

JupyterHub in Engineering Education

PyData PDX November, 2019



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Division of Engineering and Industrial Technology

Portland Community College

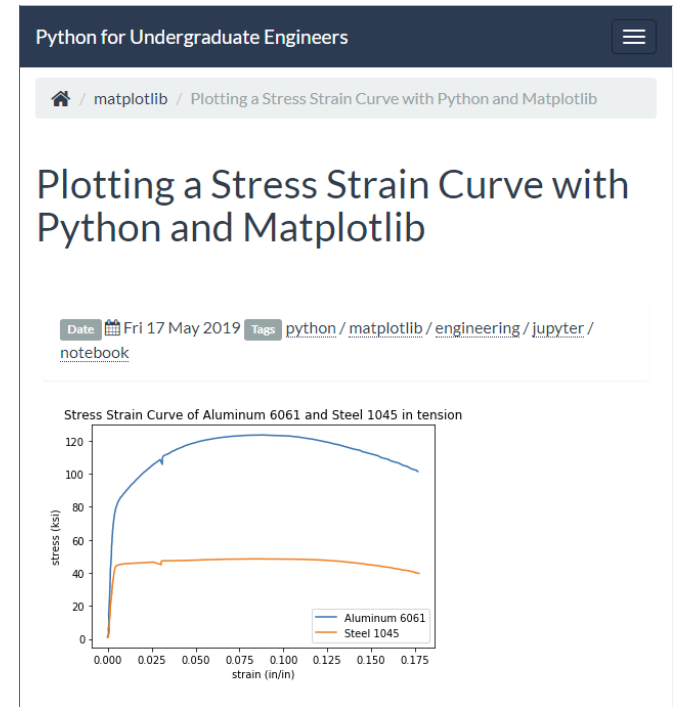
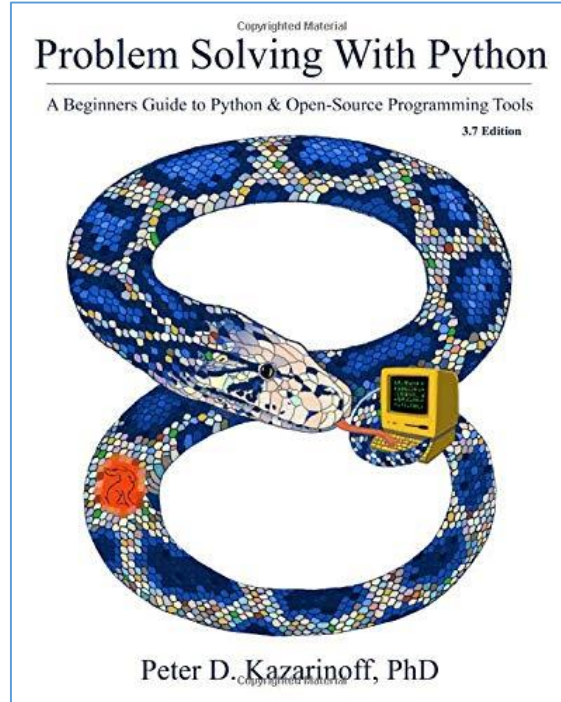
[@pkazarinoff](#) GitHub: [ProfessorKazarinoff](#)

Slides: github.com/ProfessorKazarinoff/PyDataPDX-2019-11

Who is Peter?



