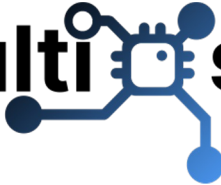




UNIVERSITY
OF BERGEN

Multi**scale**



E E S S I

EUROPEAN ENVIRONMENT FOR
SCIENTIFIC SOFTWARE INSTALLATIONS

Thomas Röblitz (University of Bergen)

Bergen Open Source Conference, 23 October 2026

*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?*



EESSI what? --> pronounced "easy"

It was started in
Europe

EUROPEAN ENVIRONMENT FOR SCIENTIFIC SOFTWARE INSTALLATIONS

keeping many versions
for many years

by sysadmins of
HPC machines

streaming ready-to-use
binaries

performance is important

The landscape of scientific computing has changed...

- **Explosion of available scientific software applications** (bioinformatics, AI boom, ...)
- Increasing interest in **cloud** for scientific computing (flexibility!)
- Increasing **variety in processor (micro)architectures** beyond Intel & AMD:
Arm is ~~coming~~ here (see Fugaku, JUPITER, ...), RISC-V is coming (soon?)
- In stark contrast: available (wo)manpower in HPC support teams is (still) limited
- **Software installation tools like EasyBuild and Spack are no longer sufficient...**

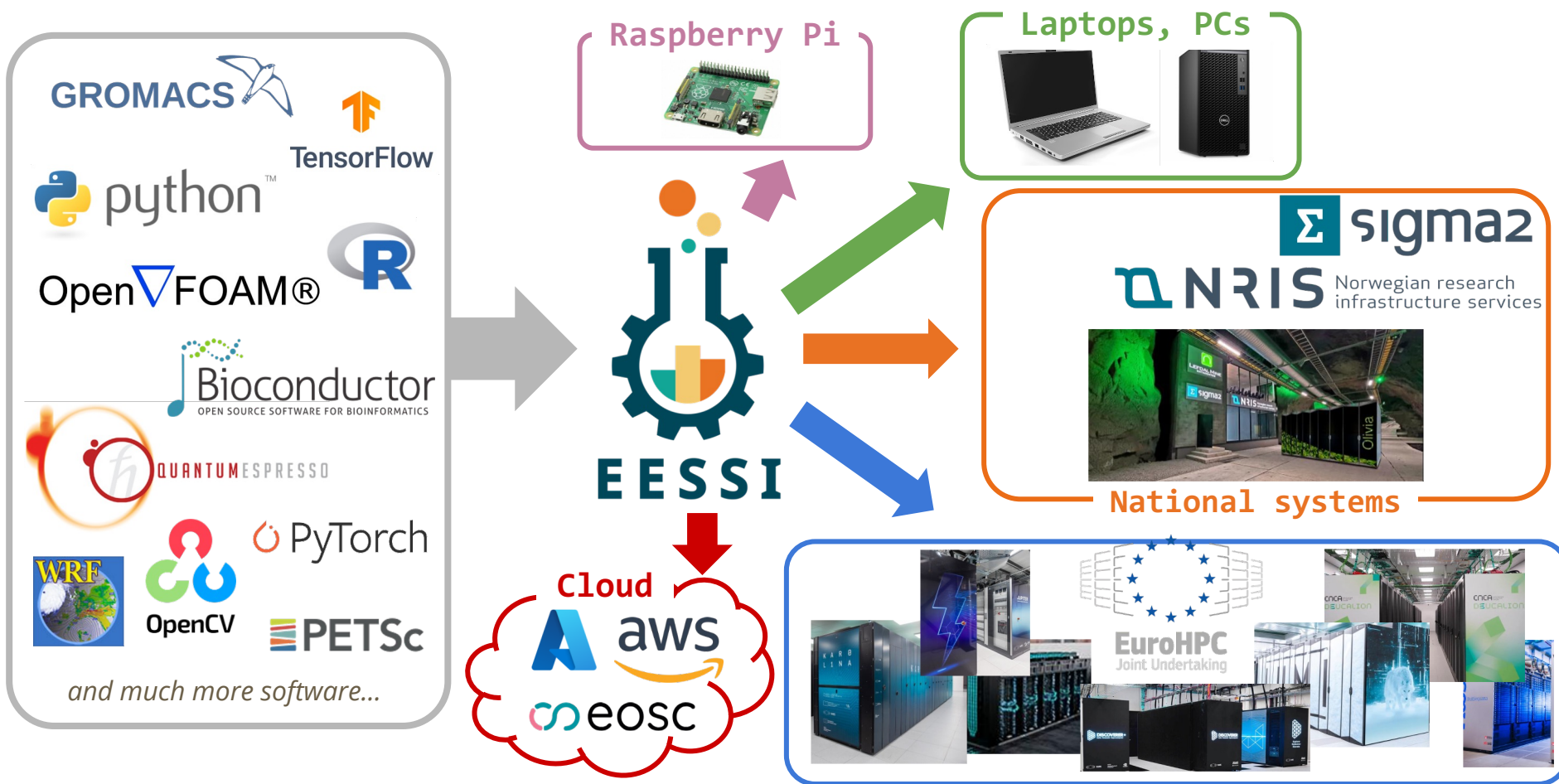


Major goals of EESSI



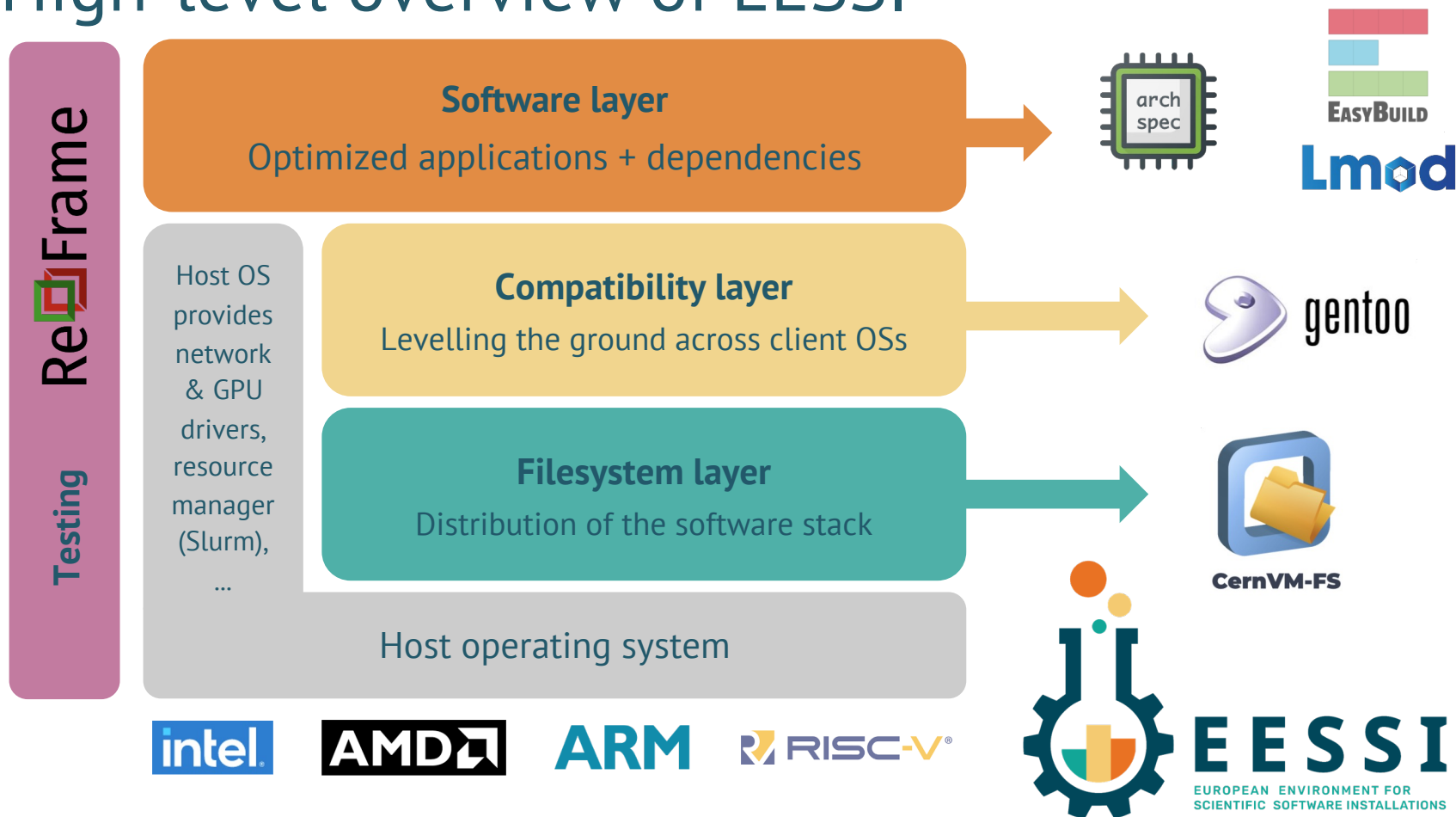
- Providing a truly **uniform software stack**
 - Use the (exact) same software environment everywhere
 - **Without sacrificing performance** for “mobility of compute” (like is typically done with containers/conda)
- **Avoid duplicate work** (for researchers, HPC support teams, sysadmins, ...)
 - Tools 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, ...

