EuroHPC Joint Undertaking

Federation Platform

Federated Software Catalog

25 February 2026

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https://my-eurohpc.eu

The EuroHPC Federation Platform (EFP)

"A one-stop-shop for accessing and utilizing EuroHPC systems and services"

A platform and federation framework which provides **a streamlined, single point of onboarding** and via which user can **access all systems and services** available to them in the EuroHPC ecosystem.

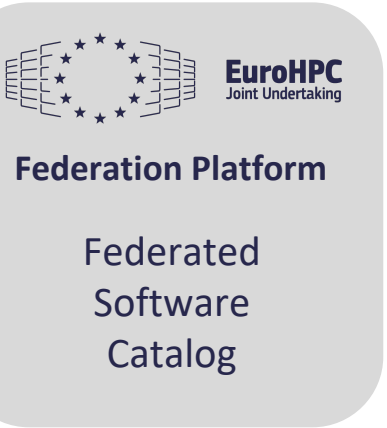
Direct access | Interactive interfaces | Programmatic APIs | Unified software stack

EuroHPC Joint Undertaking

Federation Platform

Agenda for this webinar

- Introduction to EFP Federated Software Catalog (FSC)
- Introduction to the European Environment for Scientific Software Installations (EESSI)
  - High-level design
  - User experience
  - Current status: available software, supported CPUs & GPUs
  - Ongoing work
- Integration of EESSI into the EFP Federated Software Catalog
- Availability of Federated Software Catalog on EuroHPC supercomputers
- Live demo with GROMACS on EuroHPC systems
- Adding software to EFP FSC
- What about performance?
- Using EESSI beyond EFP
- Getting help



EFP Federated Software Catalog (FSC)

- **Uniform software stack** for end users
  - Applications, tools, libraries (not system software)
  - Same set of software installations everywhere
  - Identical user workflow **across systems**
- **Available on all EuroHPC systems**

  (alongside existing central software stack)
- Easy to navigate, search, use, …
- Integrated with other components of EFP

  (Interactive, Workflows, MyEFP, …)

European Environment for Scientific Software Installations (EESSI)

EESSI is the base for the EFP Federated Software Catalog

- Started as community project in 2020
- Grew out of EasyBuild community
- Inspired by Compute Canada software stack
- Production repository (software.eessi.io) since 2023
- Developed & supported by MultiXscale EuroHPC CoE since 2023

https://multixscale.eu

EESSI
EUROPEAN ENVIRONMENT FOR SCIENTIFIC SOFTWARE INSTALLATIONS

https://eessi.io

EESSI as a central software stack for EuroHPC

GROMACS
TensorFlow
python
OpenFOAM®
R
Bioconductor
OPEN SOURCE SOFTWARE FOR BIOINFORMATICS
QUANTUMESPRESSO
PyTorch
WRF
OpenCV
PETSc

(and more software)

EESSI
EUROPEAN ENVIRONMENT FOR SCIENTIFIC SOFTWARE INSTALLATIONS

Automatically "streamed" to EuroHPC systems (and beyond)









