Cyberhubs

Install and run a collaborative Jupyterhub environment with third-party authentication, for example on a Compute Canada cloud server

Falk Herwig

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Data: Insights and Challenges in a Time of Abundance

By Susanna Kohler on 11 May 2018 FEATURES

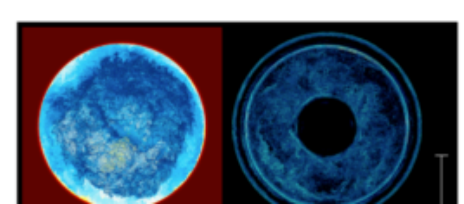
Share:

A screen capture of the user interface for WorldWide Telescope, a tool for visualizing astronomical data. [Rosenfield et al. 2018]

One of the most rapidly evolving elements of astronomy research is how we handle data. With telescopes and computer simulations progressively producing ever vaster quantities, how can we process and analyze this data? What tools can we use to turn it into new astronomical discoveries?

The future of astronomy relies on new innovations on this front, and in a Special Issue of the *Astrophysical Journal Supplement Series*, 23 papers explore different insights and challenges related to astronomical data — presenting new workflows, software instruments, databases, and tutorials that will aid astronomers in generating novel and significant research results.

Here are the broad categories of data in astronomy that are touched on in this special issue:



1. Cloud-Based Research Environments for Discovery

Collaborations in astronomy are often large and broadly distributed. As a result, the astronomy community needs the infrastructure to be able to access large data sets, combine

The Astrophysical Journal Supplement Series, 236:2 (16pp), 2018 May https://doi.org/10.3847/1538-4365/aab777

Cyberhubs: Virtual Research Environments for Astronomy

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[4] LCSE, University of Minnesota, Minneapolis, USA
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Abstract

Collaborations in astronomy and astrophysics are faced with numerous cyber-infrastructure challenges, such as large data sets, the need to combine heterogeneous data sets, and the challenge to effectively collaborate on those large, heterogeneous data sets with significant processing requirements and complex science software tools. The `cyberhubs` system is an easy-to-deploy package for small- to medium-sized collaborations based on the Jupyter and Docker technology, which allows web-browser-enabled, remote, interactive analytic access to shared data. It offers an initial step to address these challenges. The features and deployment steps of the system are described, as well as the requirements collection through an account of the different approaches to data structuring, handling, and available analytic tools for the NuGrid and PPMstar collaborations. NuGrid is an international collaboration that creates stellar evolution and explosion physics and nucleosynthesis simulation data. The PPMstar collaboration performs large-scale 3D stellar hydrodynamics simulations of interior convection in the late phases of stellar evolution. Examples of science that is currently performed on `cyberhubs`, in the areas of 3D stellar hydrodynamic simulations, stellar evolution and nucleosynthesis, and Galactic chemical evolution, are presented.