EESSI as shared software stack for HPC, cloud, and beyond

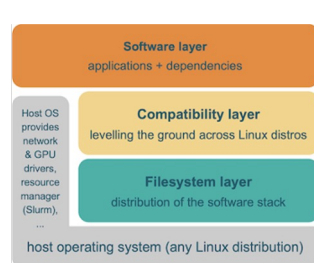


How EESSI works

High-level overview of EESSI



The “trick” behind the EESSI software layer



Software installations only link to **libraries from compatibility layer or other installations in software layer**, *not* from host (Linux) operating system.

- Because of this, these software installations work on any Linux distribution
- This is ensured via ***RPATH linking***
- Build tools (like CMake) need to be made aware of **alternative system root** (sysroot)
- Some exceptions need to be made: GPU driver libraries must be provided by host OS
- “*Containers without the containing*”

Accessing EESSI via CernVM-FS

```
# Native installation
# Installation commands for RHEL-based distros
# like CentOS, Rocky Linux, AlmaLinux, Fedora, ...

# install CernVM-FS

sudo yum install -y https://ecsft.cern.ch/dist/cvmfs/cvmfs-release/cvmfs-release-latest.noarch.rpm
sudo yum install -y cvmfs

# create client configuration file for CernVM-FS
# (no proxy, 10GB local CernVM-FS client cache))
sudo bash -c "echo 'CVMFS_CLIENT_PROFILE='single'' > /etc/cvmfs/default.local"
sudo bash -c "echo 'CVMFS_QUOTA_LIMIT=10000' >> /etc/cvmfs/default.local"

# Make sure that EESSI CernVM-FS repository is accessible
sudo cvmfs_config setup
```

Alternative ways of accessing EESSI are available, via a container image, via cvmfsexec, ...
eessi.io/docs/getting_access/native_installation - eessi.io/docs/getting_access/eessi_container

