

MUSES review: collaboration and cyberinfrastructure

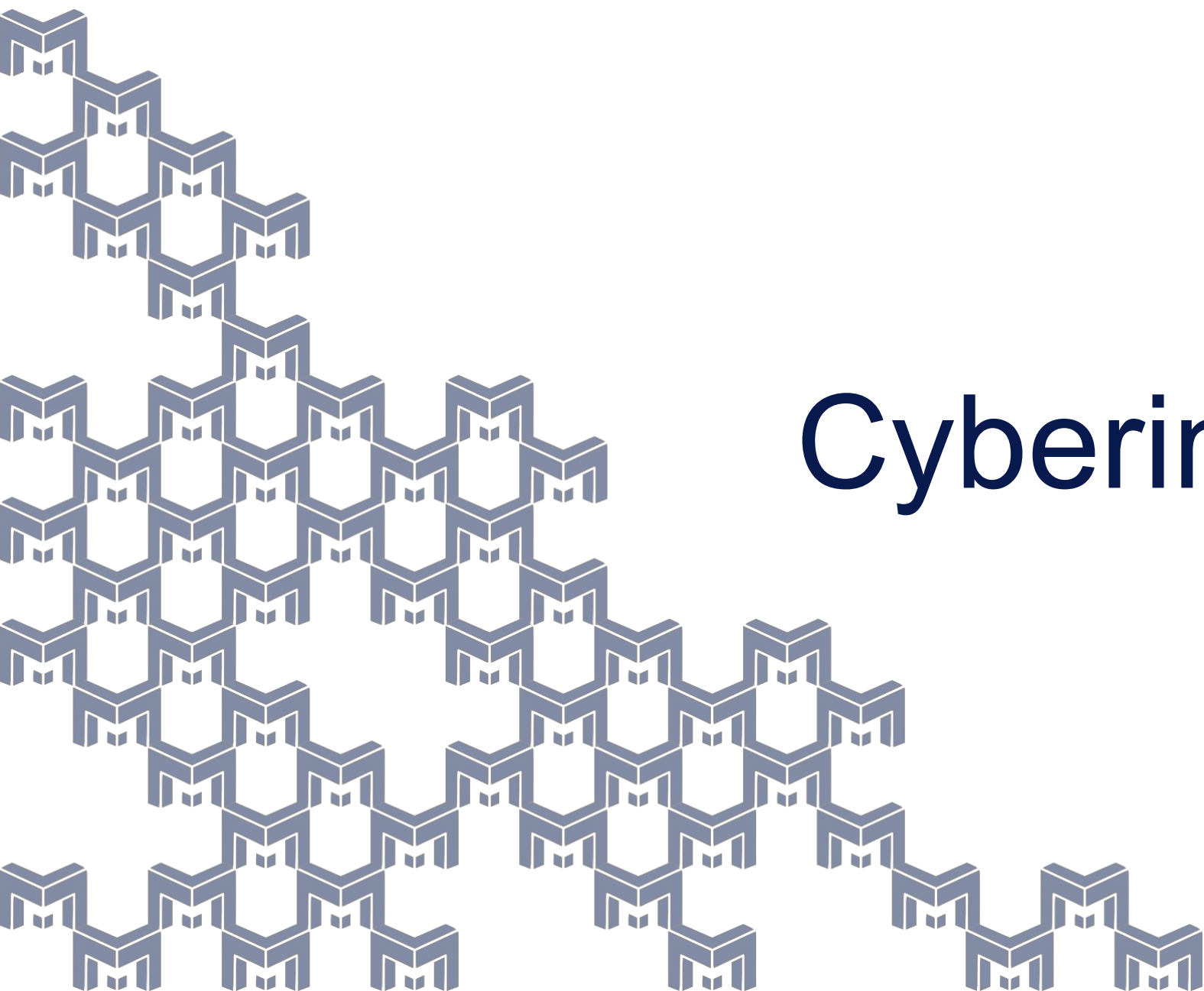
Nico Yunes

Physics Professor and Director of ICASU
University of Illinois Urbana-Champaign

Andrew Manning

Senior Research Scientist
National Center for Supercomputing Applications





Cyberinfrastructure

What does “cyberinfrastructure” (CI) actually mean???

- **Cyberinfrastructure*** consists of systems, data and information management, advanced instruments, visualization environments, and people, **all linked together by software and advanced networks to improve scholarly productivity** and enable knowledge breakthroughs and discoveries not otherwise possible.

Figure 2 shows the distinction between the systems that are elements of cyberinfrastructure and cyberinfrastructure as a system that includes humans as an integral part. The critical issue here is the astronomer (in this case Scott Michael of Indiana University) is able to interactively watching the output of simulations running remotely at the Pittsburgh Supercomputing Center. Data from the simulation are written to the Data Capacitor at IU as simulations are being performed, and **the researcher can either allow simulations to run to completion or cancel jobs when simulations produce nonsensical results. In the latter case the astronomer is able to adjust parameters and restart jobs.** This is an excellent example of cyberinfrastructure in that it involves supercomputers, data storage systems, and visualization systems all linked by networks (in this case the TeraGrid network [16]) and middleware (in this case Globus and the Common TeraGrid Software Stack [17]), **with a researcher as an integral component of the application execution.**

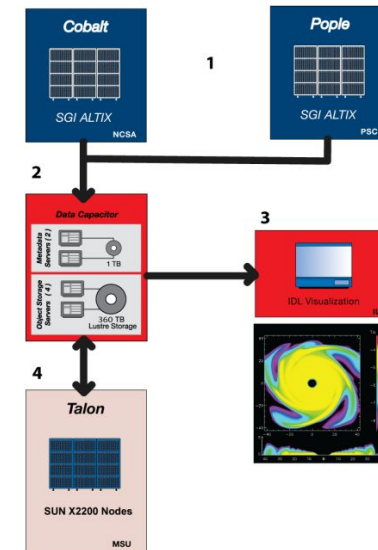
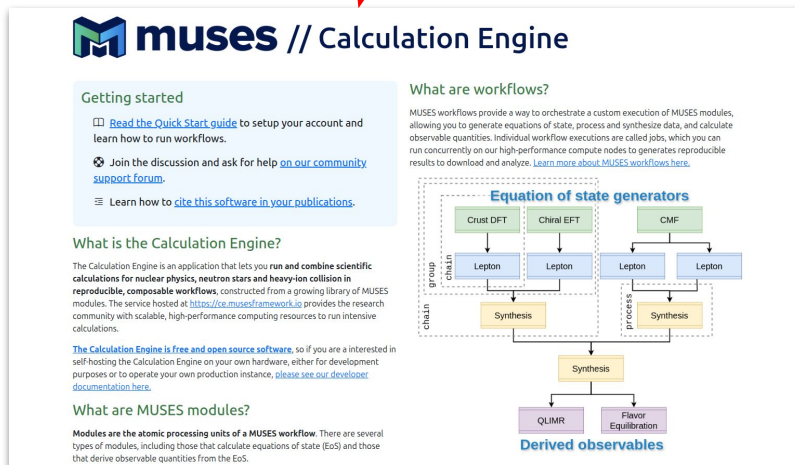


Figure 2. An astronomer (3) views the results of simulations occurring at PSC's Pople and NCSA's Cobalt supercomputers (1) as they are being written to IU's Data Capacitor (2). Further analysis of the data that have been written (2) takes place on MSU's Talon supercomputer.

* Indiana University.
What is Cyberinfrastructure?
October 2010
DOI:10.1145/1878335.1878347

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muses // Calculation Engine

Getting started

- Read the [Quick Start guide](#) to setup your account and learn how to run workflows.
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What is the Calculation Engine?

The Calculation Engine is an application that lets you run and combine scientific calculations for nuclear physics, neutron stars and heavy-ion collision in reproducible, composable workflows, constructed from a growing library of MUSES modules. The service hosted at <https://ce.musesframework.io> provides the research community with scalable, high-performance computing resources to run intensive calculations.

The Calculation Engine is free and open source software, so if you are interested in self-hosting the Calculation Engine on your own hardware, either for development purposes or to operate your own production instance, please see our [developer documentation](#) here.

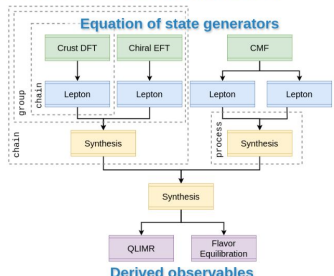
What are MUSES modules?

Modules are the atomic processing units of a MUSES workflow. There are several types of modules, including those that calculate equations of state (EoS) and those that derive observable quantities from the EoS.

What are workflows?

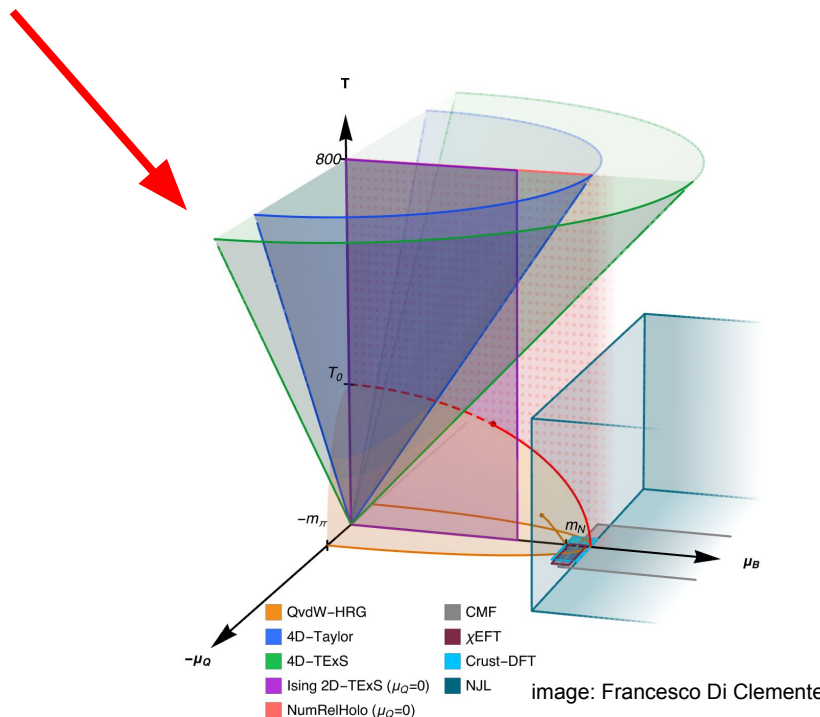
MUSES workflows provide a way to orchestrate a custom execution of MUSES modules, allowing you to generate equations of state, process and synthesize data, and calculate observable quantities. Individual workflow executions are called jobs, which you can run concurrently on our high-performance compute nodes to generate reproducible results to download and analyze. [Learn more about MUSES workflows here.](#)

Equation of state generators



Derived observables

- QUMR
- Flavor Equilibration



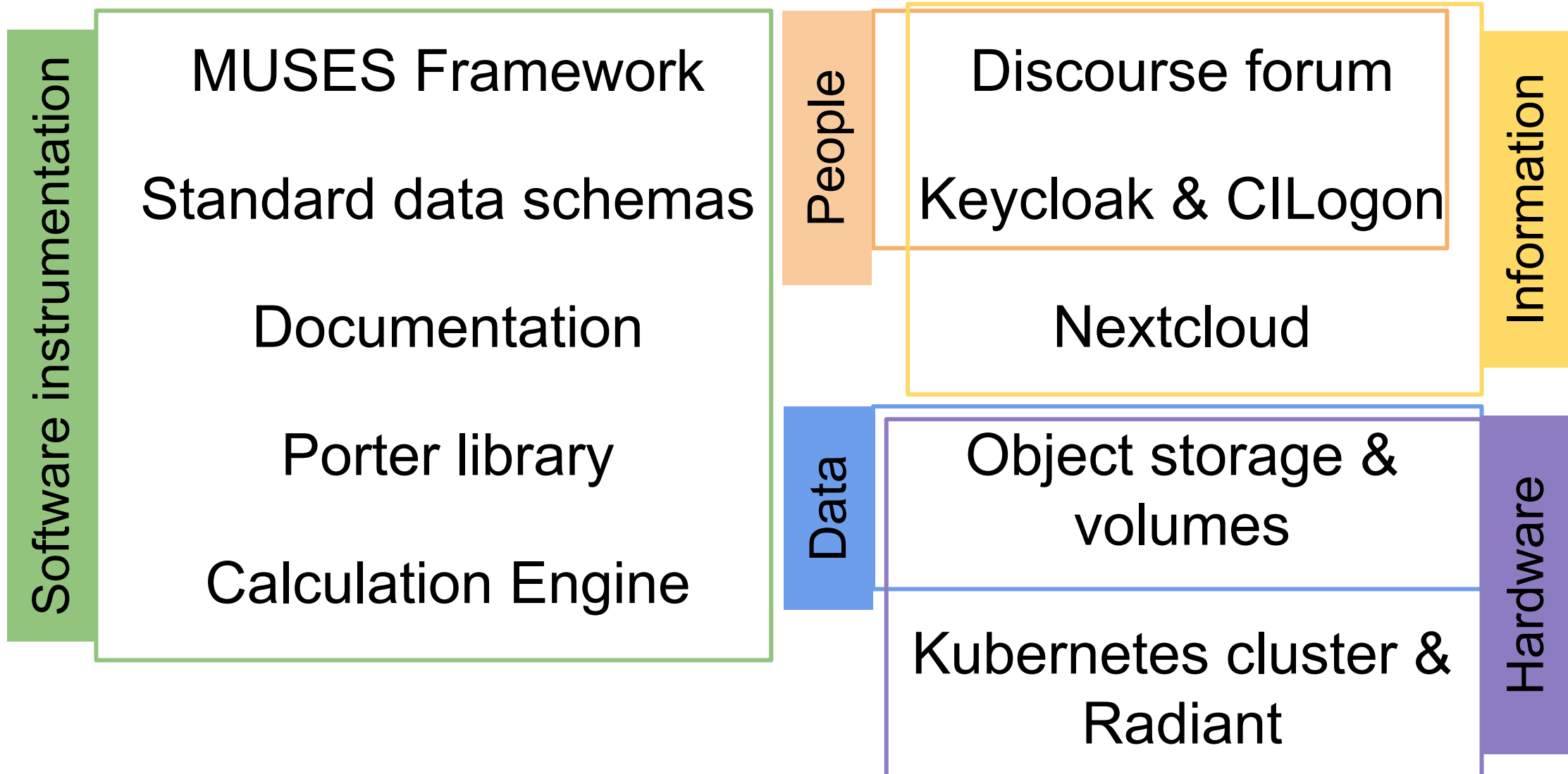
Look in mirror

- **Script** - a file whose statements are executed line-by-line to take specific actions or generate particular outputs.
- **Module*** - a **collection of related functions** and classes that are **reusable**. Multiple scripts or other modules may import the same module to reduce redundant code.
- **Library** - a **collection of modules** and scripts with a **well-defined interface** designed to provide a specific set of capabilities.
- **Application** - similar to a **library**, but is executed to provide a service or perform a set of tasks.
- **Package** - a self-contained unit of software that can be installed, typically via a package manager (apt, brew, pip, npm). A package can install a **library** or an **application**.

