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on behalf of the SubMIT Project team

Computing Workshop
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What is a Jupyter Notebook?

A useful mixture of code and rich text elements (plots, equations, comments, etc.), divided into cells, each of which can be executed at any time.

Welcome! This is an example Jupyter Notebook

We can add comments, links, equations,

$$\vec{F} = -\frac{Gm_1m_2}{\vec{r}^2}$$

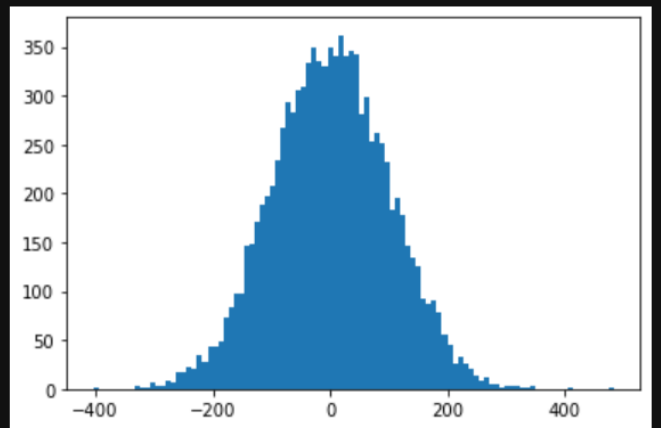
and much more!

[2]:
```
import numpy as np
import matplotlib.pyplot as plt
```

[13]:
```
y = np.random.normal(0,100,10000)
print(y[0:5])
```

```
[  51.27752874  179.30835419   -3.51233416 -121.79948416   86.4265991 ]
```

[14]:
```
_ = plt.hist(y, bins=100)
```



What is a Jupyter Notebook?

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They run on a server-client application via browser: the Jupyter Notebook App.

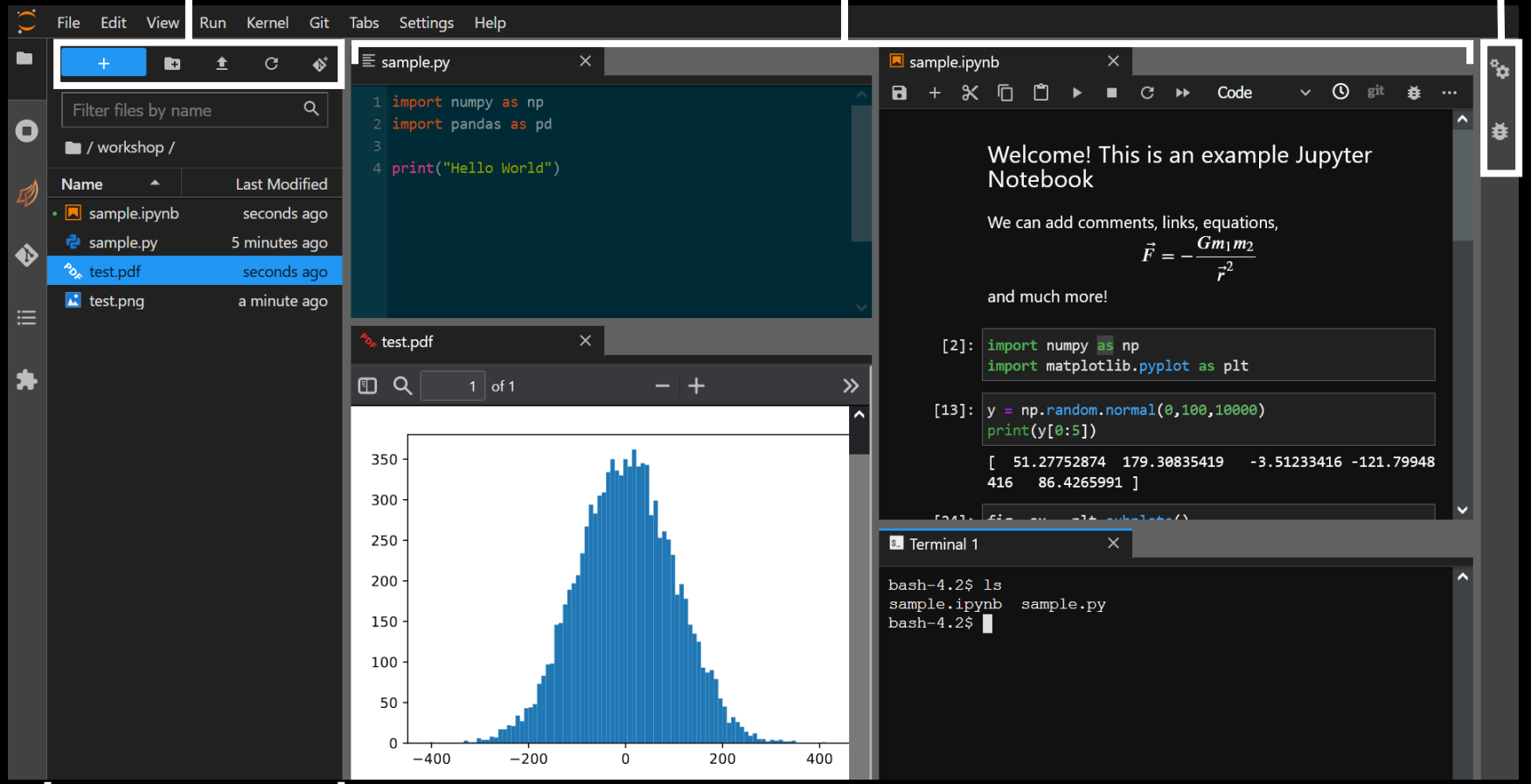
An extension of the Notebook App: JupyterLab.

