

Getting started on subMIT: How to Interact with subMIT

subMIT Annual Workshop 2024

<https://indico.mit.edu/event/956/>

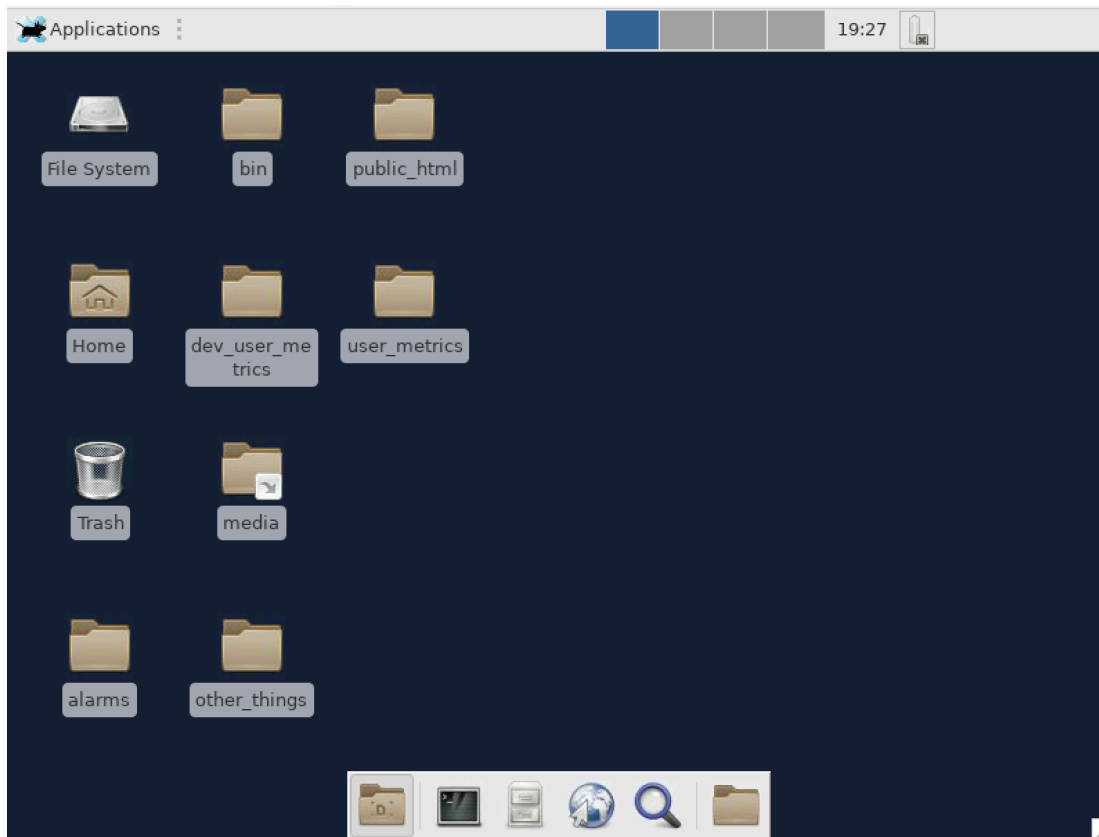
Matt Heine 2/2/2024



Outline

- X2Go
- JupyterHub
- Visual Studio Code (VSCoDe)
- terminal / ssh

X2Go

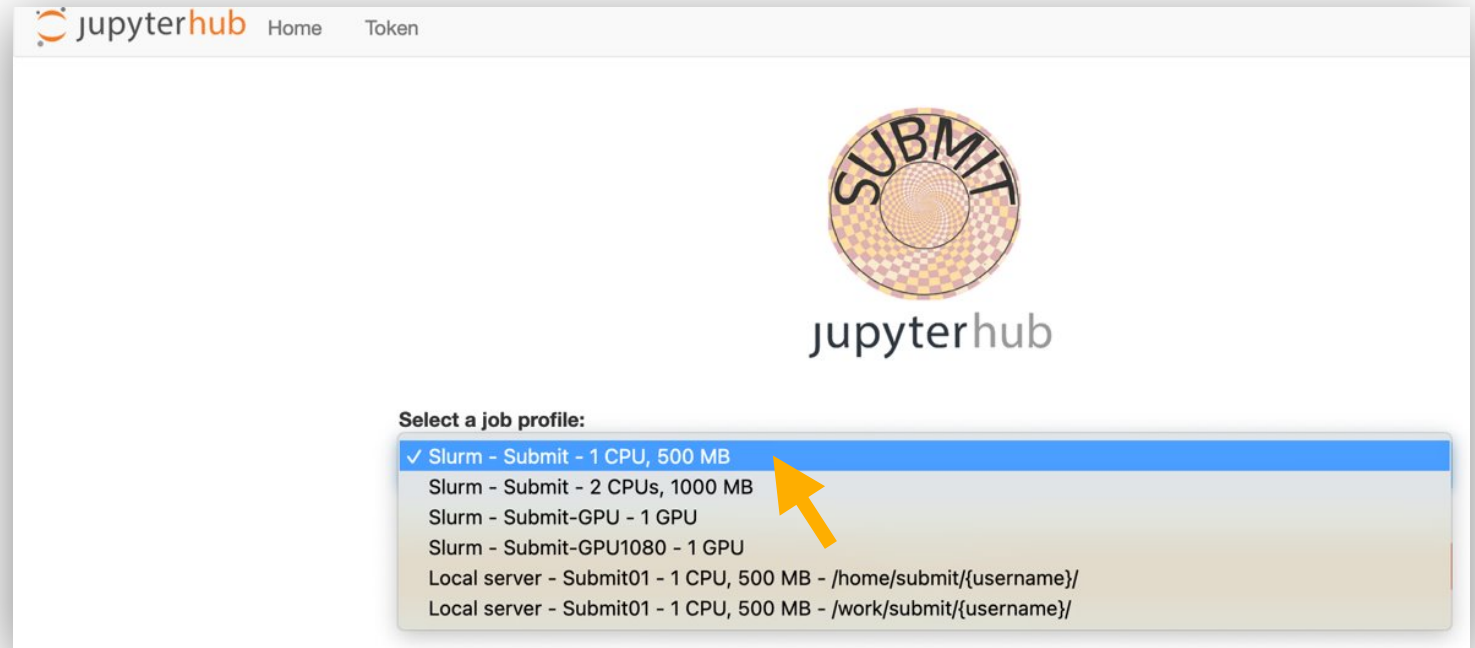


- Familiar GUI interaction w/ the cluster
- Easy alternative to manual X11 Forwarding
- Run GUI applications with little/no setup
- subMIT User's Guide: <https://submit.mit.edu/submit-users-guide/program.html#x2go>

JupyterHUB

- Access subMIT from a web browser

<https://submit.mit.edu/jupyter/>



- Easy interactive access to compute resources, including GPUs.
(Not just login nodes)
- Create/Run Jupyter Notebooks
- also built-in terminal (in web browser)

JupyterHUB