* The word “module” is a bit overloaded in computer science. A “MUSES module” is actually more of a “library” as defined above; however, we coined “MUSES module” based on the “modular” components that extensibly define the CE capability.

- In computer programming, a [software framework](#) is “an abstraction in which software, providing generic functionality, can be **selectively changed by additional user-written code**, thus providing application-specific software. It **provides a standard way to build and deploy applications** and is a **universal, reusable software environment** that provides particular functionality as part of a larger software platform to facilitate the development of software applications, products and solutions.”
- The **MUSES framework** defines a standardized way to package otherwise independent software libraries that calculate equations of state and related physical quantities, such that they can be integrated into data processing workflows in a larger application.
- A **MUSES module** is a **library** that has been **packaged** according to the **MUSES framework**.

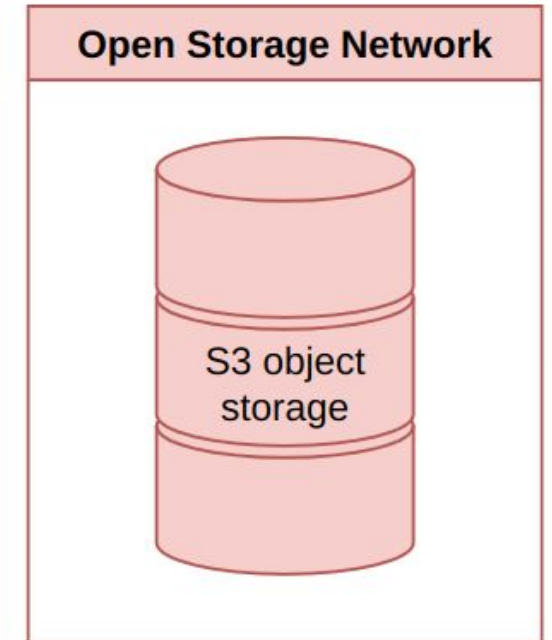
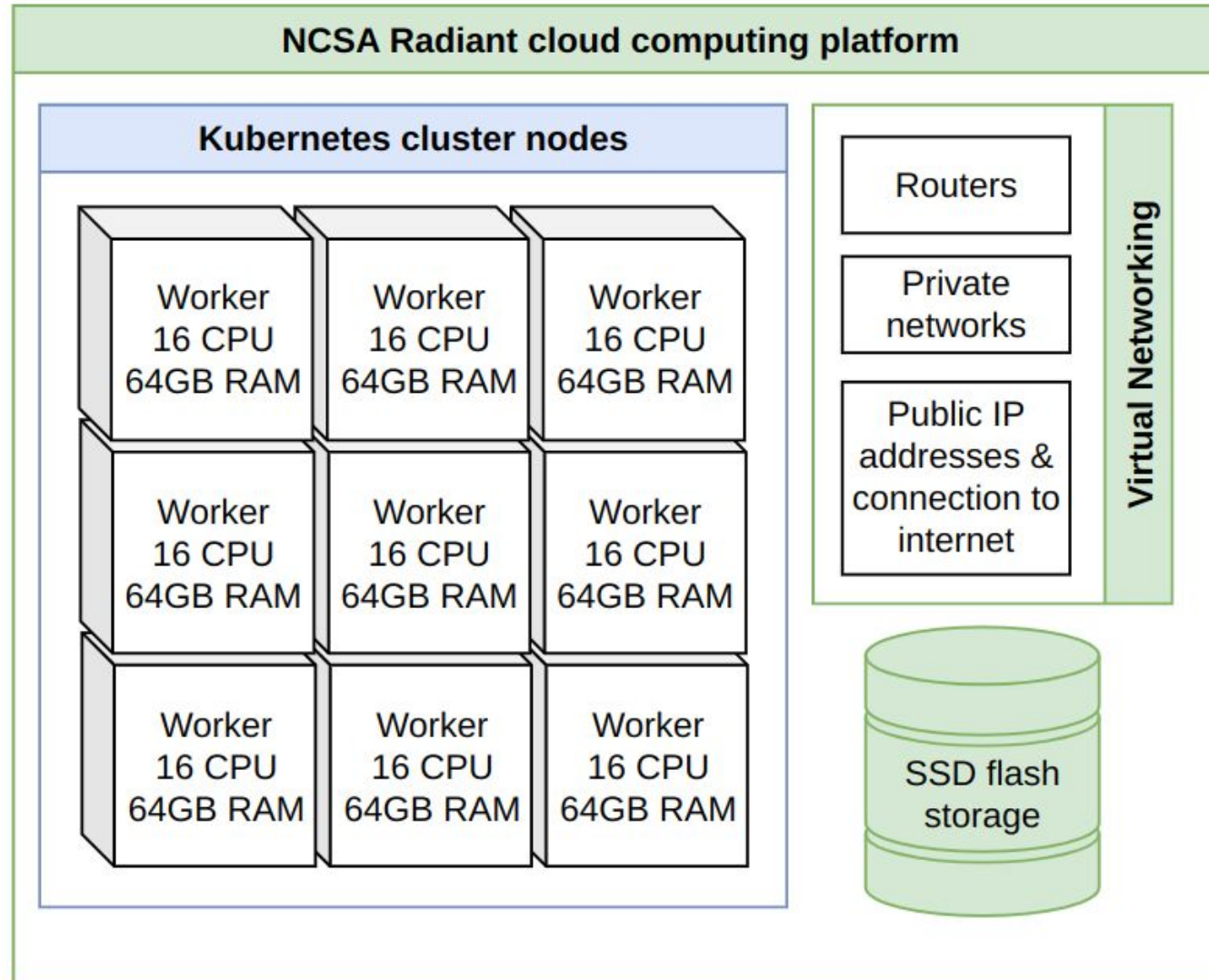
What comprises MUSES cyberinfrastructure?



Physical & virtual infrastructure



openstack



OSN is a bulk storage system provided by a federated network of institutions via NSF ACCESS

Physical & virtual infrastructure

I | **NCSA**

NCSA Radiant cloud co



Open Storage Network

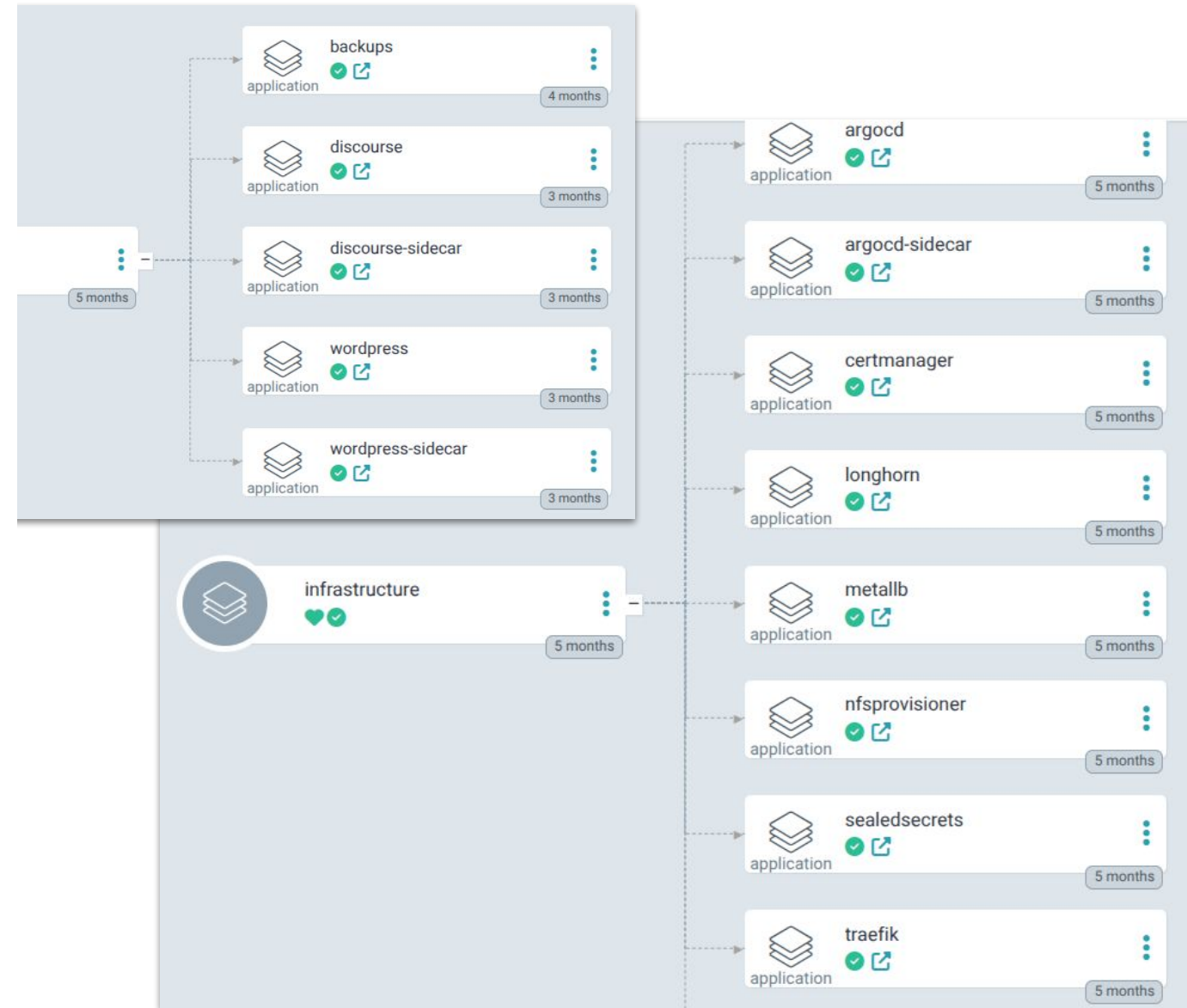


Foundational:

- Deployment system
- Secrets management
- Persistent storage provisioner
- Web ingress & TLS certificates
- Identity & access management
- Backup system

Services:

- Cloud file storage
- Discussion forum
- MUSES project website
- JupyterHub
- Calculation Engine

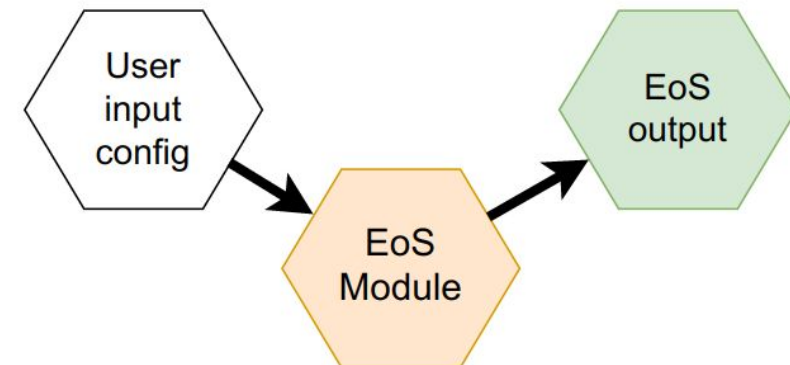


The Calculation Engine is a software **application** that

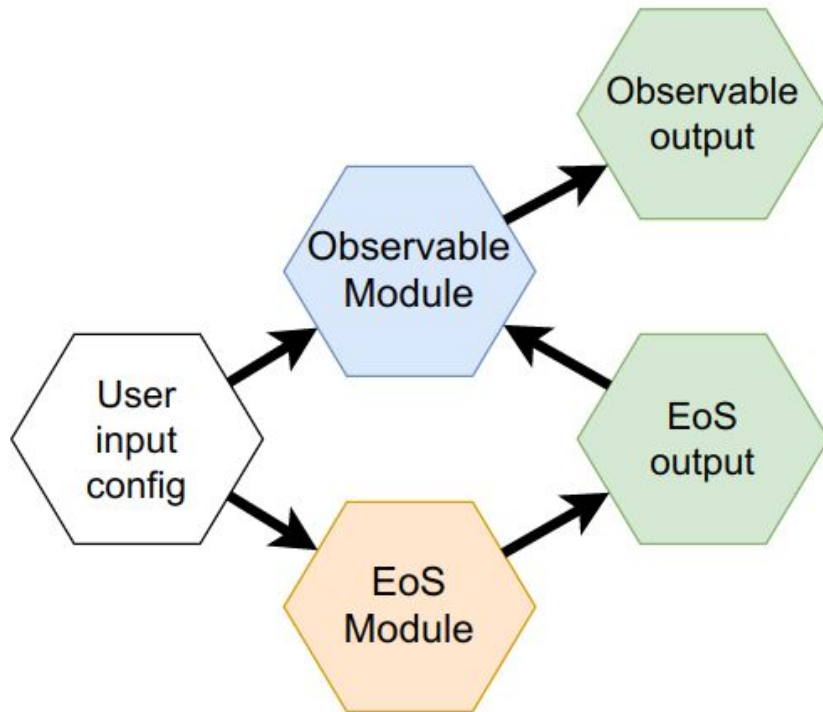
- manages user-submitted **jobs**
 - a **job** is the execution of one or more modules in a data processing **workflow**.
- manages the movement of data between subsystems
- serves data for download
- enforces access control
- organizes and stores information in a structured database
- tracks data provenance (does it really?)