Key words: methods: data analysis – stars: abundances – stars: evolution

Cyberhubs systems architecture

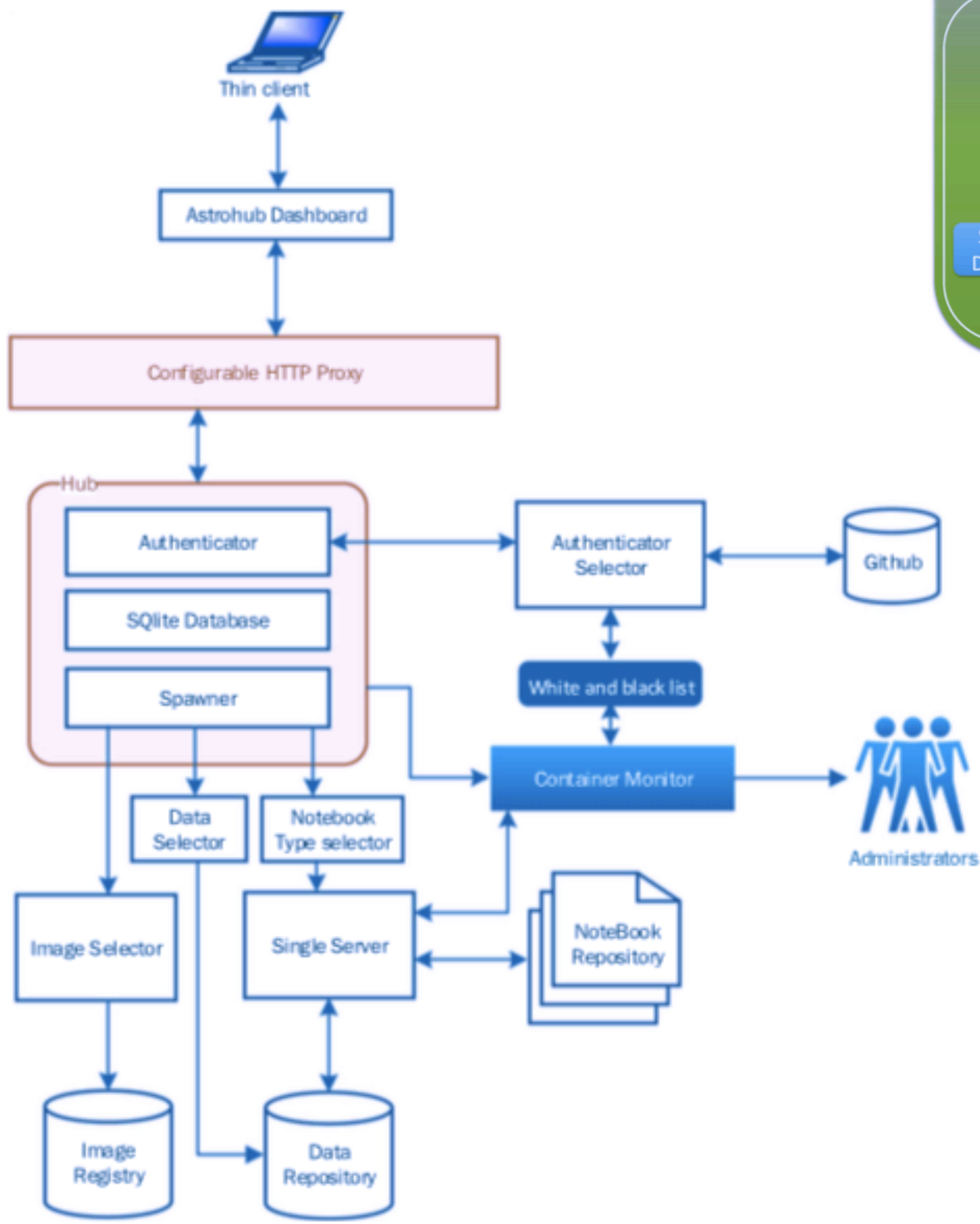
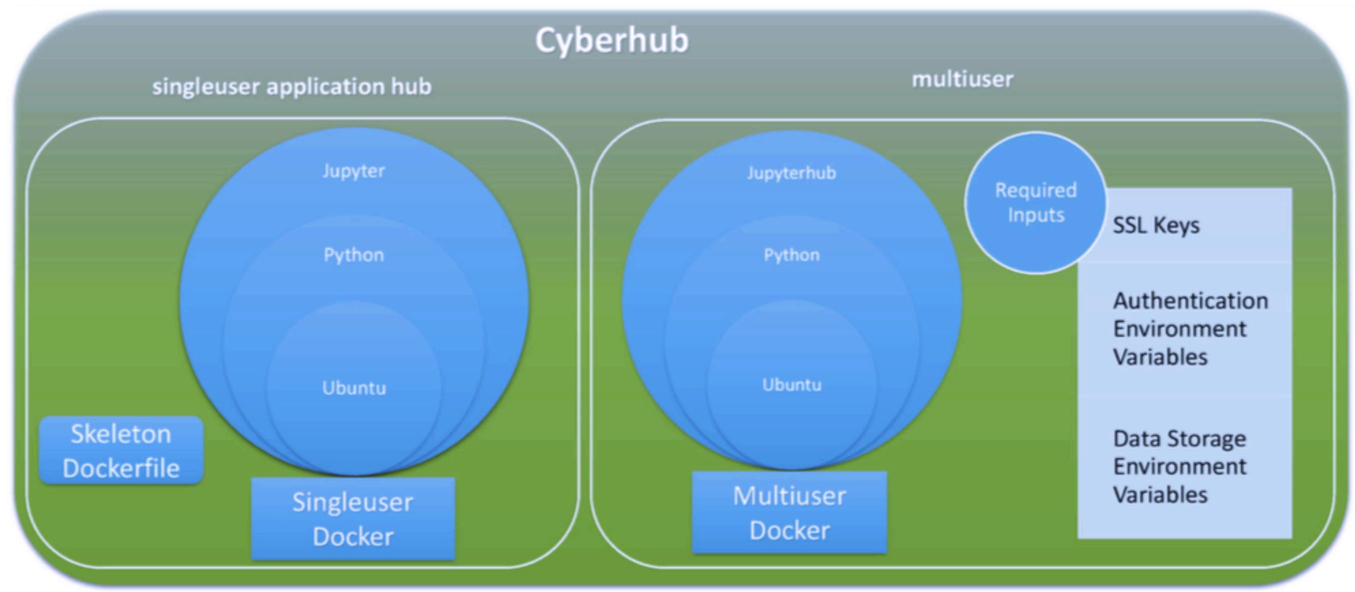