- Engineering Transfer
- 2-year Engineering Tech



Blog: pythonforundergradengineers.com

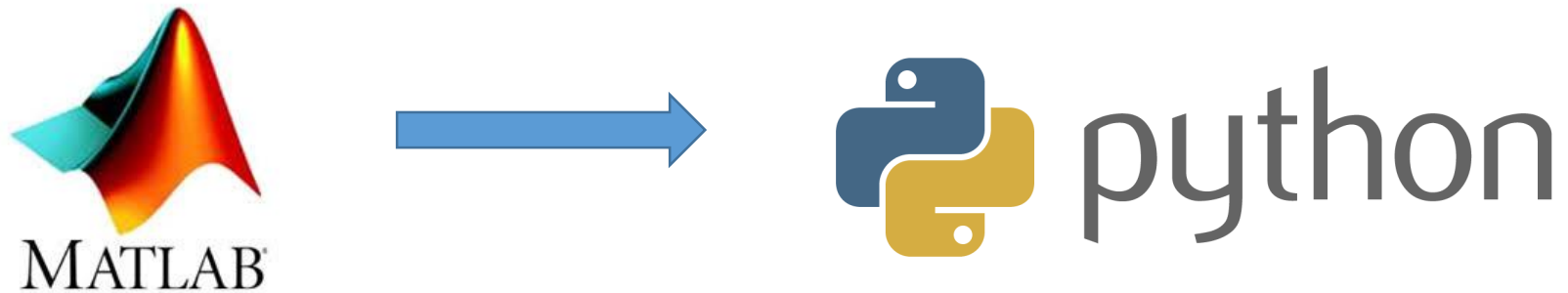
GitHub: github.com/ProfessorKazarinoff

Twitter: [@pkazarinoff](https://twitter.com/pkazarinoff)

- 6 in 10 of CC students experience food insecurity
- 3 in 10 CC students experience housing insecurity
- 1 in 10 of CC students is homeless



Moving from MATLAB to Python



Could save students \$25,000 in one year

Students use Desktops, Laptops, Chromebooks, Tablets and Phones



Jupyter Notebooks

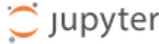

```

Anaconda Prompt - jupyter notebook
[I 09:35:24.740 NotebookApp] Serving notebooks from local directory: C:\Users\peter.kazarinoff\Documents
[I 09:35:24.740 NotebookApp] The Jupyter Notebook is running at:
[I 09:35:24.741 NotebookApp] http://localhost:8888/?token=f0231ebbc26a7b8e6dbe1f0b6fa61b40e00062ece87728a1
[I 09:35:24.741 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 09:35:24.749 NotebookApp]

To access the notebook, open this file in a browser:
file:///C:/Users/peter.kazarinoff/AppData/Roaming/jupyter/runtime/nbserver-9516-open.html
Or copy and paste one of these URLs:
http://localhost:8888/?token=f0231ebbc26a7b8e6dbe1f0b6fa61b40e00062ece87728a1_

```

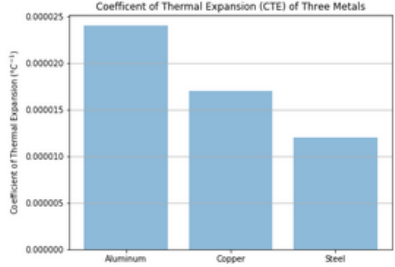
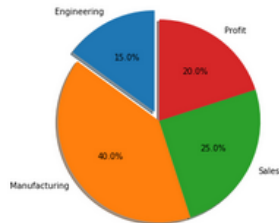
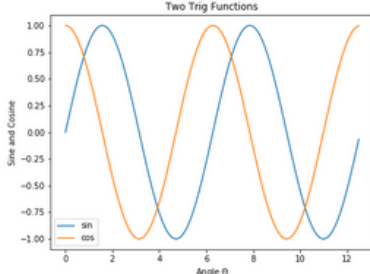


 **Lab_8_Notes-Plotting_with_Python** Last Checkpoint: 06/14/2018 (autosaved)  Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Notes Lab 8 - Plotting with Python

In this set of notes, you will learn how to build plots using Python and a package called **matplotlib**.



Static Jupyter Notebooks Online

GitHub

ProfessorKazarinoff / ENGR114

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Code Issues 0 Pull requests 0 Projects 0 Wiki Security Insights Settings

Branch: master ENGR114 / ENGR114-Labs / Lab01-Circuit_Python / Lab01-Circuit-Python.ipynb Find file Copy path

SYAM107u8248 Edits to Lab 1 Circuit Python 6cb4c17 12 days ago

1 contributor

601 lines (600 sloc) 20.9 KB

Lab 01 - Circuit Python

Prelab

Read this entire document. Browse through the introduction to Circuit Python and the Circuit Playground Express using the links below.