A workflow is a processing sequence of one or more **MUSES modules**, in which output of one module is used as the input to the subsequent modules.

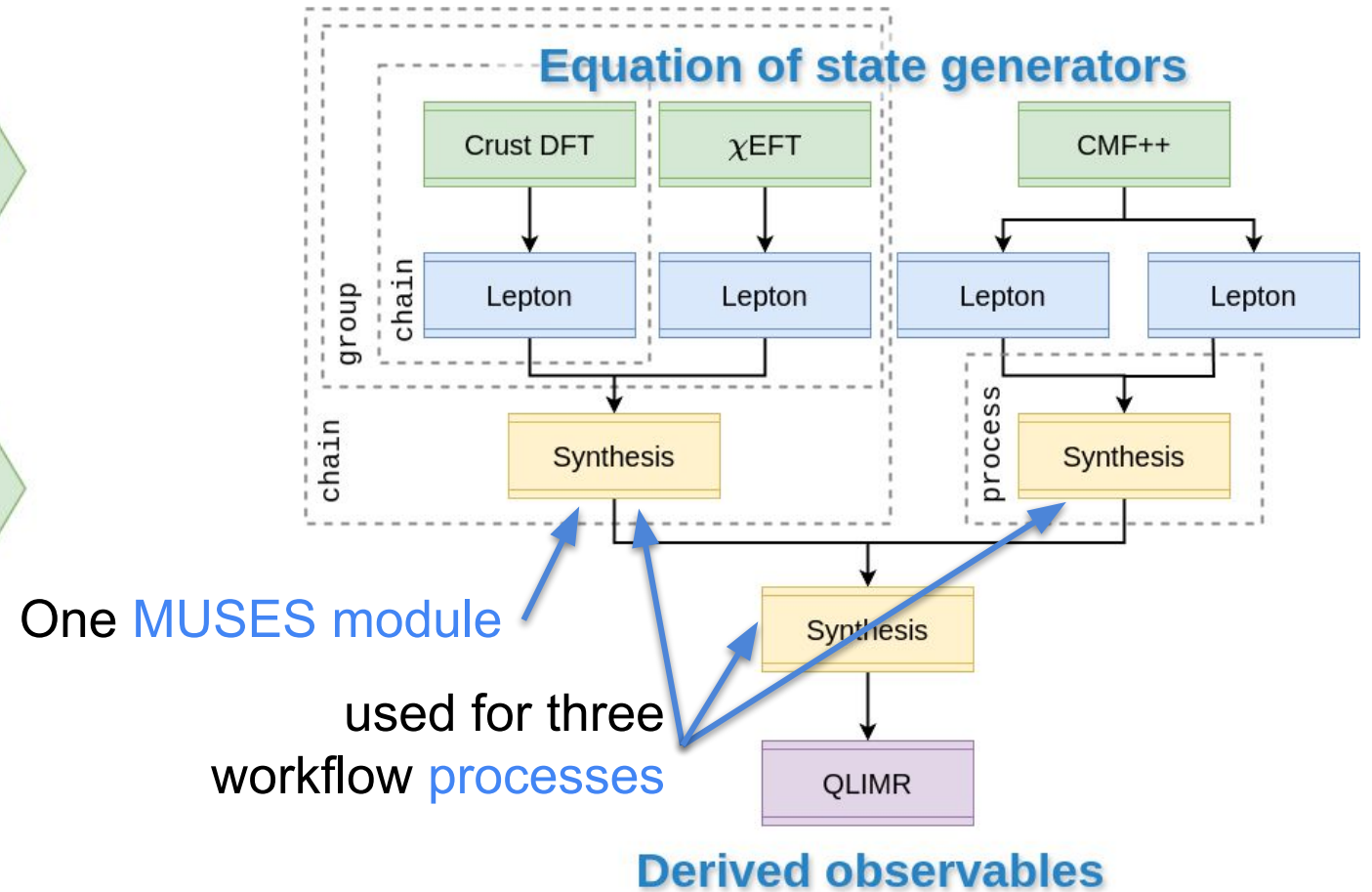
The simplest case is a single module execution such as calculating an equation of state.



The most common multi-module sequence will generate an EoS and then calculate some physical observables using a second module.



More complex workflows are supported as well (arbitrary DAGs limited only in number of processes).

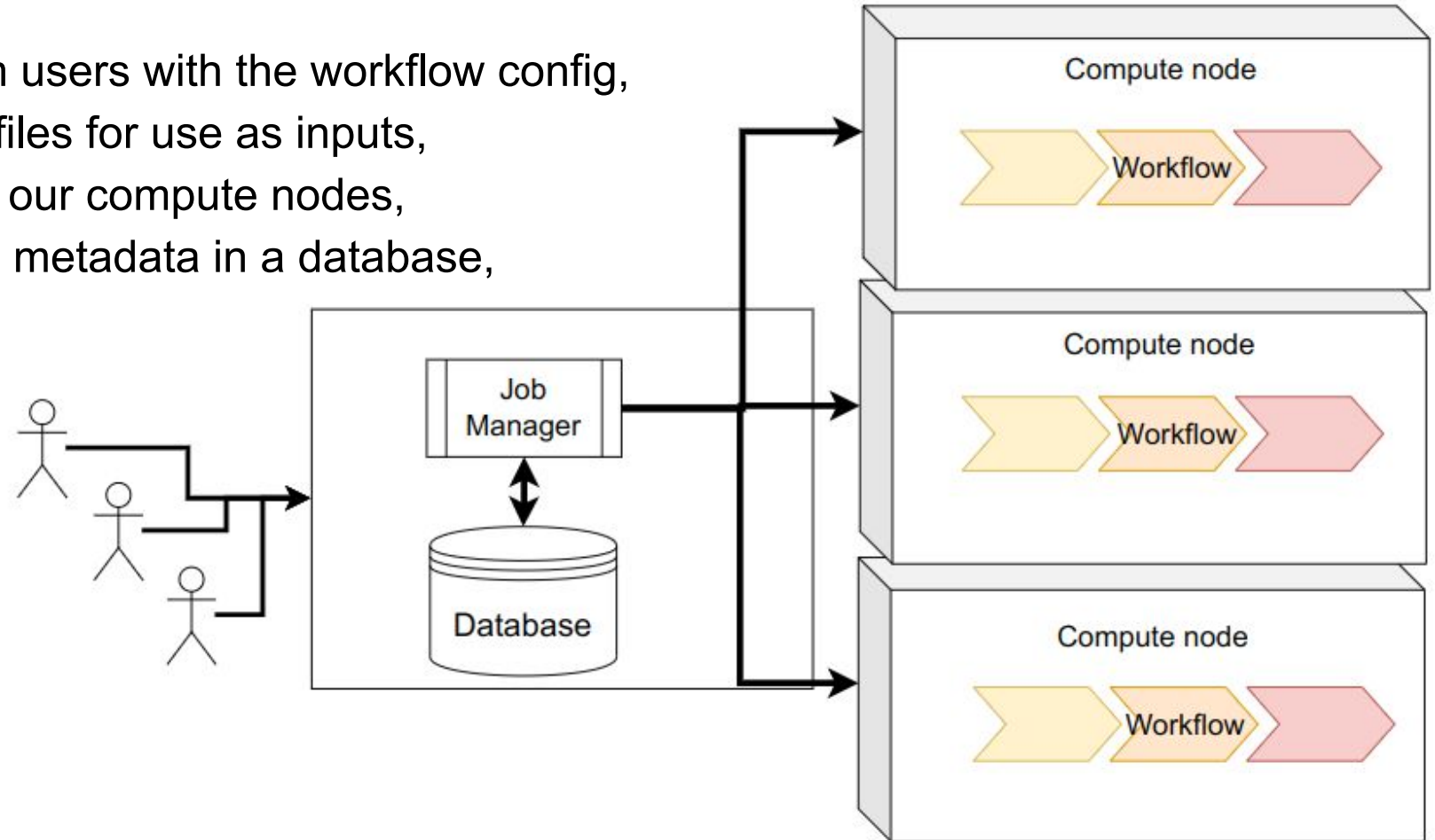


From the perspective of data flow, the CE

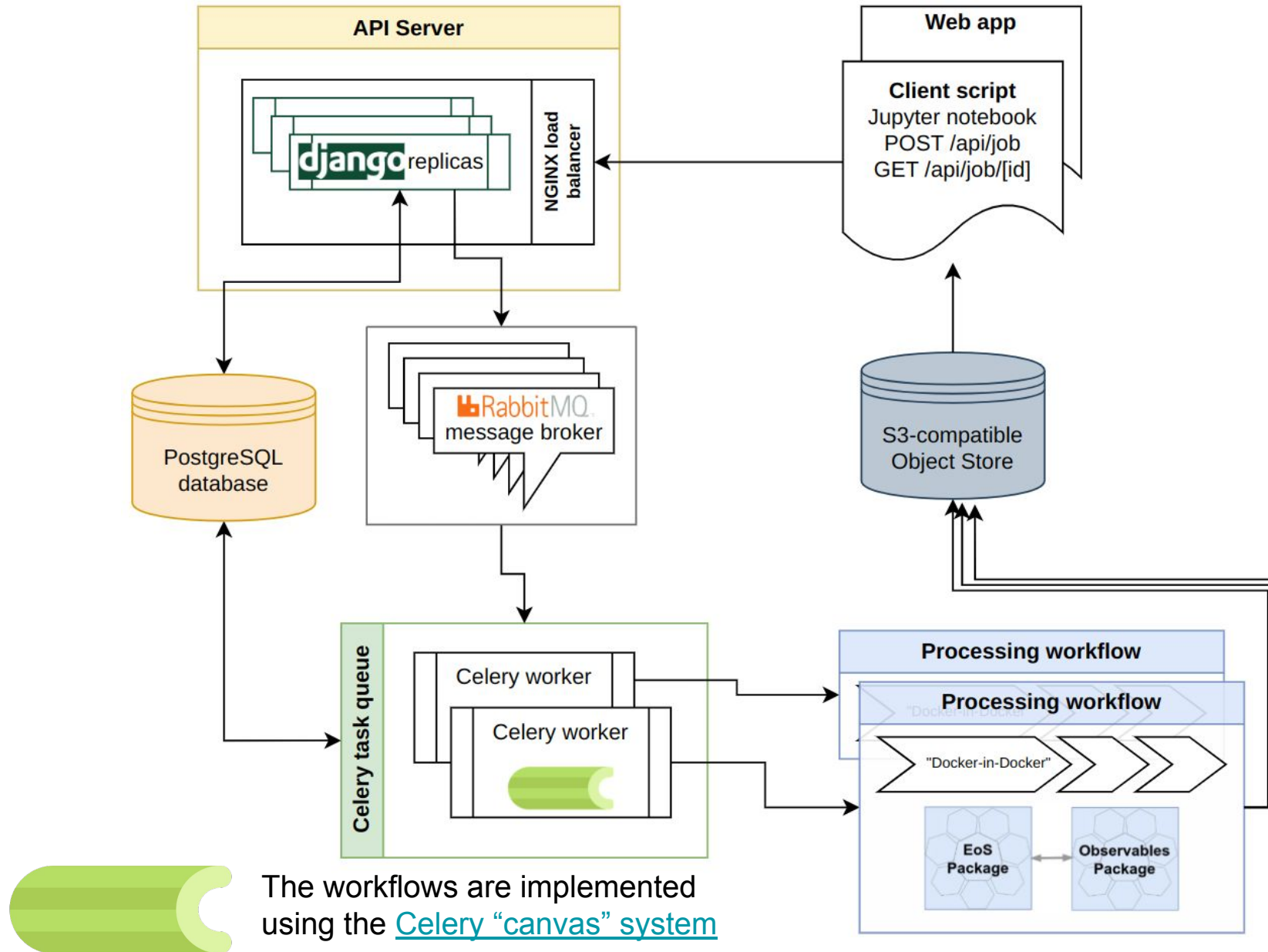
- takes the input requests from users with the workflow config,
- (optionally) stores uploaded files for use as inputs,
- launches processing jobs on our compute nodes,
- keeps track of job status and metadata in a database,

