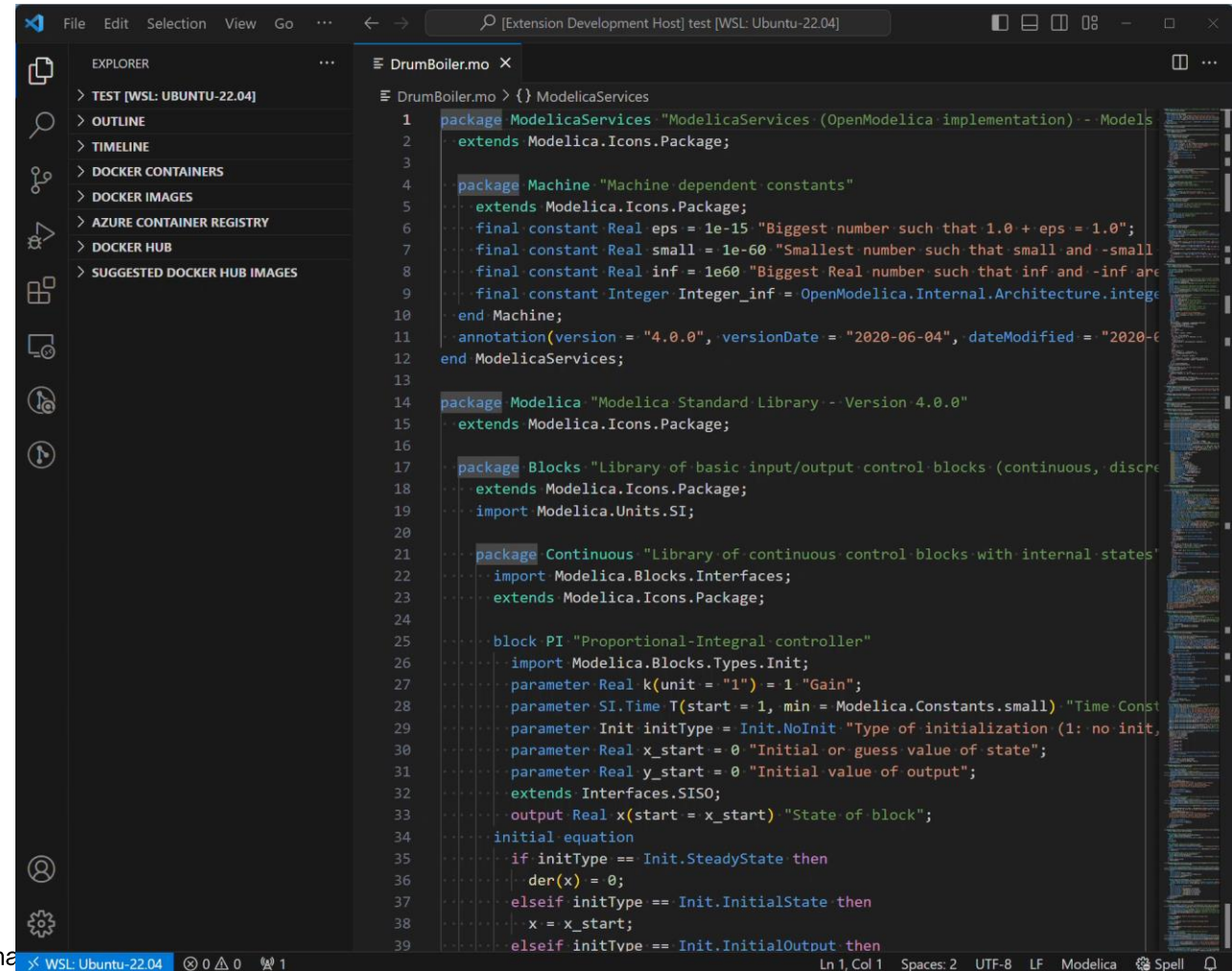
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MODELICA LANGUAGE SERVER

