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EESSI test suite

10th EasyBuild User Meeting@ Juelich

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EESSI
EUROPEAN ENVIRONMENT FOR SCIENTIFIC SOFTWARE INSTALLATIONS

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The EESSI test suite

Goal of the EESSI test suite

- To test the functionality and performance of the EESSI software stack on a wide range of systems

The opportunity

- Same software (modules) on every system

The challenge

- Every system is different! Need tests that are *portable*

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Writing portable tests is challenging…

- EESSI test suite is based on ReFrame
- ReFrame tests are *typically* very system specific, example attributes:
  - `valid_systems`: on which systems this test can/should run
  - `num_cpus_per_task`, `num_tasks`, `num_gpus_per_node`: typically chosen to match the system
  - And many more …
- ReFrame offers *amazing* fine-grained control, but at the cost of portability

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How we make EESSI tests portable

- All system-specific information goes into ReFrame config file
- Make the test do something sensible *based on the config file*, examples:
  - Launch one rank per available (physical) CPU core / numa node / socket / GPU
  - Skip a test if the system has insufficient memory to run it
  - Skip a test that requires GPUs if the system doesn't have any

N.B. Tests ≠ benchmarks! These portable tests are *not* guaranteed to get the best performance from your system for a particular use case, they are meant to spot performance changes.

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MPI4PY example

```
@rfm.simple_test
class EESSI_MPI4PY(rfm.RunOnlyRegressionTest, EESSI_Mixin):
    device_type = DEVICE_TYPES[CPU]
    compute_unit = COMPUTE_UNIT[CPU]

    module_name = parameter(find_modules('mpi4py'))

    n_iterations = variable(int, value=1000)
    n_warmup = variable(int, value=100)

    executable = 'python3'
    executable_opts = ['mpi4py_reduce.py', '--n_iter', f'{n_iterations}', '--n_warmup', f'{n_warmup}']

    time_limit = '5m00s'

    bench_name = 'mpi4pi'
    bench_name_ci = 'mpi4pi'

    readonly_files = ['mpi4py_reduce.py']

    def required_mem_per_node(self):
        return self.num_tasks_per_node * 100 + 250

    @sanity_function
    …
    @performance_function('s')
    …
```

Requires ‘CPU’ feature

Launch one task per core

Create tests for all modules called mpi4py/<something>

Automatically tags a test instance with this bench_name with ‘CI’ tag

Request sufficient memory, and skip if nodes don’t have enough

Multiscale

See https://www.eessi.io/docs/test-suite/writing-portable-tests/#as-portable-reframe-test

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How we use the EESSI test suite

- We run the test suite periodically (daily/weekly) on about 5 different systems
- We run selected (single node) tests when building new software for EESSI (before deployment)
- Some of us also use the test suite to test local module stacks!