A Quick Introduction to EESSI, powered by FOSS

Filesystem layer

CernVM-FS

Global distribution of software installations *(on-demand streaming)*

Compatibility layer

gentoo linux™

Abstraction from the host operating system *(containers without the containing)*

ReFrame

Regression testing of software

EESSI

EUROPEAN ENVIRONMENT FOR SCIENTIFIC SOFTWARE INSTALLATIONS

Software layer

EasyBuild.io

Set of optimized software installations for specific CPU/GPU generations

Intuitive user interface: module load, module avail, …

Lmod

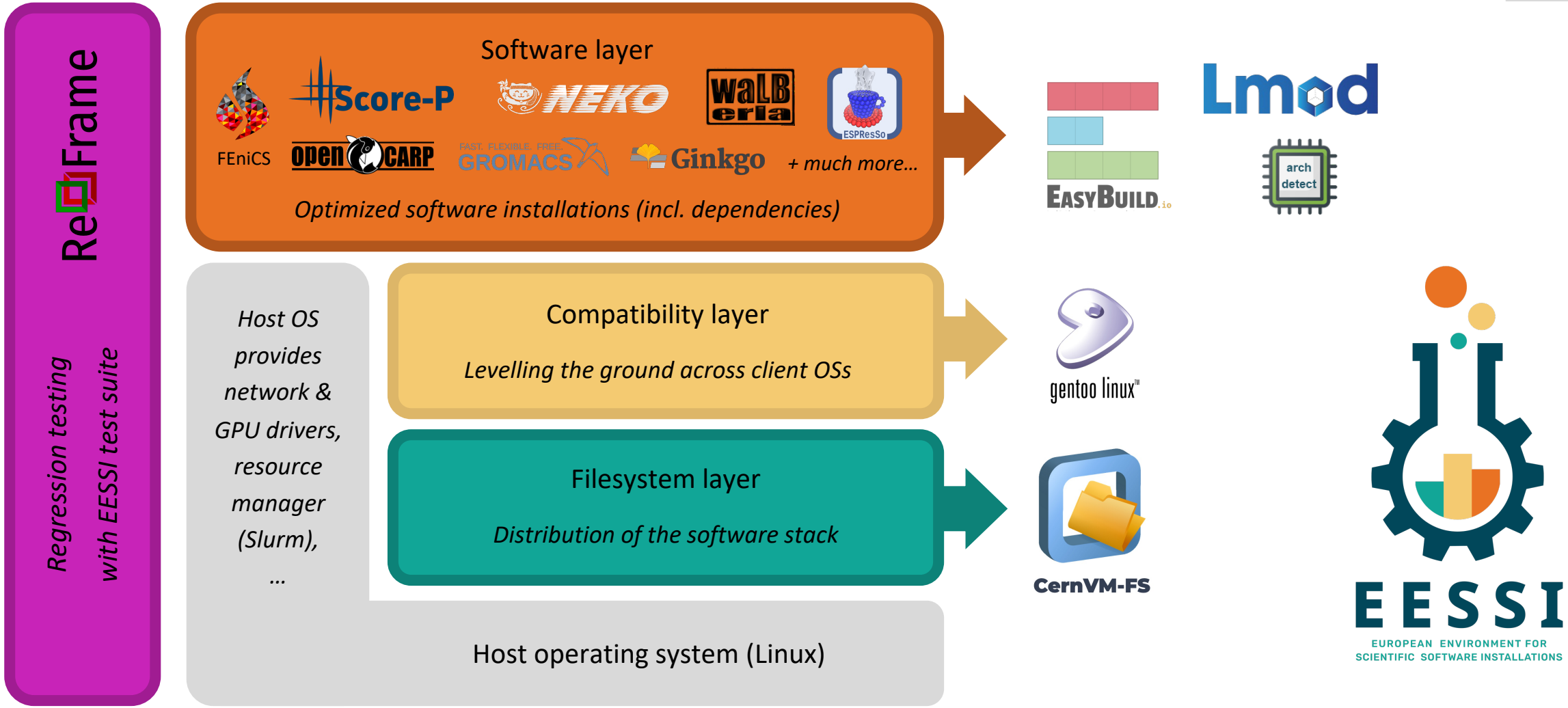
arch detect

Detection of host CPU/GPU, to automatically make best installations available

MAGIC CASTLE

Creating ephemeral clusters in the cloud (building & testing)

High-level design of EESSI



The EESSI user experience

Software installations provided by EESSI are available via `/cvmfs/software.eessi.io`

Recommend way of working:

0) Make sure that EESSI is accessible: `ls /cvmfs/software.eessi.io`

1) Update your shell environment by initializing EESSI (incl. auto-detection of CPU & GPU)

   For example:

```
module use /cvmfs/software.eessi.io/init/modules
module load EESSI/2025.06
```

2) Load one or more modules to "activate" the software you want to use

   For example: `module load GROMACS/2025.2-foss-2025a`

3) Science!

Running software is (typically) **"streamed in" on-demand** via CernVM-FS

Feels like a local software stack, yet same software stack available everywhere!