- Jupyter Notebooks: Self-Contained
 - Code
 - Results / Visualization
 - Documentation (Markdown, LaTeX)
 - Easily shared
- Kernels = sets of software / packages used to run code in your notebook
 - Use your conda environments as kernels (automatic setup)
 - Use singularity images (containers) as kernels
 - Change kernels w/ a click
- Mathematica accessible via JupyterHub
- Many languages (even w/in same notebook)
- Many extensions
 - Debugging
 - Source Control (git /github)

subMIT User's Guide:

<https://submit.mit.edu/submit-users-guide/program.html#jupyterhub>

<https://submit.mit.edu/submit-users-guide/program.html#jupyterhub-for-mathematica>

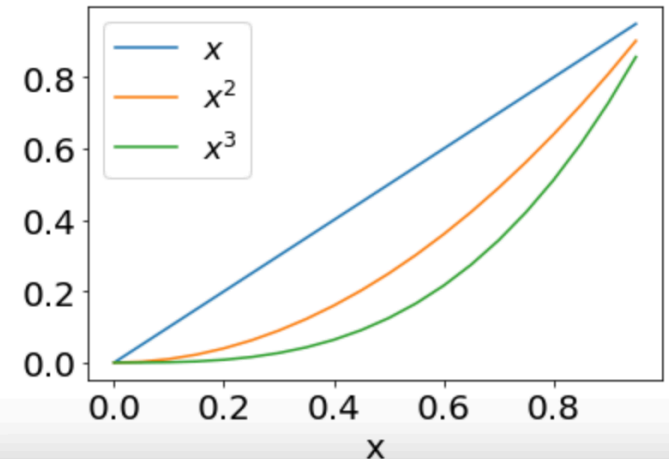
A Quick Example

```
In [1]: %%latex
Here we will plot  $x$ ,  $x^2$ , and  $x^3$ 
```