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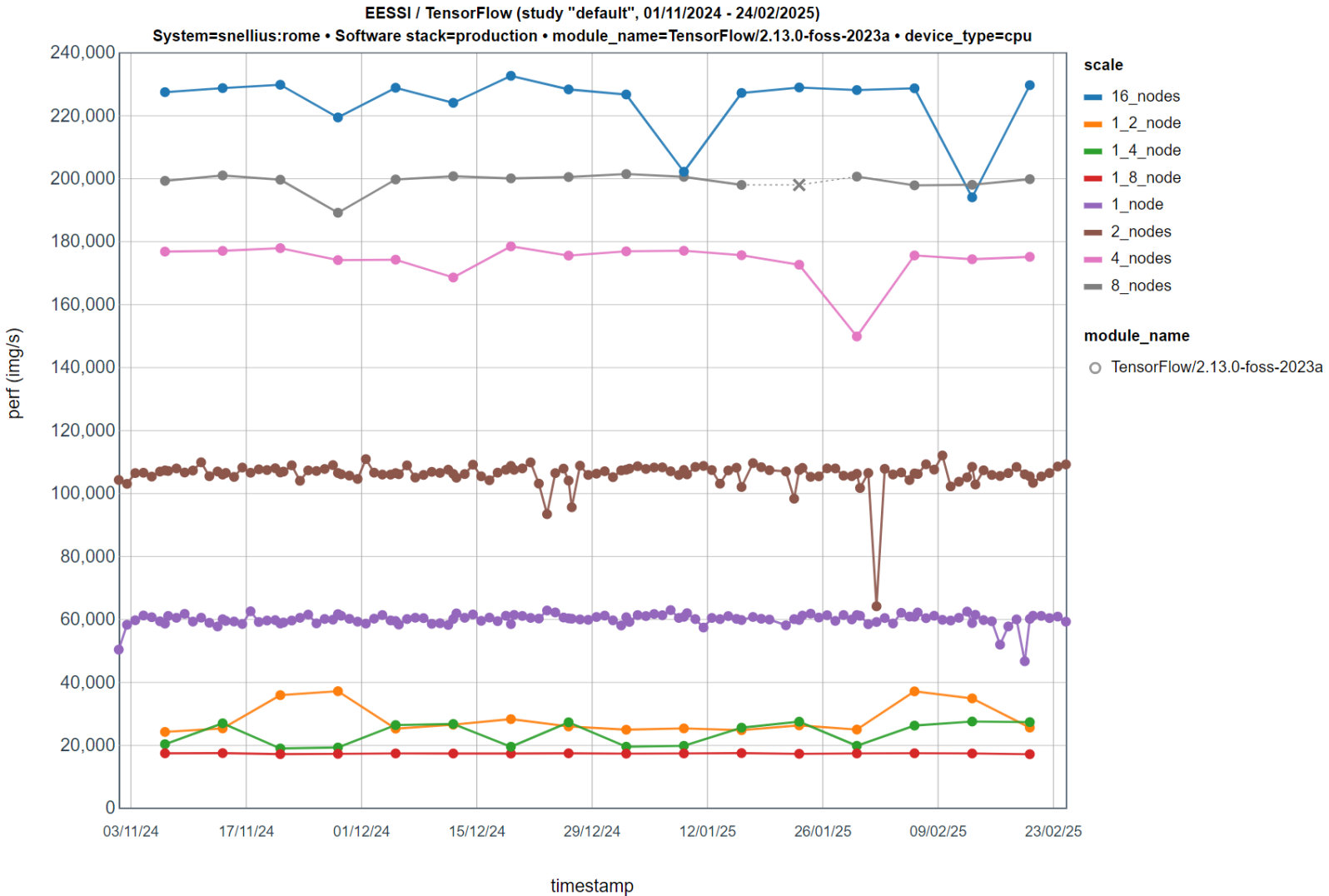

Writing an EESSI test suite configuration

Goal: For everyone to have run the EESSI test suite on your HPC cluster (or laptop) by the end of EUM'25!

- Step 1: install ReFrame & the EESSI test suite
- Step 2: create a ReFrame configuration file
- Step 3: run reframe --list -t CI
- Step 4: run reframe --dryrun -t CI -n /<somehash>
- Step 5: run reframe --run -t CI -n /<somehash>

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Find presentation online

- Detailed steps on subsequent slides
- Quickest way: copy-paste from slides at https://github.com/casparvl/EUM25

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Step 1: Install ReFrame & EESSI test suite

```
module purge  # Use system python
python3 -m venv $HOME/eessi_testsuite/eessi_testsuite_venv
source $HOME/eessi_testsuite/eessi_testsuite_venv/bin/activate
pip install reframe-hpc
pip install eessi-testsuite
# Check we can use things from ReFrame's hpctestlib
python3 -c 'import hpctestlib.sciapps.gromacs'
# Check we can use things from the EESSI testsuite
python3 -c 'import eessi.testsuite.eessi_mixin'
```

See: https://www.eessi.io/docs/test-suite/installation-configuration/

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Step 2a: create ReFrame config file

```
cd $HOME/eessi_testsuite/
wget https://raw.githubusercontent.com/casparvl/test-suite/refs/heads/update_example_settings/config/settings_example.py
export RFM_CONFIG_FILES=$HOME/eessi_testsuite/settings_example.py
export RFM_PREFIX=$HOME/eessi_testsuite/reframe_runs
export RFM_CHECK_SEARCH_PATH=$HOME/eessi_testsuite/eessi_testsuite_venv/lib/python3.9/site-packages/eessi/testsuite/tests/
export RFM_CHECK_SEARCH_RECURSIVE=1
```


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Step 2b: create ReFrame config file