The next step: JupyterLab

Shortcuts: create new files, folders, upload

Scripts, notebooks, terminals, files, etc.

More shortcuts: settings, debugger



File manager

Terminal access

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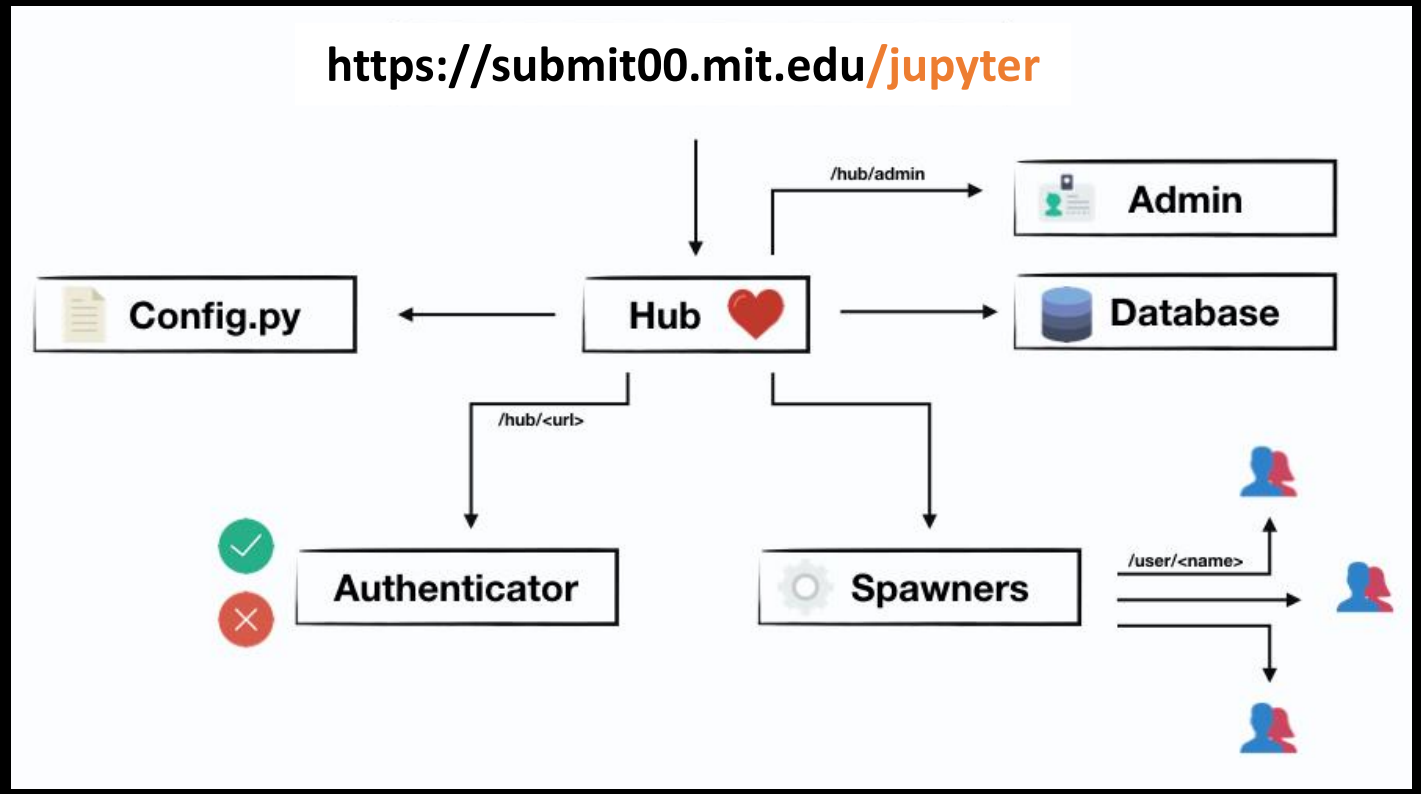
An extension of the Notebook App: JupyterLab.

