Clearing the Fog! Getting Started on Cumulus: a Near to the Ground On Campus Cloud Solution

Research Computing
UNIVERSITY OF COLORADO **BOULDER**

Be Boulder.

Getting Started on CUmulus

Gerardo Hidalgo-Cuellar
www.rc.colorado.edu
rc-help@colorado.edu

Slides and tutorial:
https://github.com/ResearchComputing/CUmulus_tutorials

Survey at: http://tinyurl.com/curc-survey18

Learning Objectives

- Logging into CUmulus via Horizon (the CUmulus web portal)
- Creating your instance (i.e. virtual machine)
- Logging into your instance via ssh

Outline

- What is CUmulus?

- CUmulus Access
  - Access to CUmulus and the allocation process
  - Logging into Horizon (CUmulus web portal)
  - Creation of an instance
  - Logging into your instance

- Demo workflow one might use on CUmulus:
  - Web App & Database
  - CUmulus + CURC HPC Integration

What is CUmulus?

- CUmulus is CU Research Computing's free-to-use on-premise cloud service.
- Supports cases not well-suited for HPC such as
  - research-oriented web servers
  - databases
  - long-running services
- Provides users with persistent or ongoing availability by allocating them a logically isolated section of the cloud.

What is CUmulus?

- You get your own virtual “world” for experimentation - an environment that can be easily created/deleted.
  - Install Software
  - Administer your instance (you’re in control!)
  - Run applications and jobs
  - Interface w/ other CURC services: Blanca, Alpine, PetaLibrary

- You can request specific resources (CPU, storage, memory) and can set up persistent storage.

CUmulus Access

CUmulus Access and Allocation

Users will submit a proposal for your use case (email rc-help@colorado.edu):

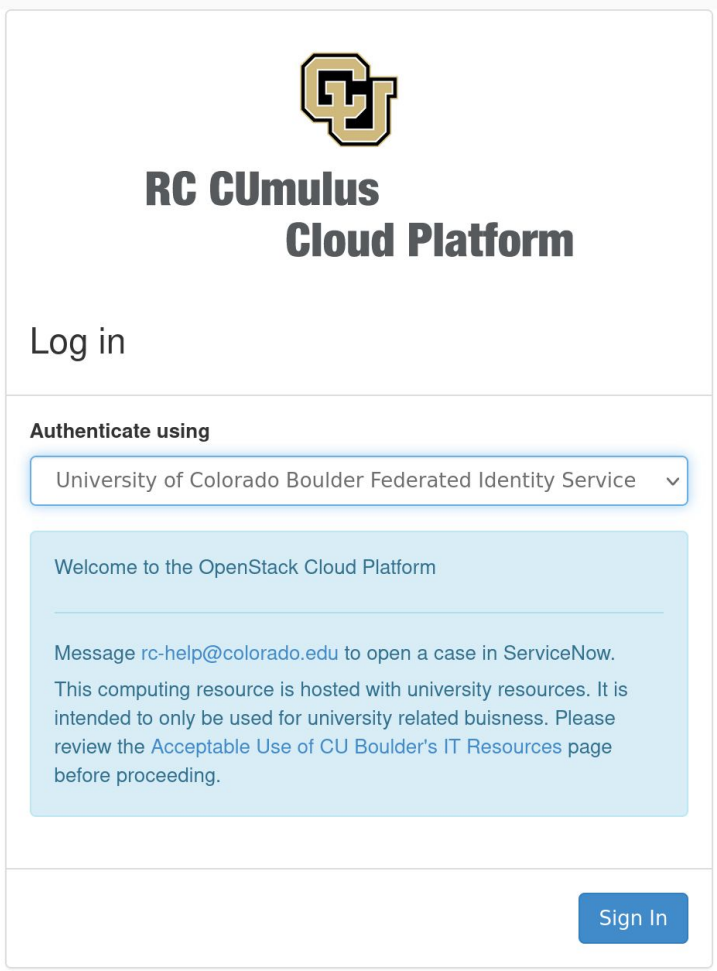
- Describe your CUmulus workflow
- Describe why your workflow is appropriate for CUmulus
- Estimate the resources you require:
  - operating system, CPU cores, disk space, memory

This is an iterative process where we work with you to make sure the request for resources fits your (and our) needs.

