



Chameleon Cloud Tutorial

National Science Foundation

Program Solicitation # NSF 13-602

CISE Research Infrastructure: Mid-Scale Infrastructure - NSFCloud (CRI: NSFCloud)

Cloud - Getting Started

Objectives

In this tutorial, you will learn how to create a Chameleon account and use the Chameleon resource leasing process to create on-demand bare metal servers using the Chameleon user interface.

#	Action	Detail	Time (min)
1	Register for a Chameleon Cloud account	You will learn how to register for your own Chameleon account, and how to utilize its basic features.	10
2	Chameleon user interface quick overview	To begin, we will walk through the Chameleon user interface capabilities, such as reservation, leasing, server provisioning, private/public IP addresses, networks, and more.	10
3	Create a Chameleon Cloud bare metal server	Lastly, you will learn how to create and log in to a new bare metal instance on Chameleon Cloud using your new Chameleon Cloud account.	10

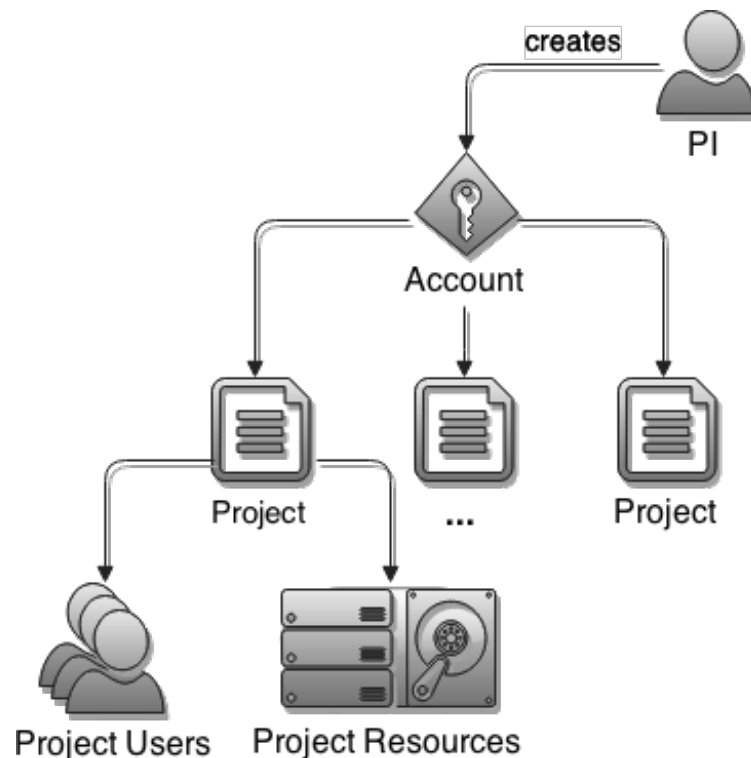
Prerequisites

The following prerequisites are expected for successful completion of this tutorial:

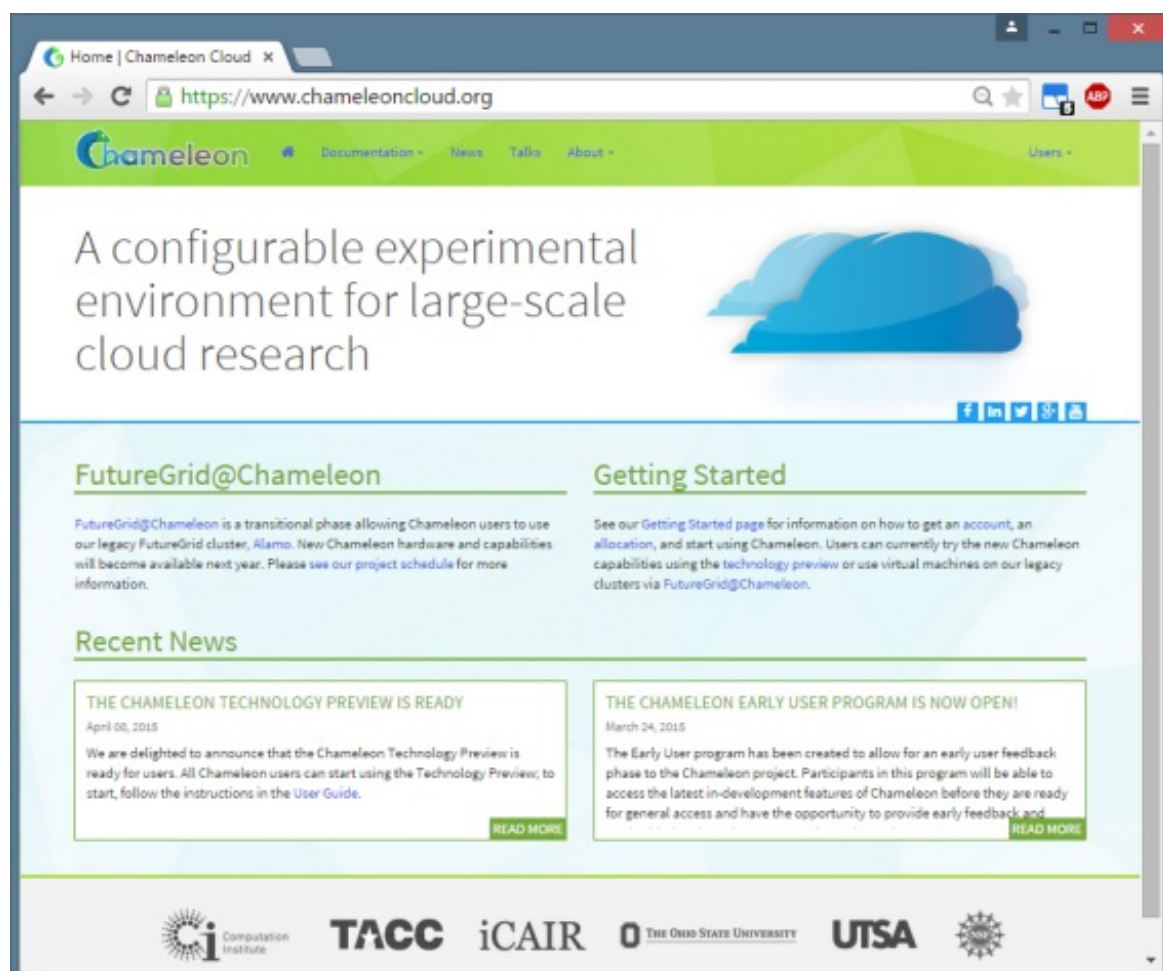
- An SSH client (Windows users can download PuTTY (<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>))
- A basic knowledge of Linux