- <https://learn.adafruit.com/welcome-to-circuitpython>
- <https://learn.adafruit.com/adafruit-circuit-playground-express>

nbviewer

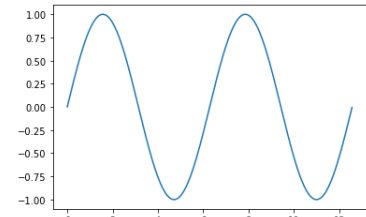
jupyter nbviewer

JUPYTER FAQ </> [Menu] [GitHub] [Share] [Download]

PyPDXWest-2019-10 / matplotlib_example.ipynb

```
In [1]: import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline

In [2]: x = np.arange(0,np.pi*4,0.01)
y = np.sin(x)
plt.plot(x,y)
plt.show()
```

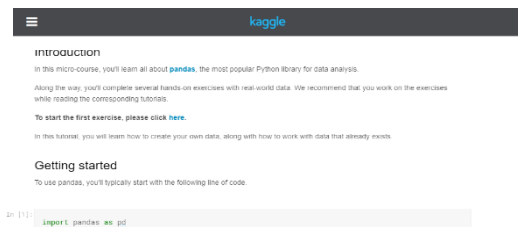


Dynamic Jupyter Notebooks Online



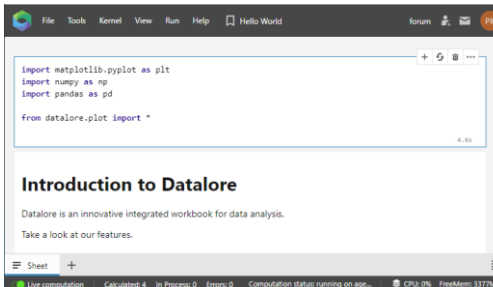
Turn a Git repo into a collection of interactive notebooks

Kaggle Kernels

A screenshot of the Kaggle Kernels website. The header has the Kaggle logo. The main content area is titled 'Introduction' and contains text about learning pandas. Below this is a 'Getting started' section with a code cell containing the line 'import pandas as pd'.

```
20 1:1 import pandas as pd
```

JetBrains Datalore

A screenshot of the JetBrains Datalore interface. It shows a code editor with Python code for importing matplotlib, numpy, and pandas, and using Datalore's plot function. Below the code editor is a section titled 'Introduction to Datalore' which describes it as an innovative integrated workbook for data analysis.

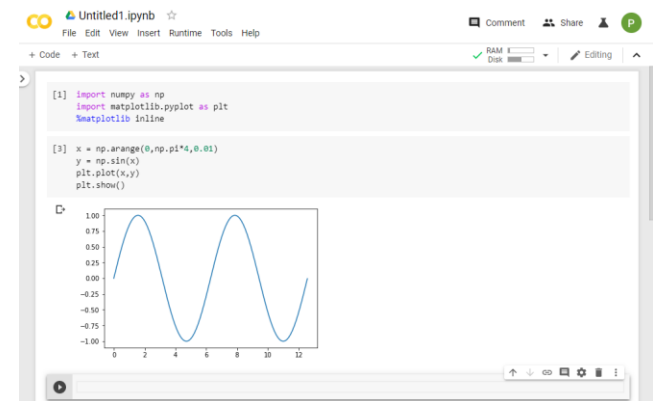
```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd

from datalore.plot import *
```

Introduction to Datalore

Datalore is an innovative integrated workbook for data analysis. Take a look at our features.

