



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

Getting Started on CUMulus

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Slides available at:

Tutorial at:

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

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:
 - Query Twitter via the Twitter API and store data into a mySql database (using docker containers).

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
 - web servers
 - databases
 - long-running services
- Provides users with a logically isolated section of the cloud, with their own resources

What is CUMulus?

- You get your own “world” a sandbox environment that can be easily created/deleted.
 - Install Software
 - Administer your instance
 - Run applications and jobs
- You can request specific resources (CPU, storage, memory) and can set up persistent storage.

CUmulus Access

CUmulus Access and Allocation

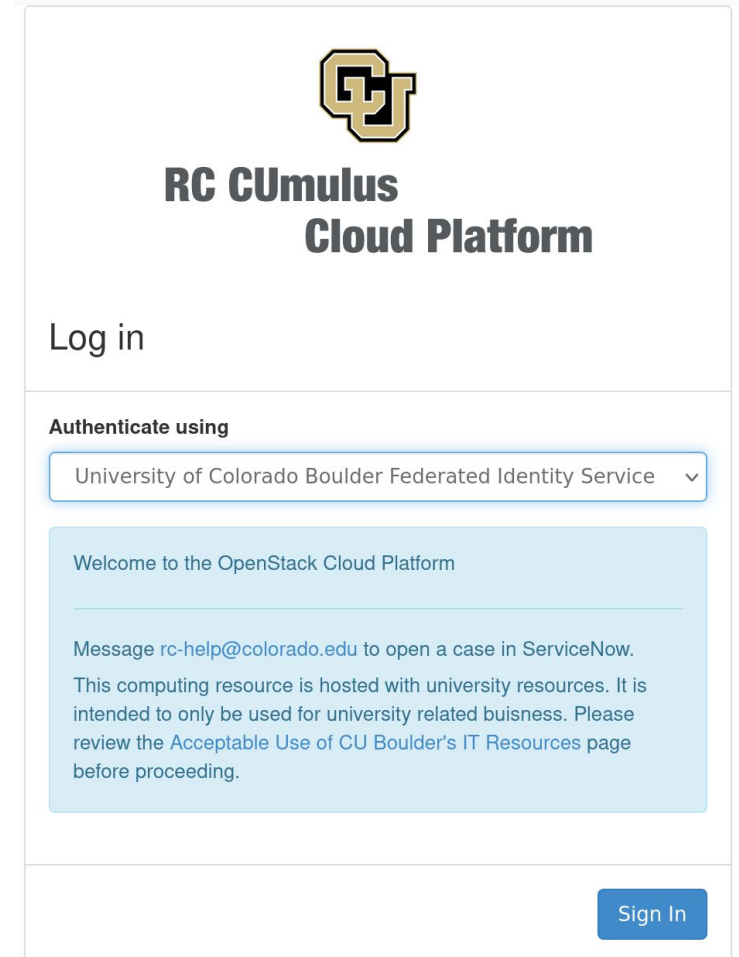
Users will submit a proposal for your use case (email rc-help@colorado.edu):

- 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.