Figure 1. cyberhubs general system architecture.



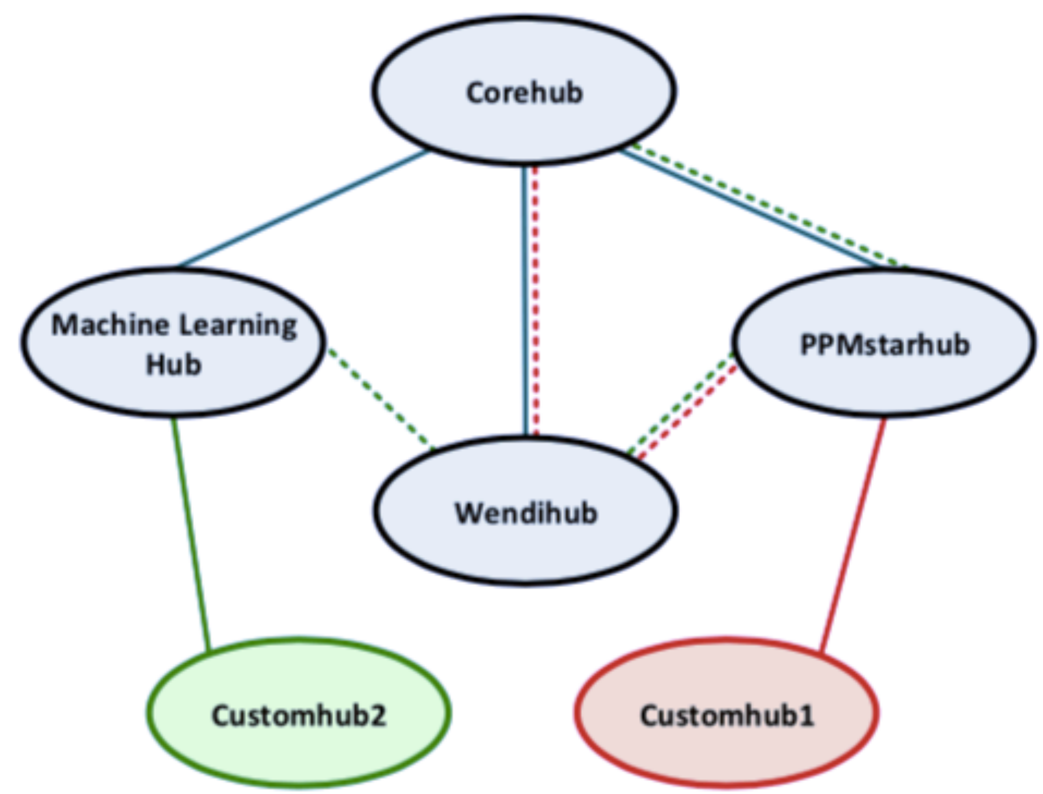
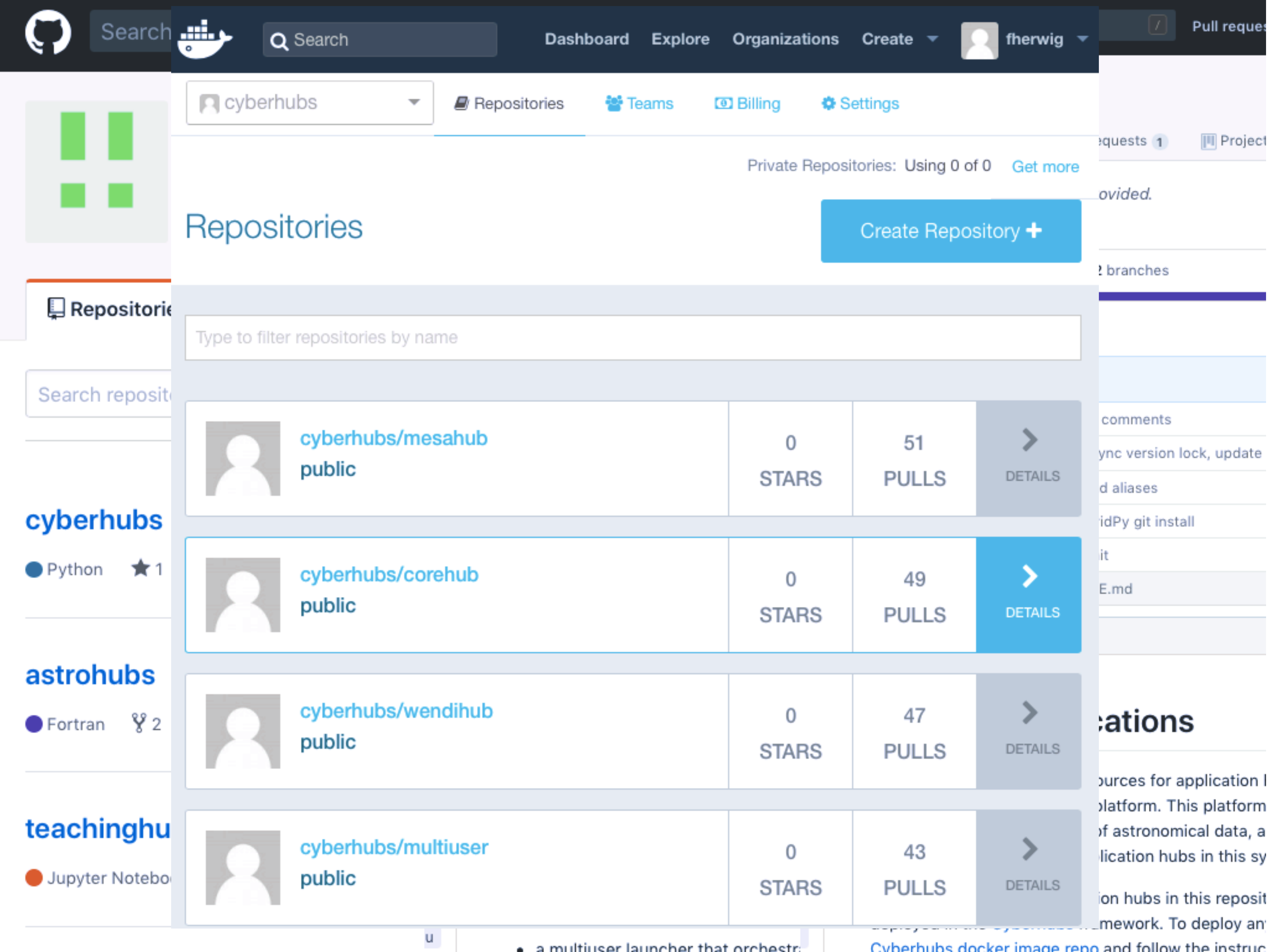


Figure 3. cyberhubs administrators can build application images by chaining existing application images and adding customization through dockerfile-based builds. By starting from the prebuilt PPMstarhub, which is itself based on Codehub, one can build in sequential steps Wendihub and Machine Learning Hub each on top of the previous. At this point the capabilities and analytic tools of three application hubs are combined and can be the bases for another addition of tools and data stores to create Customhub2. Similarly, for example, Customhub1 can be built as a combination of Corehub, Wendihub, and PPMstarhub.