- Learn more about the allocation request process at https://www.colorado.edu/rc/userservices/allocations

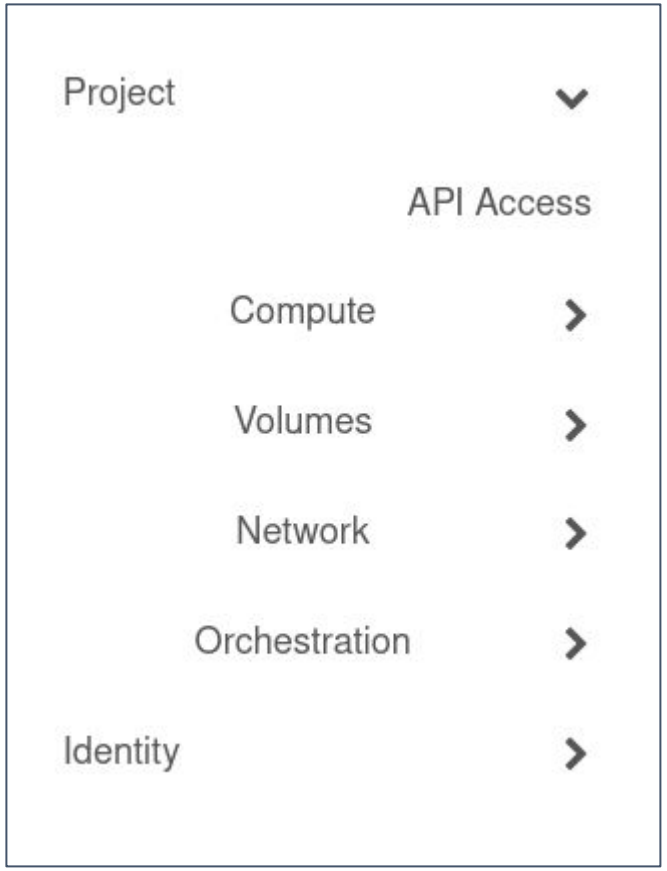
Log in to Horizon

- Horizon is the CUmulus web portal
  - cumulus.rc.colorado.edu/
- Let's take a brief tour of Horizon
- Log in with your institution's credentials:



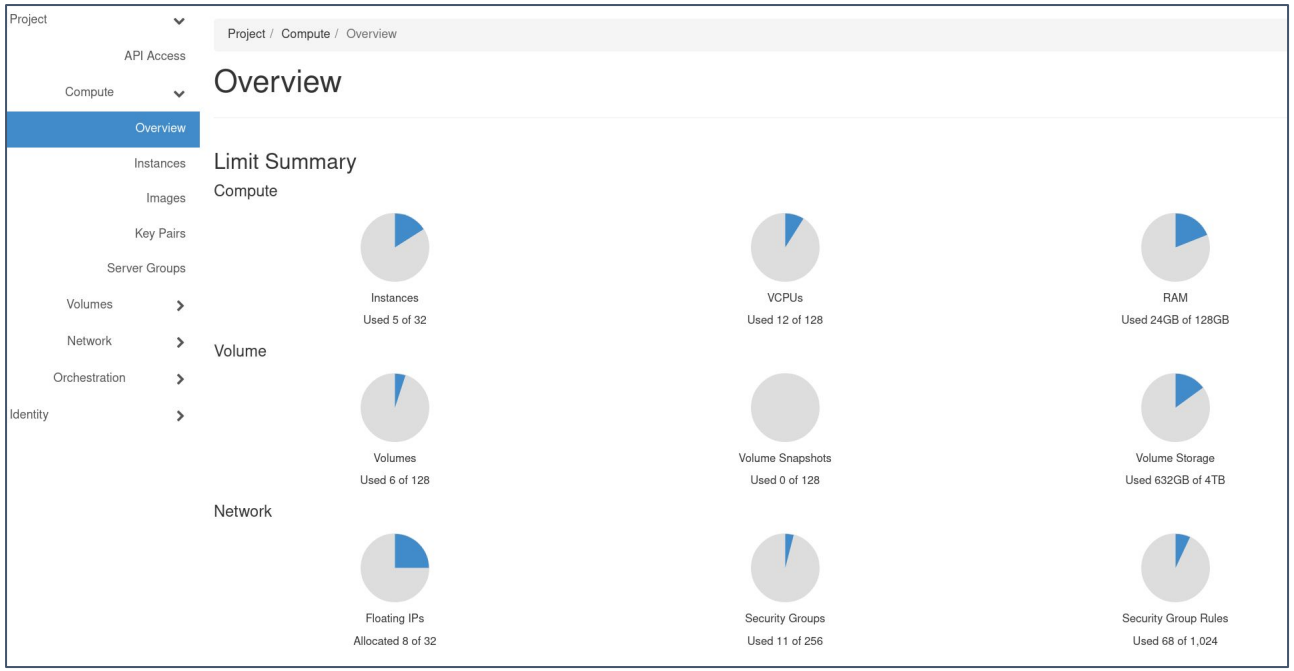
Navigate Horizon

- Choose your project (top left)
  - Generally users only have 1 project
- 4 main sections
  - Compute
  - Volumes
  - Networks
  - Orchestration