Log in to Horizon

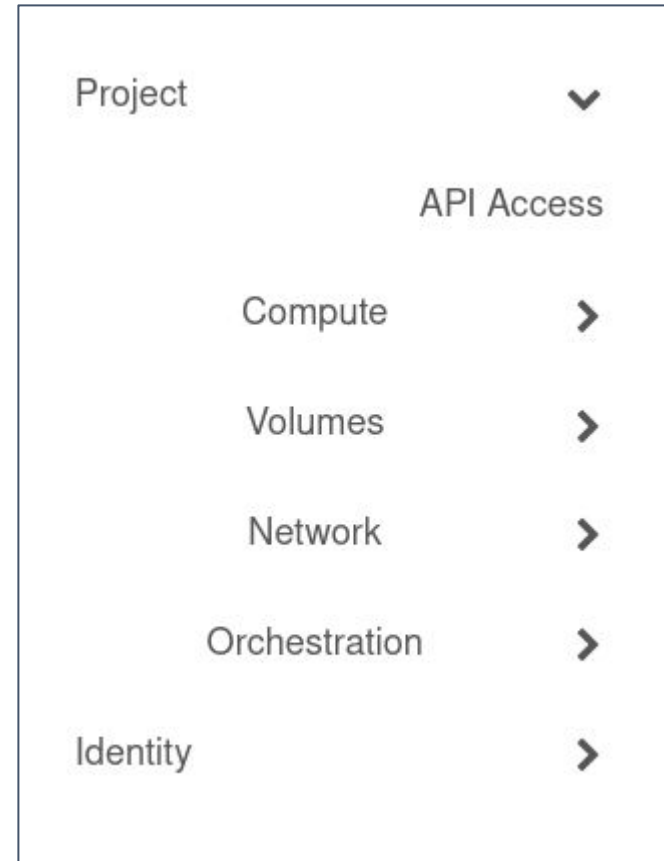
- Horizon is the CUmulus web portal
 - cumulus.rc.colorado.edu/
- Let's take a brief tour of Horizon
- Log in with your institution's credentials:



The screenshot shows the login interface for the RC CUmulus Cloud Platform. At the top is the CU Boulder logo and the text "RC CUmulus Cloud Platform". Below this is a "Log in" section. Under the heading "Authenticate using", there is a dropdown menu currently set to "University of Colorado Boulder Federated Identity Service". Below the dropdown is a light blue informational box containing the text: "Welcome to the OpenStack Cloud Platform", "Message rc-help@colorado.edu to open a case in ServiceNow.", and "This computing resource is hosted with university resources. It is intended to only be used for university related buisness. Please review the Acceptable Use of CU Boulder's IT Resources page before proceeding." At the bottom right of the page is a blue "Sign In" button.

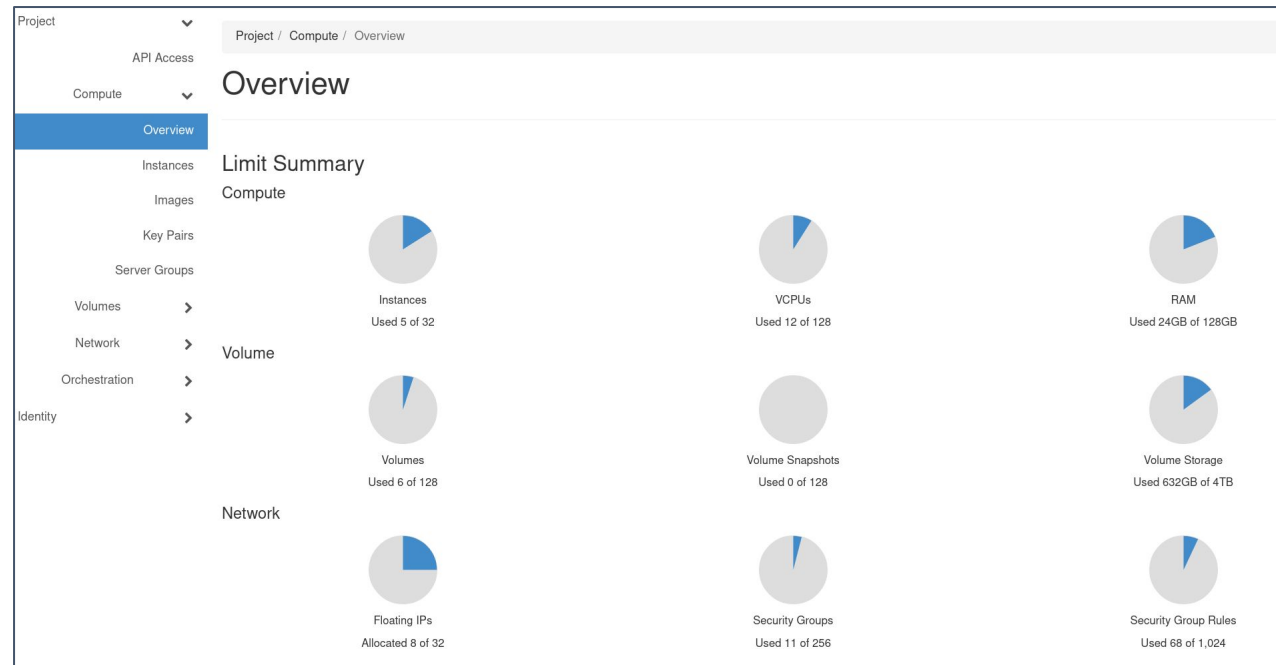
Navigate Horizon

- 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
- 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:

The screenshot shows a 'Launch Instance' dialog box with a sidebar on the left containing links: Details (selected), Source, Flavor, Networks, Network Ports, Security Groups, Key Pair, Configuration, Server Groups, Scheduler Hints, and Metadata. The main area contains a text box for 'Instance Name', a text box for 'Description', a dropdown for 'Availability Zone' (set to 'ucb-east-1b'), and a dropdown for 'Count' (set to '1'). A message at the top right says: 'Please provide the initial hostname for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings.' On the right, a donut chart shows 'Total Instances (32 Max)' with '19%' usage. A legend indicates: 5 Current Usage (blue), 1 Added (light blue), and 26 Remaining (grey). At the bottom are buttons: 'Cancel', '< Back', 'Next >', and 'Launch Instance'.

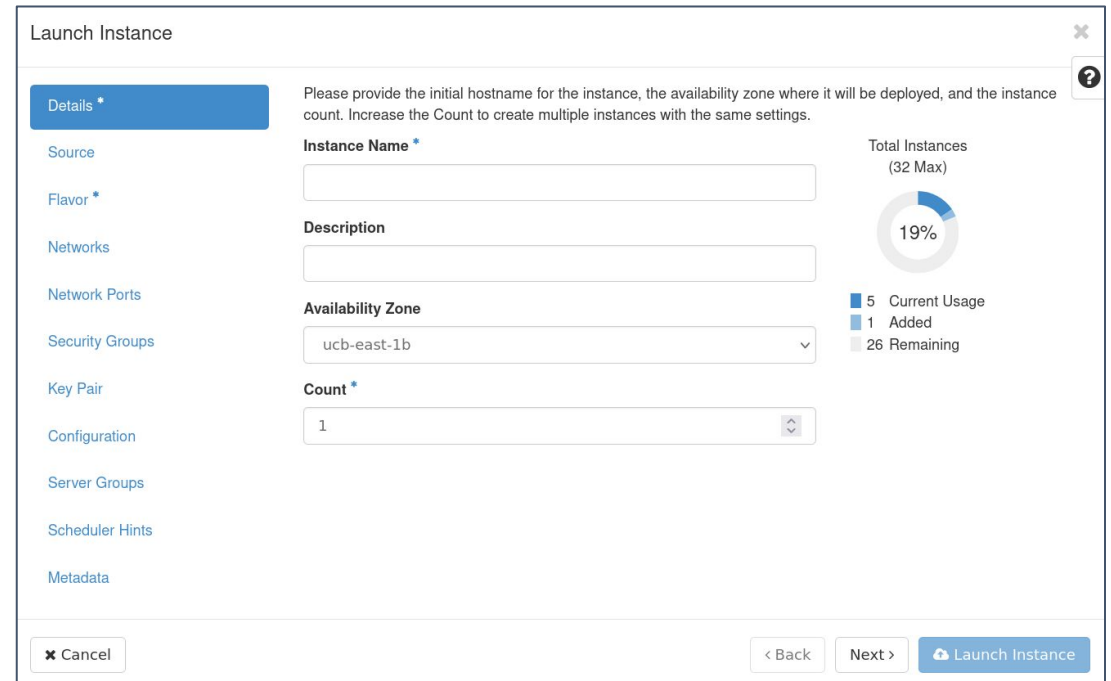
Field	Value
Instance Name	[Empty]
Description	[Empty]
Availability Zone	ucb-east-1b
Count	1

Usage Statistics:

- Total Instances (32 Max): 19%
- 5 Current Usage
- 1 Added
- 26 Remaining

Details

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



The screenshot shows a 'Launch Instance' dialog box with a sidebar on the left containing links to 'Details', 'Source', 'Flavor', 'Networks', 'Network Ports', 'Security Groups', 'Key Pair', 'Configuration', 'Server Groups', 'Scheduler Hints', and 'Metadata'. The 'Details' tab is active. The main area contains a text box for 'Instance Name', a text box for 'Description', a dropdown menu for 'Availability Zone' (set to 'ucb-east-1b'), and a dropdown menu for 'Count' (set to '1'). A message at the top right says: 'Please provide the initial hostname for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings.' On the right side, there is a circular progress indicator showing '19%' usage, with a legend indicating '5 Current Usage', '1 Added', and '26 Remaining'. At the bottom, there are buttons for 'Cancel', '< Back', 'Next >', and 'Launch Instance'.

Category	Value
Instance Name	
Description	
Availability Zone	ucb-east-1b
Count	1

Total Instances (32 Max): 19%
5 Current Usage, 1 Added, 26 Remaining

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 “no” be aware of “zombie” volumes that will stay around when the instance is deleted

Launch Instance

Instance source is the template used to create an instance. You can use an image, a snapshot of an instance (image snapshot), a volume or a volume snapshot (if enabled). You can also choose to use persistent storage by creating a new volume.

Select Boot Source

Image

Create New Volume

Yes No

Volume Size (GB) *

1

Delete Volume on Instance Delete

Yes No

Allocated

Displaying 0 items

Name	Updated	Size	Type	Visibility
Select an item from Available items below				

Displaying 0 items

Available 9 Select one

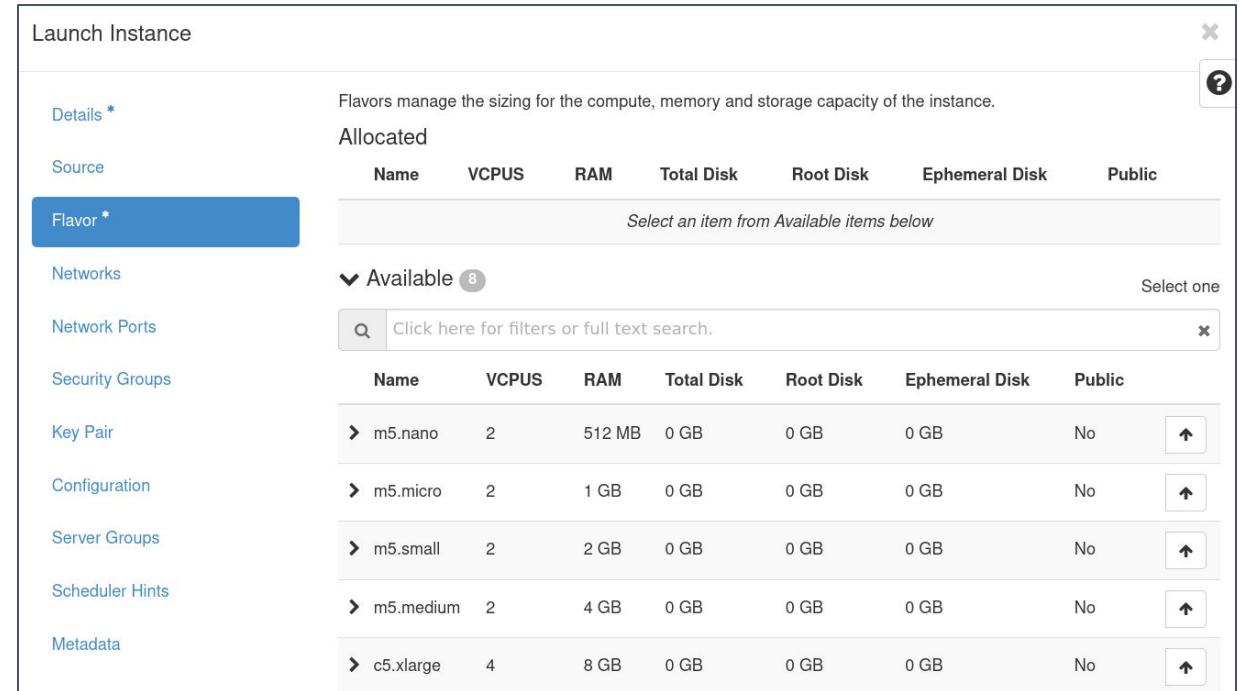
Click here for filters or full text search.