and handles things like

- notifying users when their jobs are complete
- returning output data

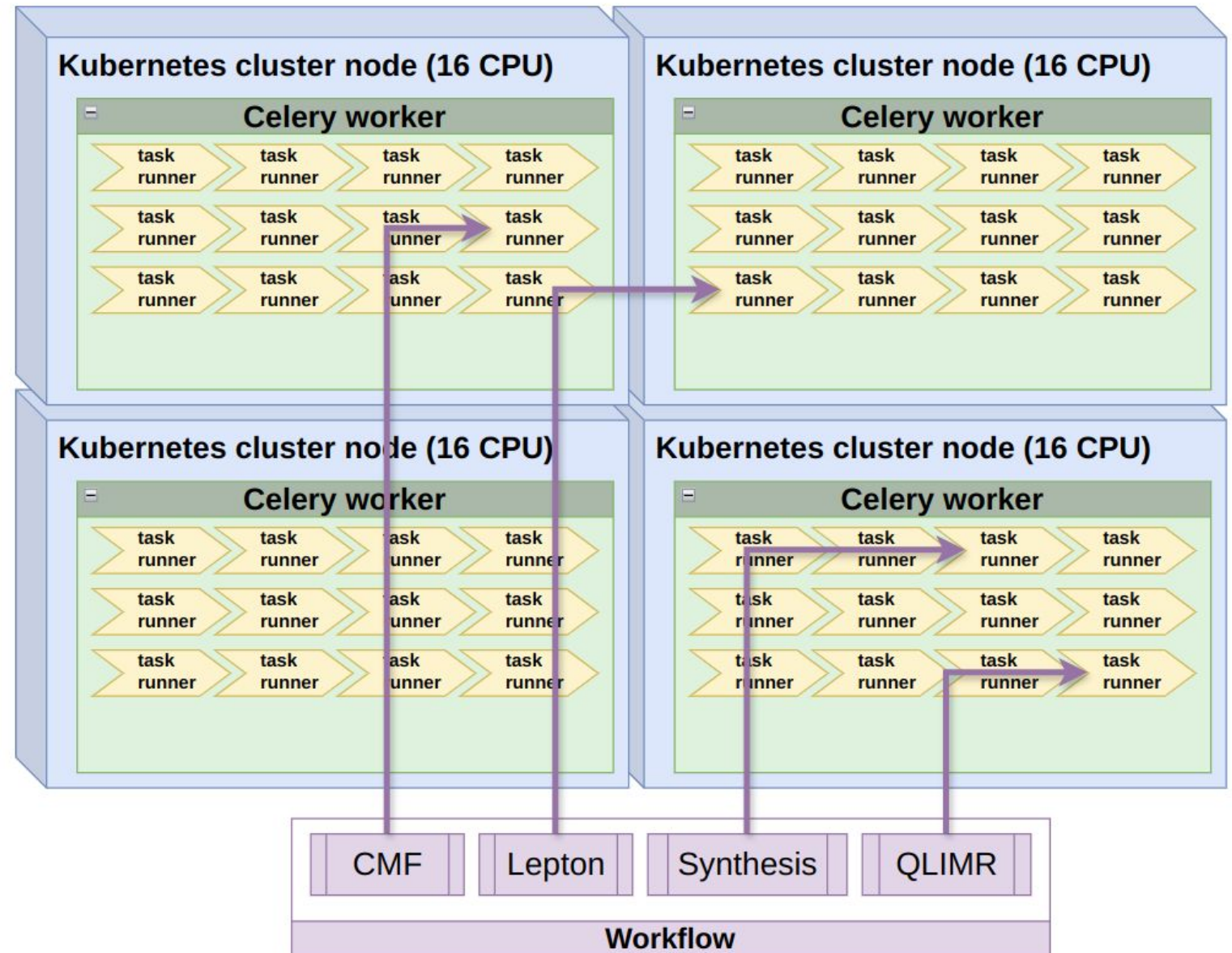


Calculation Engine system architecture



Current configuration:

- 10 worker nodes
- 160 cores
- 640 GB memory
- 1 task worker per node
- 12 concurrent tasks per worker
- 120 concurrent tasks
- 12 core limit per worker



[A particular version of the CE has a static set of registered modules](#) available for use in workflows.

These are documented in [the version-controlled CE documentation](#).

The equation of state modules include:

- Chiral EFT – `chiral_eft` (v1.0.1)
- Chiral Mean Field – `cmf_solver` (v1.0.3)
- Crust DFT – `crust_dft` (v1.0.3)
- Ising 2D T'-Expansion Scheme (Ising-2DTEs) – `eos_ising_texs_2d` (v1.0.2)
- 4D Taylor-expanded lattice (BQS) – `eos_taylor_4d` (v1.0.2)
- 4D lattice T-Expansion Scheme (4D-TEs) – `eos_texs_4d` (v1.0.1)
- Holographic – `holographic_eos` (v1.3.0)
- Lepton – `lepton` (v1.0.3)
- NJL – `njl` (v1.0.0)

CE v1.10.0

The observables modules include:

- Flavor Equilibration – `flavor_equilibration` (v1.0.0)
- QLIMR – `qlimr` (v1.0.2)
- Synthesis – `synthesis` (v1.0.4)

- Ising 2D T'-Expansion Scheme (Ising-2DTEs)
- 4D Taylor-expanded lattice (BQS)
- 4D T'-Expansion Scheme (4D-TEs)
- Physics Overview
 - Change of Coordinates
 - T' Expansion Scheme
 - Susceptibilities
 - Limits of Applicability
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- Quickstart
- Units
- Parameters
- Detailed Running
- Troubleshooting
- Flavor Equilibration Module
- Holographic EoS Code – C++ Version
- Lepton Module
- Nambu-Jona-Lasinio (NJL)
- QLIMR Module
- Synthesis Module
- DEVELOPER GUIDE
 - Overview
 - Modules
 - API Server

[Home](#) / [4D T'-Expansion Scheme \(4D-TEs\)](#) / [Physics Overview](#)

[View page source](#)

Physics Overview

The present code implements a **Four-Dimensional T' Expansion Scheme (4D-TEs)** to construct a QCD equation of state (EoS) that depends on temperature T and three independent chemical potentials: baryon μ_B , electric charge μ_Q , and strangeness μ_S . This code was written following the method described in Ref. ¹.

Compared to traditional Taylor expansion methods (limited to $\mu/T \lesssim 2.5-3$), the 4D-TEs allows for extrapolation up to $\mu/T \sim 3.5$ in the direction of the baryon chemical potential, extending the usable region of the QCD phase diagram significantly. This method relies on a change of coordinates and a local rescaling of temperature using generalized susceptibilities computed from continuum-estimated lattice data and HRG results.

The T'-expansion scheme is based on the observation that the dependence of certain fluctuation observables on baryon chemical potential μ_B can be effectively captured by a chemical-potential-dependent shift in temperature.

In the 2D case (involving only T and μ_B), presented in ², the expansion is defined through:

$$\frac{n_B(T, \hat{\mu}_B)}{\hat{\mu}_B} = \chi_2^B(T'),$$

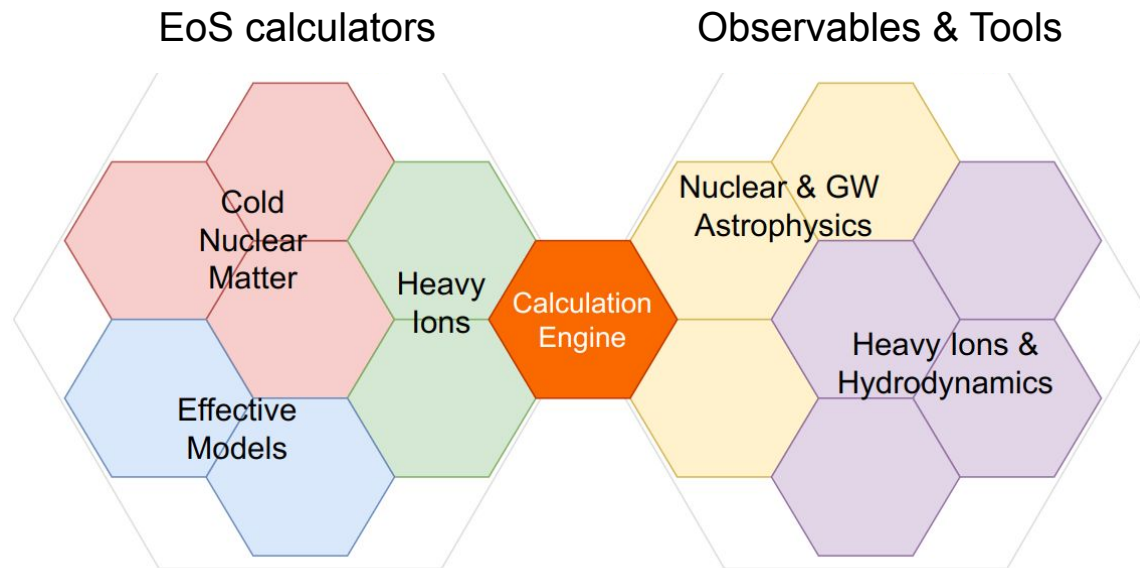
where $\hat{\mu}_B = \mu_B/T$ and the redefined effective temperature T' absorbs the μ_B dependence:

$$T'(T, \hat{\mu}_B) = T (1 + \kappa_2^B(T) \hat{\mu}_B^2 + \dots)$$

The coefficient $\kappa_2^B(T)$ is related to standard Taylor coefficients by:

$$\kappa_2^B(T) = \frac{1}{\epsilon_{T, \mu_B}^B(T)} \chi_4^B(T)$$

Integration is the process of adapting a code module to comply with [the MUSES framework we have defined](#) to allow the CE to execute workflows.



- **Containerization**

- Modules must build and push container images that the CE can download and execute via Docker.

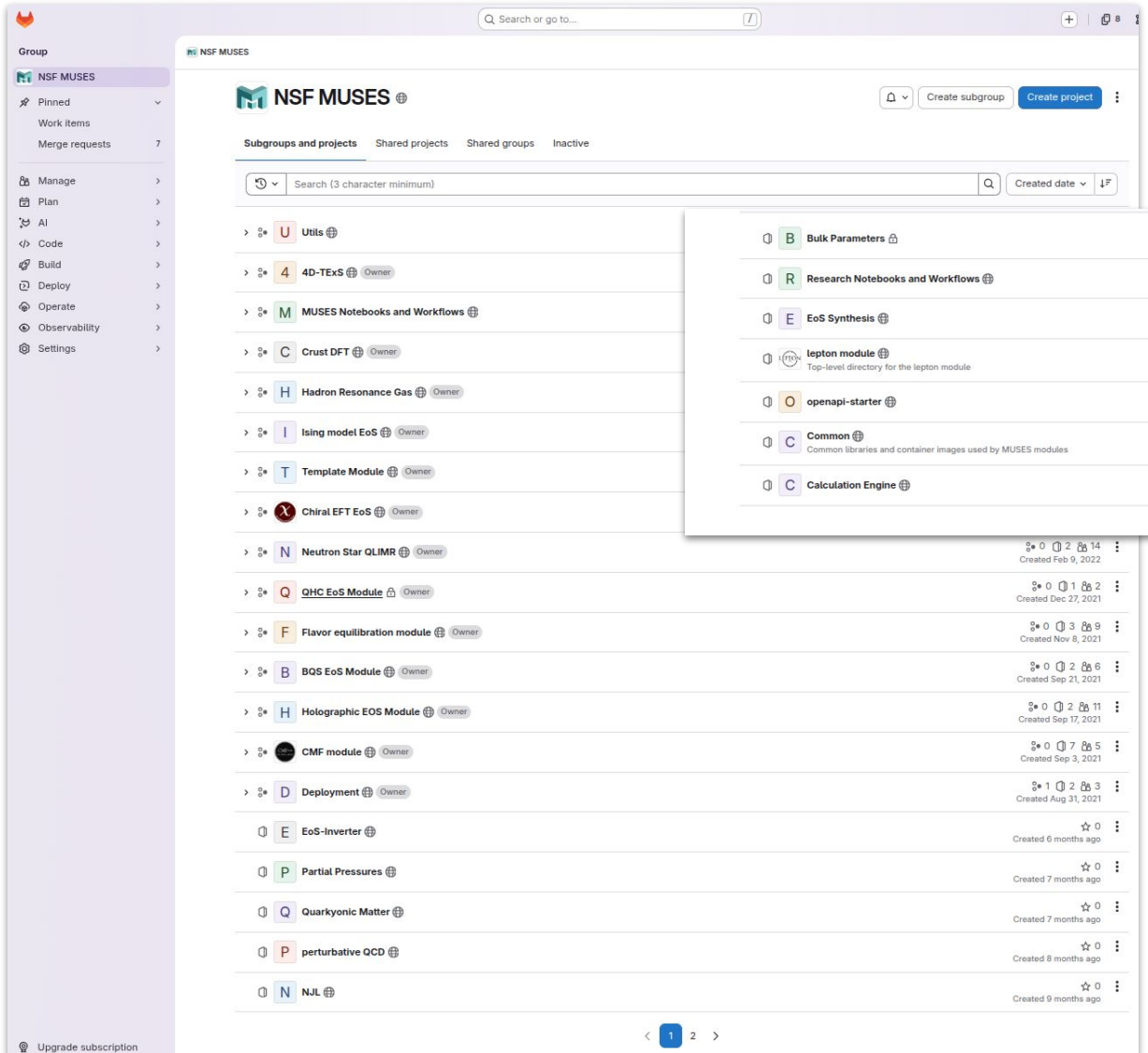
- **Manifest**

- Each module defines a so-called **manifest**, declaring information about itself in a standard format for inclusion in the CE config.

