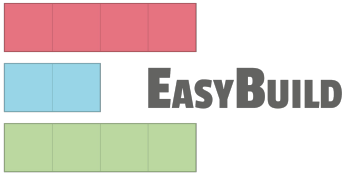

EESSI CI/CD Webinar

11 May 2026 - Alan O'Cais

https://www.eessi.io/docs/training-events/2026/webinar-series-2026Q2

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Helpful knowledge

- You have watched the episodes from the webinar series:
  - *Introduction to EESSI*
  - *Building software on top of EESSI*
- You have built a software package in some way (e.g., compiled)
  - Nice to have: heard of (and maybe used) CMake/Autotools
- You are somewhat familiar with Git
  - Nice to have: familiar with GitHub/GitLab
- Familiar with *environment modules (Lmod)*

What if you no longer have to install

a ***broad range of scientific software***

from scratch on every laptop, HPC cluster,

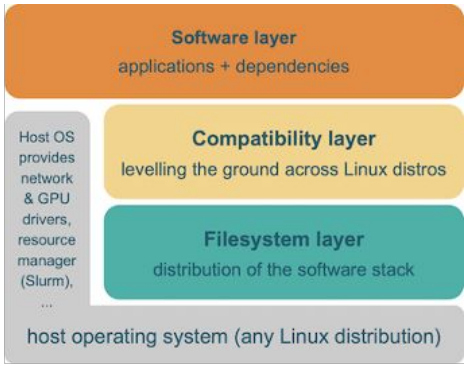
or cloud instance you use or maintain,

without compromising on performance?

Major goals of EESSI

- Providing a truly **uniform software stack**
  - Use the (exact) same software environment everywhere
  - **Without sacrificing performance** for “mobility of compute”
    (like is typically done with containers/conda)
- **Avoid duplicate work** (for researchers, HPC support teams, sysadmins, …)
  - Tools that automate software installation process
    (EasyBuild, Spack) are not sufficient anymore
  - Go beyond sharing build recipes => work towards a shared software stack
- Facilitate HPC training, development of (scientific) software, …

How does EESSI work?



- Software installations included in EESSI are:
  - Automatically **“streamed in” on demand** (via CernVM-FS)
  - Built to be **independent of the host operating system**

    “Containers without the containing”
  - **Optimized** for specific CPU generations + specific GPU types
- Initialization script auto-detects CPU + GPU of the system

The EESSI User Experience

```
$ source /cvmfs/software.eessi.io/versions/2023.06/init/lmod/bash
Module for EESSI/2023.06 loaded successfully
$ module load GROMACS/2024.1-foss-2023b
$ gmx mdrun ...
```

EESSI provides **on-demand streaming**

of (scientific) software (like music, TV-series, …)

EESSI for CI/CD

- Introducing Continuous Integration (CI)
- Navigating EESSI to build my project
- Building my project with the EESSI GitHub Action
- Navigating EasyBuild to build with **`EESSI-extend`**
- Building with **`EESSI-extend`** and the EESSI GitHub Action
- Building my project with the EESSI GitLab Component
- CI with EESSI+Spack
- Continuous Deployment and what EESSI can offer there

What is Continuous Integration (CI)?

- Development practice of frequently merging code into a shared repository
- Automated build and test run on each code change
- Helps detect bugs early and improve code quality
- Provides immediate feedback to developers
- Ensures the application is always in a deployable state

Key Components of CI

- ✅ Version Control System (e.g., Git)
- 🔄 Automated Build System
- 🧪 Automated Testing Suite
- 📣 Notification/Feedback Mechanism

Benefits of Continuous Integration

- 🔍 Early detection of integration issues
- 🚀 Faster and safer release cycles
- 🔧 Encourages small, incremental changes
- 🧠 Improved code quality and team collaboration
- 🔁 Easier refactoring and code maintenance

Specific Challenges of CI in HPC context

- Need HPC-suitable toolchains and dependencies
- Need a way to deal with MPI
- Typically want to test defined architectures
- Want to have accelerator support
- Performance and scalability (also) matter

