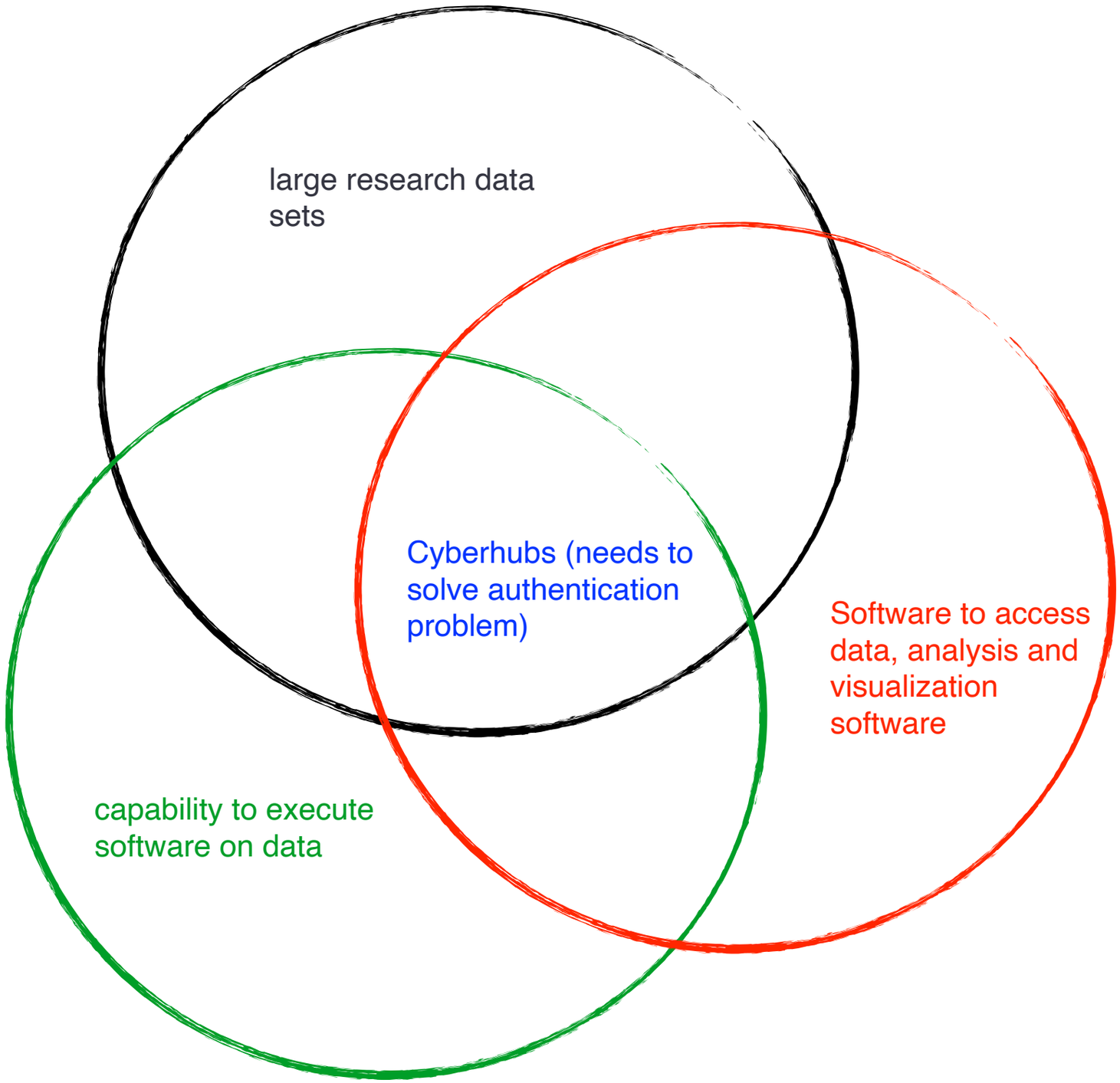
Cyberhubs

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

Falk Herwig


large research data sets
Cyberhubs (needs to solve authentication problem)
Software to access data, analysis and visualization software
capability to execute software on data