Navigate Horizon: Overview

- Land on the Overview page under “Compute”
  - quick summary of your project



Navigate Horizon: Instances

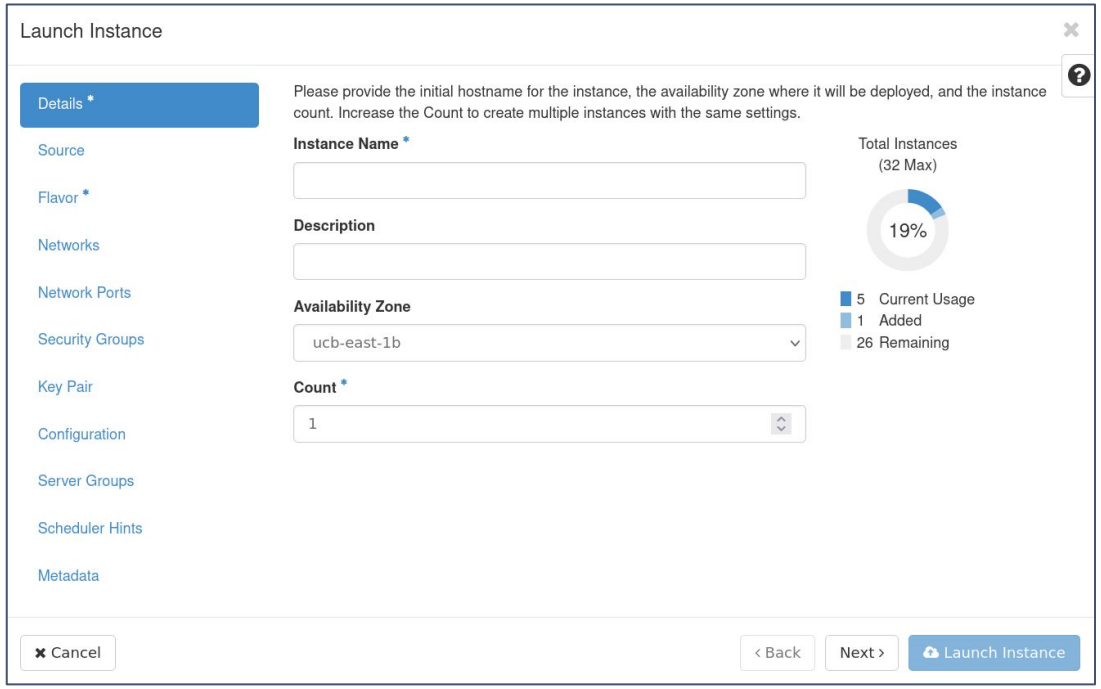
- Navigate to:
  - Project->Compute->Instances

- Instances are virtual machines that run inside the cloud, more simply: an instance is just a digital version of a physical computer.
  - Instances can perform almost all of the same functions as a computer, including running applications and operating systems.

Instance Creation

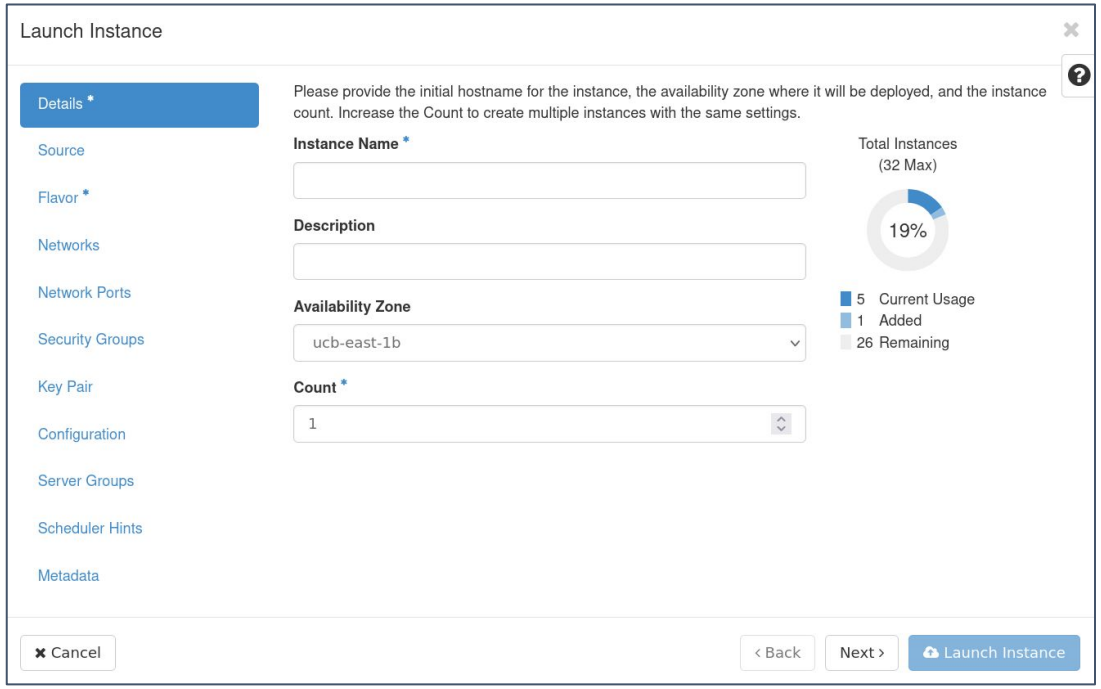
Let’s create a simple instance together

- From the instances page click on “Launch Instance”
- The Instance Creation Launcher will pop up giving us options to create our virtual machine:



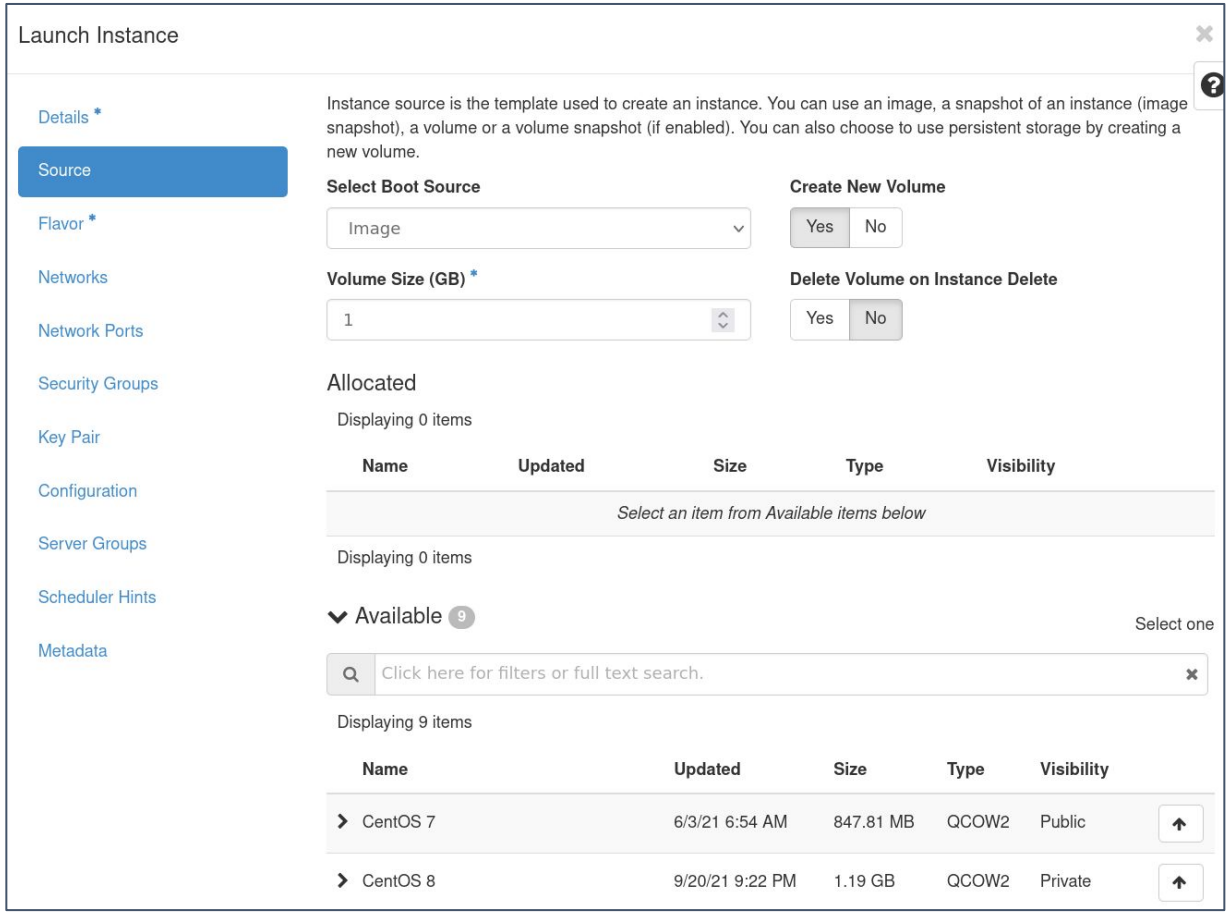
Details

- Fill out Instance details, including a name and description
  - availability zone and count can be left as defaults