Displaying 9 items

Name	Updated	Size	Type	Visibility
> CentOS 7	6/3/21 6:54 AM	847.81 MB	QCOW2	Public
> CentOS 8	9/20/21 9:22 PM	1.19 GB	QCOW2	Private

Flavor

- Choose from a list of pre-selected resources:
 - “Flavors” manage the sizing for the compute, memory, and storage of the instance.



Launch Instance

Details *
Source
Flavor *
Networks
Network Ports
Security Groups
Key Pair
Configuration
Server Groups
Scheduler Hints
Metadata

Flavors manage the sizing for the compute, memory and storage capacity of the instance.

Allocated

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public
Select an item from Available items below						

▼ Available 8 Select one

Click here for filters or full text search.

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public
> m5.nano	2	512 MB	0 GB	0 GB	0 GB	No
> m5.micro	2	1 GB	0 GB	0 GB	0 GB	No
> m5.small	2	2 GB	0 GB	0 GB	0 GB	No
> m5.medium	2	4 GB	0 GB	0 GB	0 GB	No
> c5.xlarge	4	8 GB	0 GB	0 GB	0 GB	No

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.

Launch Instance

Details *
Source
Flavor *
Networks
Network Ports
Security Groups
Key Pair
Configuration
Server Groups
Scheduler Hints
Metadata

Networks provide the communication channels for instances in the cloud.

▼ Allocated 1 Select networks from those listed below.

	Network	Subnets Associated	Shared	Admin State	Status
1	projectnet2021-private	projectnet2021-private-subnet	No	Up	Active

▼ Available 0 Select at least one network

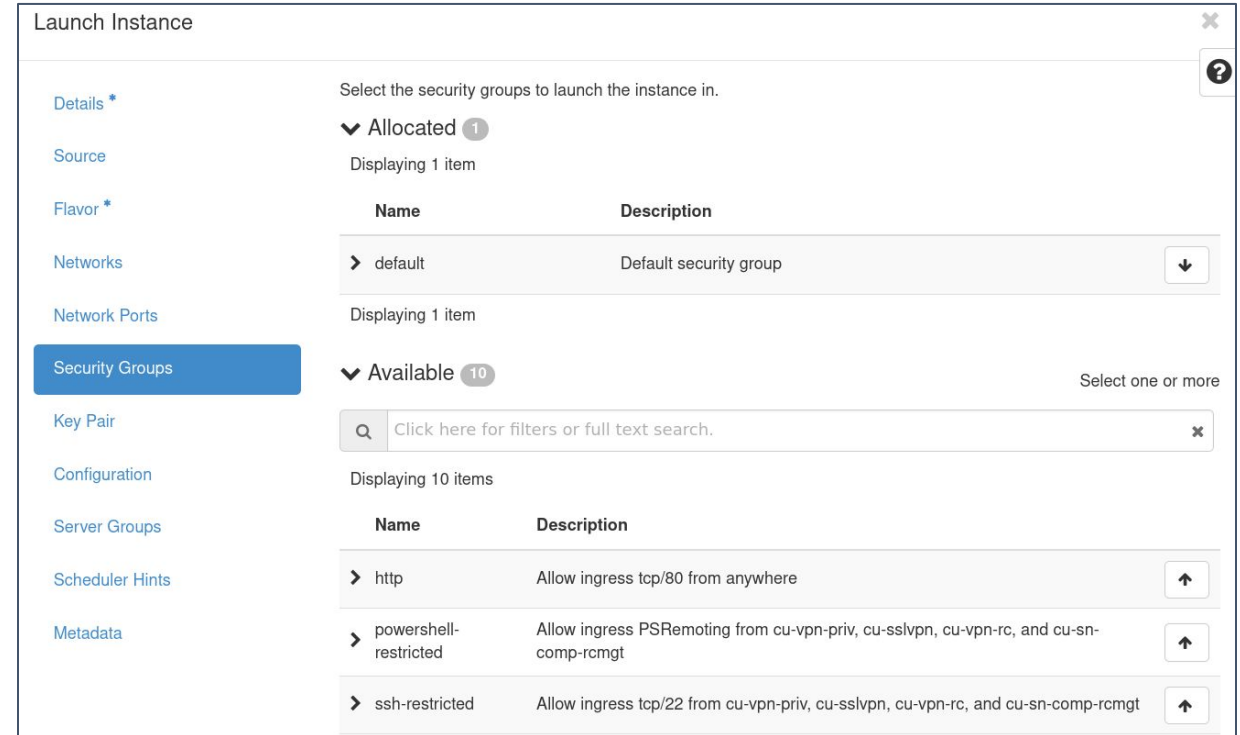
Click here for filters or full text search.