Using EESSI

eessi.io/docs/using_eessi/eessi_demos



```
/cvmfs/software.eessi.io/versions/2025.06/software
```

```
-- linux
```

```
| -- aarch64
```

```
| | -- a64fx
```

```
| | -- generic
```

```
| | -- neoverse_n1
```

```
| | -- neoverse_v1
```

```
| | -- nvidia
```

```
| | -- grace
```

```
-- x86_64
```

```
| -- amd
```

```
| | -- zen2
```

```
| | -- zen3
```

```
| | -- zen4
```

```
| | -- zen5
```

```
| -- generic
```

```
-- intel
```

```
| -- cascadelake
```

```
| -- haswell
```

```
| -- icelake
```

```
| -- sapphirerapids
```

```
-- skylake_avx512
```

```
| -- modules
```

```
-- software
```

```
$ source /cvmfs/software.eessi.io/versions/2025.06/init/lmod/bash
```

Modules purged before initialising EESSI

Module for EESSI/2025.06 loaded successfully

EESSI has selected x86_64/amd/zen2 as the compatible CPU target for EESSI/2025.06 **Automatically detects CPU microarchitecture**

EESSI did not identify an accelerator on the system
(for debug information when loading the EESSI module, set the environment variable EESSI_MODULE_DEBUG_INIT)

```
{EESSI 2025.06} $ module load R/4.5.1-gfbbf-2025a
```

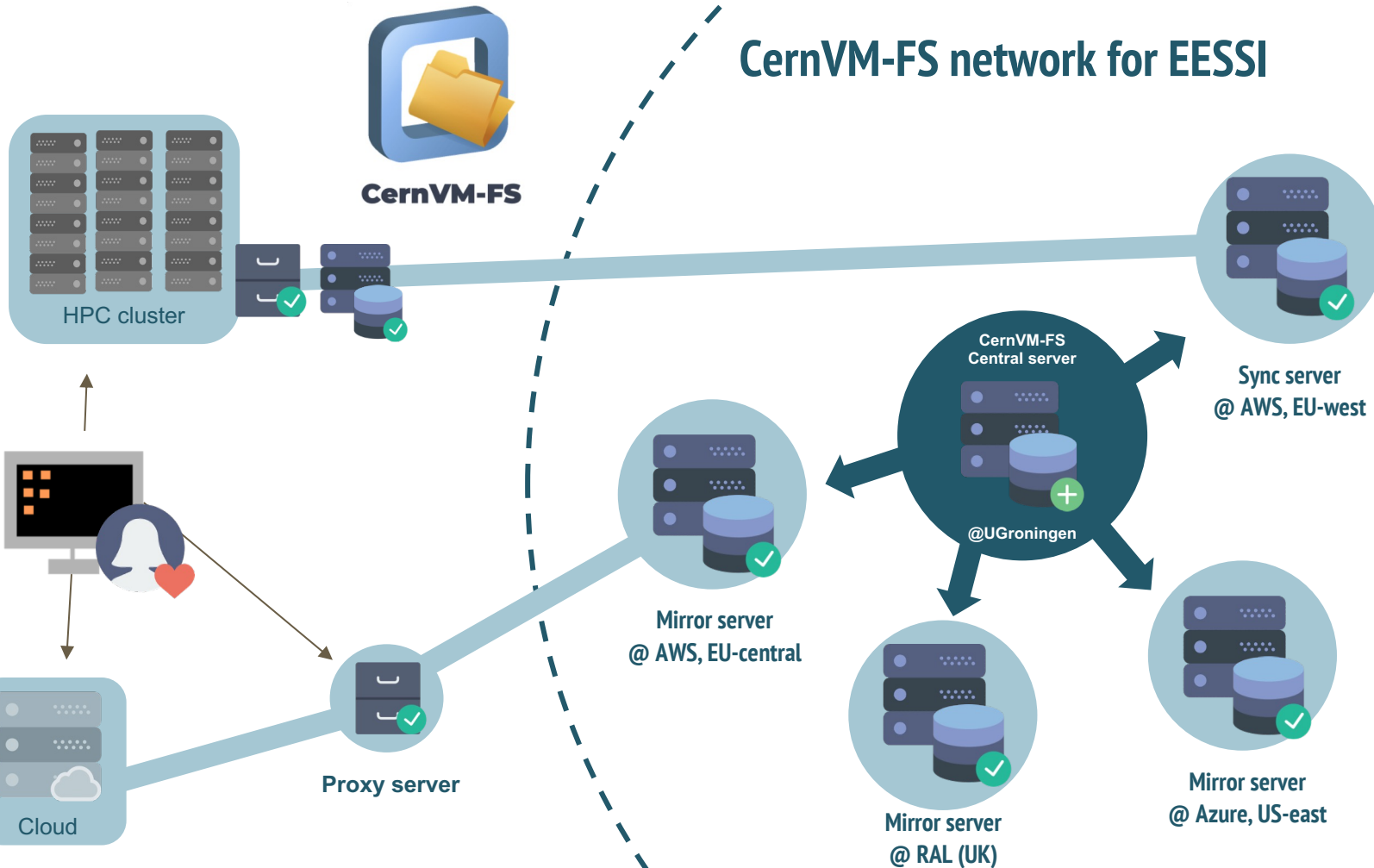
```
{EESSI 2025.06} $ which R
```

```
/cvmfs/software.eessi.io/versions/2025.06/software/linux/x86_64/  
amd/zen2/software/R/4.5.1-gfbbf-2023a/bin/R
```

```
{EESSI 2025.06} $ R --version
```

```
R version 4.5.1
```