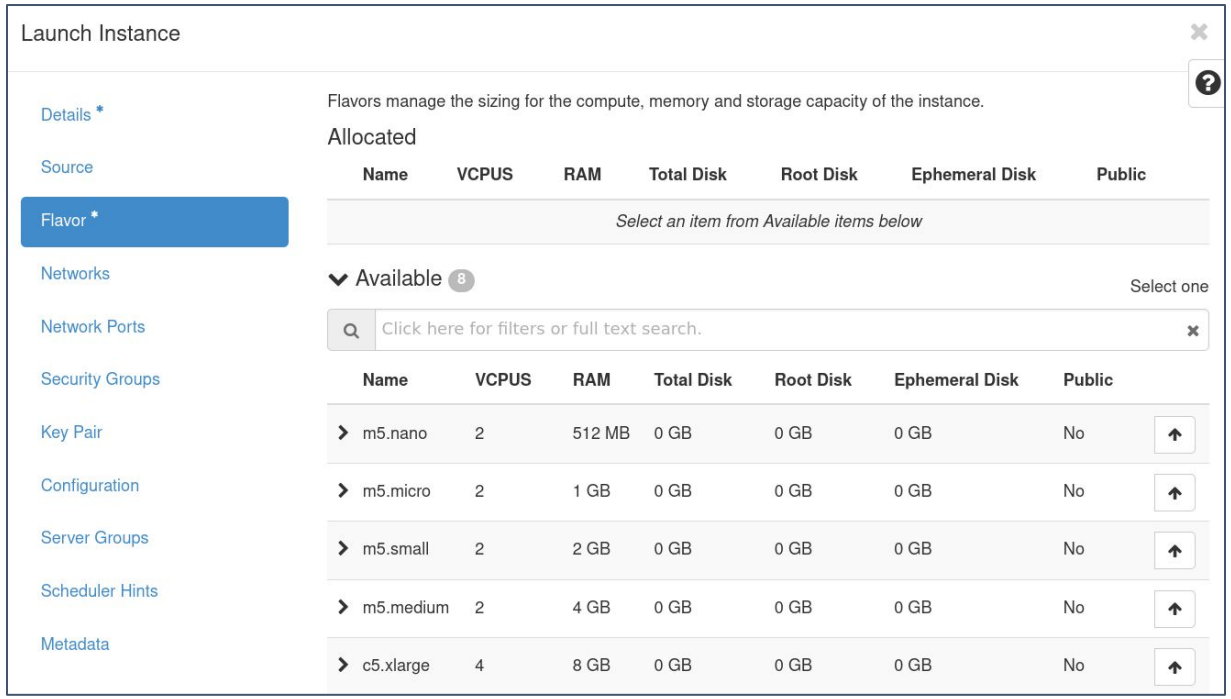
Source

- You can choose an operating system from the images CURC provides
- Choose to have your storage volume deleted on Instance Deletion
  - If you select fno" be aware of "zombie" volumes that will stay around when the instance is deleted