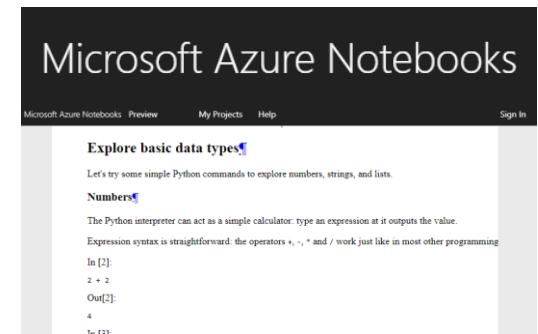
Google CoLab

A screenshot of the Google CoLab interface. It shows a code editor with Python code for importing numpy and matplotlib, and plotting a sine wave. Below the code editor is a plot of a sine wave.

```
[1] import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline

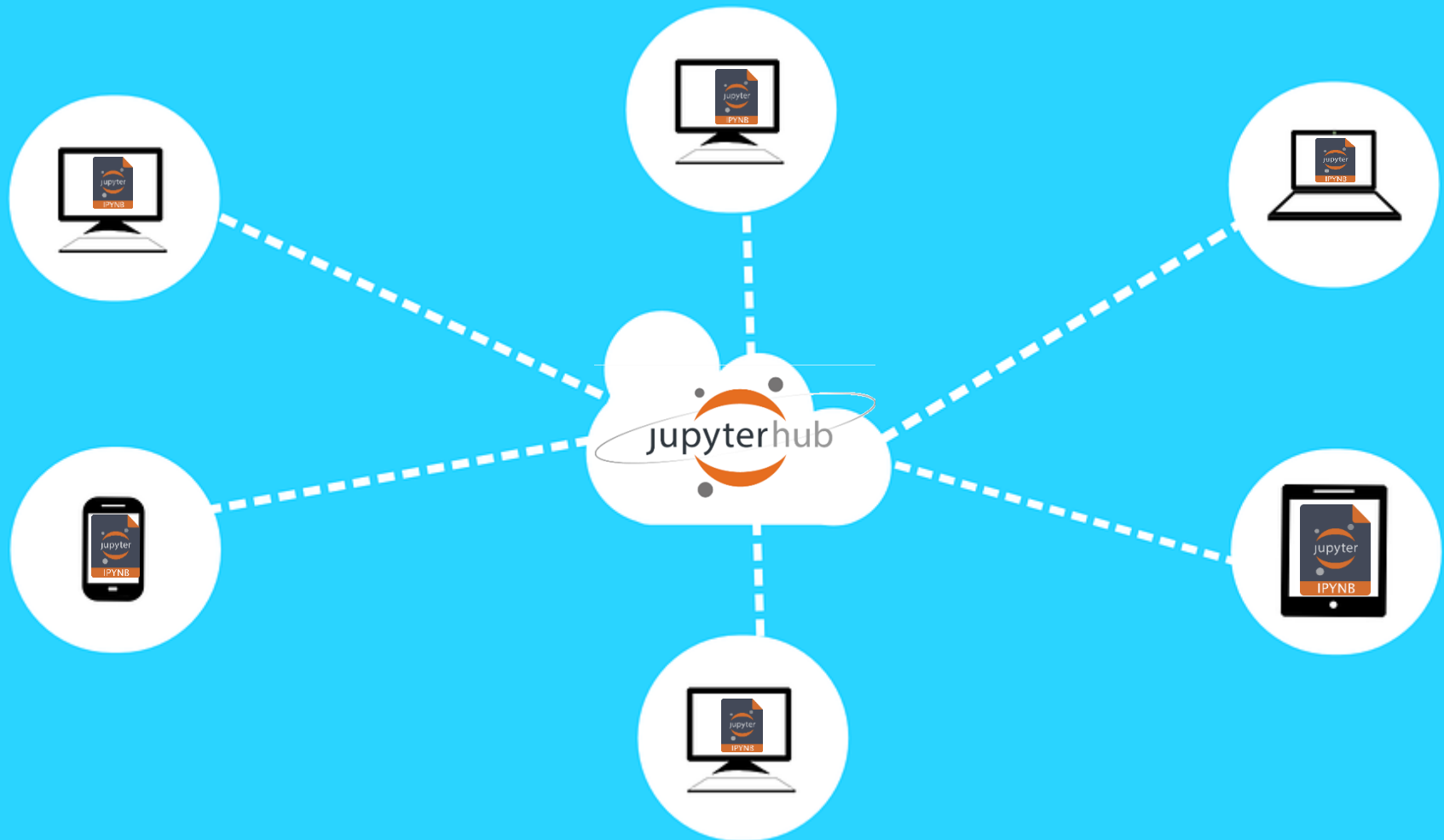
[2] x = np.arange(0, np.pi*4, 0.01)
y = np.sin(x)
plt.plot(x, y)
plt.show()
```