Current status of EESSI: available software

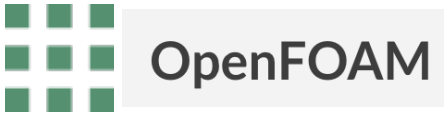
- Production EESSI repository (`software.eessi.io`) already provides a rich software stack
- Spread across two versions of EESSI: 2023.06 and 2025.06
- In total, EESSI includes:
  - 730 unique software projects, plus ~3,000 extensions (Python, R, …)
  - Over 26,000 software installations
- Overview of included software is available in EESSI documentation:

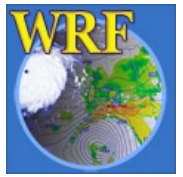
  https://eessi.io/docs/available_software
- MyEFP will feature Software Listing, providing overview for Federated Software Catalog

Current status of EESSI: available software (selection)

https://eessi.io/docs/available_software

FEniCS





Current status of EESSI: CPU targets

- EESSI currently supports 14 different CPU targets
- Each CPU target corresponds to a specific CPU microarchitecture (CPU generation)
  - AMD CPUs: Zen 2 (Rome), Zen 3 (Milan), Zen 4 (Genoa)
  - Intel CPUs: Haswell, Skylake, Cascade Lake, Ice Lake, Sapphire Rapids
  - Arm CPUs: Neoverse N1, Neoverse V1, Fujitsu A64FX, NVIDIA Grace
  - Generic targets for both Intel/AMD (x86_64) and Arm (aarch64) as fallback
- See also https://eessi.io/docs/software_layer/cpu_targets
- Software Listing in MyEFP will map this to EuroHPC supercomputer partitions

Current status of EESSI: GPU support

- EESSI currently includes software installations that target NVIDIA GPUs
- Different generations are supported, based on CUDA Compute Capabilities (CC)
  - In EESSI 2023.06: Volta (CC 7.0, V100), Ampere (CC 8.0, A100), Hopper (CC 9.0, H100/H200)
  - In EESSI 2025.06: Volta, Ampere, Hopper, Blackwell (CC 10.0 + CC 12.0)
- Running CUDA software included in EESSI should work out of the box,
  as long as NVIDIA GPU drivers have been exposed to EESSI
- Building CUDA software on top of EESSI requires a full CUDA SDK installation
  that is “injected” into EESSI
- See also https://eessi.io/docs/gpu

Current status of EESSI: ongoing work

- Onboarding of more software, in collaboration with community (incl. EuroHPC projects)
- Optimized installations for additional CPU targets:
  - AMD Turin (Zen5 microarchitecture) in EESSI 2025.06
  - AWS Graviton 4 + 5 CPUs
- Support for AMD GPUs (ROCm ecosystem)
- Development of `eessi` command line tool (see github.com/EESSI/eessi-cli)
  - To get started: 1) `pip install eessi` 2) `eessi --help`
- Soon: kickstarting new EESSI version (2026.x),

  incl. recent software versions built with updated compiler toolchain

Integration of EESSI into EuroHPC Federation Platform

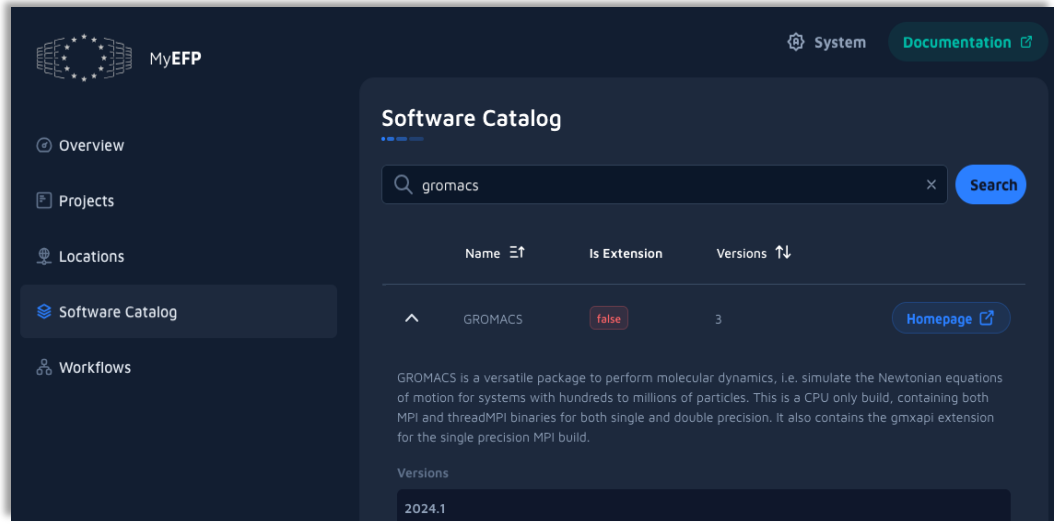
EESSI is the base for the Federated Software Catalog (FSC) component of EFP