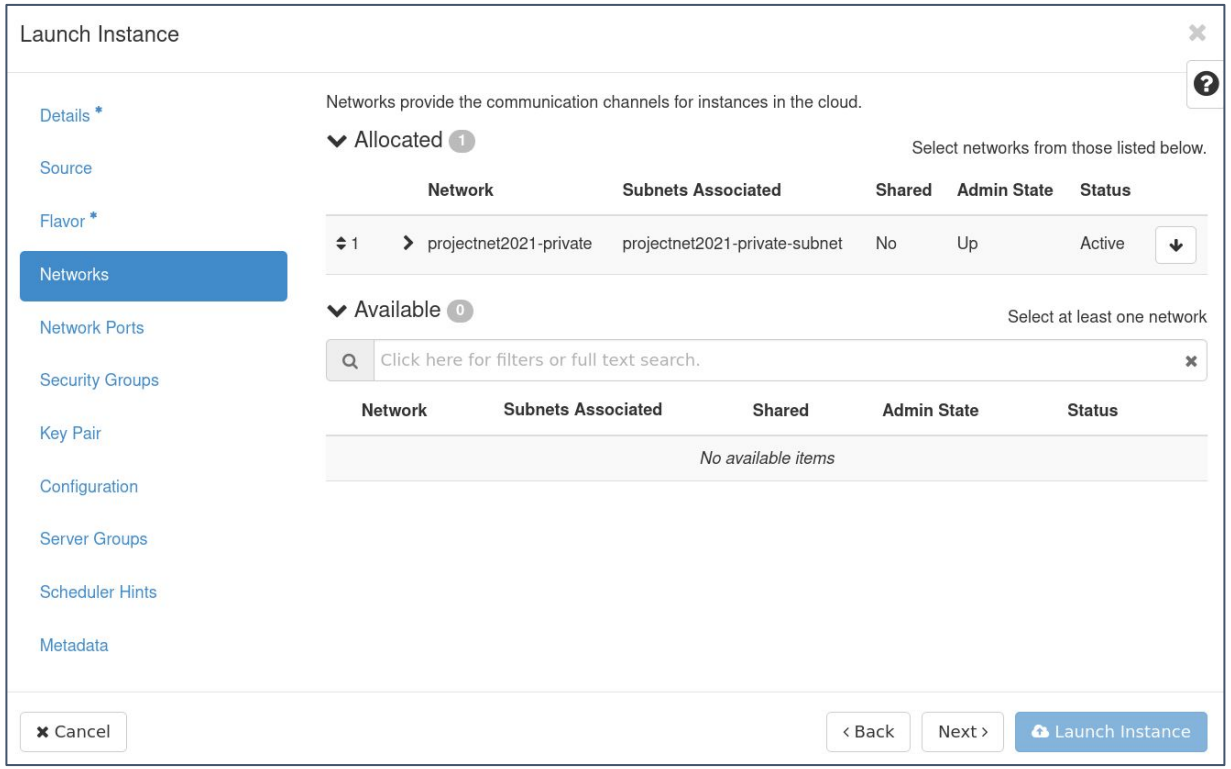
Flavor

- Choose from a list of pre-selected resources:
  - A flavor defines the compute, memory, and storage capacity of our instance.



Networks & Network Ports

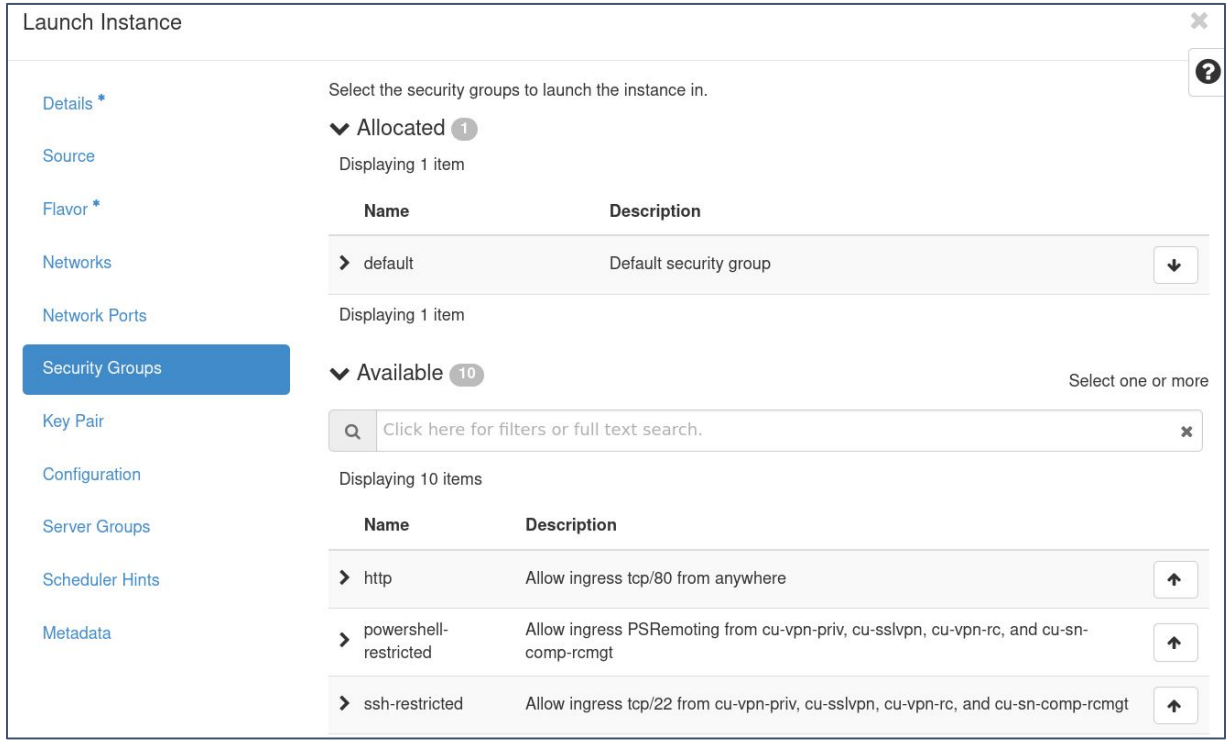
- Select a project network, which determines routability of either a public/internet or campus/internal floating IP.
  - We'll choose an external network
- Ports provide extra communication channels to your instances.
- You can select ports instead of networks or a mix of both.