Step 1: Register for a Chameleon Cloud user account

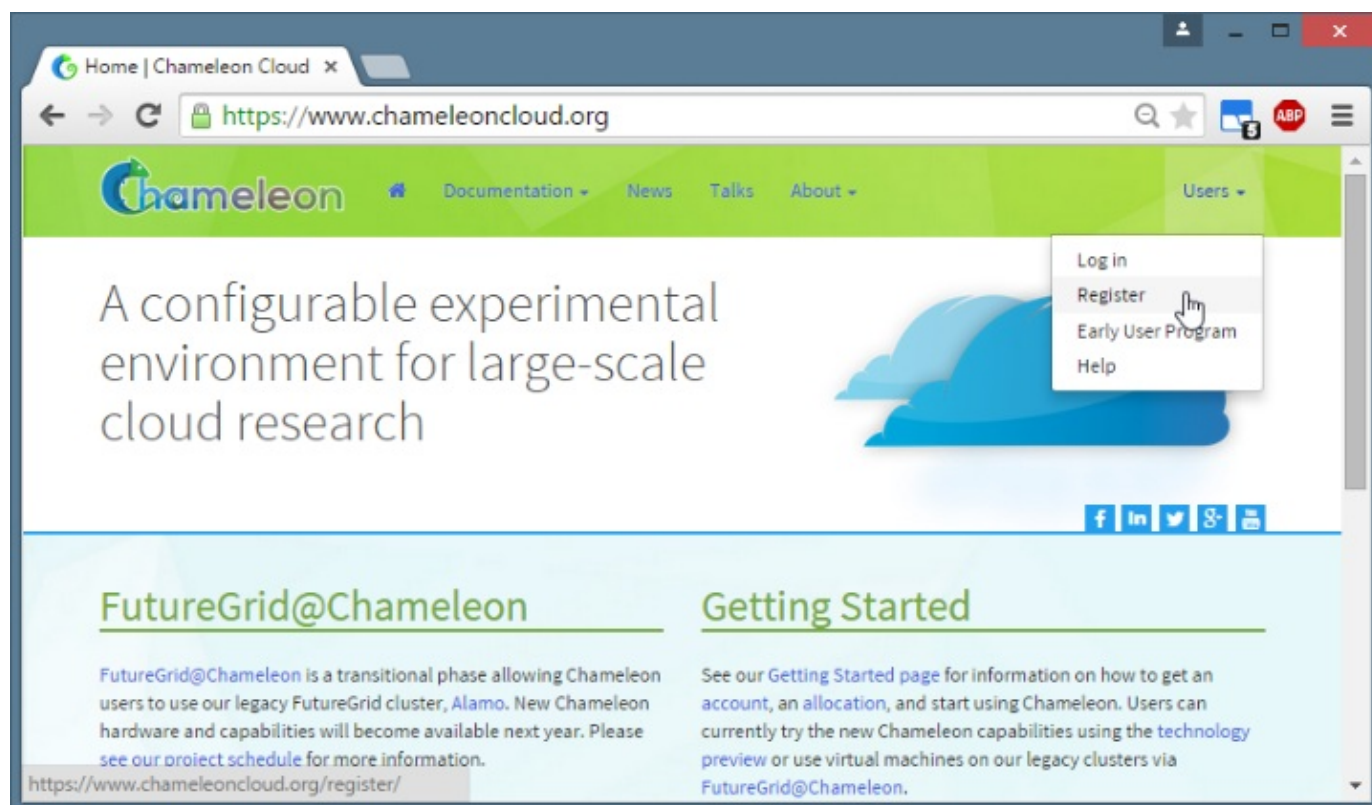
In this step, you will create your very own Chameleon Cloud user account. However, before we begin, it will be useful to define some Chameleon Cloud terminology and the relationship between these entities. A Chameleon user account, which we will register for below, is required to create projects. A project, in turn, can have any number of other Chameleon users associated with it. As such, users added to a project are known as “project users” for that project. Projects will also have resources, such as a number of bare metal servers, associated with them. Together, these concepts form a hierarchy:



To begin, browse to the Chameleon Cloud homepage (<https://www.chameleoncloud.org/>).



Find and click on the “Users” button located in the upper right-hand corner of the page. Click on “Register” from the pop-up menu that appears.



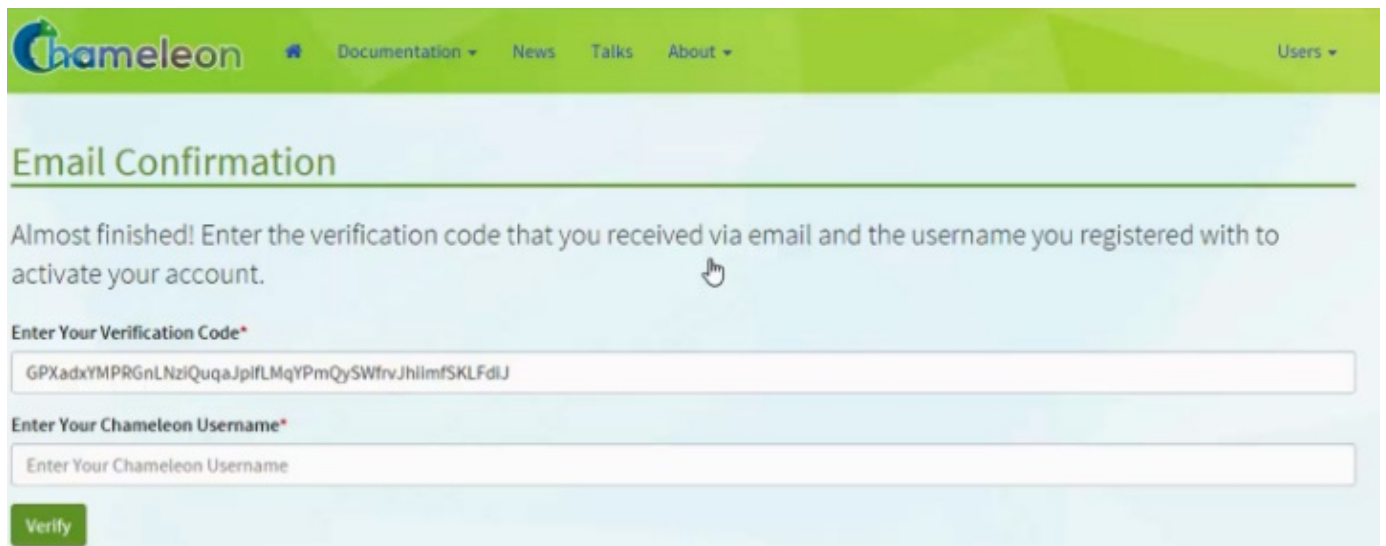
You will be required to complete two sections: “Contact Information” and “Account Information”.

A screenshot of the Chameleon Cloud registration form. The form is divided into two main sections: 'Contact Information' and 'Account Information'. The 'Contact Information' section includes fields for First name, Last name, Email address, Institution (a dropdown menu with 'Choose one' and a link 'My institution is not listed'), Country of Residence (a dropdown menu with 'Choose one'), and Country of Citizenship (a dropdown menu with 'Choose one'). There is also a 'PI Eligibility' section with a checkbox labeled 'PI Eligible' and a note: 'Faculty and Research Staff from U.S.-based institutions can request PI Eligibility on Chameleon.' The 'Account Information' section includes fields for Username (with a note: 'Usernames must be 3-8 characters in length, start with a letter, and can contain only lowercase letters, numbers, or underscore.'), Password, and Confirm Password. Below these fields, there are criteria for passwords: 'Must not contain your account name or parts of your full name', 'Must be a minimum of 8 characters in length', and 'Must contain characters from at least three of the following: uppercase letters, lowercase letters, numbers, symbols'. At the bottom of the form, there are 'Save Profile' and 'Cancel' buttons.

When finished, click on “Save Profile”. You will be taken back to the Chameleon Cloud homepage with a message notifying you to check your email for account verification.

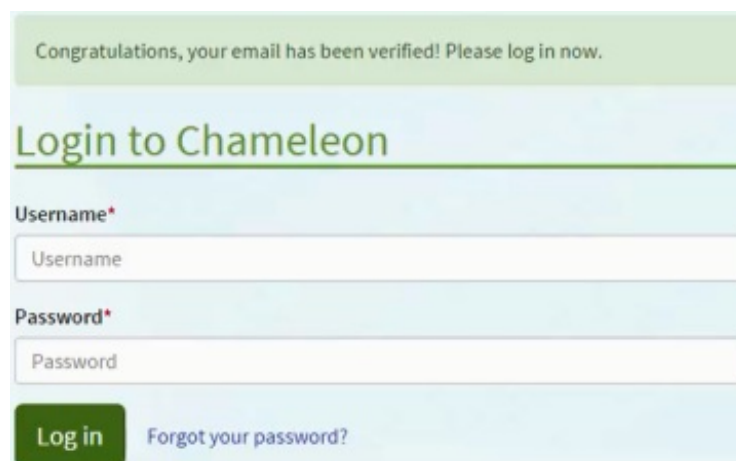
Congratulations! Your account request has been received. Please check your email for account verification. X

You should receive an email instructing you to click on a link in order to confirm your email address. Upon doing so, you will be taken to an email confirmation page where you are asked to provide your Chameleon username. After doing so, click on “Verify”.