CernVM-FS network for EESSI



Releases, software provided and supported CPUs/GPUs

Releases and repositories

software.eessi.io (Production Repository)

dev.eessi.io

2023.06

Since June 2023

1,247 installations
(total: ~17,800)

679 unique software
projects

Toolchain:
foss/(2022b+23a+23b)

→ **GCC 12.4** ↓

2025.06

Current default

1,275 installations
(total: ~21,400)

640 unique software
projects

Toolchain:
foss/(2024a+25a+25b)

→ **GCC 13.3** ↑

2026.06

Baby repo! 🚀

250 installations
(total: ~4,500)

240 unique software
projects

Toolchain:
foss/(2026.1)

→ **GCC 15.2** ↑

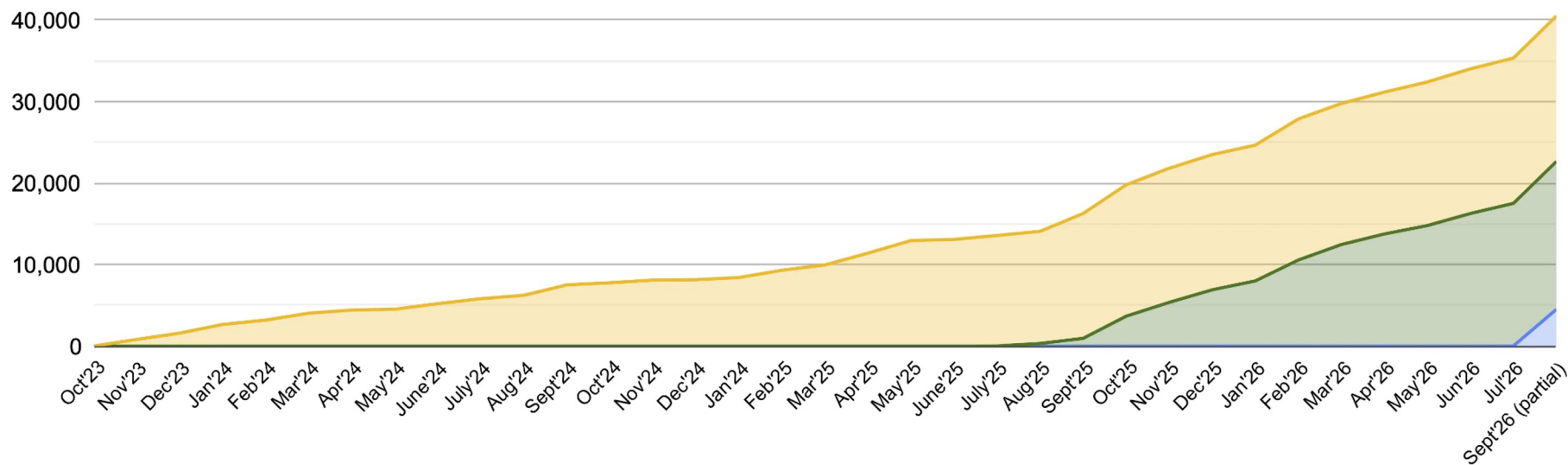
- Developer repository
- Staging area for upcoming releases
- [More about it later :\)](#)

Software evolution - all stacks



Number of software installations per EESSI version in software.eessi.io repository (CPU+GPU)

2023.06 2025.06 2026.06



Overview of available software



An up-to-date overview of available software
is available in the EESSI documentation:

https://eessi.io/docs/available_software

Software available in EESSI

Overview of software available in [EESSI's production repository](https://eessi.io) `software.eessi.io`.

752 unique software projects (+ 3007 unique extensions)

name:GROMACS

GROMACS

[\(more details\)](#)

<https://www.gromacs.org>

GROMACS is a versatile package to perform molecular dynamics, i.e. simulate the Newtonian equations of motion for systems with hundreds to millions of particles. This is a CPU only build, containing both MPI and threadMPI binaries for both single and double precision. It also contains the gmxapi extension for the single precision MPI build.

Available in EESSI versions: 2023.06 2025.06

Supported CPU families: AMD Intel Arm

Supported GPU families: NVIDIA

GROMACS

GROMACS is a versatile package to perform molecular dynamics, i.e. simulate the Newtonian equations of motion for systems with hundreds to millions of particles.

This is a GPU enabled build, containing both MPI and threadMPI binaries.

It also contains the gmxapi extension for the single precision MPI build.

homepage: <https://www.gromacs.org>

Available installations

GROMACS version	Supported CPU targets	Supported GPU targets	EESSI version	Module
2025.4	generic: aarch64, x86_64 Arm : a64fx, neoverse_n1, neoverse_v1, nvidia/grace AMD : zen2, zen3, zen4 Intel : haswell, skylake_avx512, sapphirerapids, icelake, cascadelake	(none)	2025.06	GROMACS/2025.4-foss-2025b
2025.2	generic: aarch64, x86_64 Arm : a64fx, neoverse_n1, neoverse_v1, nvidia/grace AMD : zen2, zen3, zen4 Intel : haswell, skylake_avx512, sapphirerapids, icelake, cascadelake	(none)	2025.06	GROMACS/2025.2-foss-2025a
2024.4	generic: aarch64, x86_64 Arm : neoverse_n1,	NVIDIA : cc70, cc80, cc90	2023.06	GROMACS/2024.4-foss-2023b-