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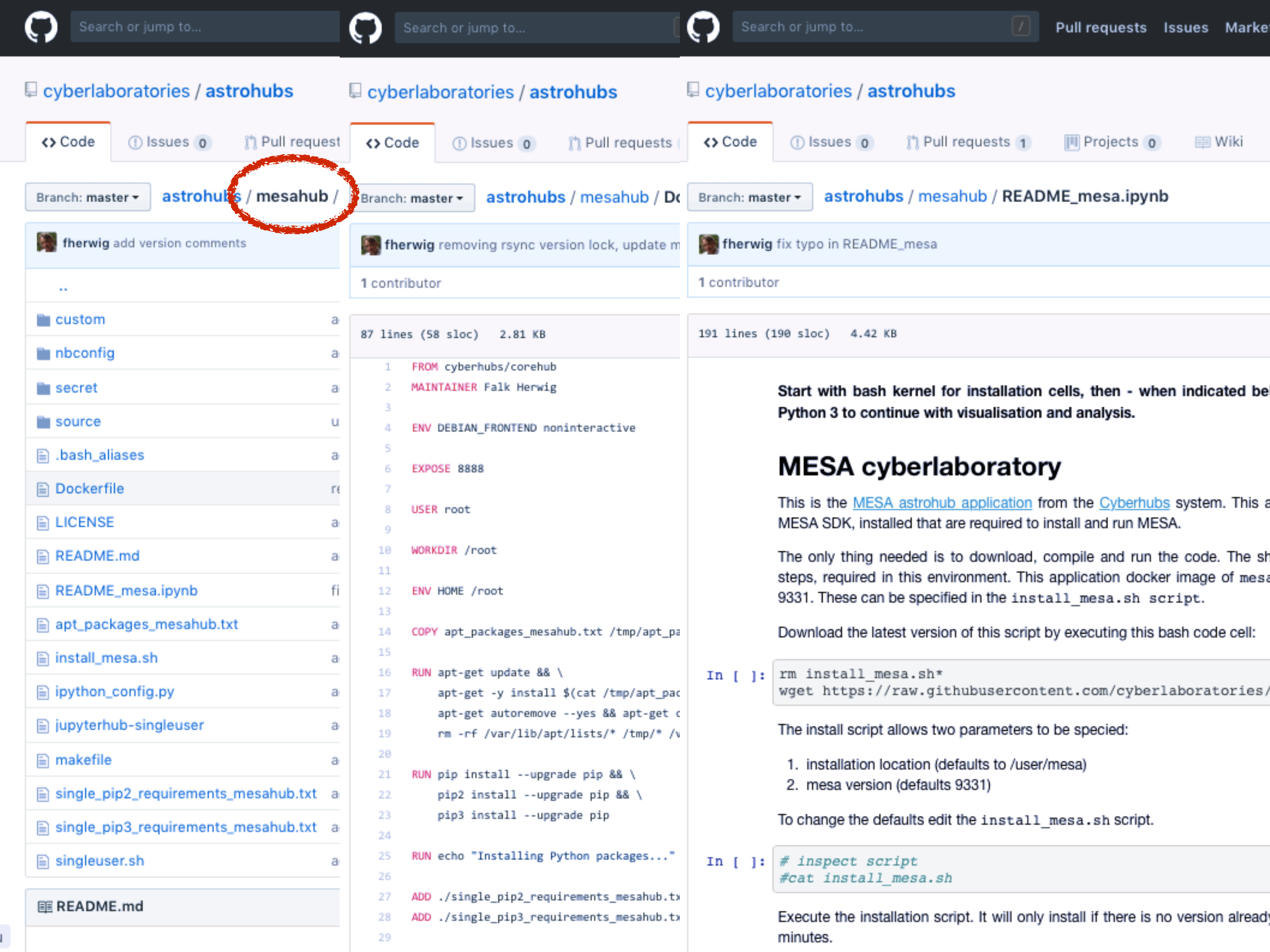
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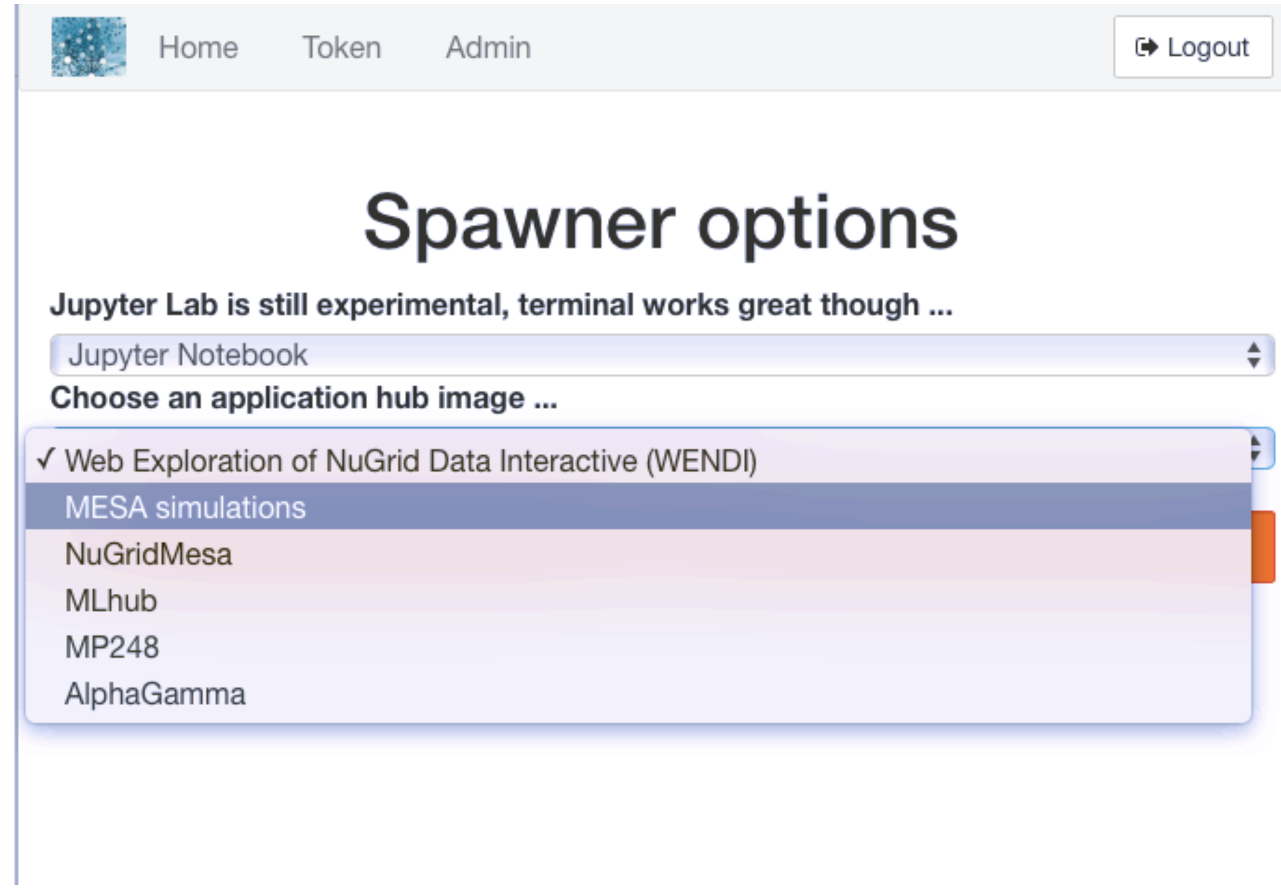
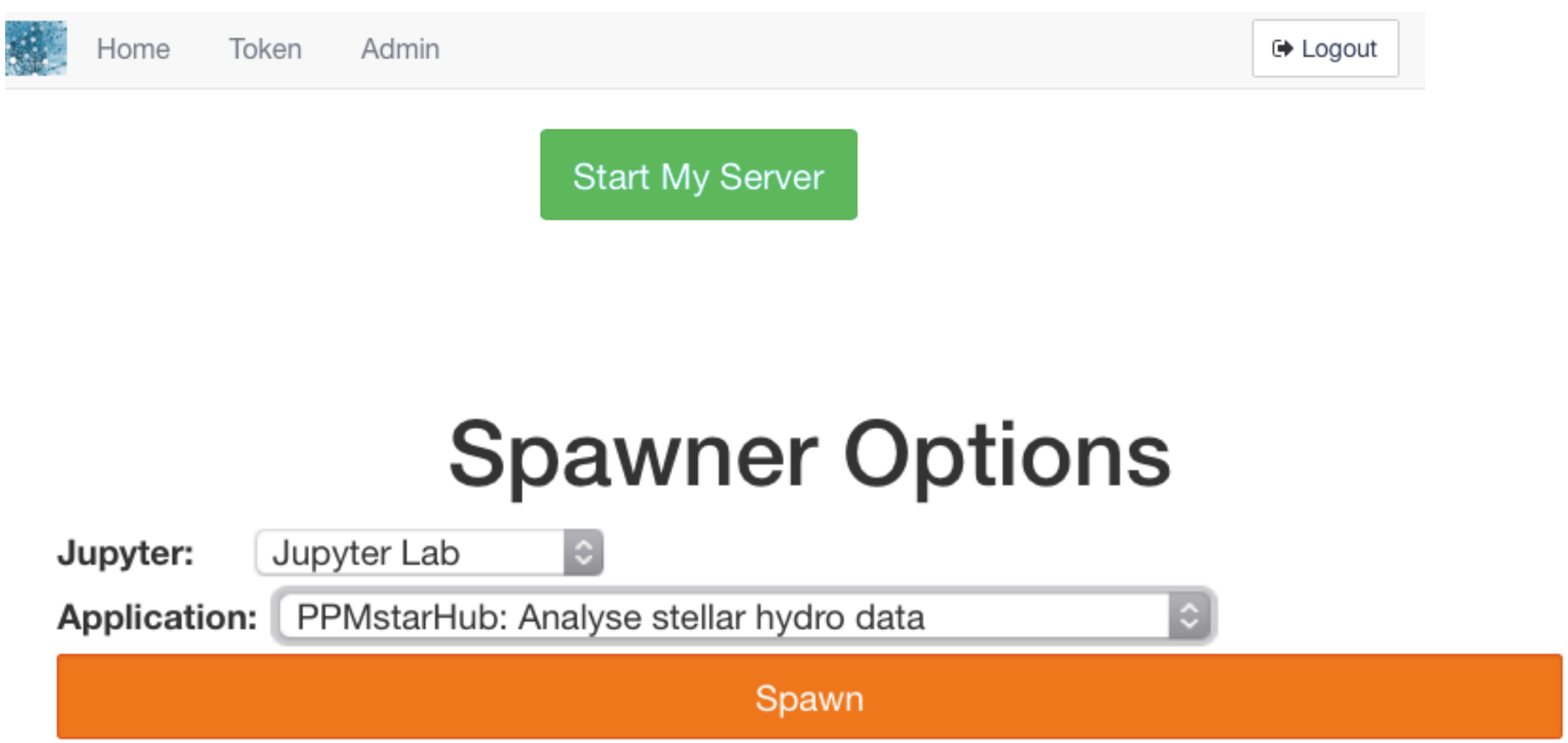
README.md
astrohubs / mesahub / Dc
fherwig removing rsync version lock, update m
1 contributor
87 lines (58 sloc) 2.81 KB
FROM cyberhubs/corehub
MAINTAINER Falk Herwig
ENV DEBIAN_FRONTEND noninteractive
EXPOSE 8888
USER root
WORKDIR /root
ENV HOME /root
COPY apt_packages_mesahub.txt /tmp/apt_pa
RUN apt-get update && \
apt-get -y install $(cat /tmp/apt_pac
apt-get autoremove --yes && apt-get c
rm -rf /var/lib/apt/lists/* /tmp/* /v
RUN pip install --upgrade pip && \
pip2 install --upgrade pip && \
pip3 install --upgrade pip
RUN echo "Installing Python packages..."
ADD ./single_pip2_requirements_mesahub.tx
ADD ./single_pip3_requirements_mesahub.tx
astrohubs / mesahub / README_mesa.ipynb
fherwig fix typo in README_mesa
1 contributor
191 lines (190 sloc) 4.42 KB
Start with bash kernel for installation cells, then - when indicated be
Python 3 to continue with visualisation and analysis.
MESA cyberlaboratory
This is the MESA astrohub application from the Cyberhubs system. This a
MESA SDK, installed that are required to install and run MESA.
The only thing needed is to download, compile and run the code. The sh
steps, required in this environment. This application docker image of mesa
9331. These can be specified in the install_mesa.sh script.
Download the latest version of this script by executing this bash code cell:
In [ ]: rm install_mesa.sh*
wget https://raw.githubusercontent.com/cyberlaboratories/
The install script allows two parameters to be specied:
1. installation location (defaults to /user/mesa)
2. mesa version (defaults 9331)
To change the defaults edit the install_mesa.sh script.
In [ ]: # inspect script
#cat install_mesa.sh
Execute the installation script. It will only install if there is no version alread
minutes.