The screenshot shows the 'Email Confirmation' page of the Chameleon website. The header is green with the Chameleon logo and navigation links: Documentation, News, Talks, About, and Users. The main heading is 'Email Confirmation'. Below it, a message says: 'Almost finished! Enter the verification code that you received via email and the username you registered with to activate your account.' There are two input fields: 'Enter Your Verification Code*' with the text 'GPXadxYMPRGnLNziQuqaJpifLMqYPmQySWfrvJhlImfSKLFdIJ' and 'Enter Your Chameleon Username*' with the placeholder 'Enter Your Chameleon Username'. A green 'Verify' button is at the bottom left.

If your information matches, you will receive a message indicating successful verification, and will be directed to login to Chameleon for the first time.



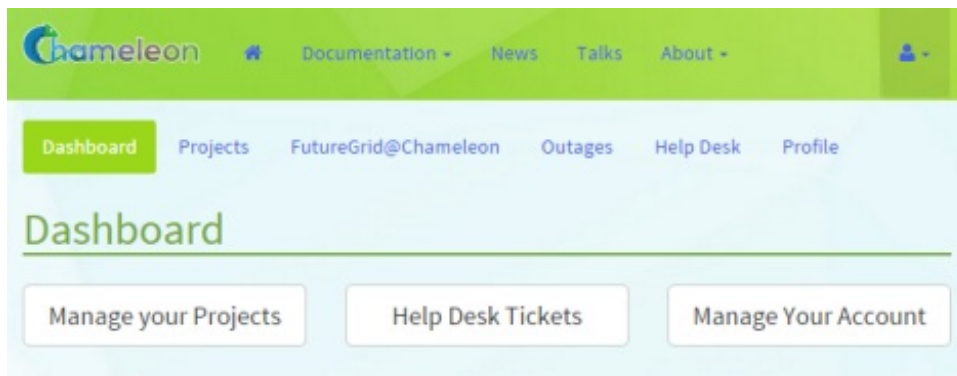
The screenshot shows the 'Login to Chameleon' page. A green banner at the top says: 'Congratulations, your email has been verified! Please log in now.' The heading is 'Login to Chameleon'. There are two input fields: 'Username*' with the placeholder 'Username' and 'Password*' with the placeholder 'Password'. A green 'Log in' button is at the bottom left, and a link 'Forgot your password?' is at the bottom right.

Upon successfully logging in, you will be asked to accept the Chameleon User Terms and Conditions. Click "Accept" to proceed.

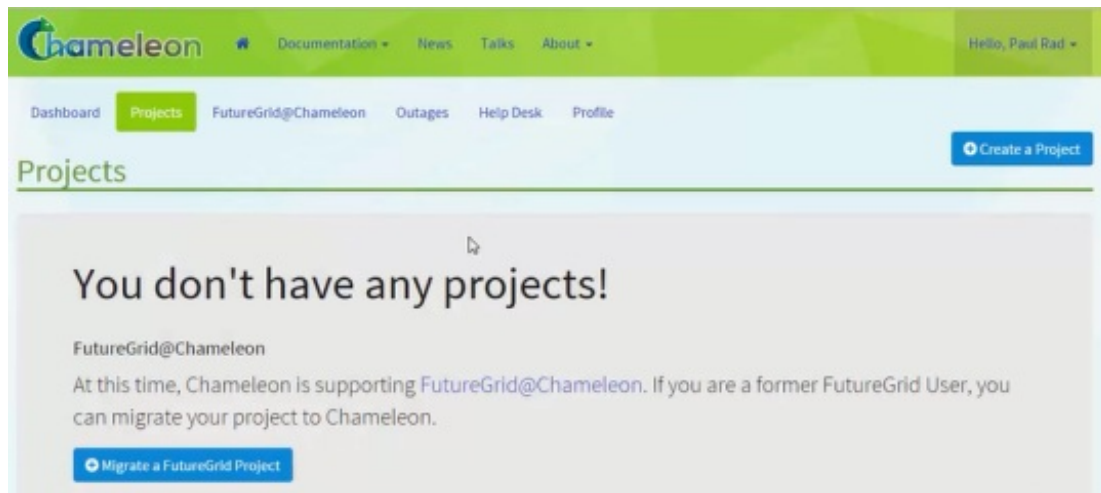


The screenshot shows the 'Please Accept Chameleon User Terms and Conditions' page. The header is green with the Chameleon logo and navigation links: Documentation, News, Talks, About, and 'Hello, Paul Rad'. The heading is 'Please Accept Chameleon User Terms and Conditions'. Below it, there are three bullet points: 'I will only use Chameleon resources to perform research work consistent with the goals of my project. I will not use Chameleon resources for activities related to financial gain, any unlawful purpose, or in a way that makes the work of other users difficult.', 'I also will acknowledge Chameleon in all publication presenting results or content obtained using Chameleon. The official acknowledgement is as follows: "Results presented in this paper were obtained using the Chameleon testbed supported by the National Science Foundation".', and 'I understand that non-compliance with the terms above will result in suspension of my account.' A green 'Accept' button is at the bottom left, and a link 'Print Terms & Conditions' is at the bottom.

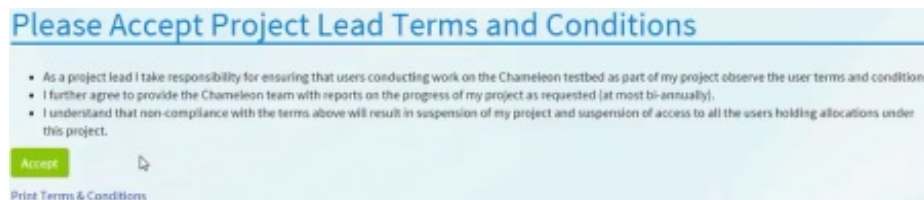
Every time you log in you will be taken to your Dashboard, where you can manage your projects, help desk tickets, as well as your account settings. As we wish to create a new project, click on the "Manage your Projects" button.



You will be told you do not currently have any projects. Click the “Create Project” button in the upper right-hand corner of the page to continue.



You should then be presented with the Project Lead Terms and Conditions. Click “Accept” to proceed.



You will then need to provide a title, description, and type. A Project ID will be automatically generated and assigned – it is displayed on this page for your reference. When you are satisfied with your input, click on “Create Project”.

The screenshot shows the 'Create a New Project' form in the Chameleon interface. The form includes the following fields and options:

- Title***: A text input field with the placeholder text 'Research into how...'.
- Abstract***: A large text area with the placeholder text 'We propose to...'.
- Type***: A dropdown menu currently showing 'Choose One'.
- Field of Science***: A dropdown menu currently showing 'COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)'.
- Project ID**: A text input field showing 'CH-300000'.

Below the Project ID field, there is a note: 'Project ID will be assigned upon creation'. At the bottom of the form are two buttons: 'Create Project' (in green) and 'Cancel'.

You will then be taken to view the new project's details. It is on this page that you can add project users. At this point, the project's "Allocation" status will be reported as "Chameleon Pending". Check in regularly to see when your project's allocation has been approved.