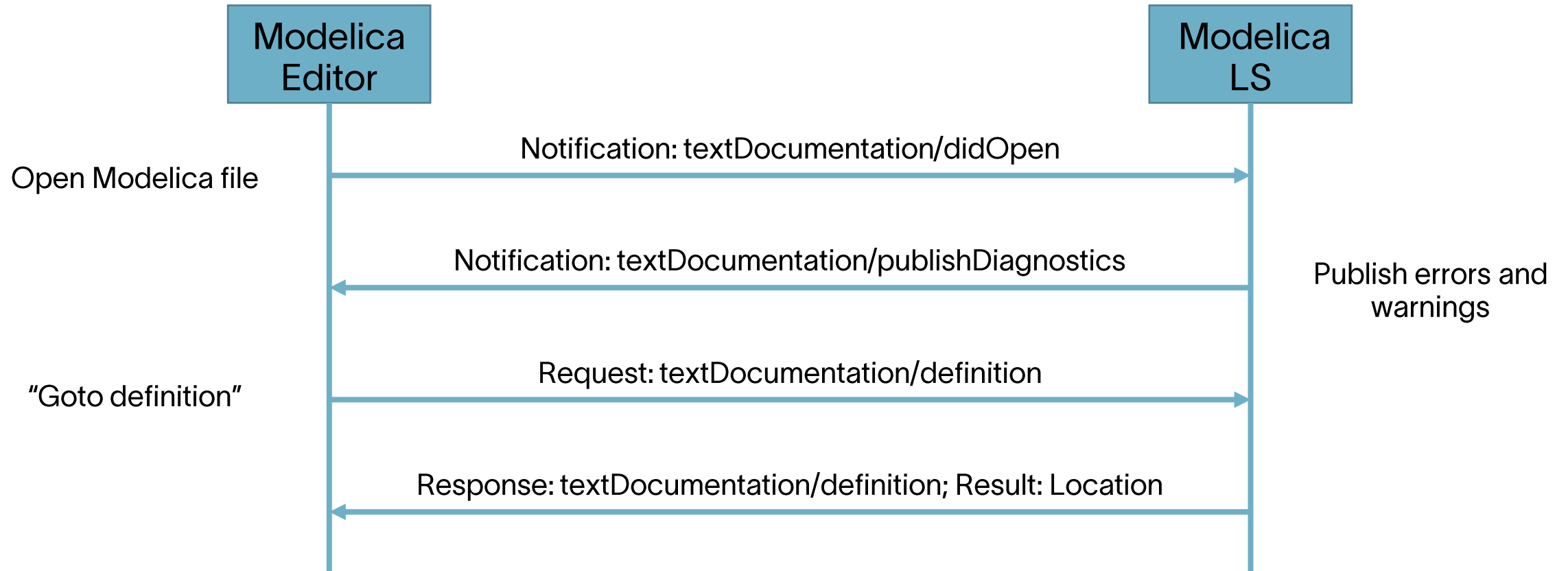
Based on

- Language Server Protocol (LSP)
- Tree-sitter parser
 - OpenModelica/tree-sitter-modelica



```
1 package ModelicaServices "ModelicaServices (OpenModelica implementation) - Models"
2   extends Modelica.Icons.Package;
3
4   package Machine "Machine dependent constants"
5     extends Modelica.Icons.Package;
6     final constant Real eps = 1e-15 "Biggest number such that 1.0 + eps = 1.0";
7     final constant Real small = 1e-60 "Smallest number such that small and -small
8     final constant Real inf = 1e60 "Biggest Real number such that inf and -inf are
9     final constant Integer Integer_inf = OpenModelica.Internal.Architecture.integer_inf;
10  end Machine;
11  annotation(version = "4.0.0", versionDate = "2020-06-04", dateModified = "2020-06-04");
12 end ModelicaServices;
13
14 package Modelica "Modelica Standard Library - Version 4.0.0"
15   extends Modelica.Icons.Package;
16
17   package Blocks "Library of basic input/output control blocks (continuous, discrete)"
18     extends Modelica.Icons.Package;
19     import Modelica.Units.SI;
20
21     package Continuous "Library of continuous control blocks with internal states"
22       import Modelica.Blocks.Interfaces;
23       extends Modelica.Icons.Package;
24
25       block PI "Proportional-Integral controller"
26         import Modelica.Blocks.Types.Init;
27         parameter Real k(unit = "1") = 1 "Gain";
28         parameter SI.Time T(start = 1, min = Modelica.Constants.small) "Time Constant";
29         parameter Init initType = Init.NoInit "Type of initialization (1: no init, 2: steady state, 3: initial state)";