THE ASTROPHYSICAL JOURNAL
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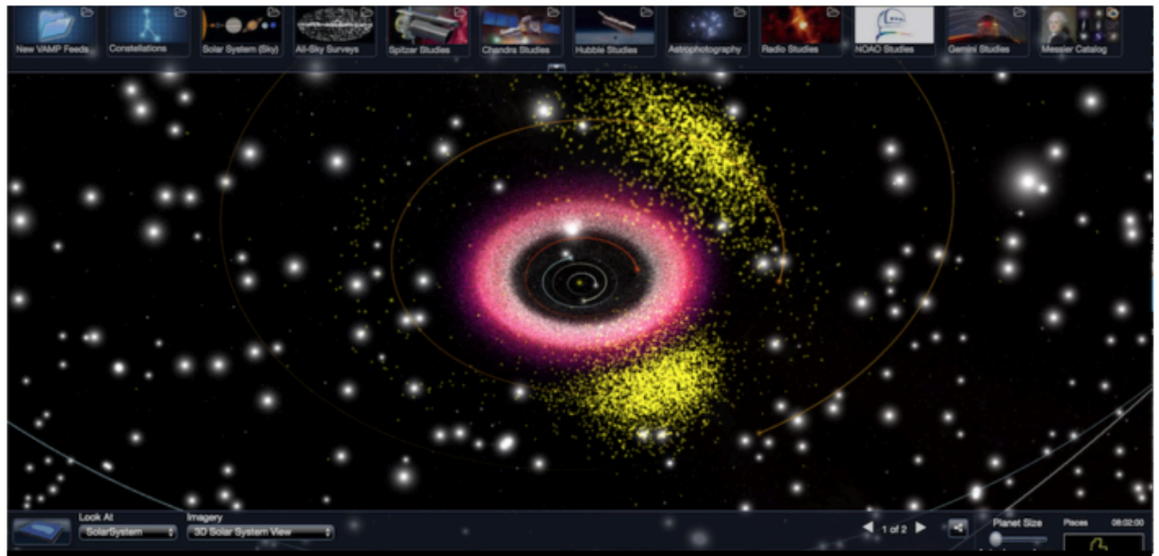
Data: Insights and Challenges in a Time of Abundance

By Susanna Kohler on 11 May 2018 FEATURES Share:

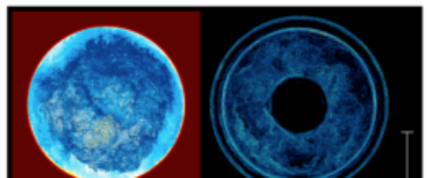


A screen capture of the user interface for WorldWide Telescope, a tool for visualizing astronomical data. [Rosenfield et al. 2018]

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

Falk Herwig[1,2,8], Robert Andrassy[1,2], Nic Annau[1], Ondrea Clarkson[1,2,8], Benoit Côté[1,2,3,8], Aaron D'Sa[2,4], Sam Jones[2,5,8], Belaid Moa[6], Jericho O'Connell[1], David Porter[7], Christian Ritter[1,2,8], and Paul Woodward[2,4]

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[3] Konkoly Observatory, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Budapest, Hungary
[4] LCSE, University of Minnesota, Minneapolis, USA
[5] Los Alamos National Laboratory, Los Alamos, New Mexico, USA
[6] Research Computing Services, University of Victoria, Victoria, Canada
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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