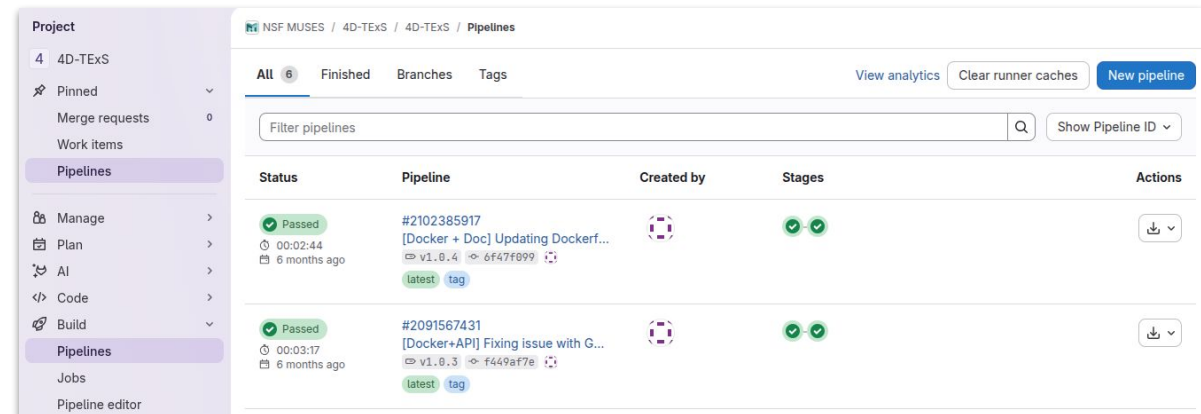
- **API specification**

- The inputs and outputs of a module must be declared in machine-level detail using the OpenAPI standard format

Module software repos and CI/CD



- Module development teams have learned to use GitLab and GitHub CI/CD pipelines to automatically build Docker images and run unit tests on those images
- This method ensures reproducibility and integrity of images with respect to the source code



Status	Pipeline	Created by	Stages	Actions
Passed	#2102385917 [Docker + Doc] Updating Dockerf... v1.0.4		✓ ✓	Download
Passed	#2091567431 [Docker+API] Fixing issue with G... v1.0.3		✓ ✓	Download

The public CE instance is a shared and finite resource. We must have a combination of **technical limits** and **rules of etiquette**.

There are tiers that set [the usage limits](#) for each user. Currently these include:

- Number of concurrent jobs
- Number of processes per workflow
- Total size of uploaded files
- Number of saved jobs

Job metadata and output files are deleted after 48 hours unless they are saved.

Saved jobs and uploaded files can be marked public for use by anyone.

From May 2025: tada! Public version is online!



ce.musesframework.io

muses Jobs Uploads API token Docs T. Andrew Manning (andrew.manning)

muses // Calculation Engine

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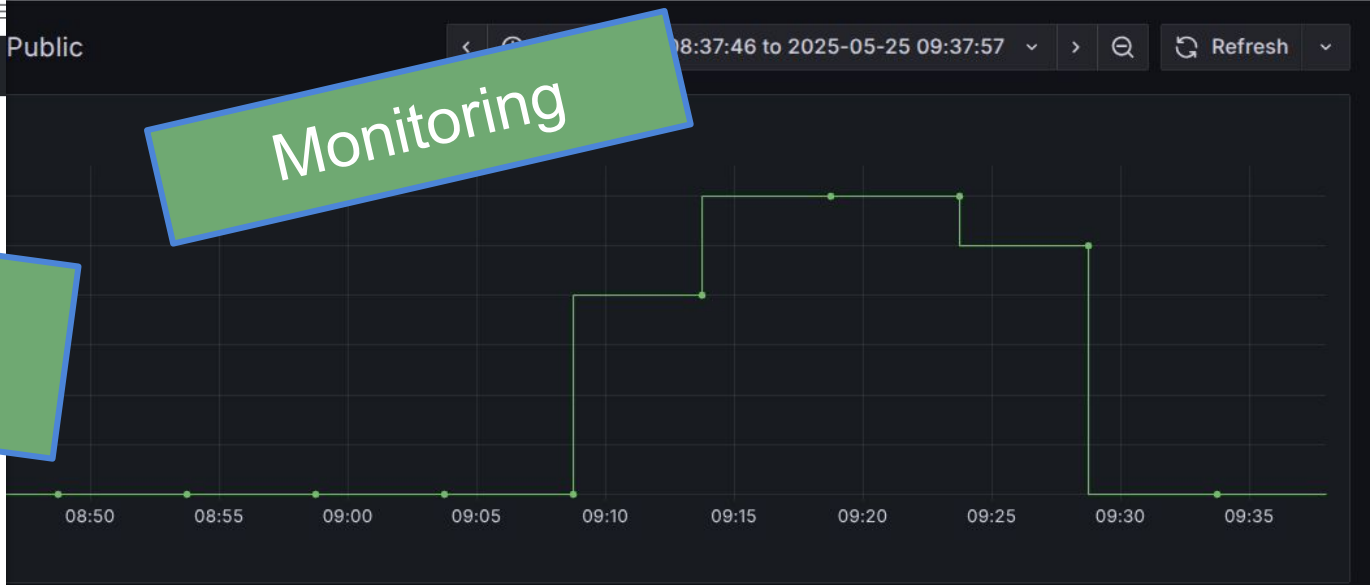
The Calculation Engine is an application that lets you run specific calculations as composable workflows, constructed from a library of MUSES modules. The service hosted at <https://ce.musesframework.io> provides the research...

Equation of state generators

```

graph TD
    subgraph group_chain [group chain]
        CrustDFT[Crust DFT] --> Lepton1[Lepton]
        ChiralEFT[Chiral EFT] --> Lepton2[Lepton]
    end
    subgraph process [process]
        CMF[CMF] --> Lepton3[Lepton]
        Lepton3 --> Lepton4[Lepton]
    end
    Lepton1 --> Synthesis1[Synthesis]
    Lepton2 --> Synthesis1
    Lepton3 --> Synthesis2[Synthesis]
    Lepton4 --> Synthesis2
  
```

Web app & API server



Monitoring

ce.musesframework.io

MUSES

Search docs

USER MANUAL

- Quick Start Guide
- MUSES Calculation Engine Tutorial
- Workflows
- How to cite the MUSES Calculation Engine
- Calculation Engine (CE) Terms of Service

MODULE DOCUMENTATION

- Chiral Effective Field Theory (xEFT)
- Chiral Mean Field (CMF) model
- Crust Density Functional Theory (Crust-DFT)
- Ising 2D T'-Expansion Scheme (Ising-2DTEXS)
- 4D Taylor-expanded lattice (BQS)

Synthesis Module

The Synthesis module is part of the MUSES framework, and it is designed to be used with an input configuration file (the config.yaml).

The code provides methods for joining two one-dimensional Equations of State (EoS), the options available are:

- Maxwell phase transition (PT)
- Gibbs phase transition
- Hyperbolic tangent interpolation
- Attaching the two EoS at a user defined variable and value.

Contents

- Quickstart
 - Local Usage
 - Docker Container

Documentation

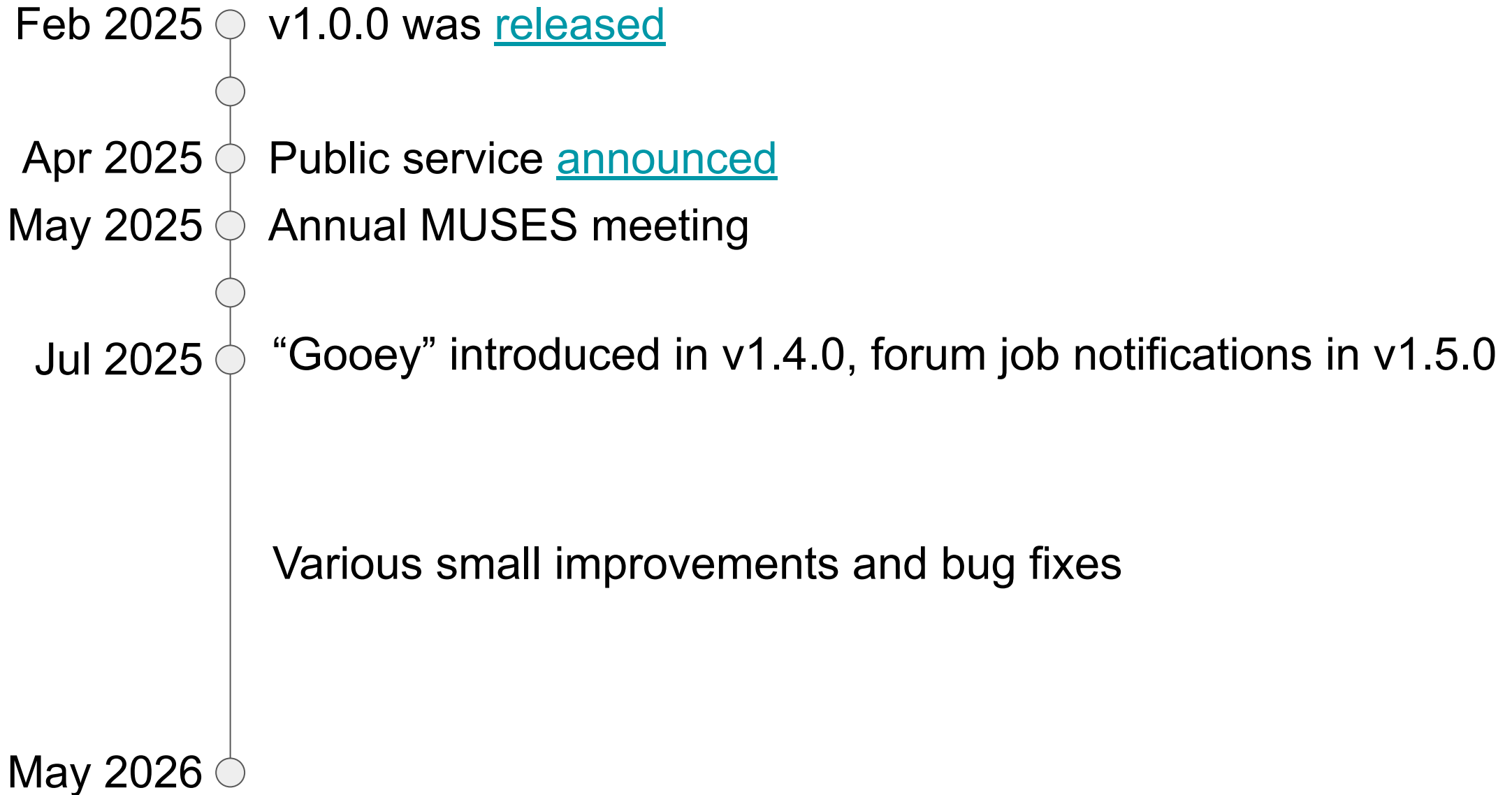
K9s v0.32.5 muses

ROLE	MEM/A	STATUS	VERSION
controlplane-01	2000	7937 Ready	v1.30.6+k3s1
controlplane-02	2000	7937 Ready	v1.30.6+k3s1
controlplane-03	2000	7937 Ready	v1.30.6+k3s1
worker-16cpu-01	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-02	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-03	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-04	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-05	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-06	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-07	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-08	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-09	16000	64298 Ready	v1.30.6+k3s1
worker-16cpu-10	16000	64298 Ready	v1.30.6+k3s1

Horsepower graph showing multiple fluctuating lines over time from 09:05 to 09:35. The y-axis represents horsepower, ranging from 25000 to 30000. The lines show high-frequency oscillations that drop to zero at approximately 09:28.

Horsepower

Calculation Engine history



Intermittent bursts of activity

Typically 1 or 2 simultaneous users



Majority of jobs were run almost a year ago by a “power user” who generously offered to help us debug the system by thrashing it relentlessly.