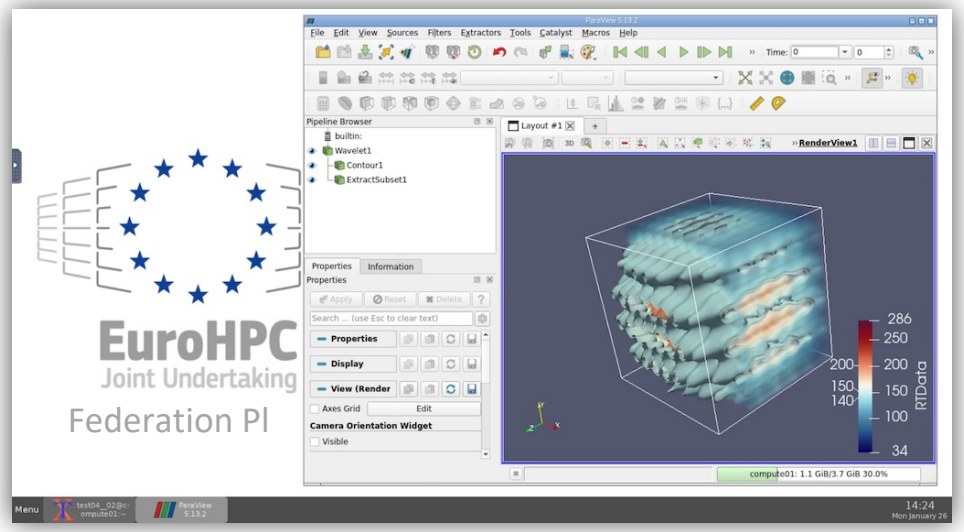
EFP FSC is already available on EuroHPC supercomputers, or will be very soon

- EFP consortium is working together closely with EuroHPC Hosting Entities on this
- Deployment of EESSI will differ across systems, but user experience should be the same

Integration of EESSI into EuroHPC Federation Platform

- Software listing in MyEFP will provide EuroHPC-aware overview of available software
- Open OnDemand apps in EFP Interactive component will rely on software provided by FSC





- FSC can be used to run Slurm jobs, or run workflows with EFP Workflows component
- Focus in EFP is on EESSI 2025.06 (and more recent), though EESSI 2023.06 also available

Availability of FSC on EuroHPC systems

- Already available today on:
  - **Vega**, **Deucalion**, **Karolina**, **Discoverer, Leonardo*** (native via CernVM-FS)
  - **MareNostrum 5** (via export in GPFS), **MeluXina** (via mount of SquashFS image)

(*) only in jobs that request access to EESSI

- Coming soon on:
  - **JUPITER** (native via CernVM-FS)
  - **LUMI*** (via mount of SquashFS image)

- Later also on future EuroHPC supercomputers: Daedalus, Arrhenius, Alice Recoque, ...

  as well as AI Factories + Quantum computers

- How to get access to EESSI will differ slightly on some systems due to site policies,

  but user experience once EESSI is available should be the same across systems

Using the Federated Software Catalog: Live Demo

- Multi-node (CPU-only) GROMACS job, using EESSI 2025.06
- 2 nodes, 6 MPI ranks, 8 threads each (2x48 cores = 96 cores in total)
- Testcase B input file from Unified European Applications Benchmark Suite (UEABS)
- Exact same job script on Vega (AMD Rome partition) and Deucalion (A64FX partition)
  - On Vega: `sbatch --partition normal gromacs-UEABS-TestCaseB.sh`
  - On Deucalion: `sbatch --partition dev-arm gromacs-UEABS-TestCaseB.sh`