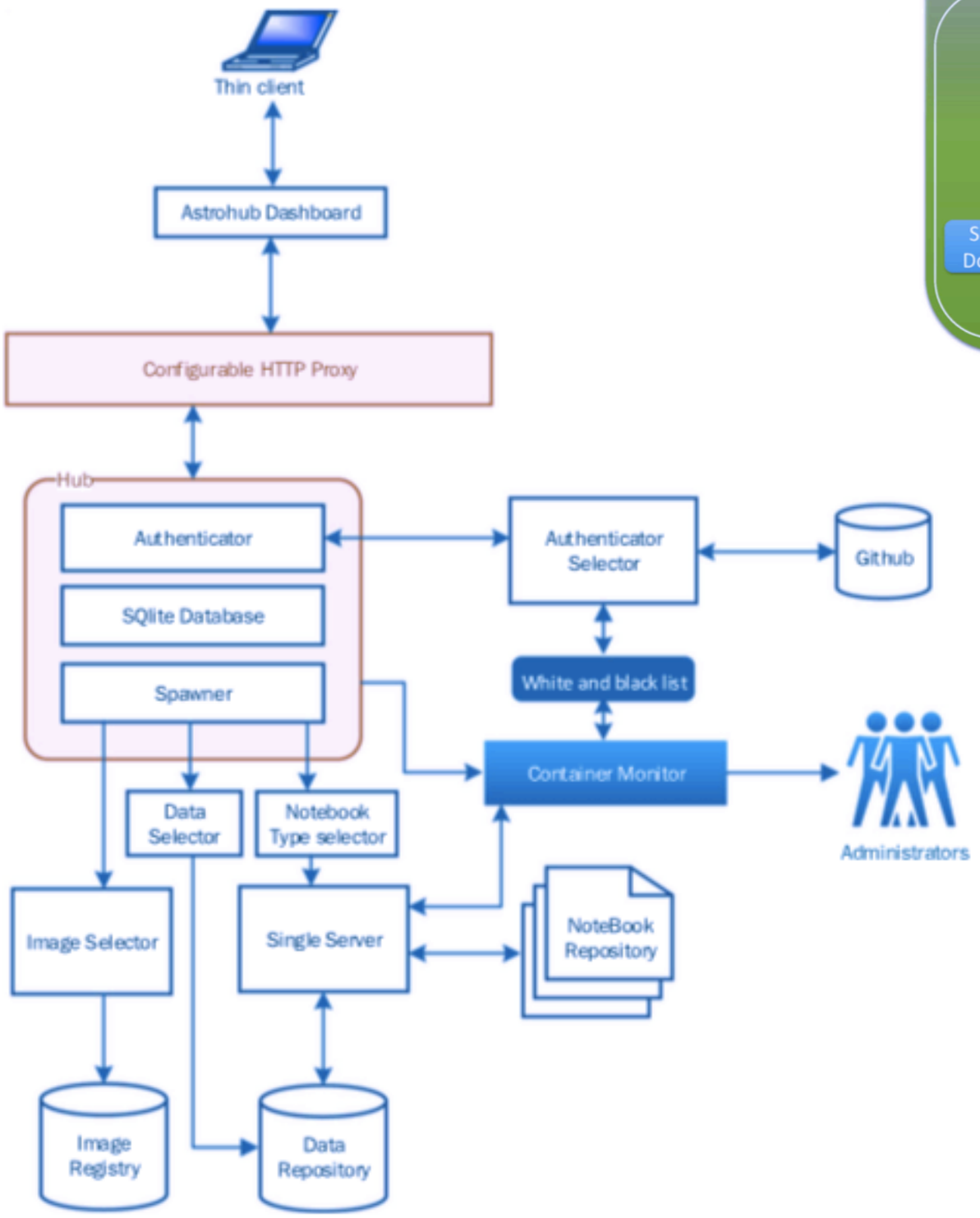
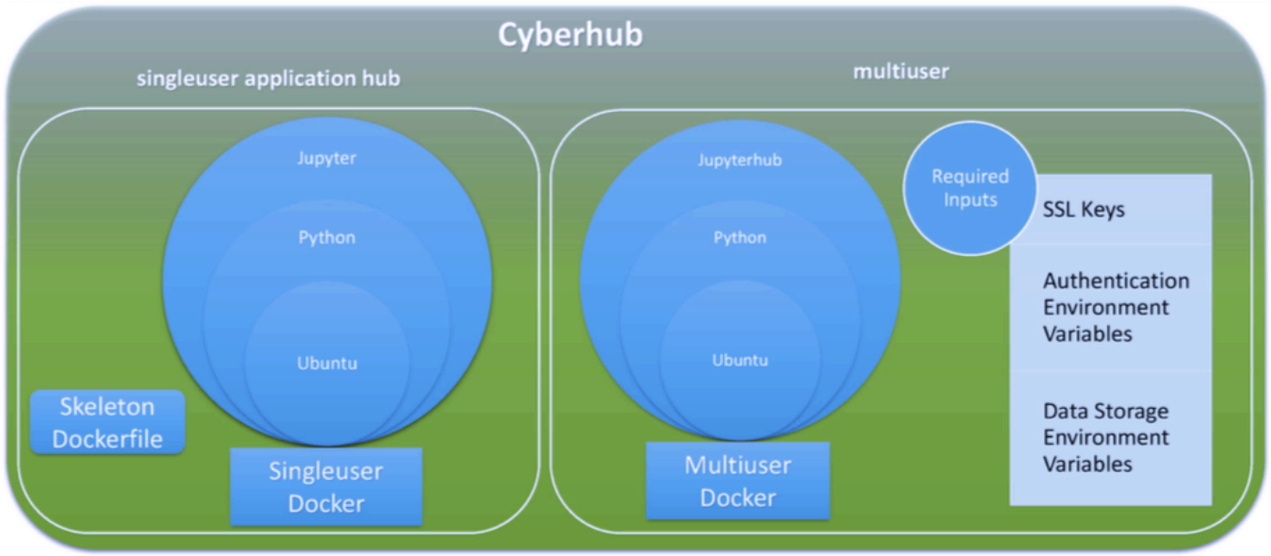