30         parameter Real x_start = 0 "Initial or guess value of state";
31         parameter Real y_start = 0 "Initial value of output";
32         extends Interfaces.SISO;
33         output Real x(start = x_start) "State of block";
34         initial equation
35           if initType == Init.SteadyState then
36             der(x) = 0;
37           elseif initType == Init.InitialState then
38             x = x_start;
39           elseif initType == Init.InitialOutput then
```

LANGUAGE SERVER PROTOCOL



MODELICA LANGUAGE SERVER

Currently available features

- Document Symbol Provider

Planned features

- [WIP] Documentation on hover
- Go to Definition
- Auto complete
- Sematic Highlighting

```
1 package p "Description"
2   · model x
3   · extends bar;
4   · end x;
5
6   · model foo "Description"
7   ·   · Real x;
8   · end foo;
9
10  · model bar "Description"
11  ·   · Real x;
12  ·   · equation
13  ·     · x = 1;
14  ·   · end bar;
15 end p;
```

CONCLUSION

I GitHub Actions

- I [OpenModelica/setup-openmodelica](#)

- I [OpenModelica/openmodelica-library-testing-action](#)

I VS Code Extension

- I [OpenModelica/modelica-language-server](#)

- I Soon™: [OpenModelica/metamodelica-language-server](#)

Contributions are welcome

The presented work is part of the PHyMoS project, supported by the German Federal Ministry for Economic Affairs and Climate Action.

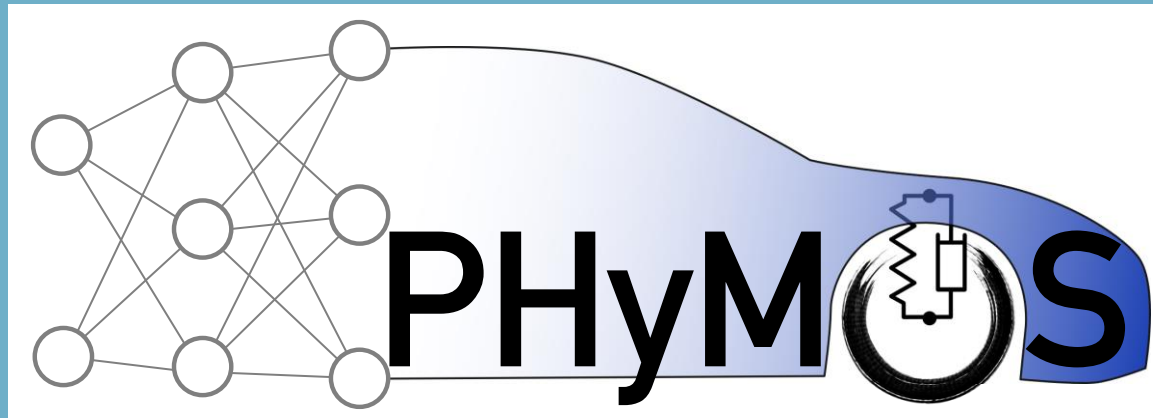
Supported by:



Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag

Project number: 19120022G



Proper Hybrid Models for Smarter Vehicles