Microsoft Azure Notebooks

A screenshot of the Microsoft Azure Notebooks interface. It shows a code editor with Python code for exploring basic data types. Below the code editor is a section titled 'Explore basic data types' which describes the Python interpreter and its syntax.

```
In [2]:
z + 2
Out[2]:
4
In [3]:
```


JupyterHub

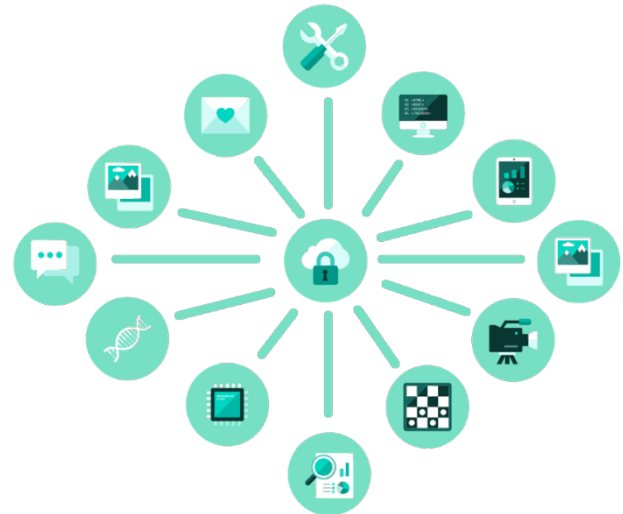
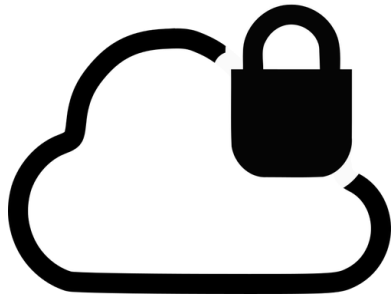


JupyterHub



Why use JupyterHub?

- You have your own OAuth and don't want to use additional usernames and passwords
- Your data is private and can't be shared in the public cloud
- Need custom packages, custom environment not available publically
- Share documents/data across users