Jupyter Notebook App and JupyterLab can run on a laptop (completely offline) or can be installed on a remote server and accessed through the internet.

Finally, JupyterHub

A multi-user **Hub** that creates a Jupyter server for each user and makes it available to access through a website.

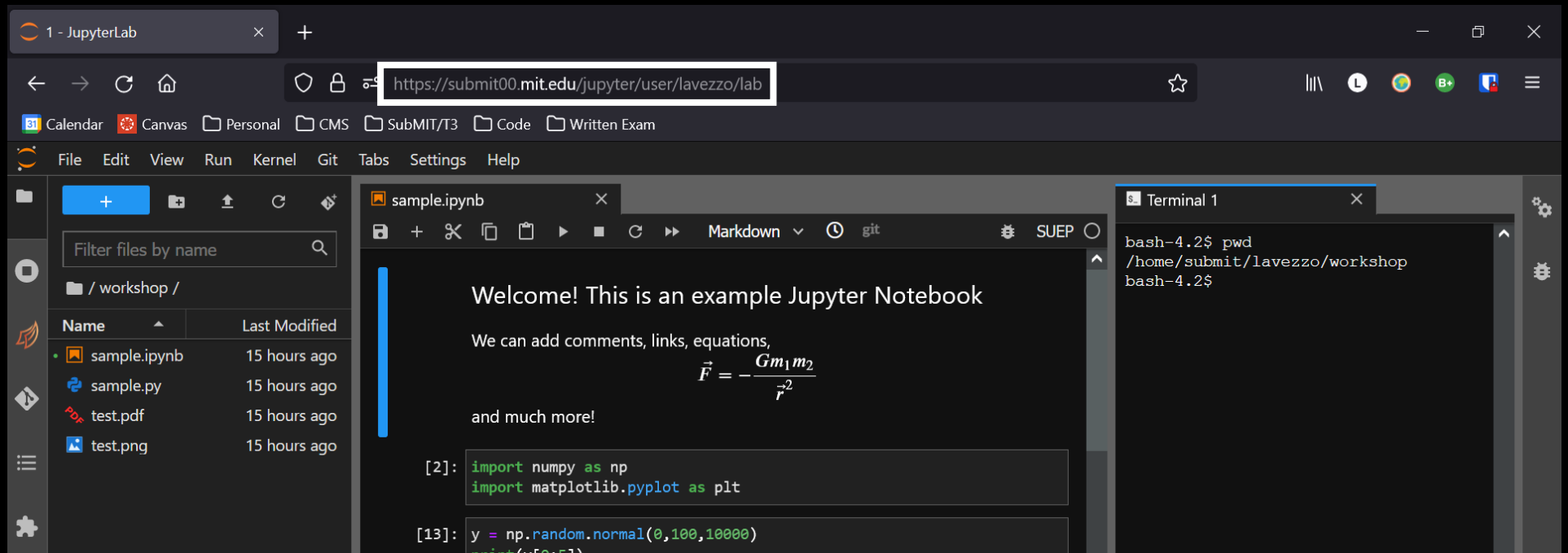


- The Hub is set up on submit00
- Authenticates users with MIT Touchstone that have already a submit login.
- Future steps:
  - Servers on multiple machines
  - Add default kernels in different languages (C++, Julia, etc)

Source: JupyterHub official documentation.