The screenshot shows the project details page for a project titled 'training' with ID 'CH-816738'. A green banner at the top states 'Your project has been created!'. Below this is a table with the following details:

PI	Paul Rad <paul.rad@gmail.com>, University of Texas at San Antonio
Abstract	To provide training and teaching materials for Chameleon Cloud users.
Type	Startup
Field of Science	COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)
Allocation	Chameleon Pending

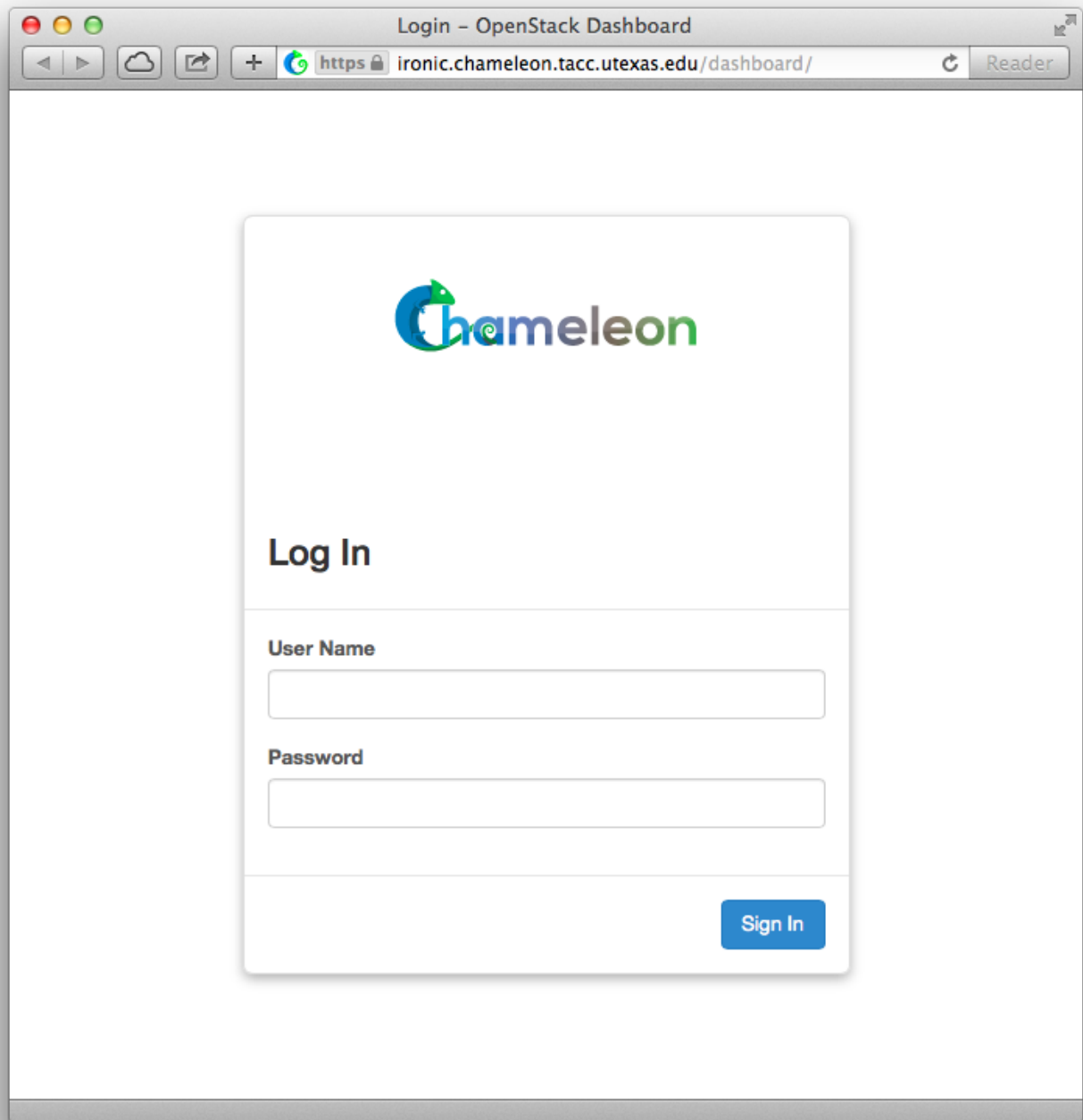
Below the table is a section titled 'Project Users'. At the bottom of this section is a form to 'Add a User to Project' with a text input for 'Username of User' and an 'Add user' button.

Step 2: Chameleon user interface quick overview

In this section, we will show you the features of the Chameleon technology preview. The technology preview of Chameleon gives access to bare-metal compute resources on which users can have administrative access to run cloud computing experiments with a high degree of customization and repeatability. Typically, an experiment will go through several phases:

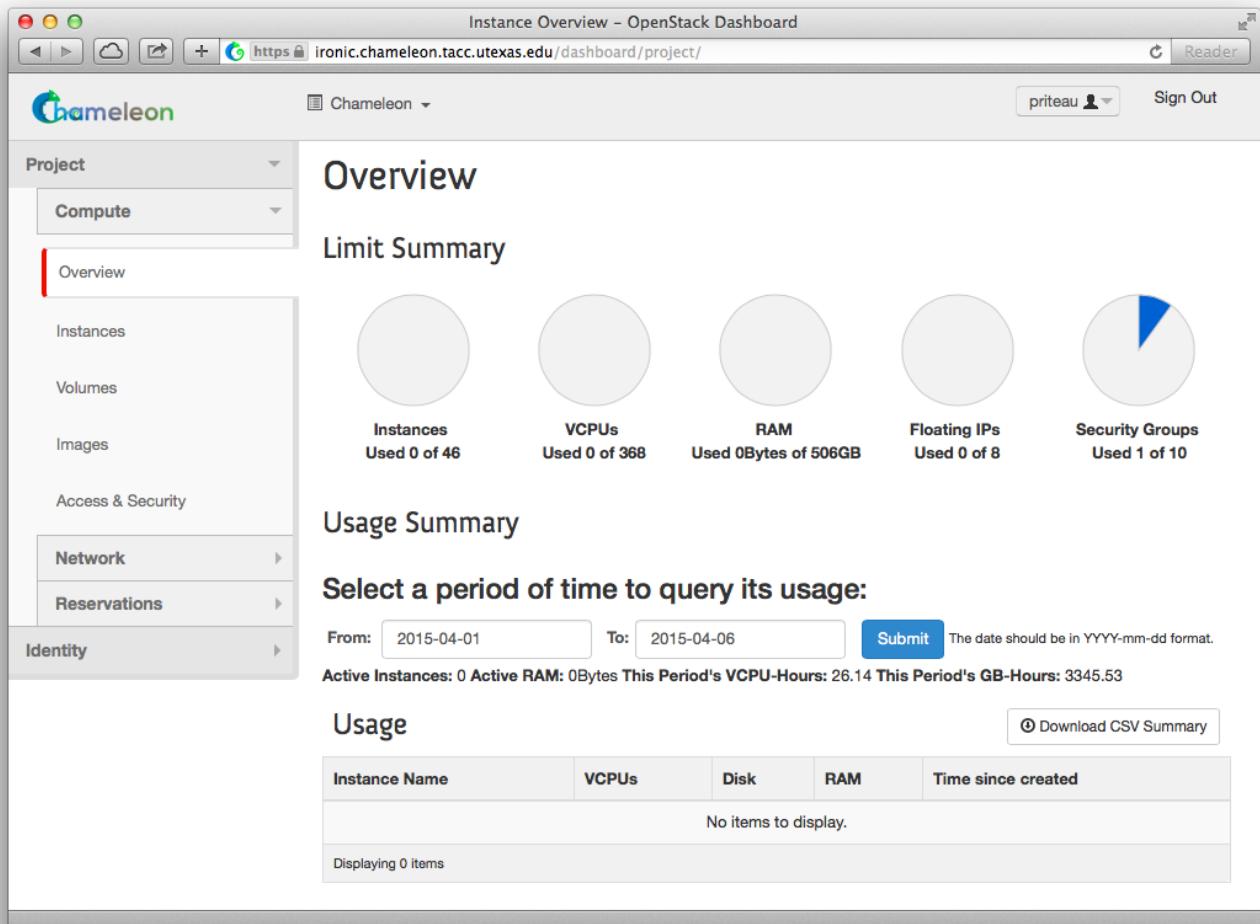
Reserving resources

Physical resources on the Chameleon technology preview must be reserved before using them for an experiment. Once a reservation has been accepted, users are guaranteed that resources will be available at the time they chose (except in extraordinary circumstances such as hardware or platform failures), which will help to run large scale experiments.