Using the Federated Software Catalog: Live Demo

```
#!/bin/bash
#SBATCH --cpus-per-task=8
#SBATCH --tasks-per-node=6
#SBATCH --nodes=2
#SBATCH --time=2:0:0

cd $HOME/EFP/FSC-demo/GROMACS

source /cvmfs/software.eessi.io/versions/2025.06/init/lmod/bash
module load GROMACS/2025.2-foss-2025a

export OMP_NUM_THREADS=$SLURM_CPUS_PER_TASK

# input file obtained from https://repository.prace-ri.eu/ueabs/GROMACS/2.2/GROMACS_TestCaseB.tar.xz
srun --mpi=pmix gmx_mpi mdrun -s GROMACS_TestCaseB/lignocellulose.tpr -deffnm GROMACS-
2025.2.TestCaseB.$SLURM_JOBID -cpt 1000 -maxh 2.0 -nsteps 50000 -ntomp $OMP_NUM_THREADS
```

Adding Software to the Federated Software Catalog

- To **add software** to the EFP Federated Software Catalog, it should be **added to EESSI**
  - Software included in EESSI is currently installed via EasyBuild
  - Redistribution of the software (+ dependencies) must be allowed

    ⇒ OK for open source software
  - Installation should work on all supported CPU targets (Intel, AMD, Arm)
  - Software test suites should pass
  - See also EESSI Contribution Policy

- Onboarding of software into EESSI is done by opening a (simple) pull request (see EESSI docs)
  - Pull request to EasyBuild must be opened & merged first if software (version) is not supported yet
- Once software is installed in EESSI, it will automatically become available on EuroHPC systems
- EFP Helpdesk can help you with onboarding of software into EESSI: helpdesk@my-eurohpc.eu

What about performance?

- EESSI included optimized software installations for specific CPU & GPU generations
- CPU & GPU of system on which EESSI is used is auto-detected
- Overall, performance should be good
  - Fine-tuning may be possible for some software, for example via environment variables
- Host injections mechanism supported by EESSI can be used to “plug in” customized libraries, like a vendor-provided MPI library
  - Must be ABI compatible with what is used in EESSI

EESSI beyond the EuroHPC Federation Platform

EESSI can already be used in other systems and environments:

- National, regional, institutional supercomputers across Europe and beyond,

  see https://eessi.io/docs/systems

- Virtual machines in commercial and on-premise cloud infrastructure,

  EESSI is integrated in tools like Magic Castle, AWS ParallelCluster, Azure HPC On-Demand Platform, …

- Personal workstations and laptops: Linux OS, Linux VM in macOS/Windows

  see for example https://eessi.io/docs/getting_access/eessi_limactl

- Continuous Integration environments like GitHub Actions, GitLab runners, …

  see https://eessi.io/docs/using_eessi/eessi_in_ci

- Raspberry Pi & RISC-V Single-Board computers

Getting help for the Federated Software Catalog

- If you have questions related to EFP Federated Software Catalog, contact EFP Helpdesk

  helpdesk@my-eurohpc.eu

- We can provide help with:
  - Answering (high-level) questions related to software available in FSC
  - Software installations included in FSC not working as expected on a EuroHPC system
  - Resolving the problems you have with onboarding of software into EESSI

Upcoming webinars – more info at https://my-eurohpc.eu/training

Webinar 1 of 5 — **Introduction to the EuroHPC Federation Platform**
Recording available!

Webinar 3 of 5 — **EFP Interactive**
Date: Wed 4 March 2026 15:30-16:30 CET | **Registration open**
Speaker: Robin Karlsson (CSC - IT Center for Science)

Webinar 4 of 5 — **EFP Authentication & Authorization Infrastructure (AAI)**
Date: Wed 29 April 2026 14:00-15:00 CET
Speaker: Josh Howlett (GÉANT)

Webinar 5 of 5 — **EFP Workflows**
Date: May 2026 *(to be scheduled)*
Speaker: *to be confirmed*

Scan me for more information on upcoming EFP webinars!

In case of questions, contact EFP consortium via: helpdesk@my-eurohpc.eu

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