JupyterHub Overview

1

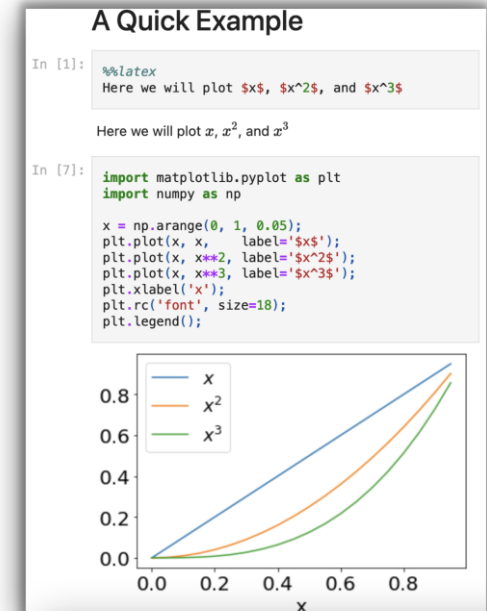### Visit

https://submit.mit.edu/jupyter

&

Authenticate with Shibboleth

2

Spawn a Server

Portability @ full power:
Full access to local machines, Slurm clusters, GPUs, etc.
via any browser

3

- Documents, code, output & terminal
  - GUI-oriented programming
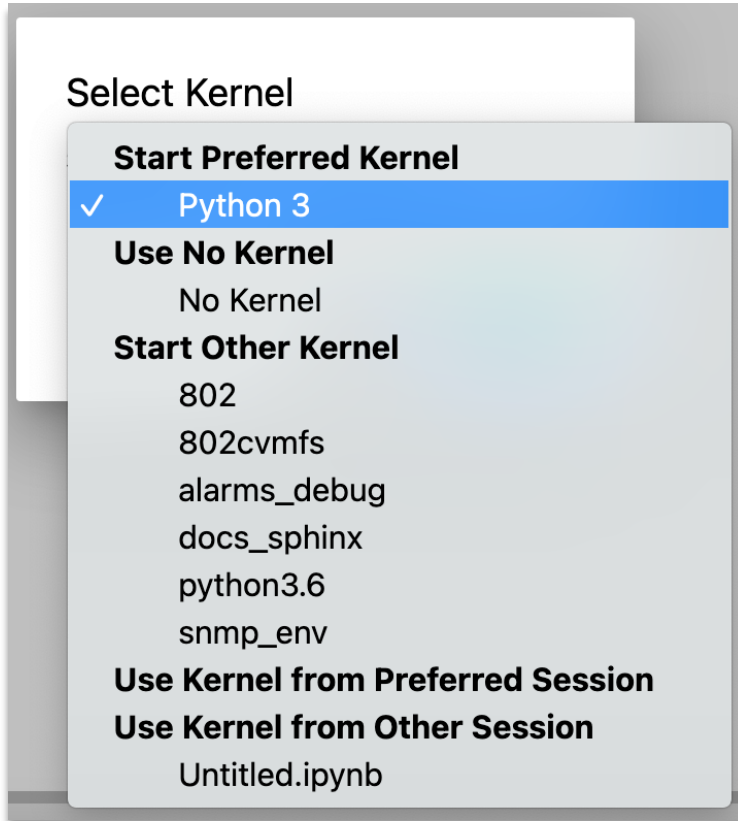- Reproducibility, information sharing

Spawning Options

- Originally, only spawned servers locally (submit01)

- **Added Slurm support**
  Launch servers on `submit` Slurm cluster. Jupyter servers managed by Slurm but continuously communicate with the Hub.

