JupyterHub Workshop 2016

Meeting Friday July 22nd, 2016

Quick Tips

- **Interact** for file sharing (URL based content sharing—makes it easier for users)
  http://www.inferentialthinking.com/
- **Ansible** for deployment
  https://github.com/compmodels/jupyterhub-deploy
- Jess' compmodels deployment as a base
  https://github.com/compmodels/jupyterhub-deploy
- Reference Deployments
  https://github.com/jupyterhub/jupyterhub-deploy-teaching
  https://github.com/jupyterhub/jupyterhub-deploy-docker

Common Themes/Visions:

Possible Projects

- Find out how many users JupyterHub can support
  Define "Modestly Sized" groups:
  "JupyterHub is designed to be a simple multi-user server for modestly sized groups of semi-trusted users."
- Supporting many (500+) users on single JupyterHub server
- Flatten learning curve
  currently too steep because of git
  Interact (mentioned in "Quick Tips") as possible solution
- Saving history when you exit the shell
- Integrating .ipynb files with Google Drive's "open with"
- Make it easier to create hubs

Overall Notes

Brian Granger – Cal Poly SLO

"Deploying JupyterHub"

Small/medium groups of trusted users

Users are not developers

Ansible Based Deployment

- We have encoded this deployment scenario as a set of configurable ansible roles
  https://github.com/jupyterhub/jupyterhub-deployteaching
- Used to teach data science at Cal Poly over multiple quarter, multiple instructors
- Can build a new server in <1 hour

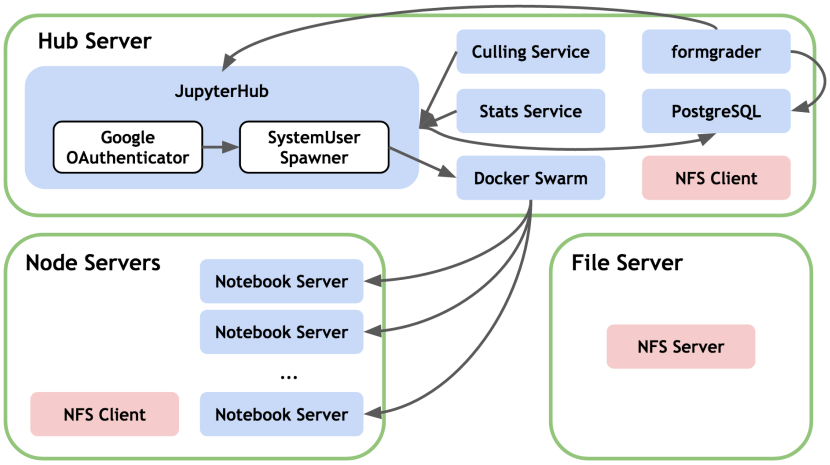
Install uses conda and some pip

Jess Hamrick – UC Berkeley

"Scaling Up JupyterHub for Education"

Scaling up to include more users (200+)

1. Isolating users with Docker
   - Isolated environment
2. Isolating 200+ users with Docker Swarm
3. Persistent files using NFS



4. Managing everything with Ansible and Docker Compose

   [DockerSpawner and SystemUserSpawner: https://github.com/jupyterhub/dockerspawner]

   Talking to JupyterHub:

   1. Get an API token
   2. Access the JupyterHub API using http://<url>:8081/hub/api/users
      - Headers: {'authorization': 'token <hub_api_token>'}
      - https://github.com/jupyterhub/jupyterhub/tree/master/jupyterhub/apihandlers

   Getting a JupyterHub URL:

   1. Run your service at:
      - http://<service_url>:<service_port>
   2. Access the proxy API
      - POST http://<url>:8001/api/routes/myservice
      - Headers: {'authorization': 'token <proxy_api_token>'}
      - Body: {'target': 'http://<service_url>:<service_port>'}
   3. Access your service at:
      - http://<url>:8000/myservice

   Authenticating with JupyterHub:

   1. Get an API token:
      - JupyterHub token
   2. Use the HubAuth service

      HubAuth service
   3. Example use case: `nbgrader formgrade`

Ryan Lovett – UC Berkeley

"Foundations of Data Science" Course

Computer Science & Statistics Dept.

- New Data Science course with "connector" courses

- Connector classes used skills from main class for specific disciplines

- Didn't want students to have to install too much software
- About 100 students (1st semester) grew to 480 students (2nd semester)
- There is a learning curve
  Not all instructors or students familiar with git
- Needed a way to push notebooks and files to students
  Interact URL based content sharing
  http://www.inferentialthinking.com/
  hub side service that pulls
  notebooks from github repos when
  students click on a textbook link

- Azure spawning issues fixed by Min
- imagespawner: HTML form that allows the user to choose which container they want to run. Give instructors a choice between regular container and one where the user has elevated privileges
  https://github.com/ryanlovett/imagespawner