Here we will plot x , x^2 , and x^3

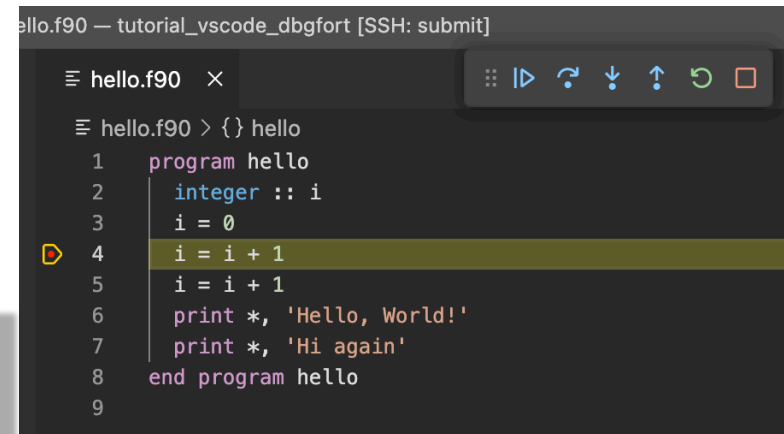
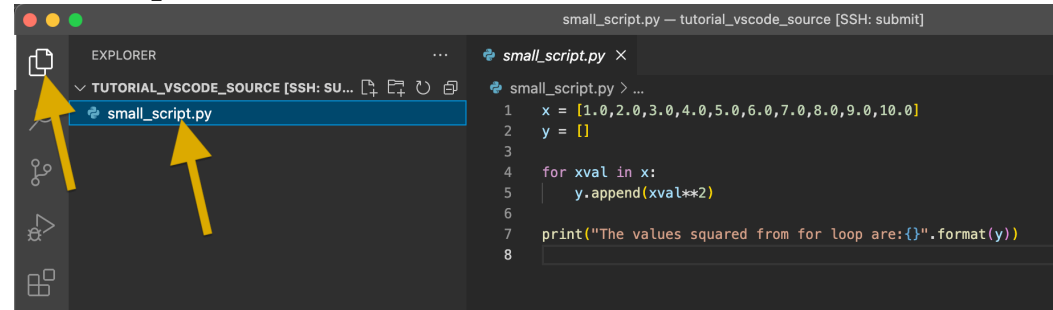
```
In [7]: import matplotlib.pyplot as plt
import numpy as np

x = np.arange(0, 1, 0.05);
plt.plot(x, x, label='$x$');
plt.plot(x, x**2, label='$x^2$');
plt.plot(x, x**3, label='$x^3$');
plt.xlabel('x');
plt.rc('font', size=18);
plt.legend();
```



Visual Studio Code: Remote Development

- code runs on subMIT cluster, GUI runs on your laptop
- File Browser
 - GUI to navigate/view your subMIT files/directories
- Many languages / extensions
 - Python, C/C++, Java, Julia, Fortran, ...
 - LaTeX, HTML/CSS, Markdown, rst, ...
- Code navigation
- Debugging (code runs on subMIT cluster)
 - breakpoints
 - inspect/watch variables (cursor hover)
 - stack navigation
- Source Control (Integrated / GUI)
- Automatic Code Completion
 - Intellisense
 - Snippets, AI-assisted development
- subMIT User's Guide:
 - <https://submit.mit.edu/submit-users-guide/program.html#vscode>
 - Tutorials: <https://submit.mit.edu/submit-users-guide/#tutorials-submit>