Setting up JupyterHub

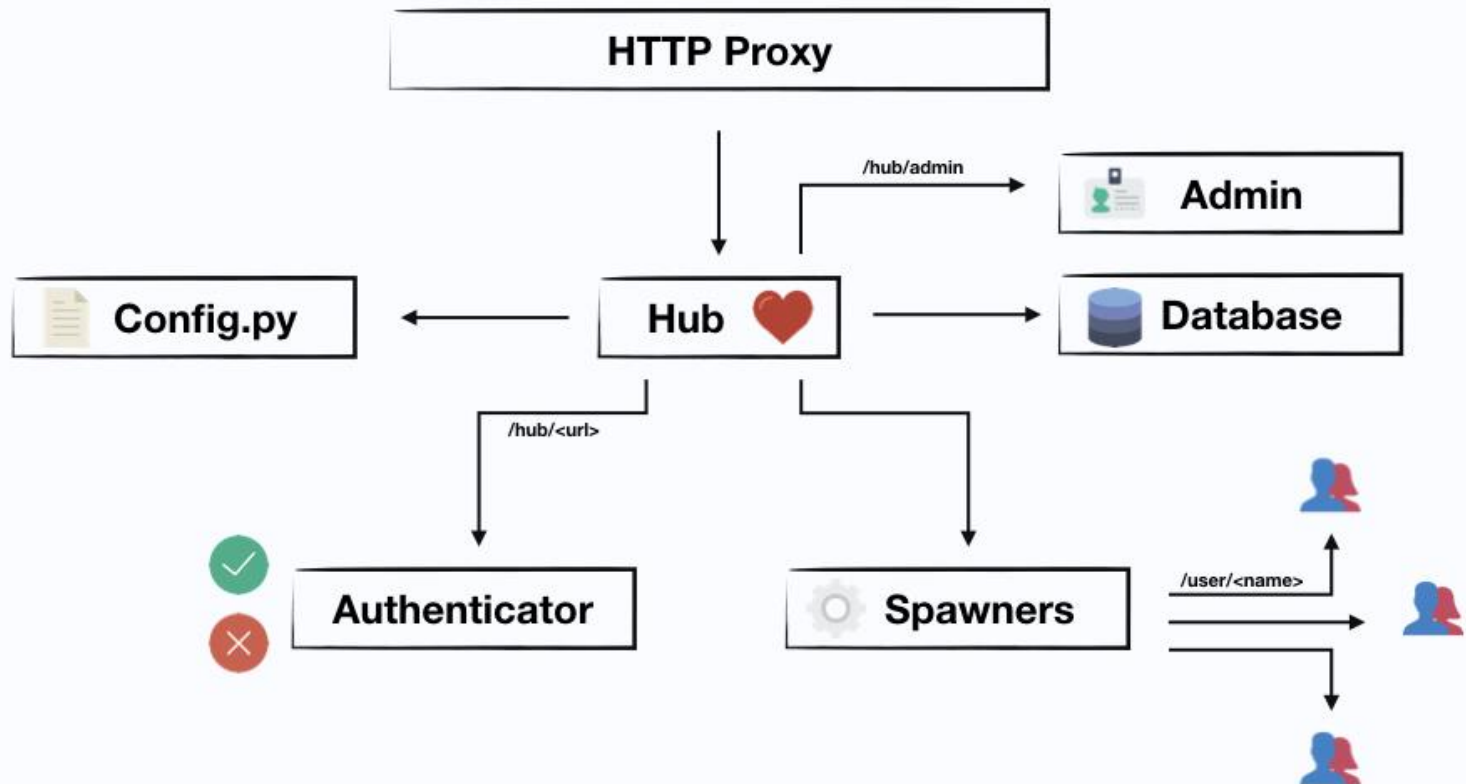


- VPS (Digital Ocean, Linode, AWS, Google Cloud, Azure, or Local Server)
- Root access (can run without sudo, but it's more complicated)
- Install Python and JupyterHub
- Configuration file
- Domain name and SSL cert
- Can use Nginx reverse proxy
- Authentication: PAM, GitHub, Google or other OAuth

```
peter@ubuntu-1804-jupyterhub: ~  
* Authenticating with public key "rsa-key-20180516"  
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.15.0-65-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
System information as of Tue Oct  8 16:28:38 UTC 2019  
  
System load:  0.0               Processes:            95  
Usage of /:   22.8% of 24.06GB   Users logged in:     0  
Memory usage: 26%              IP address for eth0: 165.22.157.61  
Swap usage:   0%  
  
* Canonical Livepatch is available for installation.  
- Reduce system reboots and improve kernel security. Activate at:  
  https://ubuntu.com/livepatch  
  
38 packages can be updated.  
0 updates are security updates.  
  
Last login: Thu Oct  3 16:18:08 2019 from 209.152.44.203  
(base) peter@ubuntu-1804-jupyterhub:~$
```

<https://jupyterhub.readthedocs.io/en/stable/>

JupyterHub

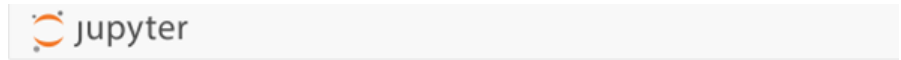


All icons were obtained on Flaticon (<https://www.flaticon.com/packs/essential-collection>)

Image: JupyterHub Docs

Authentication

GitHub OAuth



PAM Authenticator (built into Linux)

Sign in

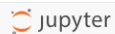
Username:


Password:

Sign In

Sign in with GitHub

Google OAuth



Portland Community College logo, featuring a stylized 'P' and 'C' inside a diamond shape.Go to PCC home