CPU targets

aarch64		generic a64fx neoverse_n1 neoverse_v1
	nvidia	grace
	aws	<i>graviton4</i>
x86_64		generic
	amd	zen2 zen3 zen4 zen5
	intel	haswell skylake_avx512 cascadelake icelake sapphirerapids <i>graniterapids</i>



green -> new CPU targets in EESSI 2026.06

bold -> from the beginning of the project

*experimental in EESSI 2026.06

riscv64	generic
---------	---------

Supported GPU targets (NVIDIA)

https://eessi.io/docs/software_layer/gpu_targets



- Different generations of NVIDIA GPUs, based on CUDA Compute Capability (CC), see also <https://developer.nvidia.com/cuda/gpus>
- In EESSI 2023.06: CC 7.0 (V100, T4), CC 8.0 (A100 & co, incl. L40), CC 9.0 (H100/H200)
- In EESSI 2025.06: CC 7.0, CC 8.0, CC 9.0, CC 10.0 (B100/B200/B300), CC 12.0 (B10, RTX PRO Blackwell)
- In EESSI 2026.06: **CC 7.5** (CUDA 13.x) , CC 8.0, CC 9.0, CC 10.0, CC 12.0
- GPU driver libraries (include `libcuda.so`) must be exposed to EESSI
- About 10% of all 45 000 software installations in EESSI are for (NVIDIA) GPUs

Supported GPU targets (AMD/ROCm)

https://eessi.io/docs/software_layer/gpu_targets



- First set of modules available in EESSI/2025.06

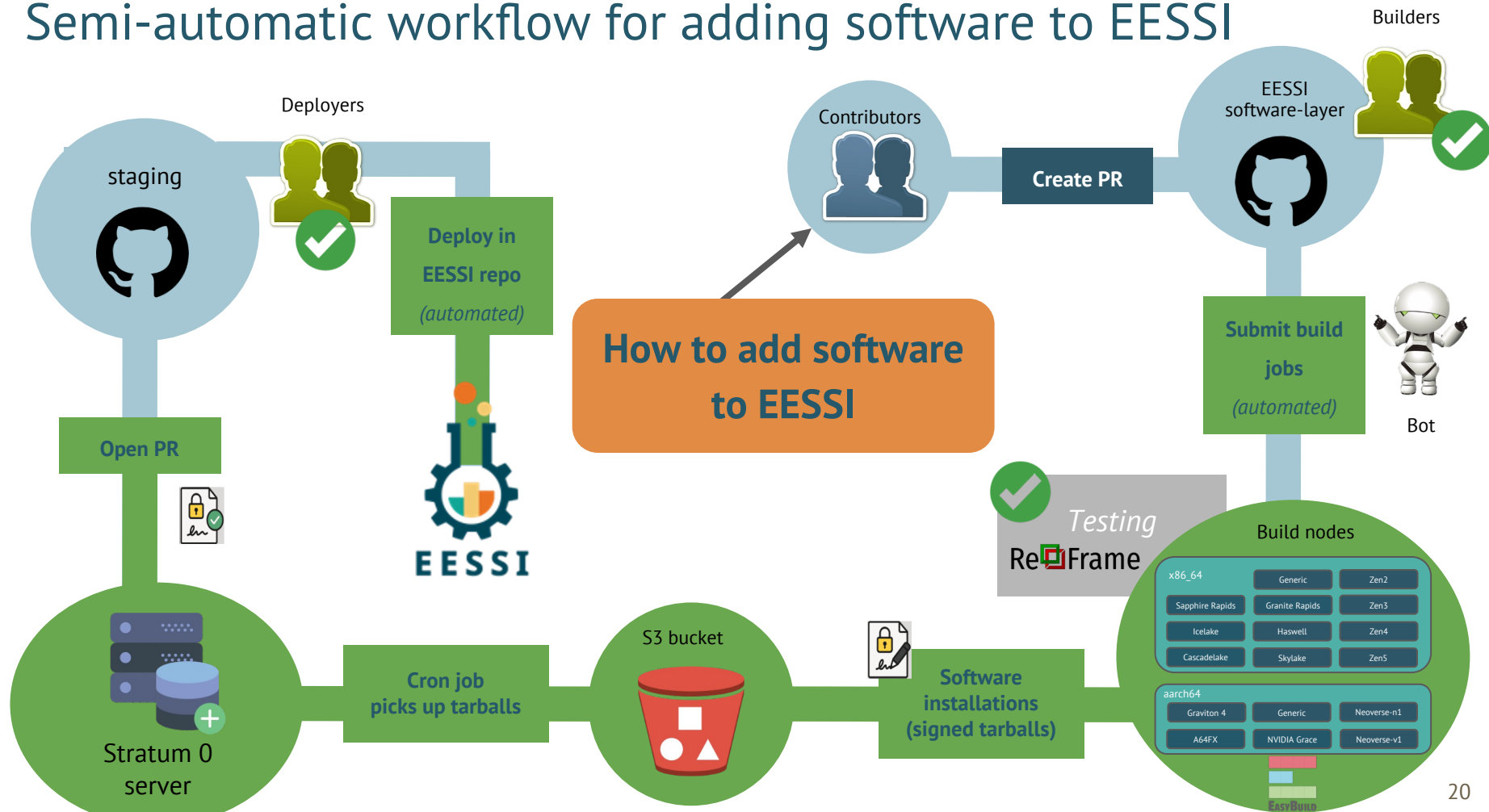
```
----- /cvmfs/software.eessi.io/versions/2025.06/software/linux/x86_64/generic/accel/amd/gfx908/modules/all -----
Boost/1.88.0-rocm-compilers-19.0.0-ROCm-6.4.1          (g,D)   rocBLAS/4.4.0-rocm-compilers-19.0.0-ROCm-6.4.1          (g)
HIP/6.4.1-rocm-compilers-19.0.0-ROCm-6.4.1             (g)     rocm-cmake/0.14.0-rocm-compilers-19.0.0-ROCm-6.4.1      (g)
hipBLAS-common/1.2.0-rocm-compilers-19.0.0-ROCm-6.4.1 (g)     rocm-compilers/19.0.0-ROCm-6.4.1                        .
hipBLASLt/0.12.1-rocm-compilers-19.0.0-ROCm-6.4.1     (g)     ROCm-LLVM/19.0.0-GCCcore-14.2.0-ROCm-6.4.1             .
HIPIFY/19.0.0-rocm-compilers-19.0.0-ROCm-6.4.1        (g)     rocminfo/1.0.0-rocm-compilers-19.0.0-ROCm-6.4.1         (g)
msgpack-cxx/7.0.0-rocm-compilers-19.0.0-ROCm-6.4.1    (g)     rocTracer/4.1.0-rocm-compilers-19.0.0-ROCm-6.4.1        (g)
RCCL/2.22.3-rocm-compilers-19.0.0-ROCm-6.4.1          (g)     Tensile/4.43.0-rocm-compilers-19.0.0-ROCm-6.4.1         (g)
```