Network	Subnets Associated	Shared	Admin State	Status
No available items				

Cancel < Back Next > Launch Instance

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



Launch Instance

Select the security groups to launch the instance in.

▼ Allocated ¹

Displaying 1 item

Name	Description
> default	Default security group

Displaying 1 item

▼ Available ¹⁰ Select one or more

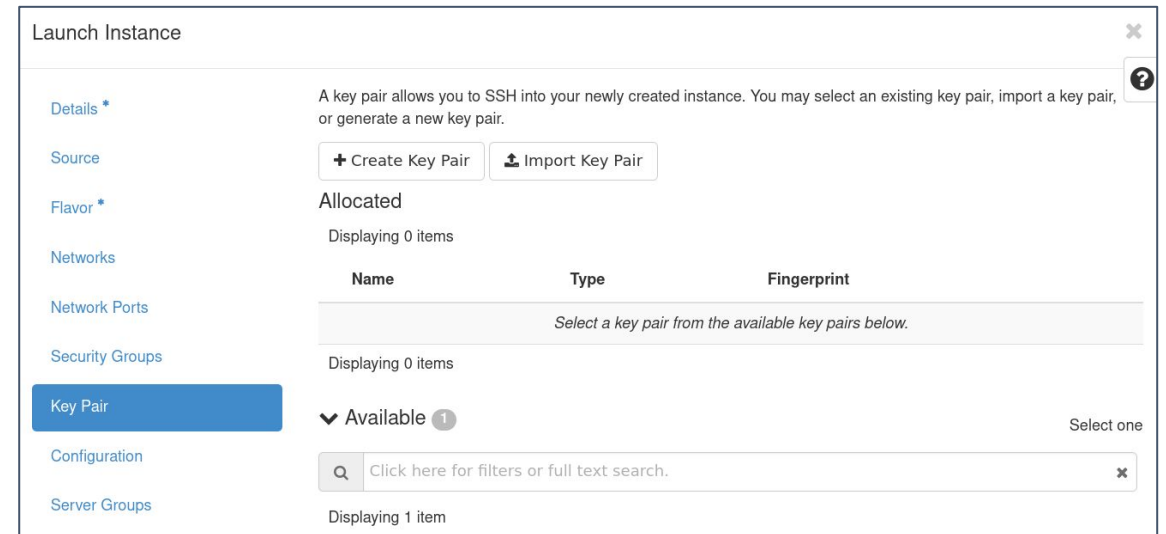
Click here for filters or full text search.

