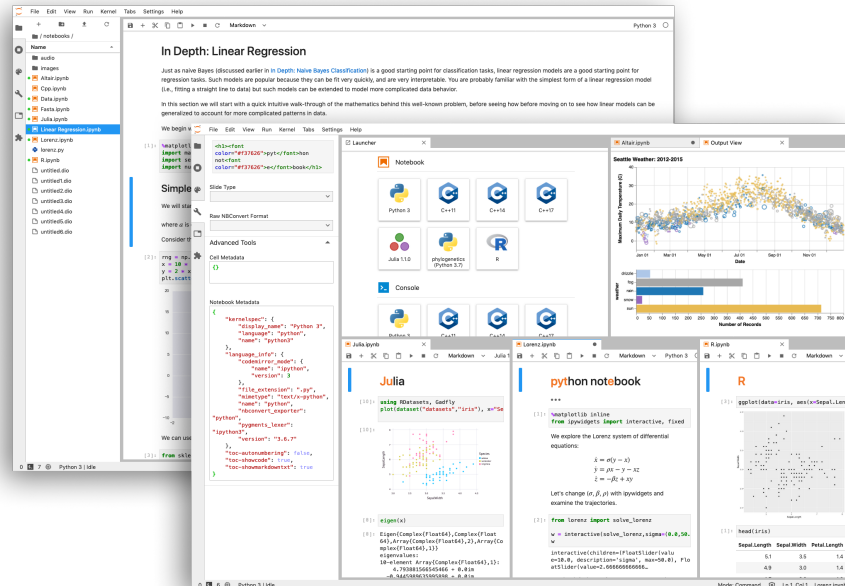


3mE JupyterHub for Education Plan



JupyterHub running several Jupyter Notebooks (image sourced from jupyter.org). Try out a Jupyter notebook by [clicking here](#).

JupyterHub is an application that provides low barrier online access to a wide variety of popular open source scientific software.¹ The flagship user interface provided by JupyterHub is the Jupyter Notebook. Jupyter Notebooks have become one of the most widely used computational communication tools in data science, AI, machine learning, and scientific computing in both industry and academia.² Jupyter Notebooks are now an integral part of teaching methods in domains that use computing because they provide a mechanism for delivering an interactive computational narrative, unlike traditional textbooks or bare source code.³ Open access electronic Jupyter has enabled interactive books that integrate directly with JupyterHub. These interactive books are now regularly being developed to enhance and ease learning.⁴

Introducing a JupyterHub to 3mE will provide a digital home for BSc and MSc students in which they can access computational assignments and teaching materials for all of their courses in one central location over the full duration of their studies. Instructors can leverage the JupyterHub for delivering and assessing course and project materials. This hub will provide an industry and research grade computing platform for both students and instructors.

¹ <https://jupyter.org/>

² Why Jupyter is data scientists' computational notebook of choice, Nature, <https://www.nature.com/articles/d41586-018-07196-1>

³ Barba et al. Teaching and Learning with Jupyter <https://jupyter4edu.github.io/jupyter-edu-book/>

⁴ <https://jupyterbook.org>

Advantages of providing a faculty wide JupyterHub are:

- Provides direct student access to advanced hardware and software even from older personal computers and with minimal prior computing knowledge.
- No software installation will be required for students (i.e. typically difficult for AI applications)
- System administrators will install and maintain the latest versions of research grade software. Therefore, instructors and students will not deal with incompatibility issues.
- Lecturers & instructors can make use of automatic grading tools (e.g. nbgrader, okpy)
- Students can be selectively given access to larger computing resources (multiple computing cores, GPUs, large data databases) for specific courses to be able to solve real world sized problems
- The hub is not tied to a specific course and course duration
- Can be used for BSc and MSc projects that are not tied to courses
- All materials can be downloaded from the JupyterHub post graduation and are accessible with the same open source and free software at home and at their companies
- Removes student temptation for pirating software for academic work
- Will be possible to provide TU Delft licensed proprietary software via the hub
- Offers a way to deliver content and instruction suitable for in-person, hybrid, and online
- Adoption aligns with the university's and the country's open science visions
- Student data will be stored under TU Delft's control to easily meet privacy standards

Project Objectives

1. Assess the faculty's computational education needs (Jan 2022)
2. Inform and educate the faculty on teaching with Jupyter (June 2022)
3. Perform a pilot study and integrate JupyterHub into several 3mE courses with support for Brightspace and autograding (June 2022)

Timeline

October 2021

- Hire system administrator for technical work

November 2021 - January 2022

- Survey the 3mE faculty involved in education to determine needs and use cases of Jupyter (now and future)
- Setup an initial JupyterHub for select pilot courses in Q3 & Q4

February 2022 - June 2022

- Provide technical support to the pilot courses
- Maintain the system
- Offer a workshop on teaching with Jupyter

July 2022 - August 2022

- Execute and improve the JupyterHub infrastructure
- Collect feedback from the pilot users and students

September 2022 - January 2023

- Open the hub for all students and courses in 3ME
- Maintain the system
- Evaluate outcomes of project and draft recommendations for long term support, including recommending mechanisms for other faculties and even researchers to buy in to the system

Budget

<u>Description</u>	<u>Cost (€)</u>
System administrator(s) salary (0.3 FTE, 1.5 year)	50k
Student and teaching assistant salaries	10k
Cloud Compute Credits (1.5 yr)	15k
2 workshops on Teaching and Authoring with Jupyter	20k
Survey	2k
Communication & Travel	3k
Total	100k

Pilot Courses

These instructors are interested in using the hub in the following upcoming courses:

- ME41055 Multibody Dynamics B [MSc], Jason K. Moore
- MS43210 Advanced Characterisation for teaching tomographic data reconstruction [MSc], Matthias Alfeld
- MS43020 Computational Materials Science [MSc], Marcel Sluiter
- WB1530-14, Thermodynamics [BSc], Rene Pecnik
- WB3240, Systeem- en regeltechniek [BSc], Kim Batselier

Initial 3mE Supporters

Matthias Alfeld, Materials Science and Engineering; Kim Batselier, Delft Center for Systems and Control; Jason K. Moore, BioMechanical Engineering; Rene Pecnik, Process and Energy; Ajay Seth, BioMechanical Engineering; Marcel Sluiter, Materials Science and Engineering; Nazli (Sarkalkan) Tumer, BioMechanical Engineering; Amir A. Zadpoor, BioMechanical Engineering