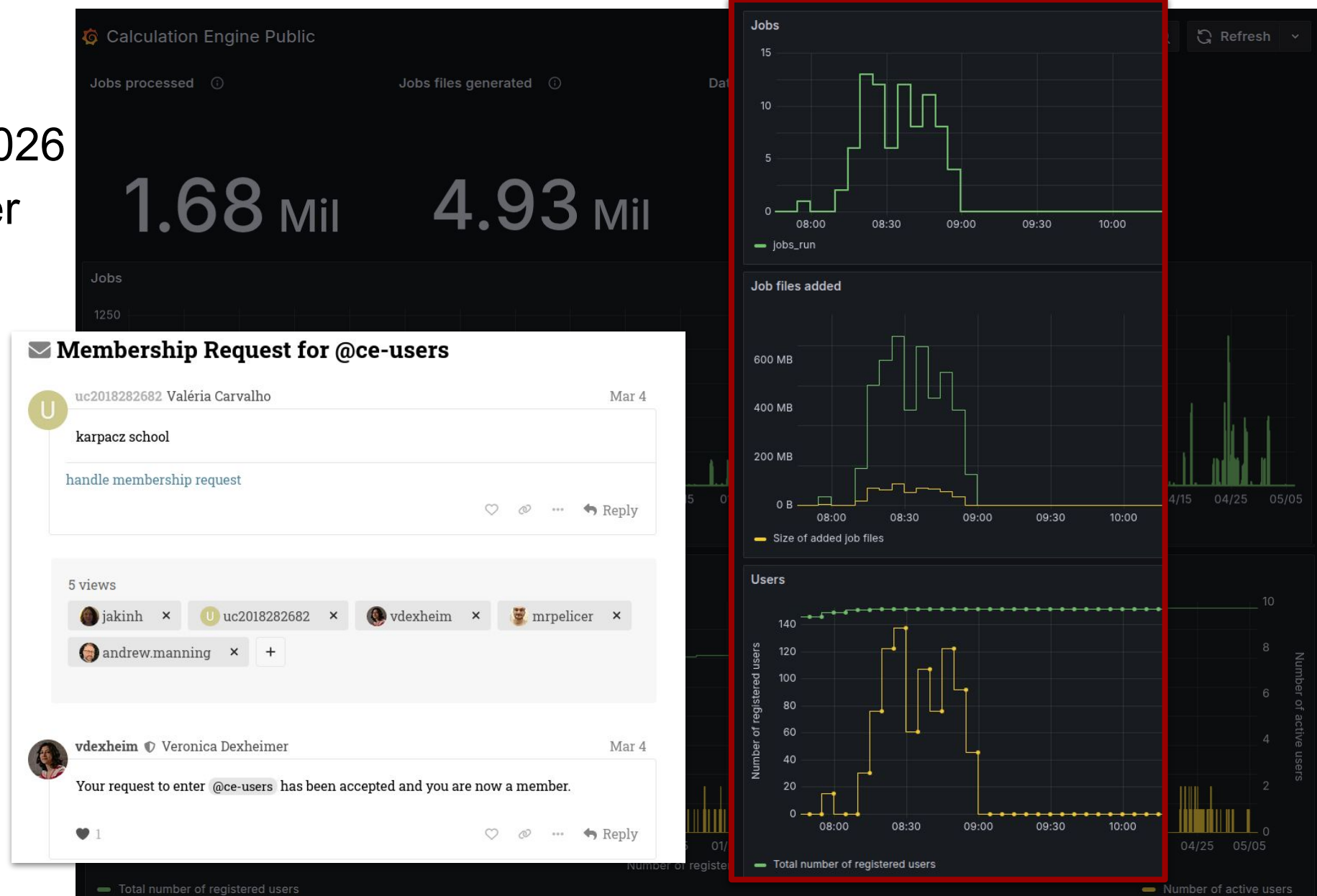
We will name no names.

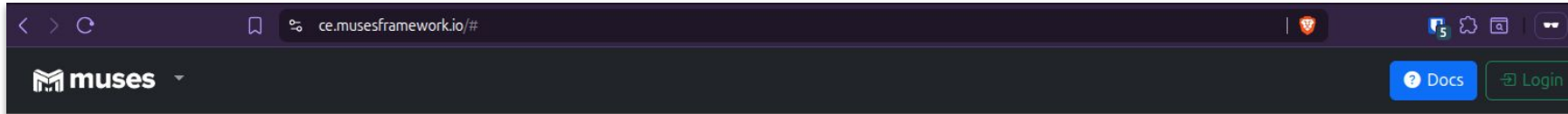


Small spike March 2026 during Karpacz winter school in Theoretical Physics

"Multimessenger Astrophysics and Cosmology".

The new user onboarding system worked smoothly!





STOP!

Before you login, you *must* read these instructions carefully to create (or use your existing) MUSES account properly.

First, [log in to our community forum using this link](#). This is where you will engage with the MUSES community and seek help when you have questions. The forum login button will take you to a CILogon screen where you can choose which identity provider (IdP) to use for authentication (typically your academic institution). **Once you have chosen your IdP you must always use the same one when logging into MUSES web services.**

Once you are logged into the forum and are satisfied with your selected IdP, proceed to click the login button below. You should be immediately redirected to this home page where you should see your name in the nav bar on the top-right of the screen.

[Click here to learn more about MUSES accounts.](#)

[Proceed to login](#)

Quick Start Guide

1. Login

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If you are already logged in and cannot recall which IdP you originally used, look at your username and email address in [your Account preferences](#); if you log out and back in, you should see the same username and email address.

Once you are logged into the forum and are satisfied with your selected IdP, open the [Calculation Engine \(CE\)](#) in the same web browser. When you click the login button, you should be redirected to the CE home page as an authenticated user. You should see your name in the top-right of the screen, on the navigation bar.

[Click here to learn more about MUSES accounts.](#)

2. Request Access

If you see the red "Request Access" button in the navigation bar, it means you do not yet have permission to use the CE. Click it to request access and follow the instructions. When one of our staff approves your request, you will receive a confirmation email. Note that this may take hours or days depending on staff availability. If you are concerned about your request and wish to contact someone, please [create a post on our support forum](#).

muses // Calculation Engine

Getting started

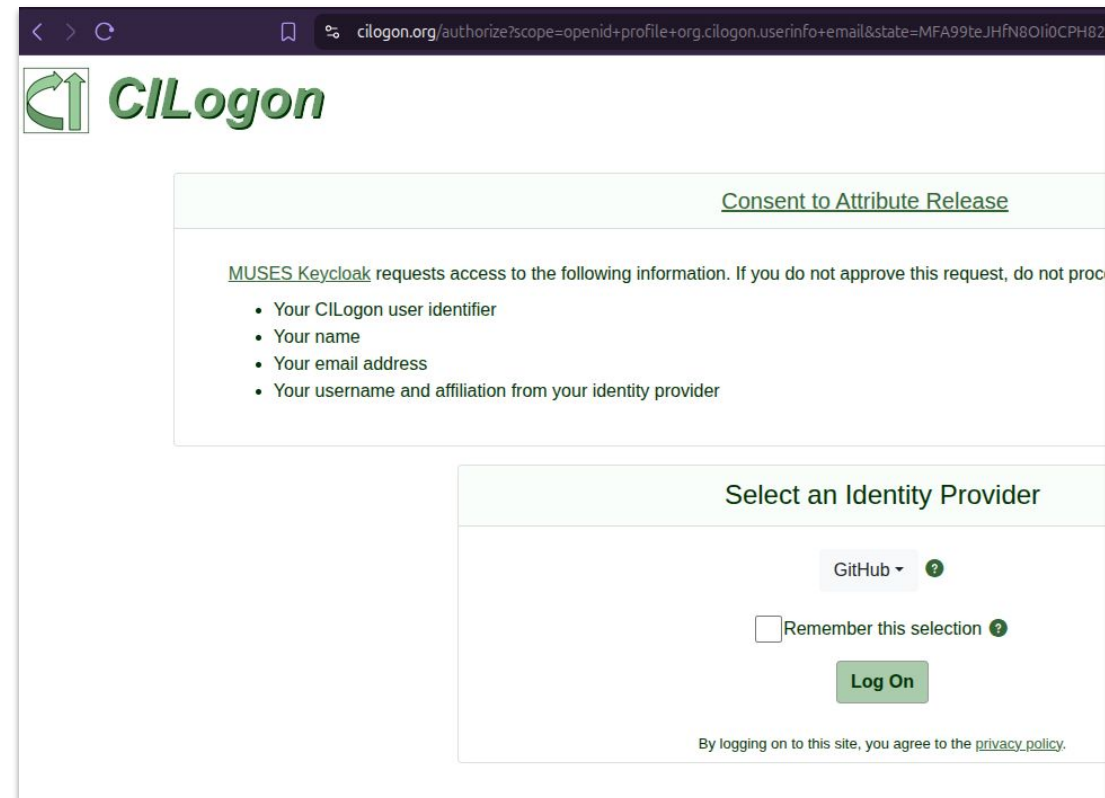
- 📖 [Read the Quick Start guide](#) to setup your account and learn how to run workflows.
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Equation of state generators

CE: New user onboarding



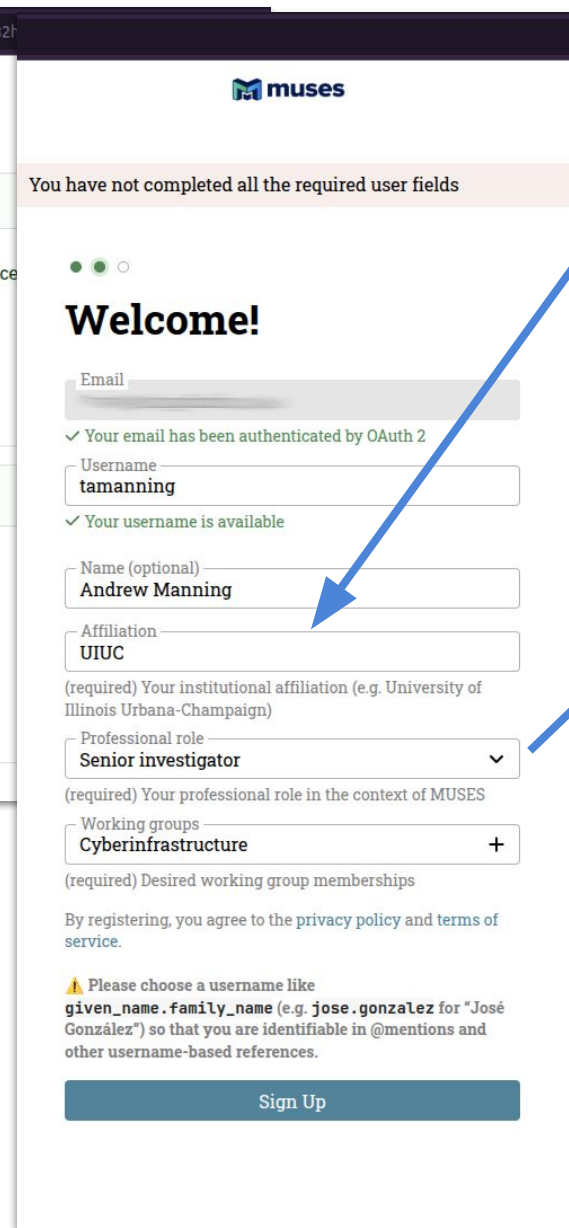
The CILogon consent screen displays the following information:

- Consent to Attribute Release**
- MUSES Keycloak** requests access to the following information. If you do not approve this request, do not proceed.
- Your CILogon user identifier
- Your name
- Your email address
- Your username and affiliation from your identity provider

Select an Identity Provider

- GitHub
- Remember this selection
- Log On

By logging on to this site, you agree to the [privacy policy](#).



You have not completed all the required user fields

Welcome!

Email

✓ Your email has been authenticated by OAuth 2

Username
tamanning

✓ Your username is available

Name (optional)
Andrew Manning

Affiliation
UIUC
(required) Your institutional affiliation (e.g. University of Illinois Urbana-Champaign)

Professional role
Senior investigator
(required) Your professional role in the context of MUSES

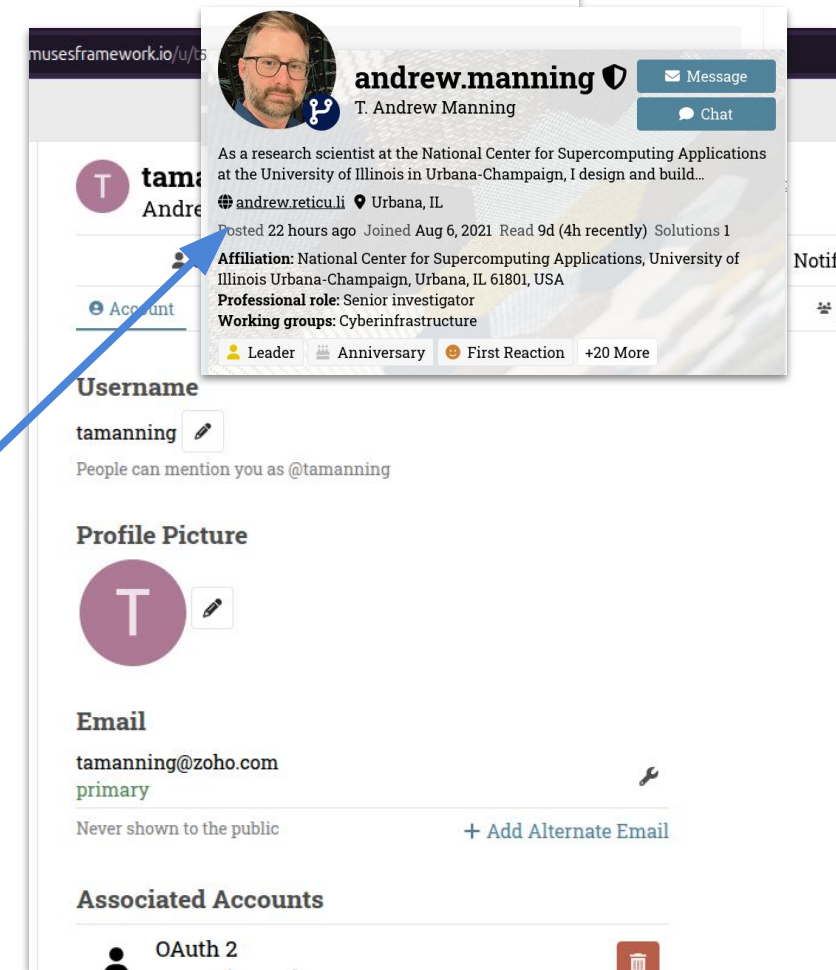
Working groups
Cyberinfrastructure
(required) Desired working group memberships

By registering, you agree to the [privacy policy](#) and [terms of service](#).