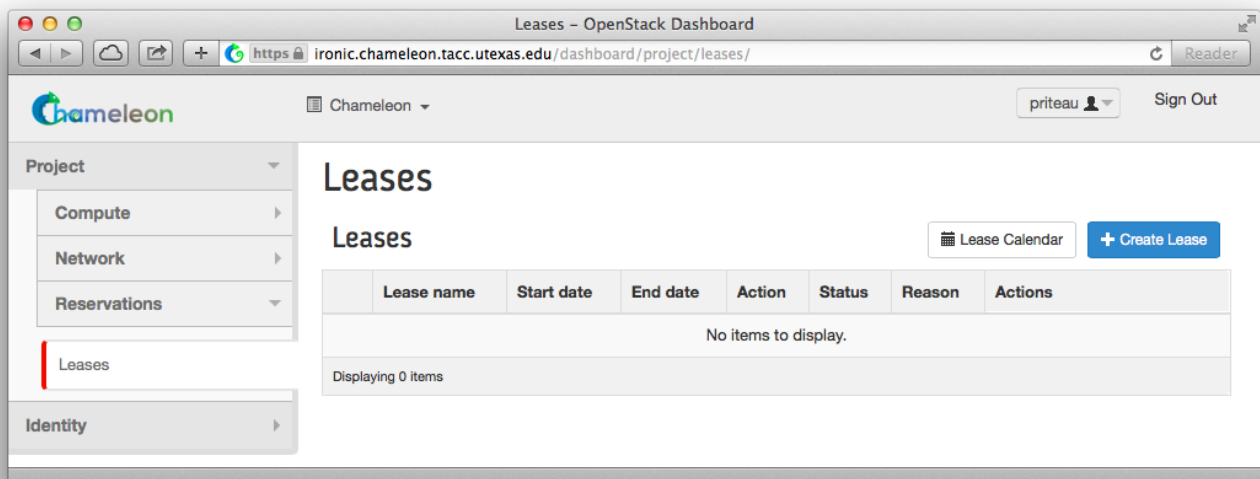


The image shows a web browser window titled "Login - OpenStack Dashboard". The address bar displays the URL "https://ironic.chameleon.tacc.utexas.edu/dashboard/" with a "Reader" button on the right. The main content area features the Chameleon logo, which consists of a stylized blue and green 'C' followed by the word "chameleon" in a green, lowercase, sans-serif font. Below the logo, the text "Log In" is displayed in a bold, black, sans-serif font. Underneath, there are two input fields: "User Name" and "Password", both with light gray borders. At the bottom right of the login form is a blue button with the text "Sign In" in white.

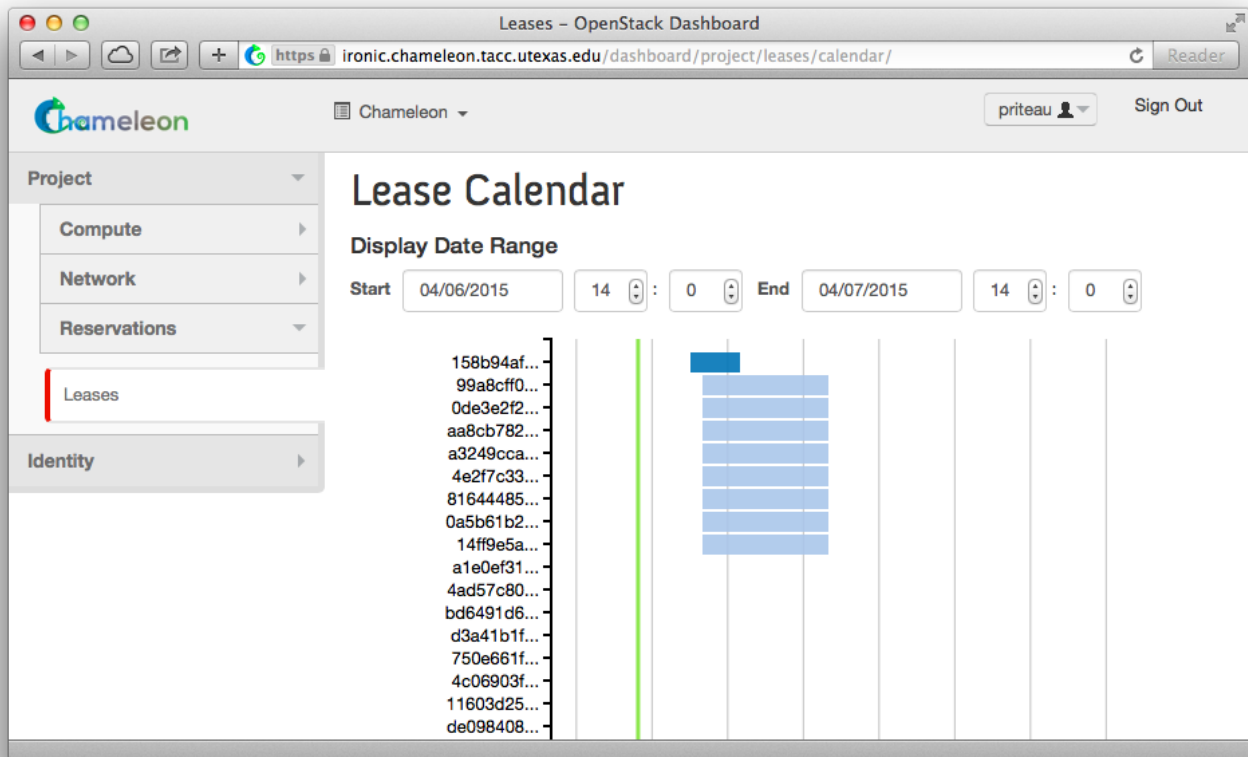
You should land on the Compute overview page for your default project. The pie charts on the page will show you what the current usage of things like instances and floating IPs is relative to the limit for your project. The usage summary will show historical usage of your project for a time period that can be selected. The usage box will show information about the instances currently running in your project.



To access the reservation system, click on Reservations then Leases.



To discover when resources are available, access the lease calendar. This will display a Gantt chart of the reservations which allows you to find when resources are available. The Y axis represents the different physical nodes in the system and the X axis represents time.



Once you have chosen a time period when you want to reserve resources, go back to the Leases screen and click on "Create Lease". It should bring up the window displayed below:

The screenshot shows the 'Create New Lease' dialog box. The dialog has a title bar with a close button. The main content area contains the following fields and controls:

- Name ***: A text input field.
- Description:**: A section with the text 'Create a new lease with the provided values.'
- Start Date/Time (UTC) ***: A text input field with a placeholder 'yyyy-mm-dd hh:mm'.
- End Date/Time (UTC) ***: A text input field with a placeholder 'yyyy-mm-dd hh:mm'.
- Resource Type ***: A dropdown menu with 'Physical Host' selected.
- Number of Hosts ***: A text input field with a value of '1'.

At the bottom right of the dialog, there are two buttons: 'Cancel' and 'Create'.

1. Pick a name for the lease. This name needs to be unique across your project. This example uses the name my-first-lease.

2. Pick a start time; if you want to create your lease soon pick a start time in the near future. Note that it must be entered in UTC! You can get the UTC time by running “date -u” in your terminal.
3. Pick an end time. Similarly, you must use UTC.
4. Choose the number of hosts, it is 1 by default.
5. Click on the “Create” button.