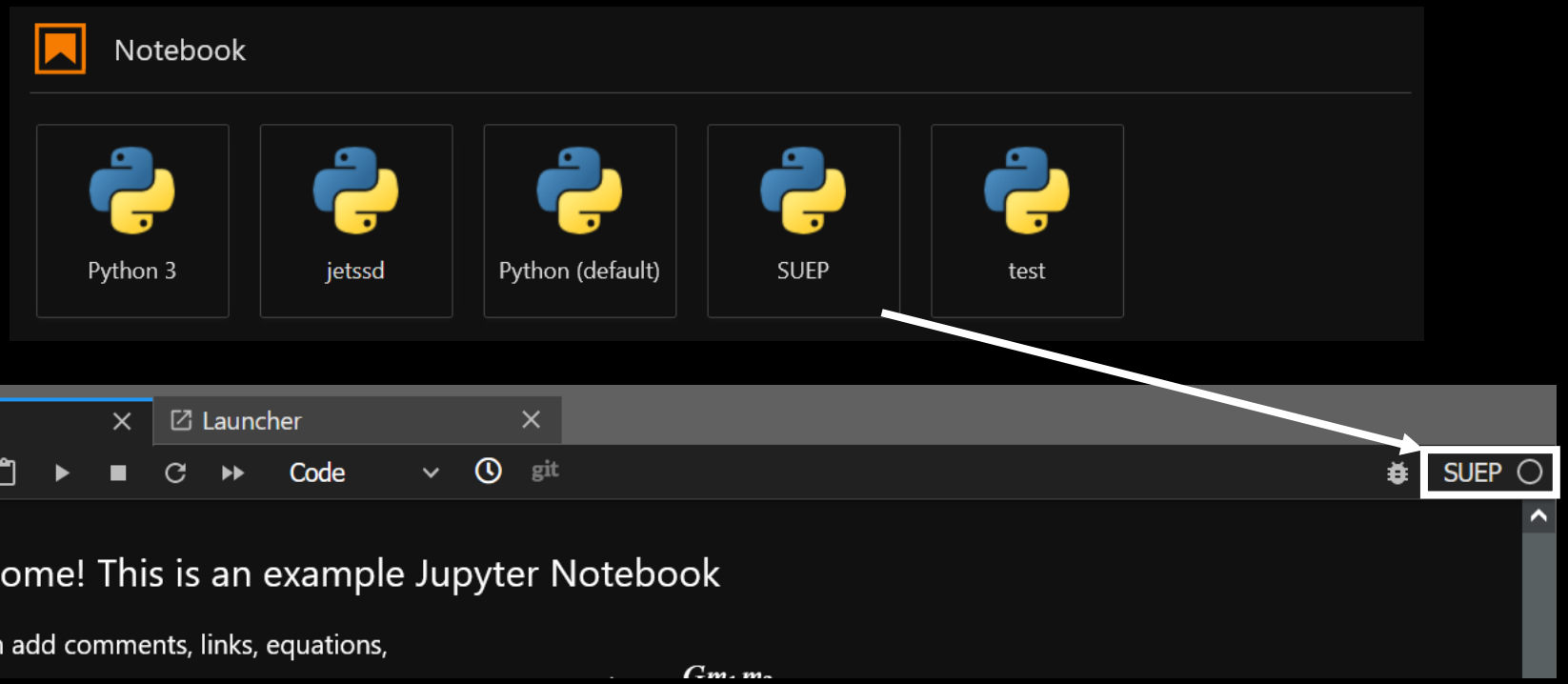
JupyterHub on subMIT

- Full access to files, software, and data,
  - Just like accessing a submit machine through the terminal
- Extensions to the hub: git, Dask, TensorBoard, debuggers, HTML, LaTeX, etc.)
- Lots of community support through Jupyter, Python, Anaconda, etc.



Environments through Anaconda

- A user can create a conda environment in which they can specify a preferred Python version and install packages within that environment.
- We then modified JupyterHub to add these environments as kernels: a notebook is executed on a specific kernel (i.e. a specific Python)
- Flexible and customizable for each user!



https://submit00.mit.edu/jupyter

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More info:
http://submit04.mit.edu/submit-users-guide/program.html#jupyterhub
http://submit04.mit.edu/submit-users-guide/program.html#conda

Example notebooks (to be expanded):
https://github.com/mit-submit/submit-examples/tree/main/jupyter

Questions, issues, help:
submit-jupyter@mit.edu