- **From user requests, added:**
  1. Access to GPUs (generic & 1080s)
  2. Servers with more CPUs
  3. Servers with more memory
  4. Reserved servers for projects (8.02)
  5. Servers on `/work/submit/$USER`
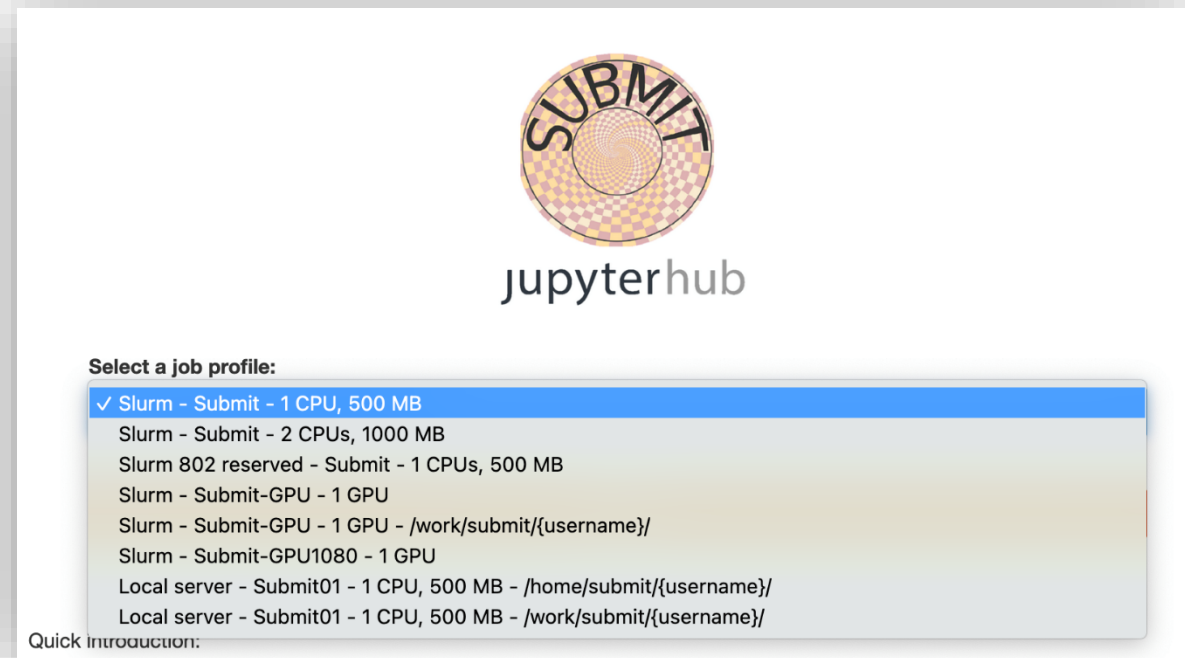
- **User base has responded well**: the majority of Jupyter users now use the new Slurm spawning option, GPUs are used

Custom Kernels

Select Kernel

Start Preferred Kernel
✓ Python 3
Use No Kernel
   No Kernel
Start Other Kernel
   802
   802cvmfs
   alarms_debug
   docs_sphinx
   python3.6
   snmp_env
Use Kernel from Preferred Session
Use Kernel from Other Session
   Untitled.ipynb

JupyterHub is set up to use the system's python & central environments that are created by sysadmins.

Wanted to give users freedom to

1. use their own software installations,

2. without burdening them with figuring out how to install them on our jupyter.

Wrote **custom software** to:

- User's custom anaconda environments automatically available as kernels

- From experience with users, some technical under-the-hood changes for improved balance of uniformity across users and user customization

- Gracefully handle user's non-functional environments

Aside: What's a kernel?
An environment with a specific python (or Julia, or C++, etc.), packages, and paths that are used to execute code in a Jupyter notebook)

8.02: Trial & Discussion

The request

Instructors wish to incorporate computation into the 8.02 classroom (VPython & Jupyter).

Their requirements:

- ✓ simultaneous usage by large classroom of students
- ✓ A common programming environment available by default to students
- ✓ Ability to use their old notebooks, vpython
- ✓ Ease of use and maintenance

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Our work

1. Modification of subMIT JupyterHub to accommodate VPython
2. Assisted in sorting out dependencies & setting up kernel
3. Making kernel accessible to large number of *simultaneous* users (via cvmfs)
4. Assisted migrating JupyterNotebook → JupyterLab
5. Can use reservation system for class time (& pre-due-date "crunch" time)

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A unique opportunity
SubMIT was able to provide unique support to this project via:
- Customization of our JupyterHub
- Continuous communication and troubleshooting between the 8.02 instructors and our team

Only possible via a local system with local support!

|	MyBinder	Google Colab	subMIT
VPython	✅	🚫	✅
Fast startup	🚫	✅	✅
Save notebooks (locally per user)	🚫	✅	✅

Not possible for any generic provider like MyBinder & Google Colab!