The screenshot shows a web browser window titled "Leases - OpenStack Dashboard" with the URL "https://ironic.chameleon.tacc.utexas.edu/dashboard/project/leases/". The page features a sidebar with navigation links: "Project", "Compute", "Network", "Reservations", "Leases", and "Identity". The "Leases" link is highlighted. In the top right corner, there is a user profile "priteau" and a "Sign Out" button. A modal dialog box titled "Create New Lease" is open in the center. It contains the following fields: "Name" (text input with value "my-first-lease"), "Start Date/Time (UTC)" (text input with value "2015-04-06 16:00"), "End Date/Time (UTC)" (text input with value "2015-04-06 18:00"), "Resource Type" (dropdown menu with "Physical Host" selected), and "Number of Hosts" (text input with value "1"). To the right of these fields is a "Description:" section with the text "Create a new lease with the provided values." At the bottom right of the dialog are "Cancel" and "Create" buttons.

Once created the lease details will be displayed. At the bottom of the page are the details about the reservation. Initially the reservation is in the Pending status, and stays in this state until we reach the start time.

Lease Detail - OpenStack Dashboard

ironic.chameleon.tacc.utexas.edu/dashboard/project/leases/c9c980bb-a13b-4a89-a8ad-ebc8f6797f1c/ Reader

Reservations

Leases

Identity

Lease Overview

Lease

Name
my-first-lease

Id
c9c980bb-a13b-4a89-a8ad-ebc8f6797f1c

Project Id
Chameleon

Start date
-

End date
-

Action
CREATE

Status
COMPLETE

Status Reason
Successfully created lease

Events

start_lease
Status: Undone
Created at: -
Updated at: -

end_lease
Status: Undone
Created at: -
Updated at: -

Reservations

physical:host
Id: 58fa6bde-bb27-4759-b5b2-422f5ee108c8
Status: Pending
Resource Id: 135
Created at: -
Updated at: -

Once the start time of the lease is reached, the lease will be started and its reservation will change to “Active”; you may need to refresh the page to see this.

Action
CREATE
Status
COMPLETE
Status Reason
Successfully created lease

Events

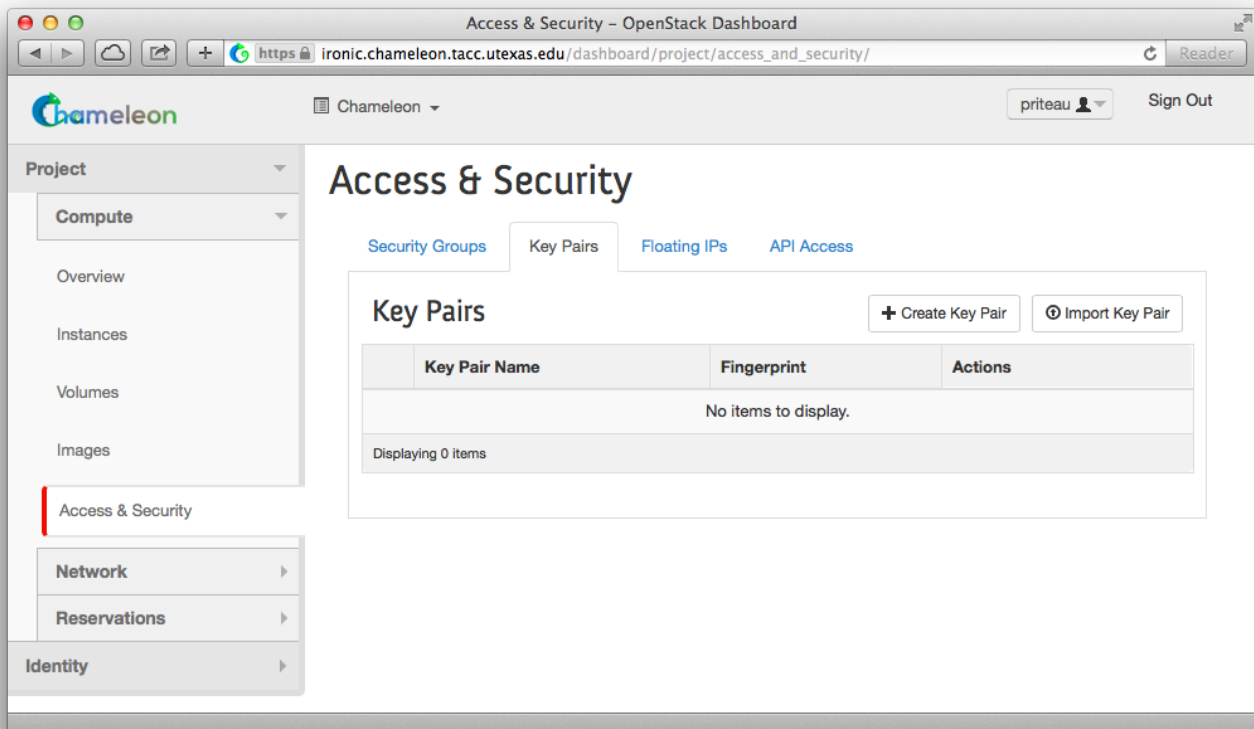
start_lease
Status: Undone
Created at: -
Updated at: -
end_lease
Status: Undone
Created at: -
Updated at: -

Reservations

physical:host
Id: 58fa6bde-bb27-4759-b5b2-422f5ee108c8
Status: Pending
Resource Id: 135
Created at: -
Updated at: -

Provisioning resources

Once your lease is started, you are almost ready to start an instance. But first, you need to make sure that you will be able to connect to it by setting up a key pair. This only has to be done once per user per project. Go to Project > Compute > Access & Security, then select the Key Pairs tab.