Displaying 10 items

Name	Description
> http	Allow ingress tcp/80 from anywhere
> powershell-restricted	Allow ingress PSRemoting from cu-vpn-priv, cu-sslvpn, cu-vpn-rc, and cu-sn-comp-rcmgt
> ssh-restricted	Allow ingress tcp/22 from cu-vpn-priv, cu-sslvpn, cu-vpn-rc, and cu-sn-comp-rcmgt

Key Pair

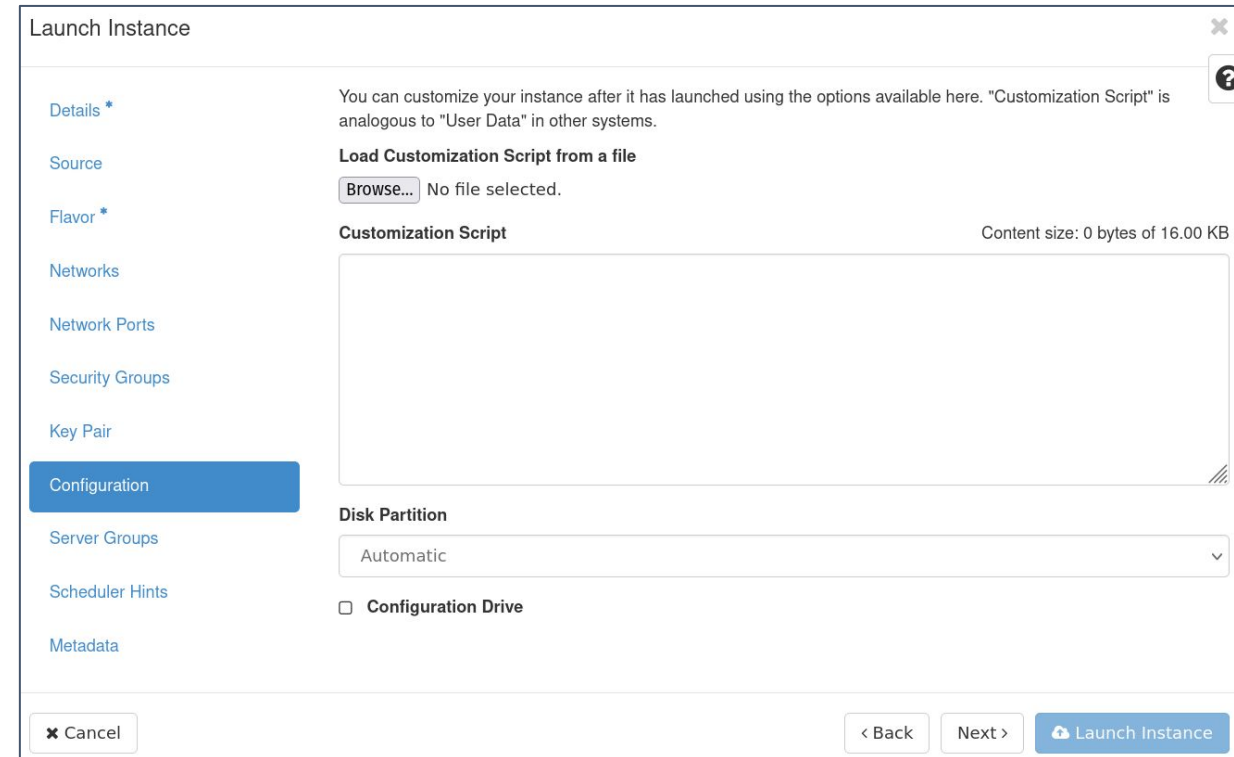
- A key pair allows you to SSH into your new instance.
 - You may select an existing key pair, import a key pair, or generate a new key pair.
-
- I find it easiest to create a keypair on my local machine and import it
 - <https://www.ssh.com/academy/ssh/public-key-authentication>



The screenshot shows the 'Launch Instance' page in the AWS Management Console. The 'Key Pair' tab is selected in the left-hand navigation menu. The main content area explains that a key pair allows SSH access to a new instance and provides buttons for '+ Create Key Pair' and '+ Import Key Pair'. Below this, there are sections for 'Allocated' (displaying 0 items) and 'Available' (displaying 1 item). The 'Available' section includes a search bar and a 'Select one' dropdown menu. A table header is visible with columns for 'Name', 'Type', and 'Fingerprint', but no data rows are shown.