Shreyas Cholia– UC Berkeley

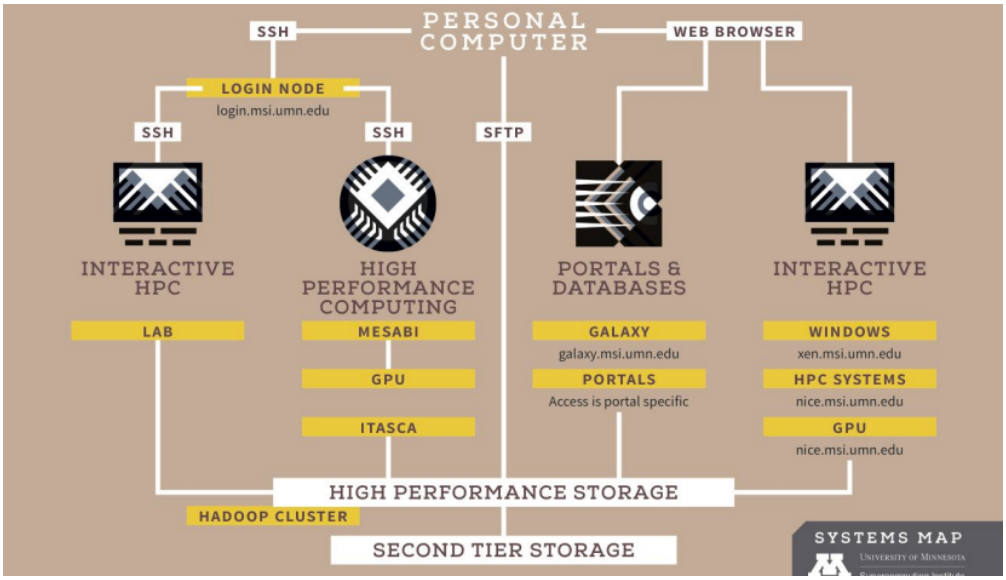
"Driving Supercomputers With Jupyterhub: NERSC Experiences On Cori"

https://github.com/NERSC

- Individual users to run their own notebook servers presents a potential security hole
- Custom Authenticator uses myproxy to login to NERSC CA server with username/password and retrieves credentials (X509 certificate)
- Jupyterhub runs as a standalone service and doesn't need root access
- We wrote an SSH Spawner that will will SSH into the Cori node with users credential
  - Uses GSISSH (but can also use regular SSH if you want to use SSH Keys instead of GSI Cer2ficates)
- SSH Spawner starts up notebook server process and goes away; Notebook server communicates directly with hub. No tunnels or persistent connections needed
- Keep track of the PID for poll and shutdown functions (also via SSH)

Michael Milligan – University of Minnesota

"Scaling Up JupyterHub for Education"



Use Cases:

- Supercomputer Gateway for Interactive HPC
- Enabling technology for Data Science Gateways

Apache web server
[reverse proxy, SSL termination, Shibboleth auth]
⇩
configurable-http-proxy
⇩
JupyterHub server
[batchspawner, profiles, remoteuser]
⇩
Job scheduling engine (Torque)

- 2016 SciPy talk: https://github.com/mbmilligan/scipy2016-jupyterhub

I. Allison, J. Colliander, M. Lamoureux – Pacific Institute for the Mathematical Sciences

"JupyterHub using Docker and Flocker on Openstack via Ansible and Vagrant"

- We want to offer similar services to orders of magnitudes more researchers

Federated identity - Shibboleth for authentication

- Also more research focused machines (HPC) for various groups.
  - At the moment we're experimenting with a larger single installation of JupyterHub
  - How far can we push a single hub and where are the bottlenecks?
  - We're trying out Swarm and Flocker for this
- Also looking at automated deployments for researchers -
  - Hubs on demand

They want to do this in a completely automated fashion

- **Vagrant** - "Reproducible development environments"
  - Allows us to define and instantiate resources
  - Providers: OpenStack, Rackspace, AWS, ...
  - Provisioners: sh, ansible
- **Ansible** - "Simple IT Automation"
  - Can take generic image and build up entire infrastructure for Docker
  - Swarm in minutes
  - Consul - distributed K/V store
- **Docker swarm** - API similarities make transition simple
  - swarm nodes can be provisioned as needed (and automated)
- **Flocker** - "container data volume manage"
  - maps common backends (EBS, GCE, Cinder) to containers

Alec Aivazis & Mike Polino – DataScience

"Lessons in transitioning a data science team to JupyterHub"

Difficulties

- VM drift, difficult debugging, reduced control for engineering team
- Discomfort in git (especially for diff'ing json docs)
- Limited by RAM in their laptops
- Sharing notebooks across Docker containers without mounting volumes or using git
  - Restful content manager: https://github.com/datascienceinc/RestfulContentManager
- Users want control over their notebook server resources (RAM / cores)
  - Mesos and DockerSpawner, re-size accessible from the UI
- Analysts want to collaborate quickly, don't want to "check out" code

    - locking mechanism and websockets
- Power users want to install notebook-specific Python packages
    - Python virtualenv per notebook

Cory Gwin – Berkeley Applied Analytics

"Custom Jupyterhub OAuthenticator"

https://github.com/jupyterhub/oauthenticator

- Simplify sign on for user so they don't have to sign in twice
- Organize user's notebooks based on username folder structure
- Edit existing OAuthenticator to fit your needs
    - Subclasses must override:
        - login_service (string identifying the service provider), used for the button name
        - login_handler (likely a subclass of OAuthLoginHandler)
        - authenticate (method takes one arg - the request handler handling the oauth callback)
- Next Steps:
    - Store API credentials for the User so they can access them.
    - Setup an API using these stored credentials inside the Notebook.
    - Investigating sharing folders based on user groups.