- Support for different AMD GPU generations: [see docs for details](#)

gfx908 (MI100), gfx90a (MI200), gfx942 (MI300), gfx1030 (RX6000), gfx1100/1 (RX7000), gfx1200/1 (RX8000 + RX9000)

- Initial goal: GROMACS with ROCm 6.4.1 (WIP), ROCm 7.x next

Semi-automatic workflow for adding software to EESSI



Testing

Software testing is an important part of EESSI



- **Smoke tests:** sanity check commands are run by EasyBuild to check that installed software is not horribly broken while using EasyBuild
- **Regression testing** via EESSI test suite: eessi.io/docs/test-suite
 - Collection of portable tests for software available in EESSI
 - Running on selected (single node) tests when building new software for EESSI (before deployment)
 - Periodically (daily/weekly) on about multiple different systems
 - Can also be used for other software stacks (that are built with EasyBuild)
 - Periodic runs of EESSI test suite help to catch performance regressions

- [illegible]

dev.eessi.io

<https://eessi.io/docs/repositories/dev.eessi.io>



software.eessi.io (production)

- Permanent installations
- Only install released software versions
- Builds for all CPU architectures
- `/cvmfs/software.eessi.io/versions/`

```
/cvmfs/dev.eessi.io/versions/2023.06/software
```

```
-- linux
  -- x86_64
    -- amd
      -- zen2
        -- modules
          -- all
            -- ESPResSo
            | -- 4.2.2-foss-2023a-2ba17de6096933275abec0550981d9122e4e5f28.lua
            -- GROMACS
            | -- 2024.3-foss-2023b-d0f934abfd1394621c40858a2c2dd9123451df4e.lua
            -- LAMMPS
            | -- 570c9d190fee556c62e5bd0a9c6797c4dffc271-foss-2023a-kokkos-dev_OBMD.lua
            -- ...
```

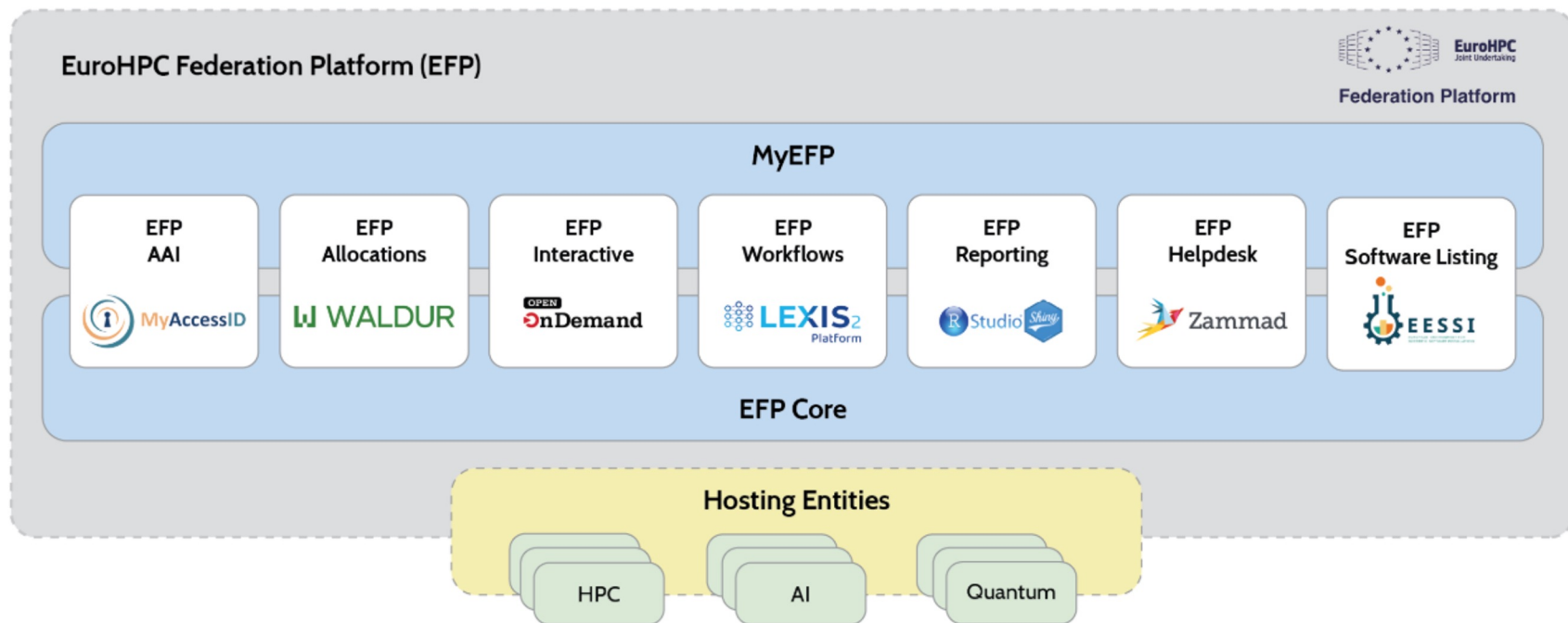
dev.eessi.io

- Temporary installations
- Can install from commits
- Patches can be added
- Can skip some CPU targets
- dev.eessi.io builds on top of software.eessi.io
- Subdirectories per project
- `/cvmfs/dev.eessi.io/project/version/`