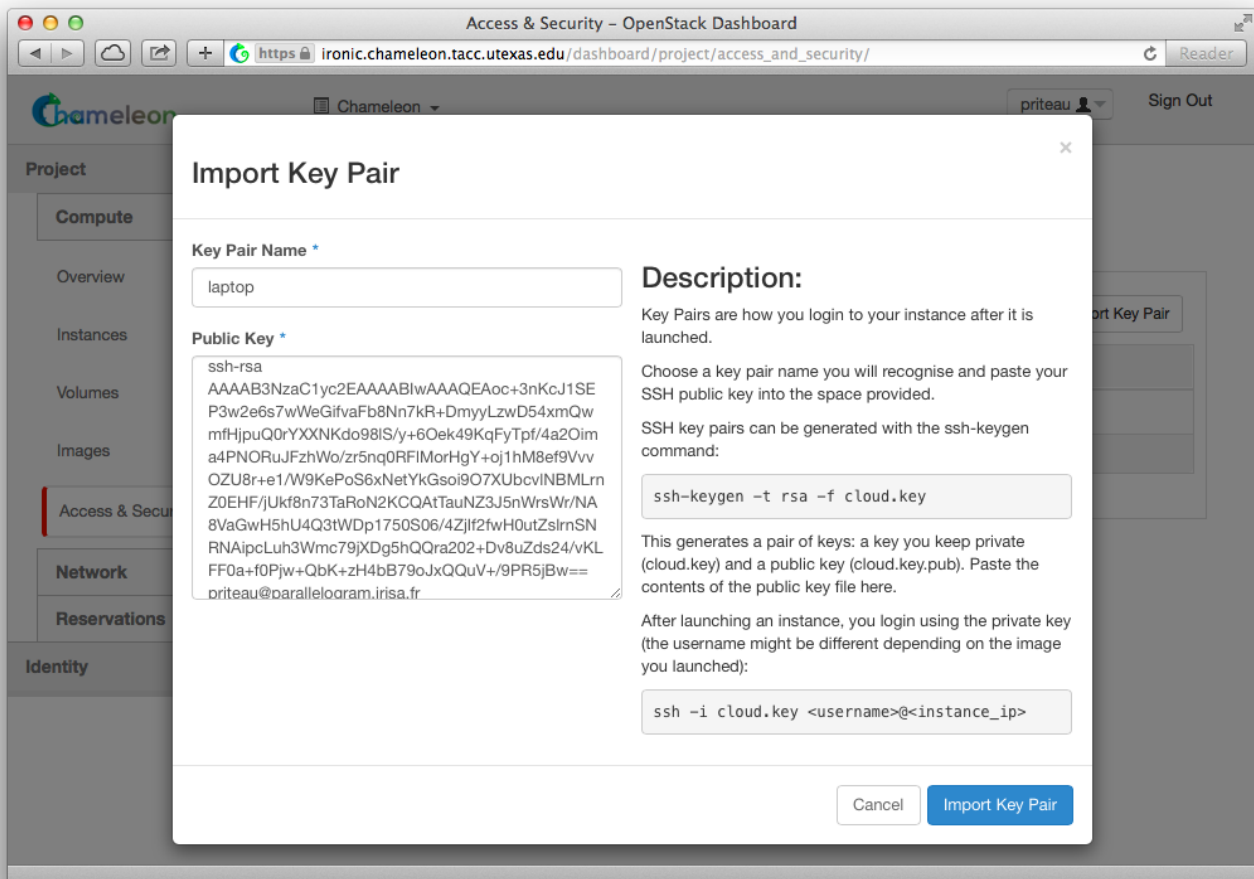


Here you can either get OpenStack to create an SSH key pair for you via the “Create Key Pair” button. If you already have an SSH key pair on your machine and are happy to use it, click on “Import Key Pair”.

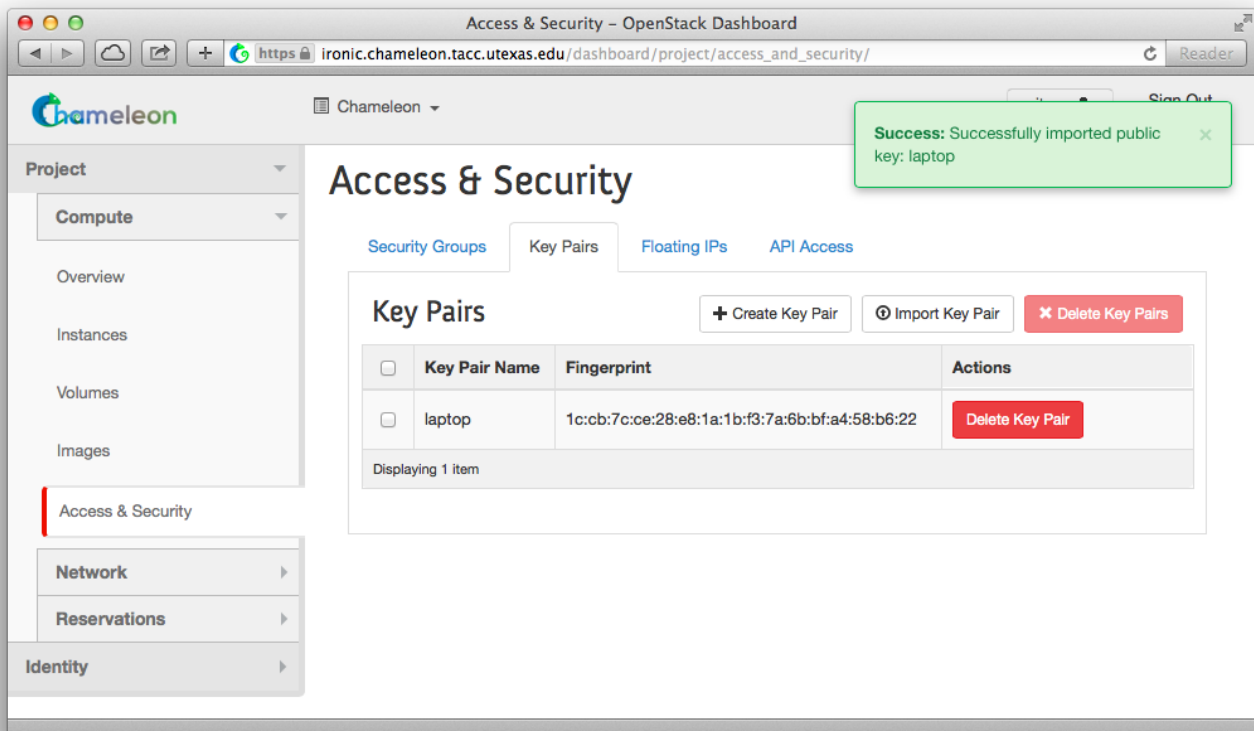
Enter a name for the key pair, for example laptop. In the “Public Key” box, copy the content of your SSH public key. Typically it will be at `~/.ssh/id_rsa.pub`. On Mac OS X, you can run in a terminal:

```
cat ~/.ssh/id_rsa.pub | pbcopy
```

It copies the content of the public key to your copy/paste buffer. Then you can simply paste in the “Public Key” box.

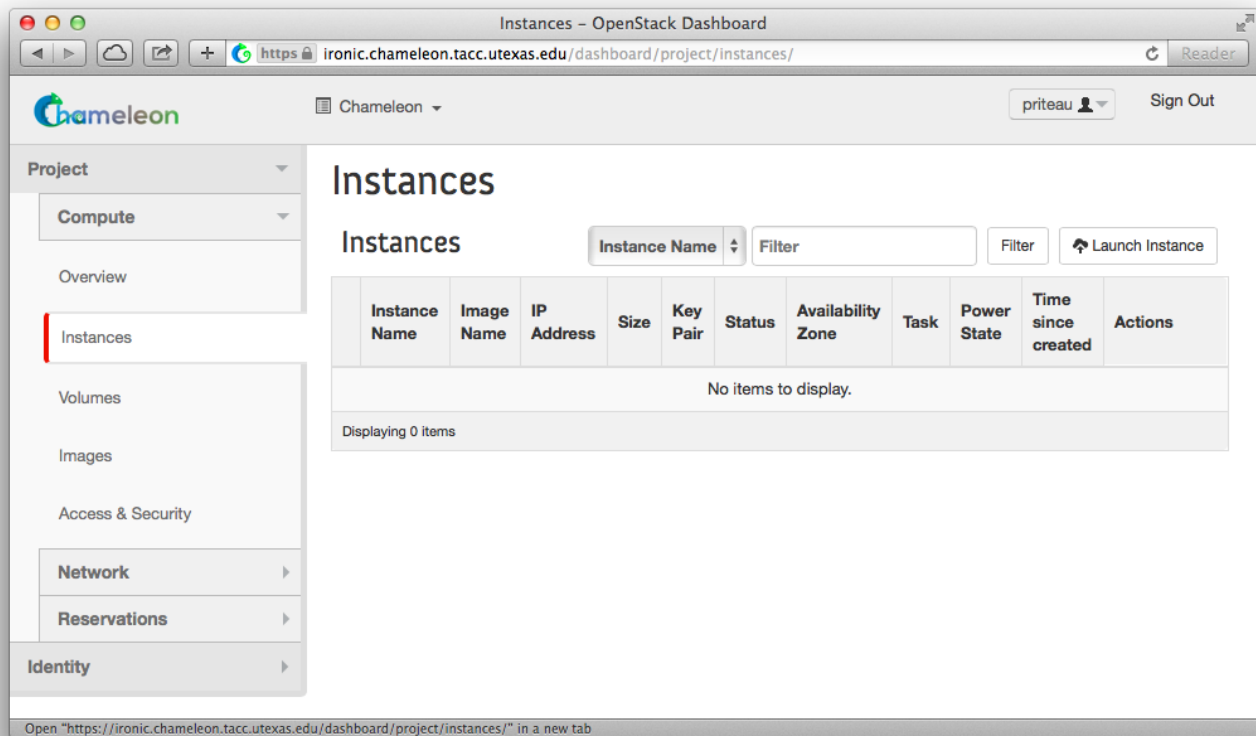


Then, click on the blue “Import Key Pair” button. This should show you the list of key pairs, with the one you just added.