⚠ Please choose a username like `given_name.family_name` (e.g. `jose.gonzalez` for "José González") so that you are identifiable in @mentions and other username-based references.

Sign Up

Now we use custom profile fields provided by Discourse instead of a custom-built service.



Profile for **andrew.manning** (T. Andrew Manning)

As a research scientist at the National Center for Supercomputing Applications at the University of Illinois in Urbana-Champaign, I design and build...

🌐 [andrew.reticu.li](#) 📍 Urbana, IL

Posted 22 hours ago · Joined Aug 6, 2021 · Read 9d (4h recently) · Solutions 1

Affiliation: National Center for Supercomputing Applications, University of Illinois Urbana-Champaign, Urbana, IL 61801, USA

Professional role: Senior investigator

Working groups: Cyberinfrastructure

👤 Leader 🗓 Anniversary 🗨 First Reaction +20 More

Username: tamanning

People can mention you as @tamanning

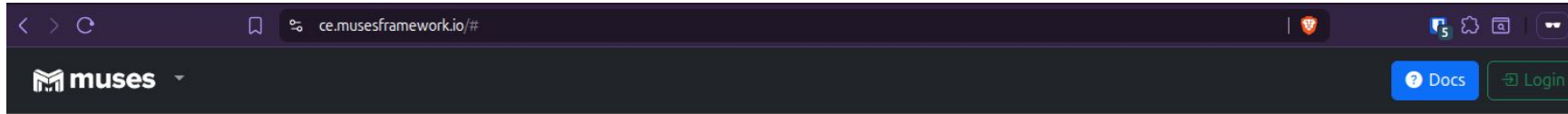
Profile Picture: T

Email: tamanning@zoho.com (primary)

Never shown to the public + Add Alternate Email

Associated Accounts: OAuth 2

- Select your preferred identify provider
- Enter MUSES profile info at account creation time.



STOP!

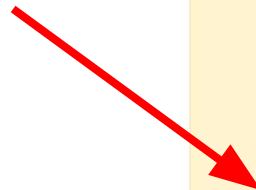
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First, [log in to our community forum using this link](#). This is where you will engage with the MUSES community and seek help when you have questions. The forum login button will take you to a CILogon screen where you can choose which identity provider (IdP) to use for authentication (typically your academic institution). **Once you have chosen your IdP you must always use the same one when logging into MUSES web services.**

Once you are logged into the forum and are satisfied with your selected IdP, proceed to click the login button below. You should be immediately redirected to this home page where you should see your name in the nav bar on the top-right of the screen.

[Click here to learn more about MUSES accounts.](#)


[Proceed to login](#)



muses // Calculation Engine

Getting started

 [Read the Quick Start guide](#) to setup your account and learn how to run workflows.

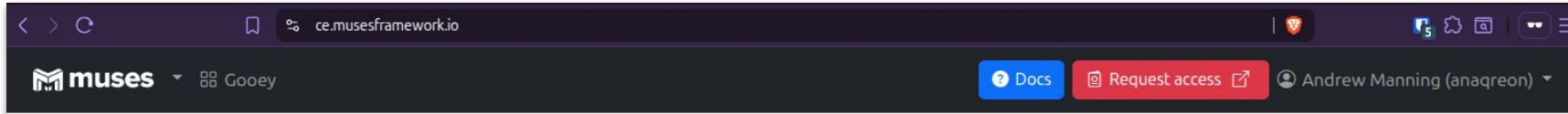
 Join the discussion and ask for help [on our community support forum](#).

 Learn how to [cite this software in your publications](#).

What are workflows?

MUSES workflows provide a way to orchestrate a custom execution of MUSES modules, allowing you to generate equations of state, process and synthesize data, and calculate observable quantities. Individual workflow executions are called jobs, which you can run concurrently on our high-performance compute nodes to generate reproducible results to download and analyze. [Learn more about MUSES workflows here.](#)





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What is the Calculation Engine?

The Calculation Engine is an application that lets you **run and combine scientific calculations for nuclear physics, neutron stars and heavy-ion collision in reproducible, composable workflows**, constructed from a growing library of MUSES modules. The service hosted at <https://ce.musesframework.io> provides the research community with scalable, high-performance computing resources to run intensive calculations.

The Calculation Engine is **free and open source software**, so if you are interested in self-hosting the Calculation Engine on your own hardware, either for development purposes or to operate your own production instance, [please see our developer documentation here](#).

What are MUSES modules?

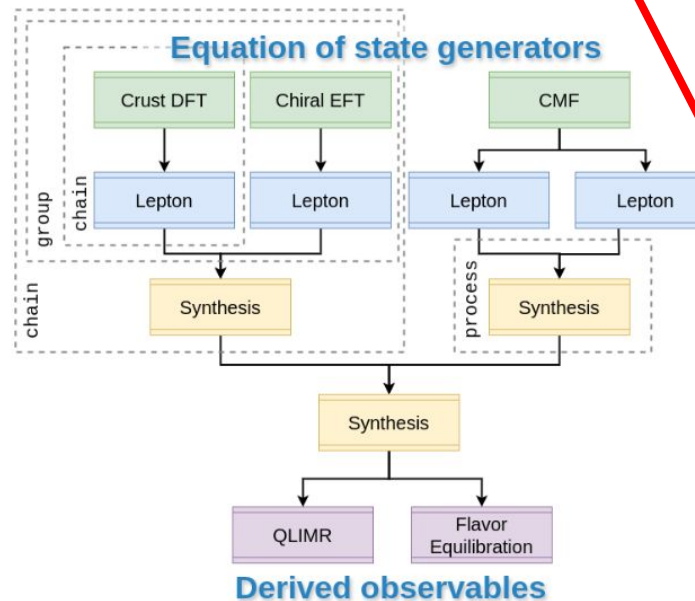
Modules are the **atomic processing units of a MUSES workflow**. There are several types of modules, including those that calculate equations of state (EoS) and those that derive observable quantities from the EoS.

The equation of state modules include:

- Chiral EFT - `chiral_eft (v1.0.1)`

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What is MUSES?

Quick Start Guide

1. Login

Important

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First, [log in to our community forum using this link](#). This is where you will engage with the MUSES community and seek help when you have questions. The forum login button will take you to a CILogon screen where you can choose which identity provider (IdP) to use for authentication. **Once you have chosen your IdP you must always use the same one when logging in to MUSES web services.**

If you are already logged in and cannot recall which IdP you originally used, look at your username and email address [in your Account preferences](#); if you log out and back in, you should see the same username and email address.

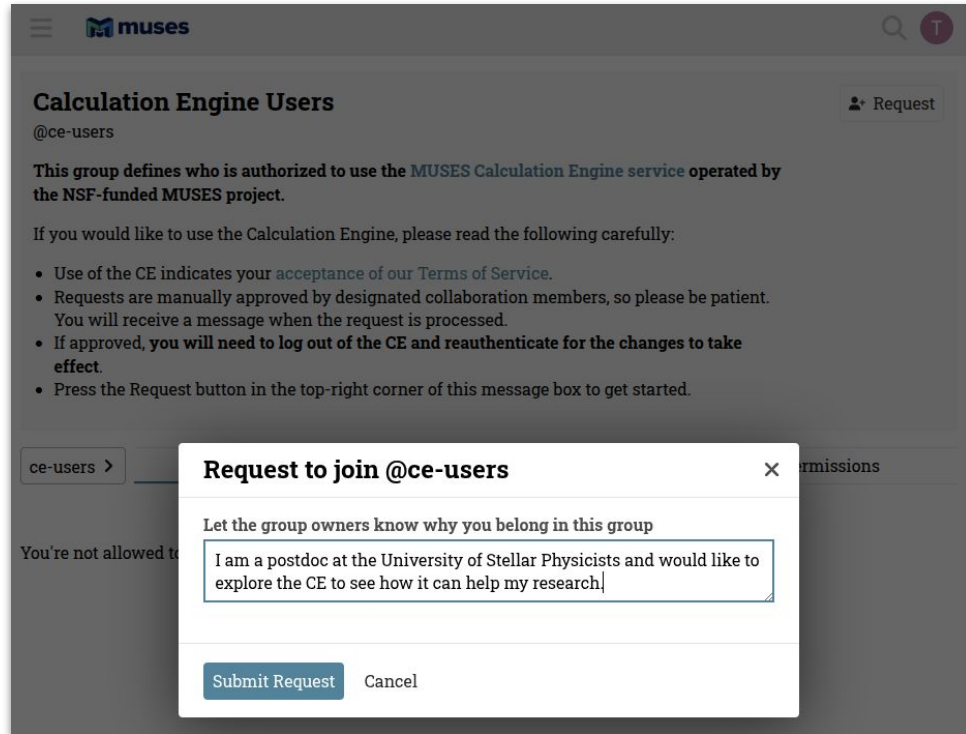
Once you are logged into the forum and are satisfied with your selected IdP, open the [Calculation Engine \(CE\)](#) in the same web browser. When you click the login button, you should be redirected to the CE home page as an authenticated user. You should see your name in the top-right of the screen, on the navigation bar.

[Click here to learn more about MUSES accounts.](#)

2. Request Access

If you see the red "Request Access" button in the navigation bar, it means you do not yet have permission to use the CE. Click it to request access and follow the instructions. When one of our staff approves your request, you will receive a confirmation email. Note that this may take hours or days depending on staff availability. If you are concerned about your request and wish to contact someone, please [create a post on our support forum](#).

CE: New user onboarding



Calculation Engine Users
@ce-users

This group defines who is authorized to use the MUSES Calculation Engine service operated by the NSF-funded MUSES project.

If you would like to use the Calculation Engine, please read the following carefully:

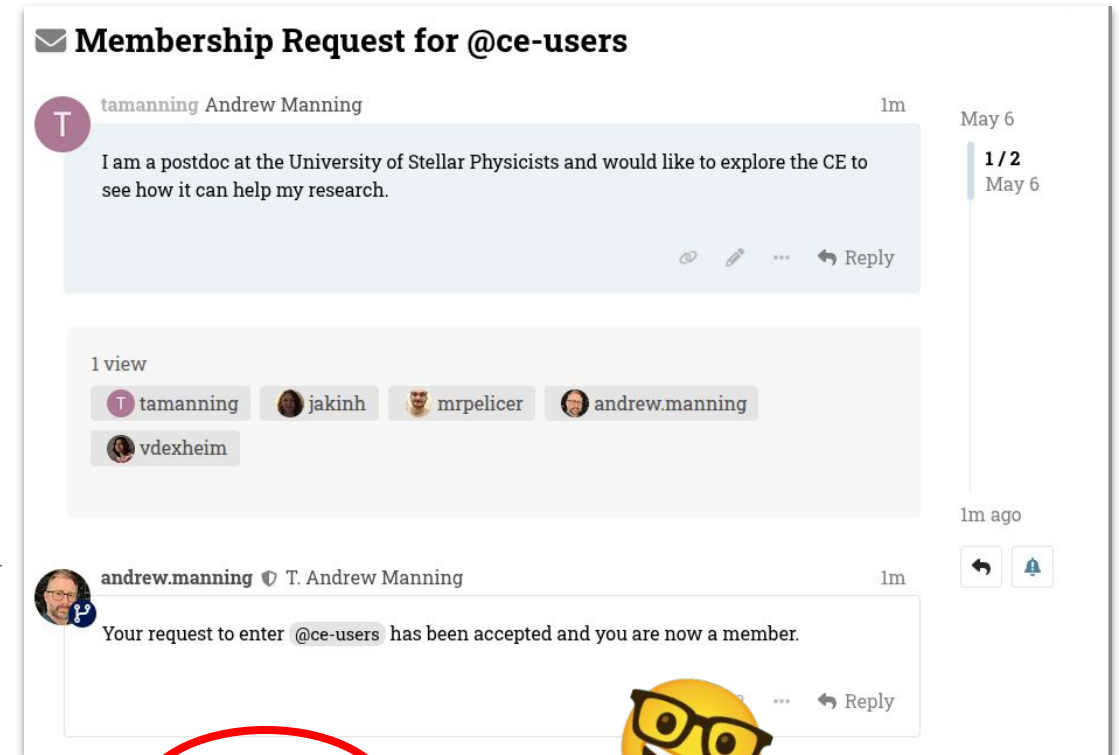
- Use of the CE indicates your acceptance of our Terms of Service.
- Requests are manually approved by designated collaboration members, so please be patient. You will receive a message when the request is processed.
- If approved, you will need to log out of the CE and reauthenticate for the changes to take effect.
- Press the Request button in the top-right corner of this message box to get started.