Currently only available for codes within the EuroHPC JU CoE MultiXscal
project! → *extended to new codes from 2027*

Integrations

European Federation Platform (EFP)



<https://my-eurohpc.eu>

EFP webinar series in Oct'26: <https://docs.my-eurohpc.eu/training/overview>

European Open Science Cloud (EOSC)



October 22, 2025 · 5 min read

EESSI available on EOSC EU Node



EESSI has recently been working together with the [European Open Science Cloud \(EOSC\)](#) to provide easy access to EESSI for those using EOSC compute resources.

A first implementation of EESSI support is now available as the [EESSI Compute Node tool in the EOSC EU Node Tools Hub](#).

[Continue reading](#)

Tools Hub

The place to find, create, publish and run tools.

[About Tools Hub](#)

+ Create

Search

Search

All Tools

My Tools

Favourites

Deployments

Alan O'Cais

EESSI Compute Node

Deploy a compute node with an extra HD disk, EESSI (<https://eessi.github.io/docs>) installed, getting the IP and SSH credentials to access via ssh.

Status: Published



Deploy

<https://eessi.io/docs/blog/2025/10/22/eosc/>

Open OnDemand (OOD)

- Web-based access to HPC resources
- Search mechanism to find specific modules

Application	Provider	URL	OS	Architecture
TechSquareInc	OSC	https://github.com/mjblu/dwig/jupyter_experience	no	node
Jupyter + Spark	OSC	https://github.com/OSC/bc_osc_jupyter_spark	no	node
Paraview	OSC	https://github.com/OSC/bc_osc_paraview	no	
RStudio Server	OSC	https://github.com/OSC/bc_osc_rstudio_server	hybrid (Bubblewrap)	mode
	University of Utah	https://github.com/CHP C-UoU/bc_osc_rstudio_server	yes	mode
	Stanford	https://github.com/stanford-rc/sh_ood-apps/rstudio	yes	mode
VMD	OSC	https://github.com/OSC/bc_osc_vmd	no	
QGIS	OSC	https://github.com/OSC/bc_osc_qgis	yes	noVNC
RELION (for regular and high-throughput optimization)	Shanghai Jiao Tong University (SJTU)	https://github.com/SJTU-U-HPC/bc_relion	yes	
Stata	OSC	https://github.com/OSC/bc_osc_stata	no	
Shiny App	University of Utah	https://github.com/CHP C-UoU/bc_osc_example_shiny	yes	
Tensorboard	Stanford	https://github.com/stanford-rc/sh_ood-apps/tensorboard	no	
Visual Studio Code	OSC	https://github.com/OSC/bc_osc_codeserver	no	mode
EESI_APP	doitnowgroup	https://github.com/doitnowgroup/openondemand-apps-collection/tree/main/EESSI_APP	no	noVNC

<https://osc.github.io/ood-documentation/latest/install-ihpc-apps.html>

Home / My Interactive Sessions / EESSI General App

Interactive Apps

- Desktops
 - Classiq
 - Desktop XFCE-GNOME
 - Desktop w.Container
- GUIS
 - Avogadro2
 - DIA
 - MATLAB
 - ParaView
 - VMD
- Script Execution
 - Cnes App
 - Pandoc App
 - Script launcher (DEMO)
- Servers
 - Code Server
 - Jupyter Notebook
 - Jupyter Notebook EESSI
- Test
 - API test
- EESSI General App

EESSI General App

This app will launch a Desktop on one node with the modules of EESSI loaded. You will be able to interact with it through a VNC session.

Desktop Environment:

Account:

Number of hours:

Module list

Module Filter:

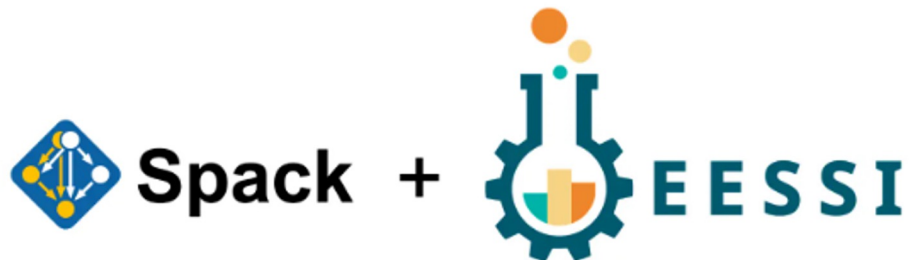
- ☐ Abseil/20230125.2-GCCcore-12.2.0
- ☐ HDF/4.2.15-GCCcore-12.2.0
- ☐ OpenJPEG/2.5.0-GCCcore-13.2.0
- ☐ Abseil/20230125.3-GCCcore-12.3.0
- ☐ HDF/4.2.16-2-GCCcore-12.3.0
- ☐ OpenMPI/4.1.4-GCC-12.2.0

Selected Modules:

* The EESSI General App session data for this session can be accessed under the [data root directory](#).