Config, Server Group, Scheduler Hints, and Metadata

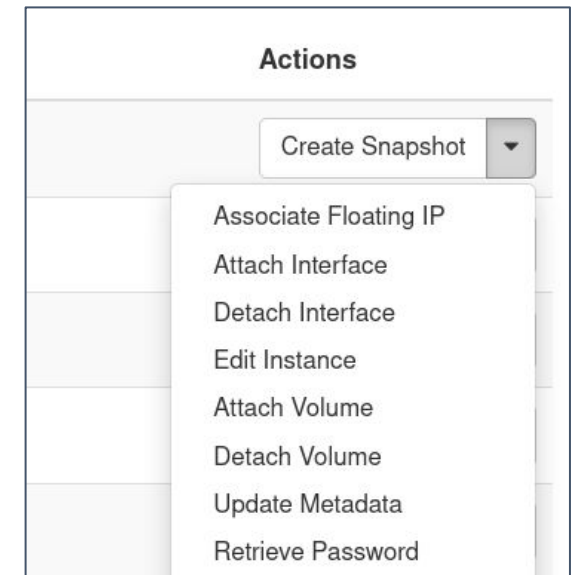
- We'll leave these as defaults as they are extra configuration we can provide our instances, but not necessary



The screenshot shows the 'Launch Instance' dialog box with a sidebar on the left containing the following links: Details *, Source, Flavor *, Networks, Network Ports, Security Groups, Key Pair, Configuration (highlighted in blue), Server Groups, Scheduler Hints, and Metadata. The main content area has a title bar 'Launch Instance' with close and help icons. Below the title bar is a text block: 'You can customize your instance after it has launched using the options available here. "Customization Script" is analogous to "User Data" in other systems.' This is followed by a section 'Load Customization Script from a file' with a 'Browse...' button and the text 'No file selected.' Below this is a 'Customization Script' section with a large text area and a 'Content size: 0 bytes of 16.00 KB' label. Underneath is a 'Disk Partition' section with a dropdown menu set to 'Automatic' and a checkbox for 'Configuration Drive' which is currently unchecked. At the bottom of the dialog are three buttons: 'Cancel' (with a close icon), '< Back', and 'Next >', followed by a blue 'Launch Instance' button with a cloud icon.

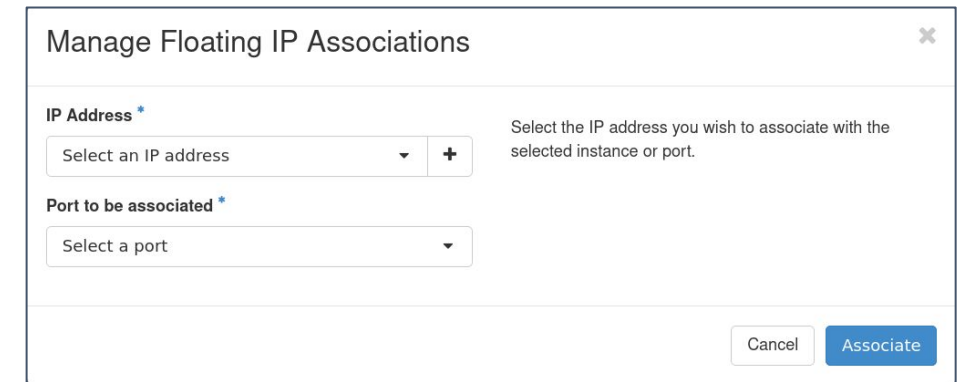
Launch Instance and Associate IP

- 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



The screenshot shows a dialog box titled "Manage Floating IP Associations" with a close button (X) in the top right corner. Inside the dialog, there are two main sections. The first section is labeled "IP Address" with a blue asterisk. It contains a dropdown menu with the text "Select an IP address" and a plus sign button to its right. To the right of this dropdown is a text label: "Select the IP address you wish to associate with the selected instance or port." The second section is labeled "Port to be associated" with a blue asterisk. It contains a dropdown menu with the text "Select a port". At the bottom right of the dialog, there are two buttons: a "Cancel" button and an "Associate" button.

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
- 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 (such as on HPC systems)
 - User administration of compute resources (using root privileges for applications such as Docker)
 - Routable floating IPs available on the internet

Thank you!

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