Impact

The user base has responded well to the new changes:

1. Most users now rely on SlurmSpawner
2. GPUs are being used through JupyterHub
3. Weekly use hovers around 15-25 users

- JupyterHub Slurm CPU
- JupyterHub Slurm GPU (Generic)
- JupyterHUB Slurm GPU (1080)
- JupyterHub Local Spawn
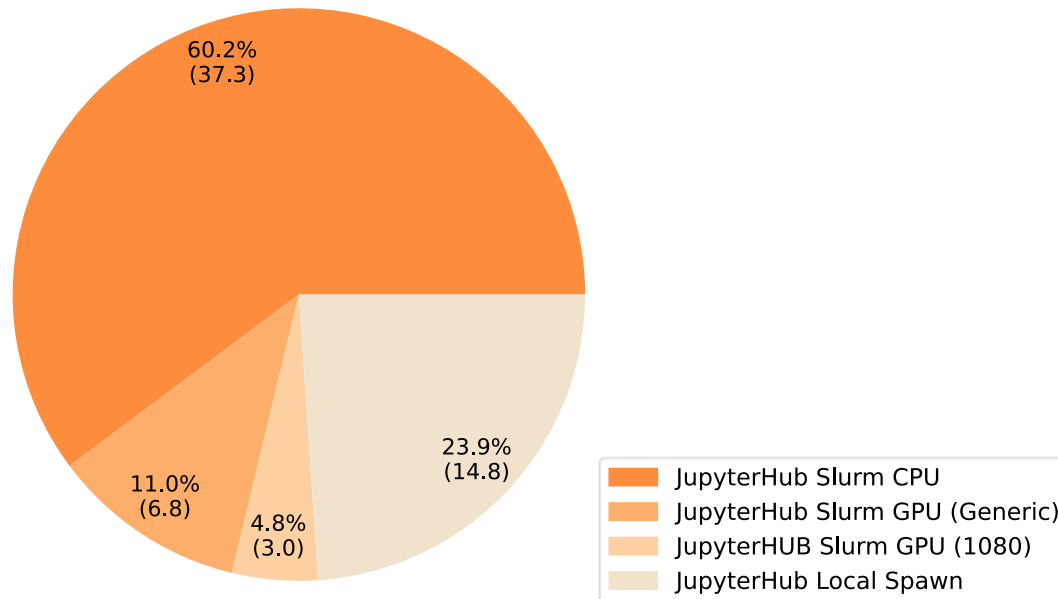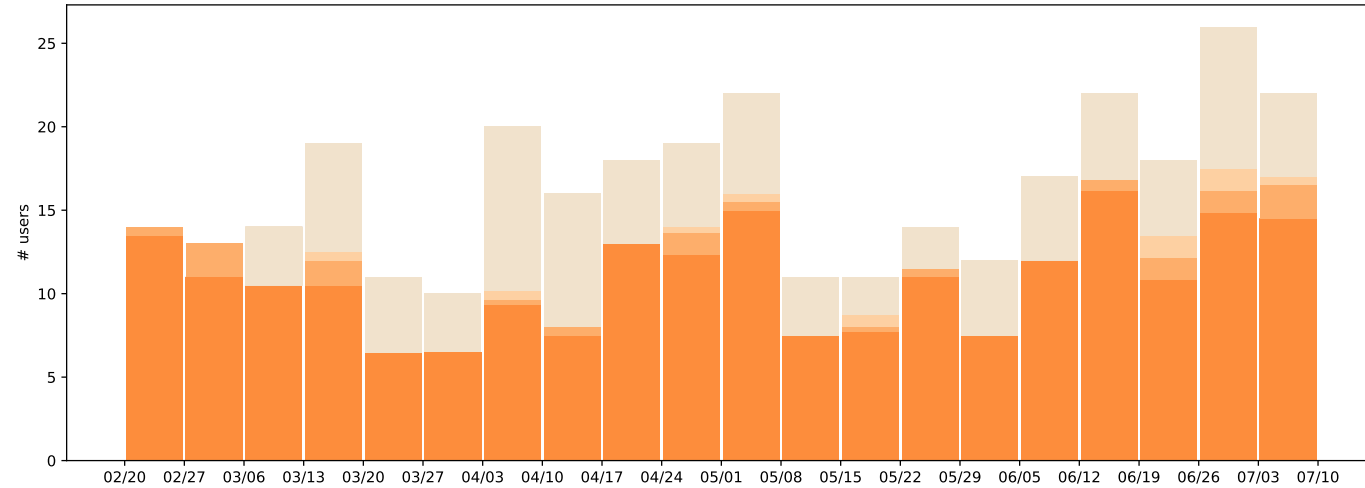
From our personal experience, JupyterHub is a great resource for students new to computing as well as more experienced ones that are can to fully leverage interactive development.

Summary

- subMIT JupyterHub is popular for interactive work

- Offer a variety of services through JupyterHub to meet various computing needs

- Provide direct ad personalized support to users & projects (e.g. 8.02)

- Able to customize JupyterHub to best support our user base

subMIT support staff assist JupyterHub users with technical details,

so <u>users can focus on physics</u>