Sign in with your MyPCC account

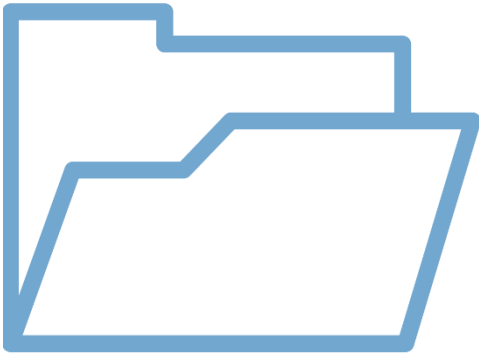
Sign in with Portland Community College

[Forgot your password?](#) [First time user?](#) [Need help logging in?](#)

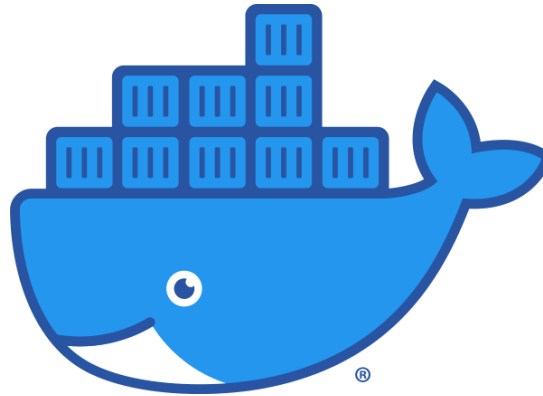
- Other OAuth Services:
BitBucket, GitLab, Globus, MediaWiki, Okpy, OpenShift, CILogon, AuthO