Figure 1. `cyberhubs` general system architecture.



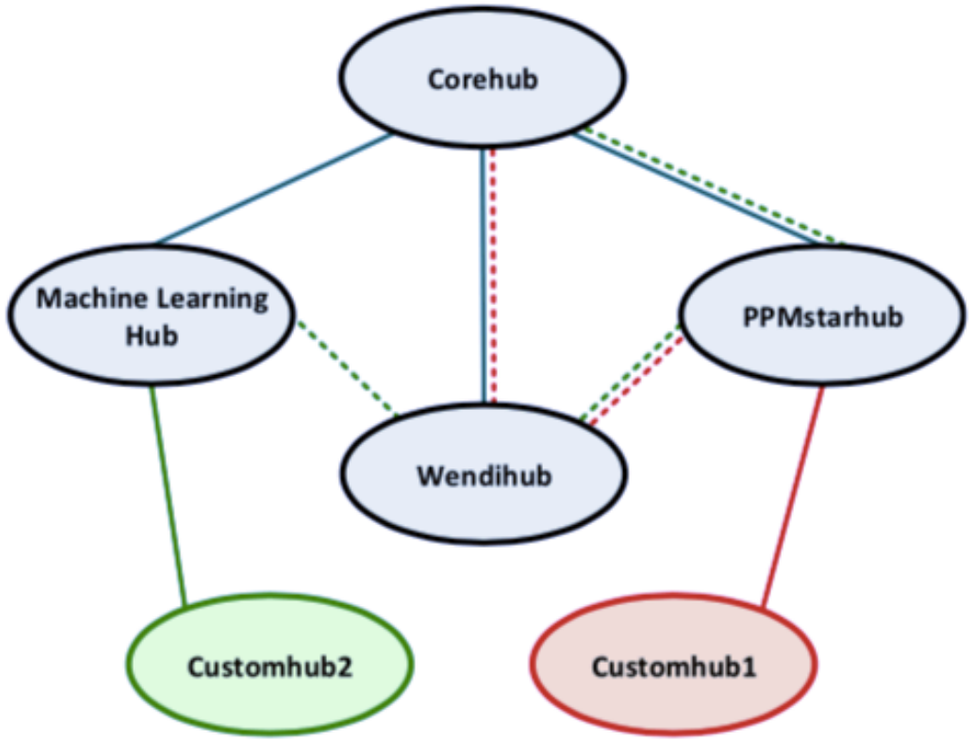


Figure 3. `cyberhubs` administrators can build application images by chaining existing application images and adding customization through dockerfile-based builds. By starting from the prebuilt `PPMstarhub`, which is itself based on `Codehub`, one can build in sequential steps `Wendihub` and `Machine 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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fherwig removing rsync version lock, update m