Now, modify `settings_example.py` to match your system

- Define a `stagedir` on a shared filesystem
- Select the matching `scheduler` https://reframe-hpc.readthedocs.io/en/stable/config_reference.html#config.systems.partitions.scheduler (set `local` if you are doing this on your laptop)
- Select the matching parallel `launcher` https://reframe-hpc.readthedocs.io/en/stable/config_reference.html#config.systems.partitions.launcher (`mpirun` *should* work for everyone, but you can use e.g. `srun`)
- Modify the `access` field to define arguments to be passed to the scheduler, etc. It should define a homogeneous set of nodes

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Step 2c: create ReFrame config file

Now, modify `settings_example.py` to match your system

- Under `resources` set the flag that should be passed to your scheduler to define required memory per node and pass `{size}` as argument
  - Slurm users: '`--mem={size}`'
  - Local spawner: '`--whatever={size}`' (unused)
- Define the max available memory per node under the `EXTRAS.MEM_PER_NODE` item (in MiB).
  - SLURM users: check `scontrol show node <nodename>` for the `RealMemory` on your nodes.
  - Local spawner: put anything (unused)

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Step 2d: create ReFrame config file

Now, modify `settings_example.py` to match your system

- Under `features` specify what FEATURES (CPU/GPU) and SCALES your system support
  - CPU partition: `'features': [FEATURES.CPU],`
  - GPU partition where you don't want to run CPU-only tests: `'features': [FEATURES.GPU],`
  - GPU partition where you also want to run CPU-only tests: `'features': [FEATURES.CPU, FEATURES.GPU],`
  - To run all scales (up to 16 nodes): `'features': [FEATURES.XYZ] + list(SCALES.keys())`
  - To run only single (full) node (e.g. local laptop): `'features': [FEATURES.XYZ] + [key for key, value in SCALES.items() if value.get("num_nodes") == 1]`
- GPU partitions only: under extras define `EXTRAS.GPU_VENDOR: GPU_VENDORS.NVIDIA`

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Step 3: run reframe --list -t CI

Run `reframe --list -t CI`

- You may get things like "`WARNING: skipping test 'EESSI_TensorFlow': the following parameters are undefined: module_name`". That's ok, it simply means you don't have the software(module) needed to run this test

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Step 3: run reframe --list -t CI

Run `reframe --list -t CI`

- If you get "`WARNING: failed to retrieve remote processor info: command 'sbatch rfm-detect-job.sh' failed with exit code 1:`", ReFrame's automatic CPU detection failed.
  - Check the ReFrame log ("`Log file(s) saved in '/path/to/log'`")
  - You might be missing `access` arguments
  - If it keeps failing, you could try 'manually' running `reframe --detect-host-topology` on the relevant node https://www.eessi.io/docs/test-suite/ReFrame-configuration-file/#create-topology-file . Then copy to `~/.reframe/topology/<system>-<partition>/processor.json`

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Step 3: run reframe --list -t CI

Run `reframe --list -t CI`

- You'll need to have at least one module available for which we have a test ☺
  - If you don't, simply install e.g. a CPU version of OSU-MicroBenchmarks with EasyBuild
- Expected output:

```
...
- EESSI_TensorFlow %scale=2_nodes %module_name=TensorFlow/2.13.0-foss-2023a %device_type=cpu /cbc475c5
- EESSI_TensorFlow %scale=1_node %module_name=TensorFlow/2.13.0-foss-2023a %device_type=cpu /9864d0f5
```


Test hash

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Step 4: run reframe --dryrun -t CI

Run `reframe --dryrun -t CI -n /<testhash>` to just run an individual test as an example

- Check the jobscript ReFrame will generate & submit in `<stagedir>/<system_name>/<partition_name>/default/<testname_testhash>/rfm_job.sh`
- If you have issues, that job script is (probably) your first place to look!

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Step 5: run reframe --run -t CI

Run `reframe --run -t CI -n /<testhash>` to just run an individual test as an example

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Summary

- Writing the ReFrame config requires some knowledge specific to the EESSI test suite, but is documented https://www.eessi.io/docs/test-suite/ReFrame-configuration-file/
- Apart from the ReFrame config, the EESSI test suite is ‘plug-and-play’!
- Number of supported applications is could be bigger – open to new contributions (see https://www.eessi.io/docs/test-suite/writing-portable-tests/)
- EESSI test suite is application-focused: no replacement for system-specific (e.g. scheduler or filesystem) tests
- Credit to ReFrame devs: EESSI test suite is possible because they spent time on our bug reports & feature requests ☺

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