Security Groups

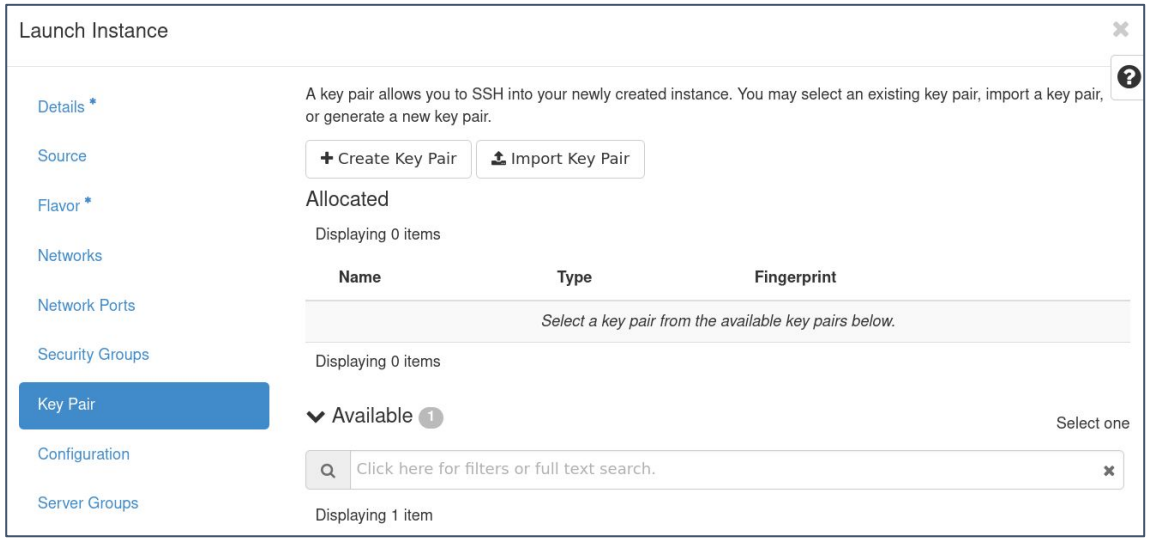
- Security Groups act as a virtual firewall for your instance to control inbound and outbound traffic.

- We'll pick ssh-restricted, http, and https for our demo



Key Pairs

- A key pair allows you to SSH into your new instance.
- You may select an existing key pair, import a key pair, or generate a new key pair.
  - I find it easiest to create a keypair on my local machine and import it
  - https://www.ssh.com/academy/ssh/public-key-authentication



Key Pairs: An aside

- SSH keys are an access credential that is used in the SSH protocol and they are foundational to modern Infrastructure-as-a-Service platforms.

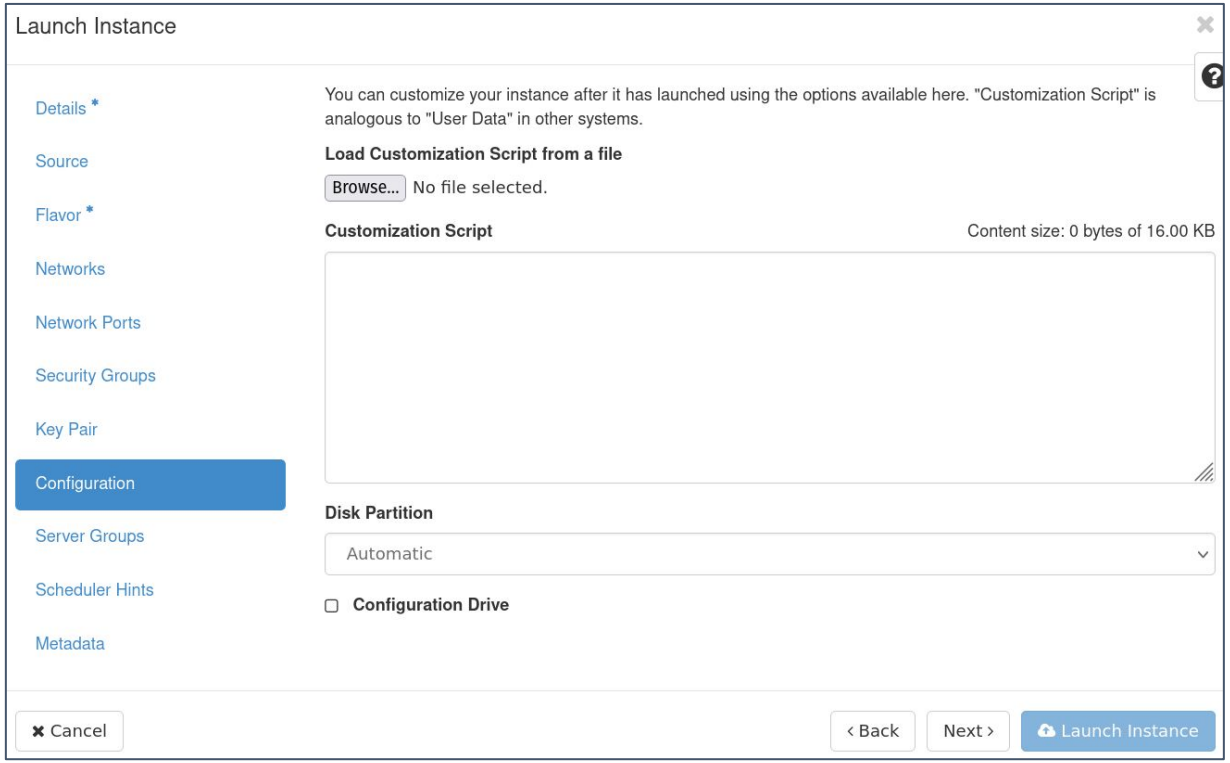
- They can be tricky to set up for new users however, so we'll go over a simple example here. From your terminal in a local machine use the ssh-keygen command to create a new ssh keypair:

```
$ ssh-keygen -t ed25519
Generating public/private ed25519 key pair.
Enter file in which to save the key (/home/username/.ssh/id_ed25519):
```