1 contributor

87 lines (58 sloc) 2.81 KB

```
1  FROM cyberhubs/corehub
2  MAINTAINER Falk Herwig
3
4  ENV DEBIAN_FRONTEND noninteractive
5
6  EXPOSE 8888
7
8  USER root
9
10 WORKDIR /root
11
12 ENV HOME /root
13
14 COPY apt_packages_mesahub.txt /tmp/apt_pa
15
16 RUN apt-get update && \
17     apt-get -y install $(cat /tmp/apt_pac
18     apt-get autoremove --yes && apt-get c
19     rm -rf /var/lib/apt/lists/* /tmp/* /v
20
21 RUN pip install --upgrade pip && \
22     pip2 install --upgrade pip && \
23     pip3 install --upgrade pip
24
25 RUN echo "Installing Python packages..."
26
27 ADD ./single_pip2_requirements_mesahub.tx
28 ADD ./single_pip3_requirements_mesahub.tx
29
```

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cyberlaboratories / astrohubs

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Branch: master ▾ 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)

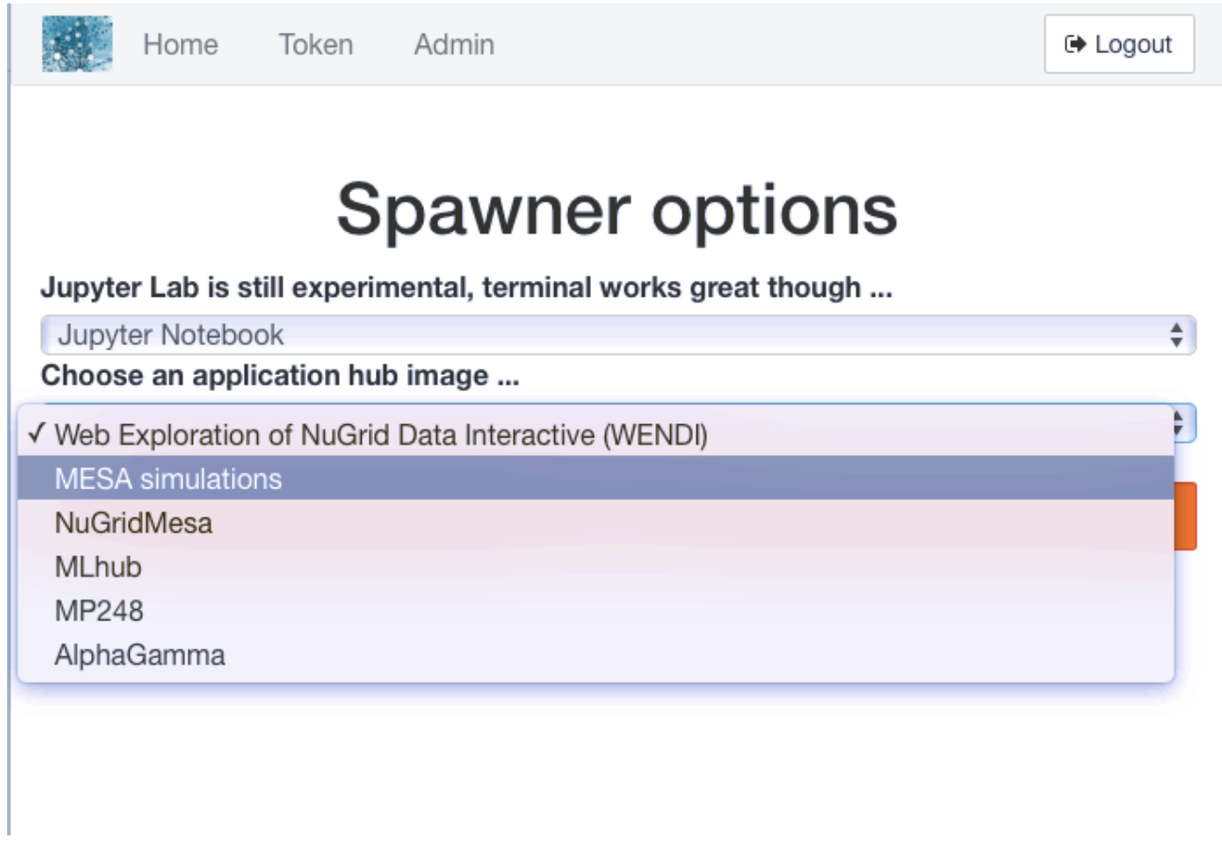
To change the defaults edit the `install_mesa.sh` script.