Storage

VPS File System



Docker

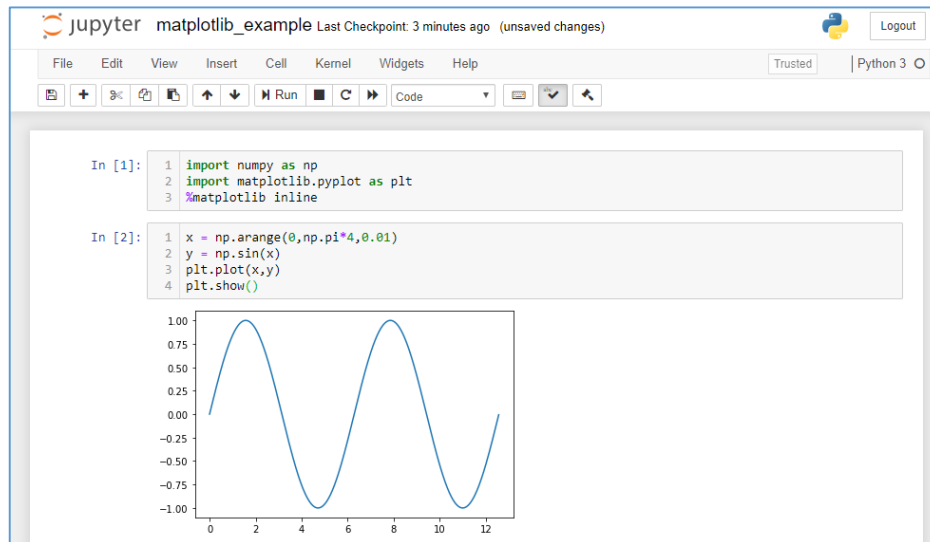


Kubernetes

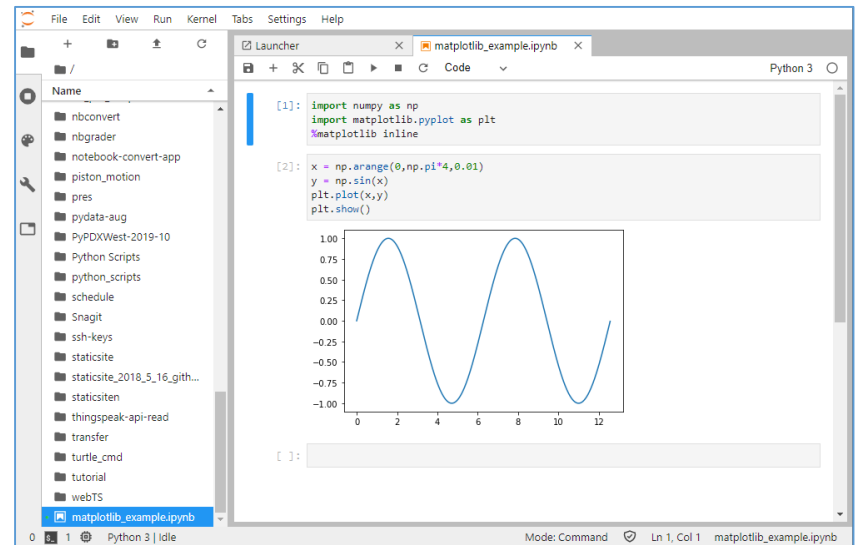


Classic Notebook or JupyterLab Interface

Classic Notebook Interface



JupyterLab Interface



nbgitpuller Extension

Build a URL for your users

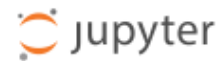
nbgitpuller link generator

JupyterHub URL	<input type="text" value="https://engr101lab.org"/>	
URL path	<input type="text" value="tree/ENGR101/course_materials"/>	optional
Repository URL	<input type="text" value="https://github.com/ProfessorKazarinoff/ENGR101"/>	
Git Branch	<input type="text" value="branch"/>	optional

Reset

<https://engr101lab.org/hub/user-redirect/git-pull?repo=https%3A%2F%2Fgithub.com%2FProfessorK>

GitHub Repo Pre-populates in user's file system



Files

Running

Clusters

Select items to perform actions on them.

☐ 0

/ ENGR101 / course_materials



..



assignments





notes


<https://jupyterhub.github.io/nbgitpuller/>

Try your own deployment:

<https://professorkazarinoff.github.io/jupyterhub-ENGR114-2019Q4/>

 JupyterHub-Deployment-ENGR114-2019Q4

 Search

 **GitHub**
0 Stars · 0 Forks

Set Up

Before we launch into the server setup, let's quickly review where certain files are going to go:


File Locations and Directory Structure

According to the [JupyterHub docs](#):

The folks at JupyterHub recommend that we put all of the files used by JupyterHub into standard UNIX filesystem locations on our server:

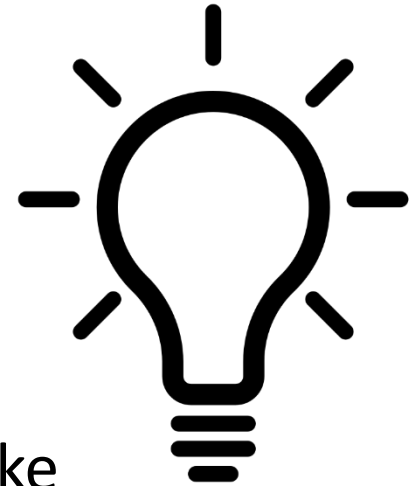
- `/srv/jupyterhub` for all security and runtime files
- `/etc/jupyterhub` for all configuration files
- `/var/log` for log files

Development tools

 **Page Contents**

- File Locations and Directory Structure
- Development tools
- Next Steps

Lessons Learned



- Authentication can be tricky. Linux does not like usernames with special characters
- A \$5/month server works with a few users. 25 users overloads a \$5/month server. Use \$40/month server for a class.
- Custom login page is possible, but takes work (html and css)
- Use a cull idle servers script to save resources
- Document! Document! Document!: You may want to spin up a new JupyterHub instance in the future.

Interested in a JupyterHub Deployment Tutorial?



Email:

peter.kazarinoff@pcc.edu

Twitter: [@pkazarinoff](https://twitter.com/pkazarinoff)

Questions?



- Slides: github.com/ProfessorKazarinoff/PyDataPDX-2019-11
- My JupyterHub Deployment Docs:
<https://professorkazarinoff.github.io/jupyterhub-ENGR114-2019Q4/>
- JupyterHub Docs:
<https://jupyterhub.readthedocs.io/en/stable/>
- nbgitpuller Plugin:
<https://jupyterhub.github.io/nbgitpuller/>

I'm Looking for Guest Speakers!

- Share your experience with a community college class
- Email: peter.kazarinoff@pcc.edu or DM on Twitter [@pkazarinoff](https://twitter.com/pkazarinoff)