- Our new keypairs have been created at `/home/username/.ssh/` and are called `id_ed25519` and `id_ed25519.pub`. The public key (.pub) can be transferred to other remote servers (*this is the key we will import to our CUmulus instance*) but the private key (no suffix) should *never* leave the host machine.

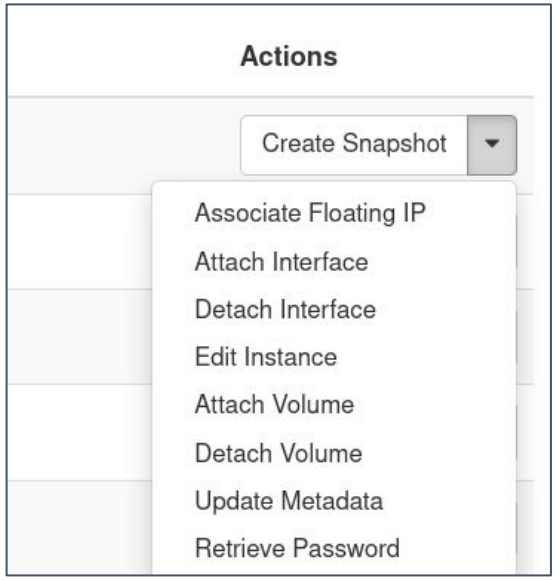
Config, Server Group, Scheduler Hints, and Metadata

- We'll leave these as defaults as they are extra configuration we can provide our instances, but not necessary



Launch Instance and Associate IP

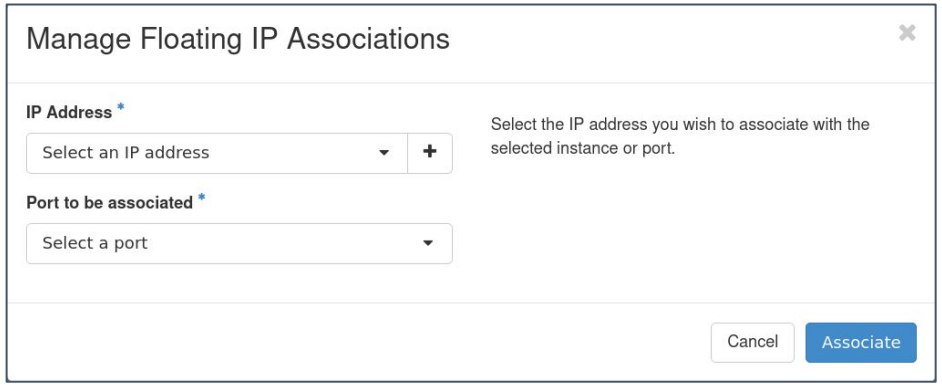
- Launch instance and wait for it to be set up



- We can then associate a Floating IP which will allow us to access the instance from outside of the CU network
  - On the right hand side of the newly created instance choose “Associate Floating IP” under the “actions” dropdown

Associate IP

- Select from available IP addresses
  - If needed you can add a floating IP, but be aware there are limited numbers of floating IPs
- Select port to be associated
  - This should be pre-populated with the internal IP of your new instance



Logging into your Instance

Logging In

- You must be on CU VPN to connect via ssh (CURC restriction)

- Open up an ssh connection providing the identity (key) file:
  - `$ ssh -i ~/.ssh/<private key> <hostname>@<external floating IP>`

- For an ubuntu instance this may look something like:
  - `$ ssh -i ~/.ssh/testkey ubuntu@123.456.789.123`

Logged In

- Congratulations! You are now logged into your instance

- You can now:
  - Install Software
  - Administer your instance
  - Run applications and jobs

Demo

Demo workflow: Twitter API with DB

- There are a (nearly) *infinite* number of workflows you could run on your CUmulus instance*

  **As long as the workflow is related to research, personal projects are not permitted.*

- We'll demo a *potential* workflow: a web application which allows users to query using the Twitter API and store this data persistently to a mysql database.

- This demo showcases a few important features of CUmulus not possible on HPC:
  - A persistent workflow not limited by wall clock times
  - User administration of compute resources (using root privileges for applications such as Docker)
  - Routable floating IPs available on the Public Internet

Thank you!

- Survey: http://tinyurl.com/curc-survey18
- Contact information: rc-help@Colorado.edu