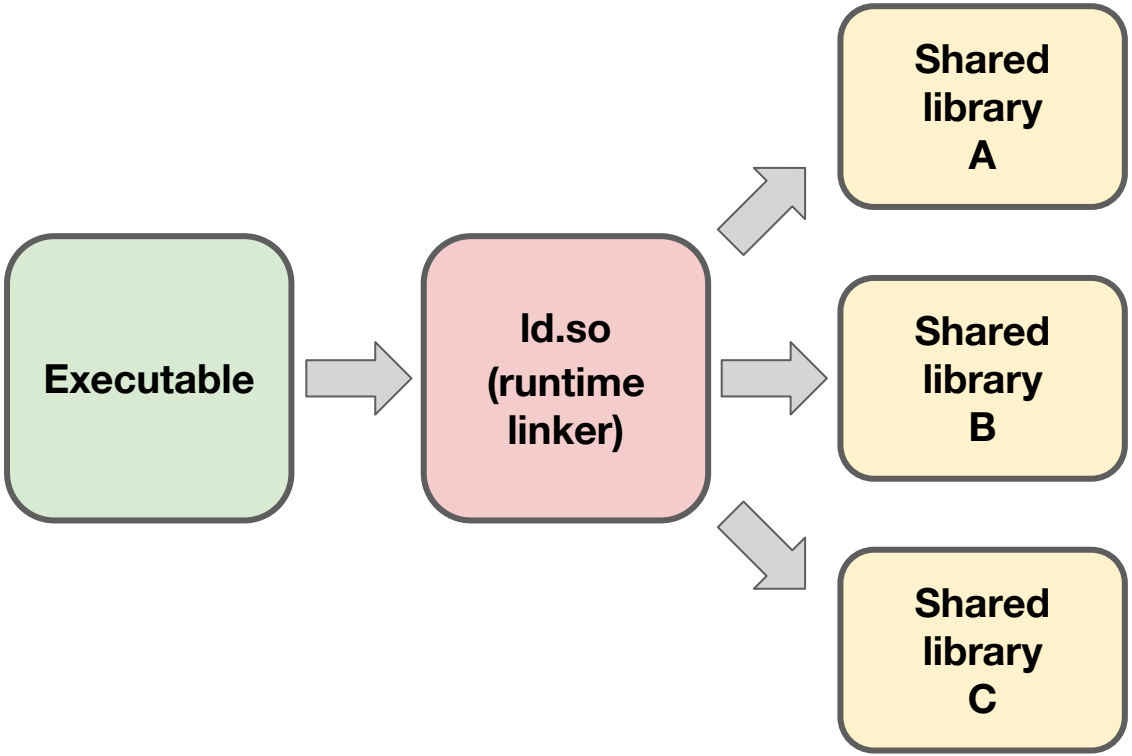
Leveraging EESSI in CI environments

- EESSI can be used in CI environments like:
  - GitHub: github.com/marketplace/actions/eessi
  - GitLab: gitlab.com/explore/catalog/eessi/gitlab-eessi
- EESSI can provide:
  - Different compilers to test your software with
  - Required dependencies for your software
  - Additional tools like ReFrame, performance analysis tools, …
- Other than CernVM-FS to get access to EESSI, no installations required!
  - Everything is pulled in on-demand by CernVM-FS
- Significantly facilitates also running CI tests in other contexts

Building on top of EESSI

- Load the necessary modules that you need for compilation
  - Compiler, MPI, libraries, dependencies,...
  - Best to try to keep dependencies in the same *toolchain*
- Load a **`buildenv`** module for your toolchain
  - Configures typical environment variables for a build (**`CC`**, **`CFLAGS`**, **`LIBS`**, **`...`**)
  - Uses *compiler wrappers* to simplify building with EESSI

Building on top of EESSI



Where does the loader find the libraries?

- Clues in environment variables
- Information in the binary (RPATH)
- It's own defaults

Big long demo:
An example software package

- github.com/EESSI/cicd-demo
- Dependencies: HDF5 and MPI
- Builds with CMake
- Tests via **`ctest`**

Cheat sheet: https://hackmd.io/myPkGyj-Rz6pQNMOZWi1IA?view

EESSI plus Spack can also work in CI

- EESSI integration with Spack is still (very much) a work in progress
- github.com/lorisercole/spood is where things are currently happening
  - Demonstrates that the integration can work
- Proof of principle of EESSI + Spack multi-arch CI on GitHub
  - github.com/ocaisa/spood/pull/1

Cheat sheet: https://hackmd.io/myPkGyj-Rz6pQNMOZWi1IA?view

Continuous Delivery (CD)

- Consider case of “release candidates” and production releases
- Developers commit code → triggers CI
- If tests pass, code can be included in a Release Candidate (RC)
- RC is deployed to a staging environment
- Manual/automated approval takes place
- RC is promoted to production manually or with a controlled deployment

What can EESSI do for CD?

- Production quality software deployed to **`software.eessi.io`**
- Development service **`dev.eessi.io`**, mostly for release candidates
  - More control for developers
  - Access/deployment to specific architectures
- EESSI is working on getting EuroHPC site support for **EESSI test suite**, could be leveraged for **`dev.eessi.io`** to remove need for direct access to resources for development

Repeat demo for yourself

- Good exercise to get the concepts straight
  - Fork github.com/EESSI/cicd-demo
  - Build locally with EESSI first
  - Transfer build to GitHub (or GitLab)
  - Port to EasyBuild (this is an investment for EESSI CD)
  - Transfer port to GitHub (or GitLab)
- Cheat sheet: https://hackmd.io/myPkGyj-Rz6pQNMOZWi1IA?view

Website: https://eessi.io

Join our Slack channel (see join link on website)

Documentation: https://eessi.io/docs

Blog: https://eessi.io/docs/blog

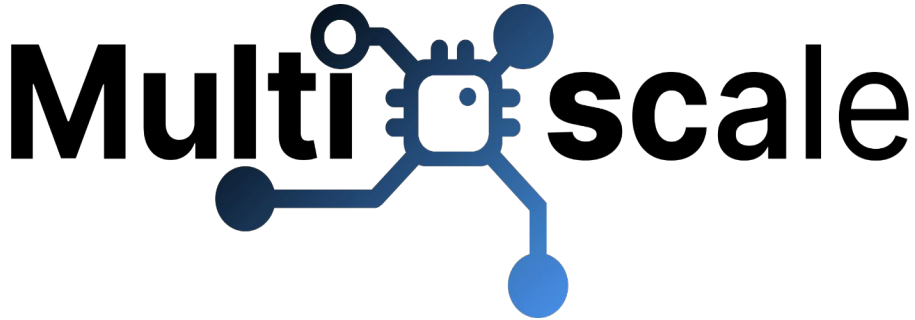
GitHub: https://github.com/eessi

Paper (open access): https://doi.org/10.1002/spe.3075

EESSI YouTube channel

Bi-monthly online meetings
(first Thursday of every other month, 14:00 CEST)

EESSI Happy Hour
(every Monday, 14:00 CEST)



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