Request to join @ce-users

Let the group owners know why you belong in this group

I am a postdoc at the University of Stellar Physicists and would like to explore the CE to see how it can help my research.

Submit Request Cancel



Membership Request for @ce-users

tamanning Andrew Manning 1m May 6

I am a postdoc at the University of Stellar Physicists and would like to explore the CE to see how it can help my research.

1 view

tamanning jakinh mrpelicer andrew.manning vdexheim

andrew.manning T. Andrew Manning 1m

Your request to enter @ce-users has been accepted and you are now a member.



muses Jobs Uploads Goey API token Docs Andrew Manning (aqreon)

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Getting started

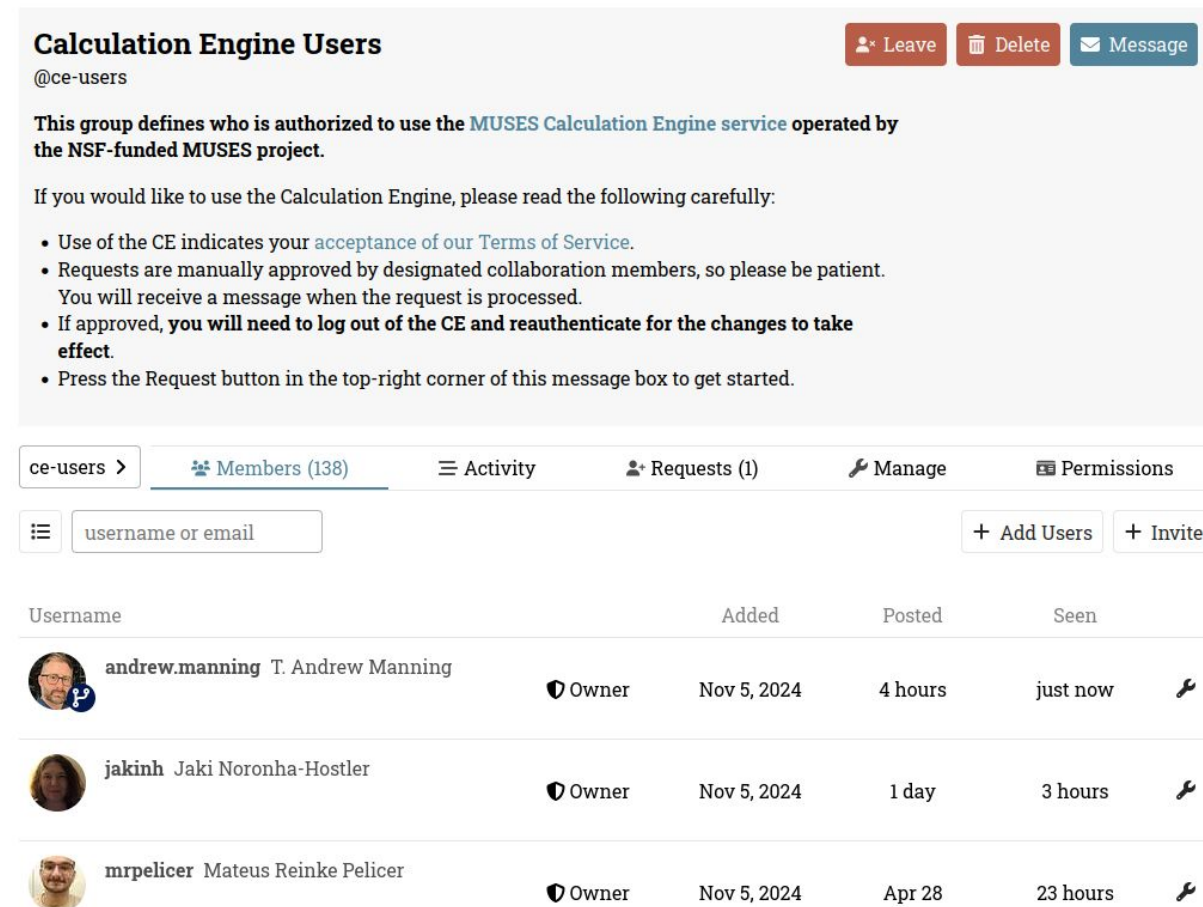
[Read the Quick Start guide](#) to setup your account and

What are workflows?

MUSES workflows provide a way to orchestrate a custom execution of MUSES modules, allowing you to generate equations of state, process and synthesize data, and calculate

Authentication (who you are) is unified with the rest of MUSES web services, where user accounts are defined on our own Keycloak server, which uses the external CILogon service as the identity broker.

Authorization (what you can do) is defined by membership in the ***ce-users*** group on the forum. The owners of this group receive notifications when someone requests access and can approve/reject with the click of a button. *The owner role is dynamic, supporting delegation of responsibility.*



Calculation Engine Users @ce-users Leave Delete Message




This group defines who is authorized to use the **MUSES Calculation Engine service** operated by the NSF-funded MUSES project.

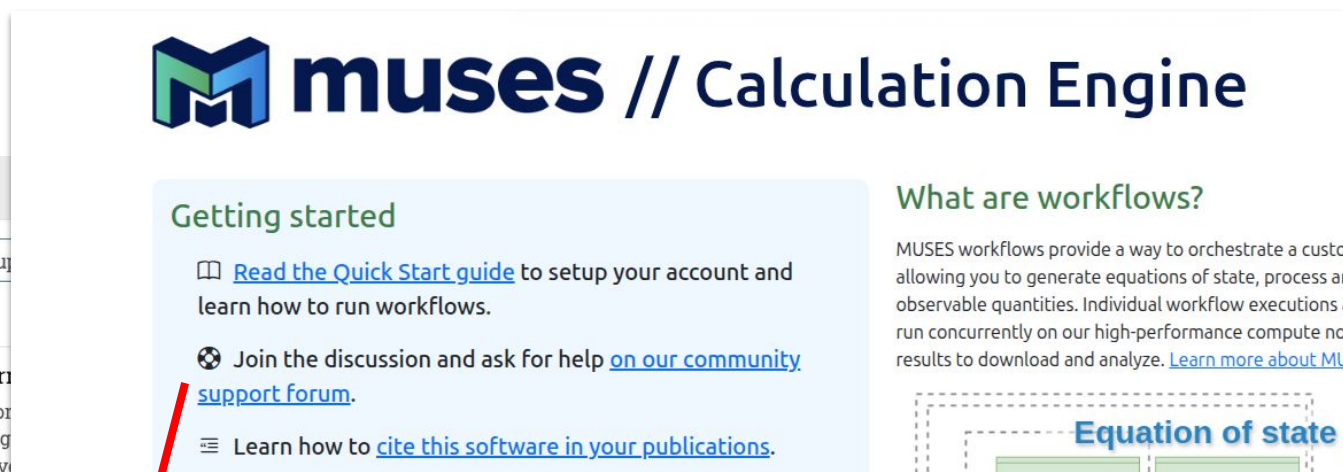
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- If approved, **you will need to log out of the CE and reauthenticate for the changes to take effect.**
- Press the Request button in the top-right corner of this message box to get started.

ce-users > Members (138) Activity Requests (1) Manage Permissions

username or email + Add Users + Invite

Username	Added	Posted	Seen
 andrew.manning T. Andrew Manning Owner	Nov 5, 2024	4 hours	just now
 jakinh Jaki Noronha-Hostler Owner	Nov 5, 2024	1 day	3 hours
 mrpelicer Mateus Reinke Pelicer Owner	Nov 5, 2024	Apr 28	23 hours



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What are workflows?

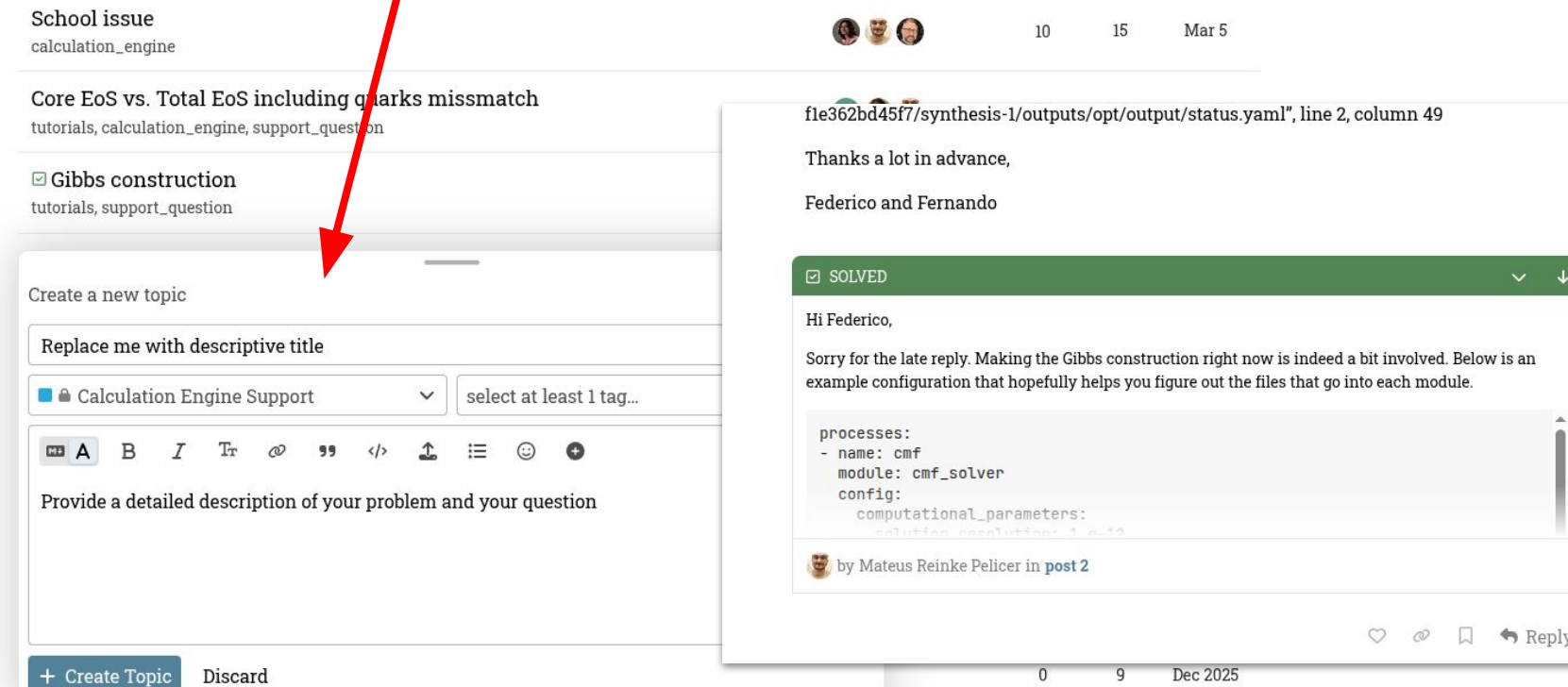
MUSES workflows provide a way to orchestrate a custom workflow allowing you to generate equations of state, process and observable quantities. Individual workflow executions are run concurrently on our high-performance compute nodes and results are available to download and analyze. [Learn more about MUSES workflows](#)

Equation of state g

The forum enables community-based support.

Authorized CE users have access to a support category where they post questions as new topics.

Topics can be marked “solved” with quick links to the answers.



School issue
calculation_engine

Core EoS vs. Total EoS including marks mismatch
tutorials, calculation_engine, support_question

Gibbs construction
tutorials, support_question

Create a new topic

Replace me with descriptive title

Calculation Engine Support select at least 1 tag...

Provide a detailed description of your problem and your question

+ Create Topic Discard

file362bd45f7/synthesis-1/outputs/opt/output/status.yaml", line 2, column 49

Thanks a lot in advance,
Federico and Fernando

SOLVED

Hi Federico,

Sorry for the late reply. Making the Gibbs construction right now is indeed a bit involved. Below is an example configuration that hopefully helps you figure out the files that go into each module.

```
processes:  
- name: cmf  
  module: cmf_solver  
  config:  
    computational_parameters:  
      resolution: 1 e-12
```

by Mateus Reinke Pelicer in [post 2](#)

0 9 Dec 2025

- Migration of forum, cloud storage, other services to other hosting providers, potentially transferring web domain ownership to new steward organization.
- Options for operating the public CE service
- CE support for custom HPC backend (Globus Compute)
- Implement KEDA (Kubernetes Event-driven Autoscaling) for hyper-efficient use of elastic computing resources (e.g. Jetstream2 via NSF ACCESS)
- CACAO template for researcher-owned CE deployment using NSF ACCESS
- Switch to Apptainer and Podman Compose to align better with FOSS and for better compatibility with HPC environments

Discussion on the future of the CI is
Tuesday afternoon