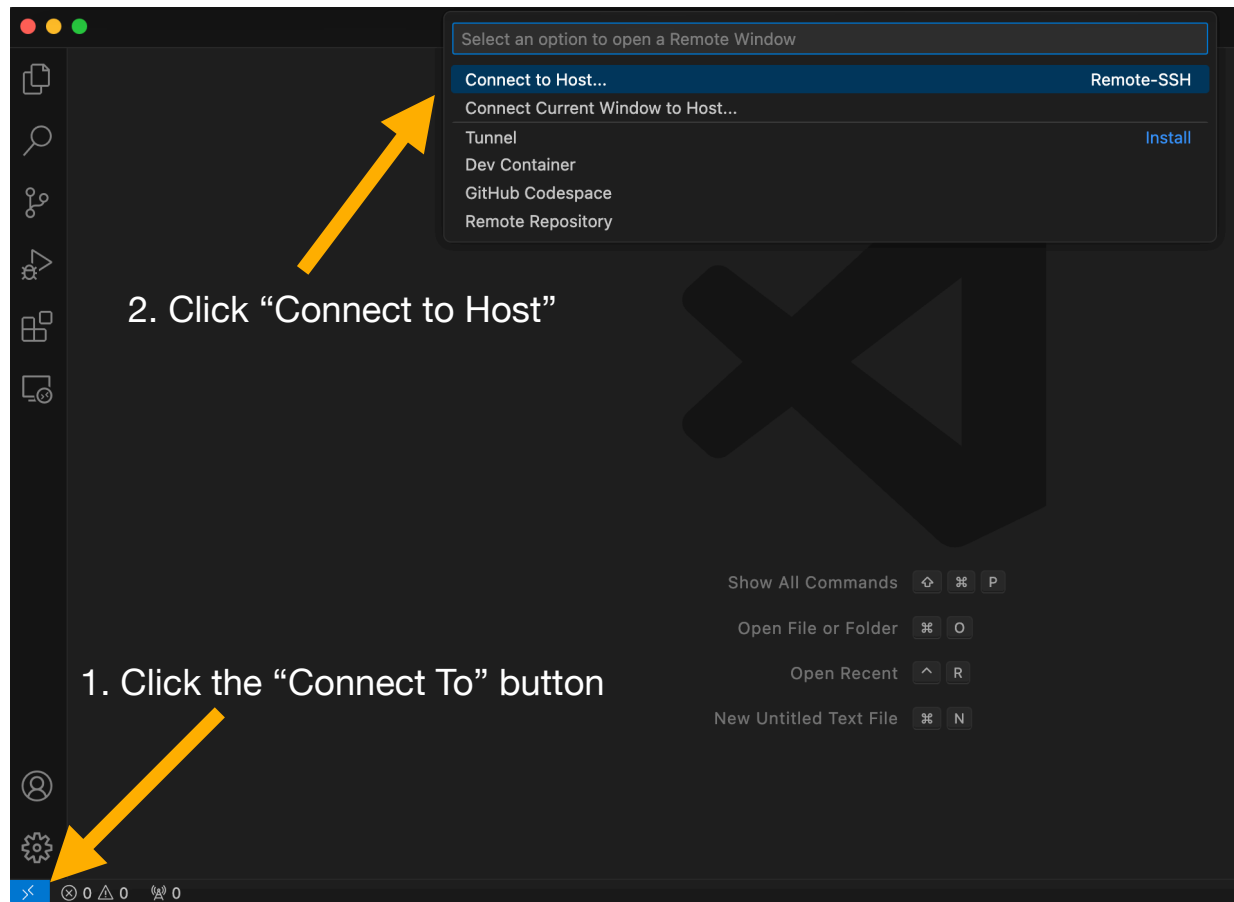


Change conda environments (on subMIT) for python code w/ a click

Visual Studio Code: How to Connect

subMIT User's Guide:

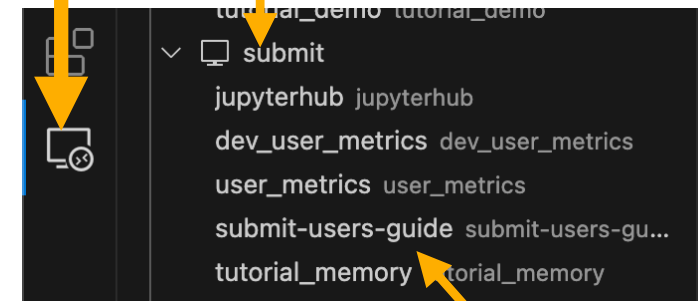
<https://submit.mit.edu/submit-users-guide/program.html#getting-started-with-vscode-on-submit>



Click "Remote Explorer"