Using Spack on top of EESSI: A Proof of Concept



EESSI provides a rich set of software installations, which were built and installed using [EasyBuild](#).

Can we convince [Spack](#) to reuse software installed in EESSI, and by doing so make EESSI more attractive to those of you who prefer using Spack over EasyBuild?

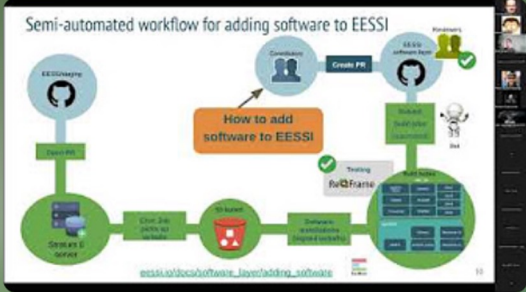
Several people have expressed interest in exposing the software installations provided by EESSI to Spack, so they can be used as dependencies when building and installing software with Spack.

<https://eessi.io/docs/blog/2026/02/05/Spack-on-top-of-EESSI-best-of-both-worlds>

Training, dissemination & support

Webinars series - spring 2026

- Introduction to EESSI
- Building software on top of EESSI
+ contributing to EESSI
- Using EESSI for Continuous Integration
- Introduction to CernVM-FS
- Using EESSI as a base for a central software stack



The screenshot shows a complex workflow diagram for adding software to EESSI. It includes steps like 'Create PR', 'Test', 'Build', and 'Deploy'. A central orange box highlights 'How to add software to EESSI'. The diagram is set against a dark background with various icons and text.

EESSI webinar series - spring 2026

by EESSI

Playlist • 5 videos • 45 views

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

▶ Play all

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

Hackathons, and other events



Copenhagen, EuroHPC User days 2025

Spotify podcast!↓



Hackathon + tutorial 2026, CINECA



HPCKP 2026, Barcelona



ISC 2026, Hamburg

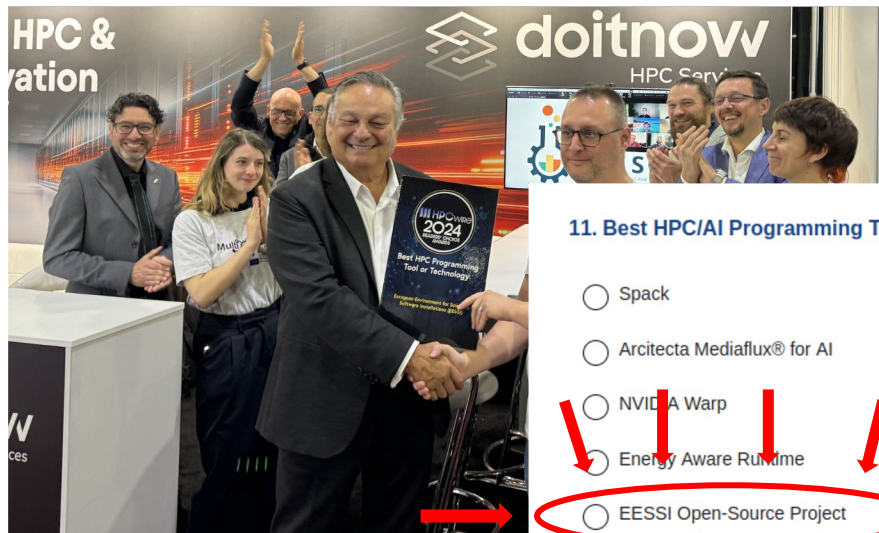


EUM 2026, Guimarães

And much more to come!



EESSI won an HPCWire Readers' Choice award! 2024 (and was nominated again in 2026 ... results pending)



11. Best HPC/AI Programming Tool or Technology

- ☐ Spack
- ☐ Arcitector Mediaflux® for AI
- ☐ NVIDIA Warp
- ☐ Energy Aware Runtime
- ☒ EESSI Open-Source Project
- ☐ AWS Agent IDE
- ☐ NVIDIA cuBLAS
- ☐ MET Norway and AI improving long-range weather prediction



<https://eessi.io/docs/blog/2026/09/20/hpcwire-readers-choice-awards-2026>

Support for installing, using, contributing to EESSI



eessi.io/docs/support

- **Via GitLab, or via email: support@eessi.io**
- Report problems
- Ask questions
- Request additional software
- Get help with contributing to EESSI
- Suggest enhancements, additional features, ...
- Confidential tickets possible (security issues, ...)

Dedicated support team, thanks to EuroHPC JU Centre-of-Excellence



What's next? EESSIER («easier»)

EESSIER project

A Transversal Centre of Excellence for Application Deployment, Delivery & Automated Integration

Goals:

- Make EESSI easier to use, ensure seamless user experience
- Establish a unified EuroHPC CI/CD pipeline
- Make software FAIR-by-design, support extensible metadata



Jan 2027 – Dec 2029 | 10 partners | Contact: support@eessi.io



Conclusions ... the three pillars of EESSI



From zero to science in minutes!

Service

A free to use, shared, optimized software stack

- Ready-to-use binaries for laptops, cloud & HPC
- Performance-optimized for each CPU/GPU target

Tools

Open Source tooling to build & operate the software stack

- EasyBuild, Lmod, Gentoo, CernVM-FS, ReFrame, ...
- Scripts & bots: automate the build procedures

Collaboration

Community-driven development & operation

- Transparent: public recipes, docs & tooling
- Open to all: started by HPC sites, welcoming everyone

Upcoming project EESSIER: more integrations + FAIRness + developer focus