Demo/examples:
https://astrohub.uvic.ca

Try the Outreach hub, login via GitHub ID





Credits

- CANFAR, Canarie
- NSERC USRA, Discovery
- NSF CDS&E, Frontiers
- WestGrid
- ECO Canada

README_mesa (autosaved)

File Edit View Insert Cell Kernel Help

Run Markdown

Start with bash kernel for installation cells, then - when ***Kernel*** **to Python 3 to continue with visualisation and an**

MESA cyberlaboratory

This is the MESA astrohub application from the Cyberhubs importantly the MESA SDK, installed that are required to in

The only thing needed is to download, compile and run the necessary steps, required in this environment. This applicat version 8118, 8845, 9331. These can be specified in the `i`

Download the latest version of this script by executing this

```
In [ ]: rm install_mesa.sh*
        wget https://raw.githubusercontent.com/cyber
```

The install script allows two parameters to be specied:

1. installation location (defaults to /user/mesa)
2. mesa version (defaults 9331)

To change the defaults edit the `install_mesa.sh` script

```
In [ ]: # inspect script
        #cat install_mesa.sh
```

Execute the installation script. It will only install if there is n maybe 20 minutes.

```
In [ ]: chmod u+x ./install_mesa.sh
        ./install_mesa.sh
```

Select a test problem to do:

```
In [ ]: cd /user/mesa/mesa/star/test_suite/7M_prems_
```

Compile local example:

```
In [ ]: ./mk
```

Run:

```
In [ ]: ./rn
```

At this point change the kernel to Python 3 and continu

```
In [ ]: %pylab nbagg
In [ ]: data_dir='/user/mesa/mesa/star/test_suite/7M
        from nugridpy import mesa as ms
```

Check NuGridPy page for documentation of the mesa mod

```
In [ ]: star = ms.star_log(data_dir)
In [ ]: star.hrd_new()
```

splay a menu

README_mesa (unsaved changes)

Logout Control Panel

File Edit View Insert Cell Kernel Help Trusted Python 3

Run Markdown

```
tr        N_cntr      Y_surf      X_avg       eta_cntr   zones retry
   lg_dt_yr     lg_Dcntr    lg_R        lg_L3a      lg_Lneu      lg_Mdot      He_core      He_c
ntr       O_cntr      Z_surf      Y_avg       gam_cntr   iters bckup
     age_yr     lg_Pcntr    lg_L        lg_LZ       lg_Psurf     lg_Dsurf     C_core       C_cn
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```

At this point change the kernel to Python 3 and continue for analysis and plotting of data.

```
In [1]: %pylab nbagg
        data_dir='/user/mesa/mesa/star/test_suite/7M_prems_to_AGB/LOGS'
        from nugridpy import mesa as ms
```

```
Populating the interactive namespace from numpy and matplotlib
```

Check NuGridPy page for documentation of the mesa module. Also, consult a NuGrid example notebook.

```
In [8]: star = ms.star_log(data_dir,clean_starlog=True)
        star.hrd_new()
```

Figure 1