Then remote hosts in your ssh config file appear

OR



... along with previously-opened folders on each host

Terminal / SSH

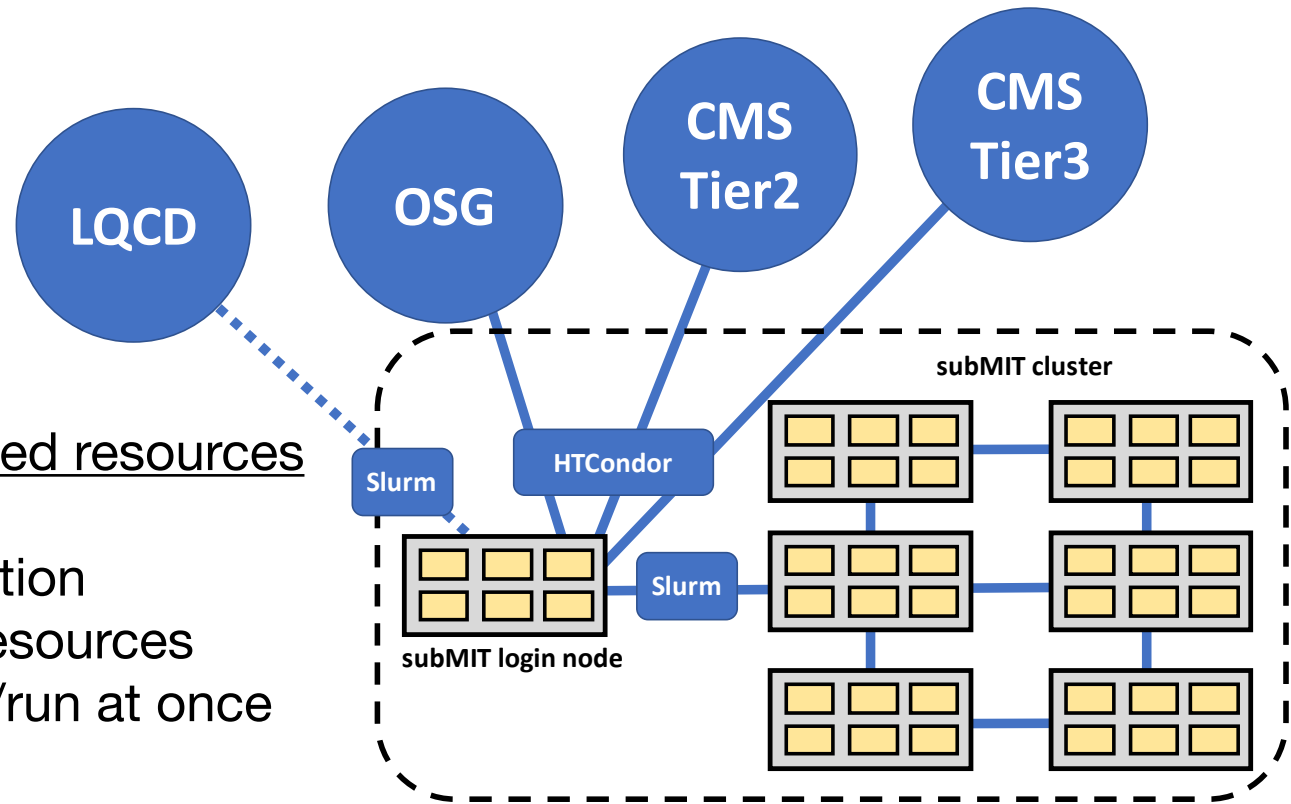
- Classic method of interaction

```
ssh <username>@submit.mit.edu
```

- MacOS / Linux : built-in. Windows : Windows Subsystem for Linux (WSL)
- Handy tip: set up ssh config file:
 - <https://submit.mit.edu/submit-users-guide/starting.html#common-issues-with-keys>
- subMIT User's Guide
 - Intro to terminal: https://submit.mit.edu/submit-users-guide/tutorials/tutorial_0.html

Batch Jobs (overview)

- See the tutorial later this morning for more info!
- What are Batch jobs?
 - request/reserve dedicated resources (nodes, cores, memory)
 - run without user interaction
 - may wait in queue for resources
 - one or many submitted/run at once



- Login nodes are only for light usage
- “Heavy lifting” (significant usage of resources) should be done via batch jobs