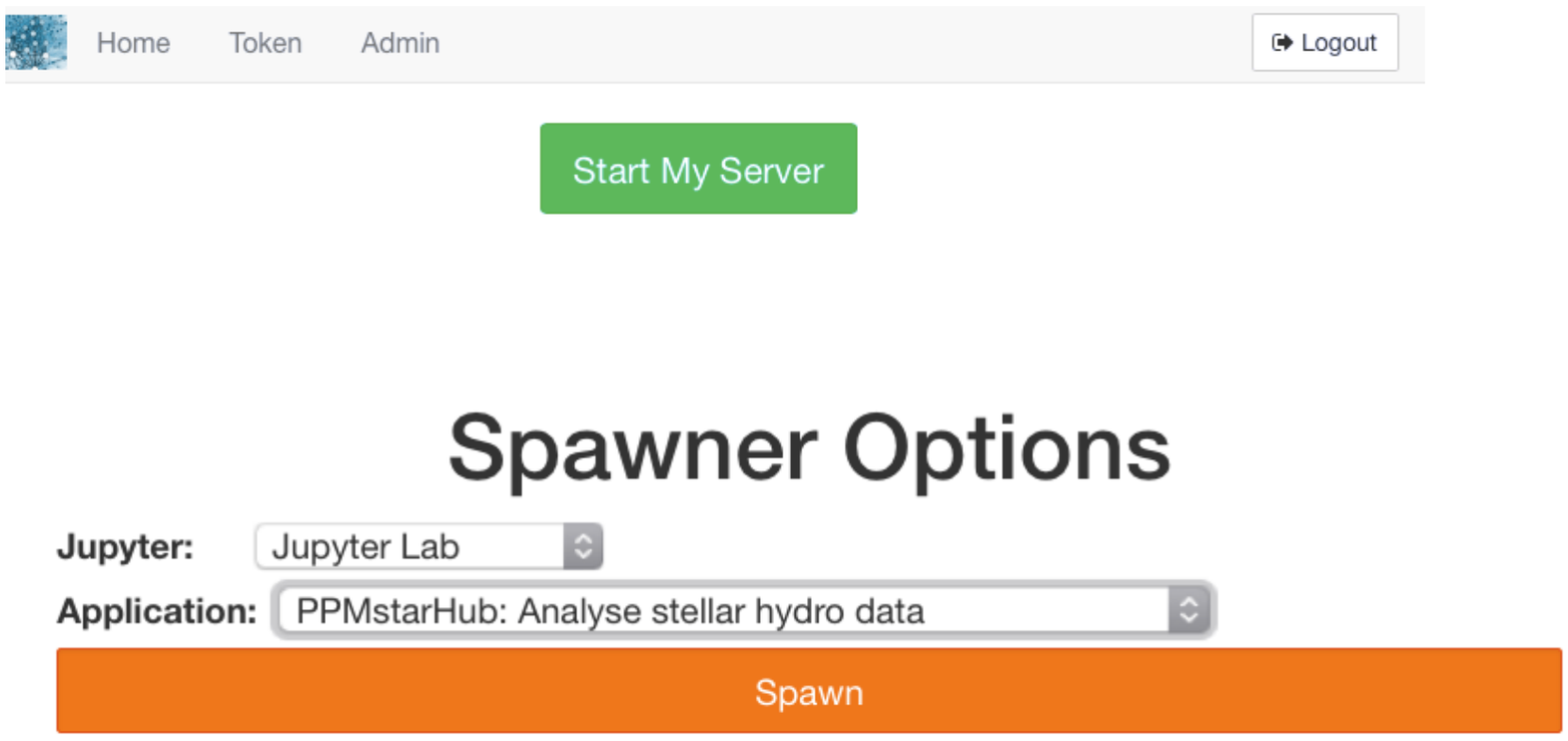
In [ ]:
```
# inspect script
#cat install_mesa.sh
```

Execute the installation script. It will only install if there is no version already 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

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


```
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
tr     Ne_cntr    Z_cntr     Z_avg     v_div_cs     dt_limit
_____________________________________________________________________________________
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       100   5.478013   4320.415 -21.511560 -21.511560   7.000000   7.000000   0.7570
00   0.000050   0.242000   0.757000 -11.606099    440       0
```

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