For those already familiar with OpenStack, note that Security Groups are not currently functioning. All instances are open to the outside world; Security Group rules are not respected. Chameleon staff are working to resolve this bug.

Now, go to the “Instances” panel.



Click on the “Launch Instance” button in the top right corner. Select a reservation in the Reservation box, pick an instance name (in this example my-first-instance) and in the Image Name list select our default environment named CC-CentOS7. If you have multiple key pairs registered, you need to select one in the “Access & Security” tab. Finally, click on the blue “Launch” button.

Instances - OpenStack Dashboard

Chameleon

priteau Sign Out

Launch Instance

Details * Access & Security * Networking * Post-Creation

Availability Zone
Any Availability Zone

Reservation
my-first-lease (58fa6bde-bb27-4759-b5b2-42)

Instance Name *
my-first-instance

Flavor *
baremetal

Instance Count *
1

Instance Boot Source *
Boot from image

Image Name
CC-CentOS7 (749.5 MB)

Specify the details for launching an instance.
The chart below shows the resources used by this project in relation to the project's quotas.

Flavor Details

Name	baremetal
VCPUs	8
Root Disk	128 GB
Ephemeral Disk	0 GB
Total Disk	128 GB
RAM	11,264 MB

Project Limits

Number of Instances 0 of 46 Used

Number of VCPUs 0 of 368 Used

Total RAM 0 of 518,144 MB Used

Cancel Launch

The instance will show up in the instance list, at first in Build status. It takes a few minutes to deploy the instance on bare-metal hardware and reboot the machine.

Instances - OpenStack Dashboard

Chameleon

priteau Sign Out

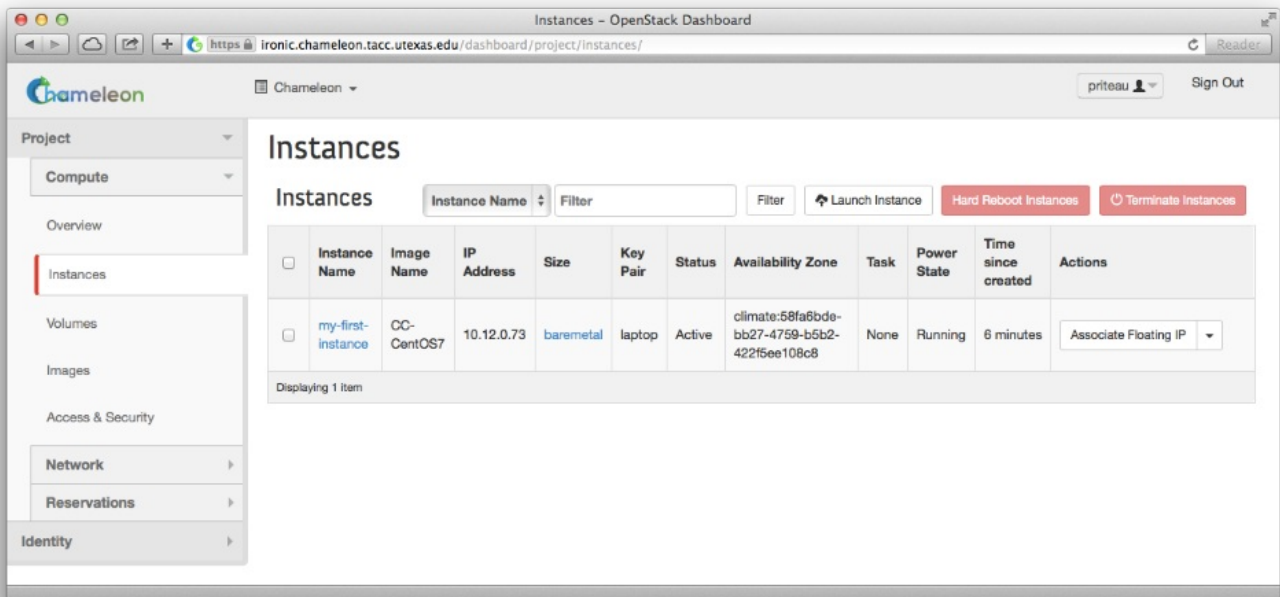
Instances

Instance Name Filter Filter Launch Instance Hard Reboot Instances Terminate Instances

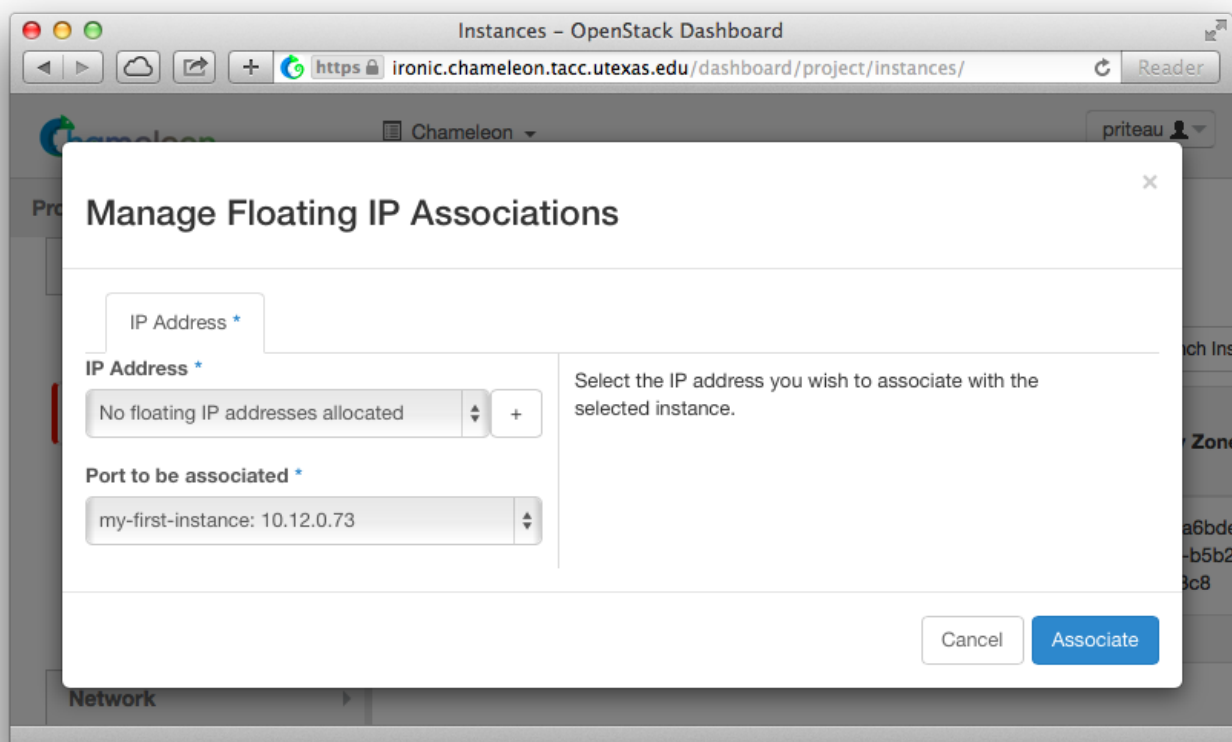
	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	my-first-instance	CC-CentOS7		baremetal	laptop	Build	climate:58fa6bde-bb27-4759-b5b2-422f5ee108c8	Spawning	No State	0 minutes	Associate Floating IP

Displaying 1 item

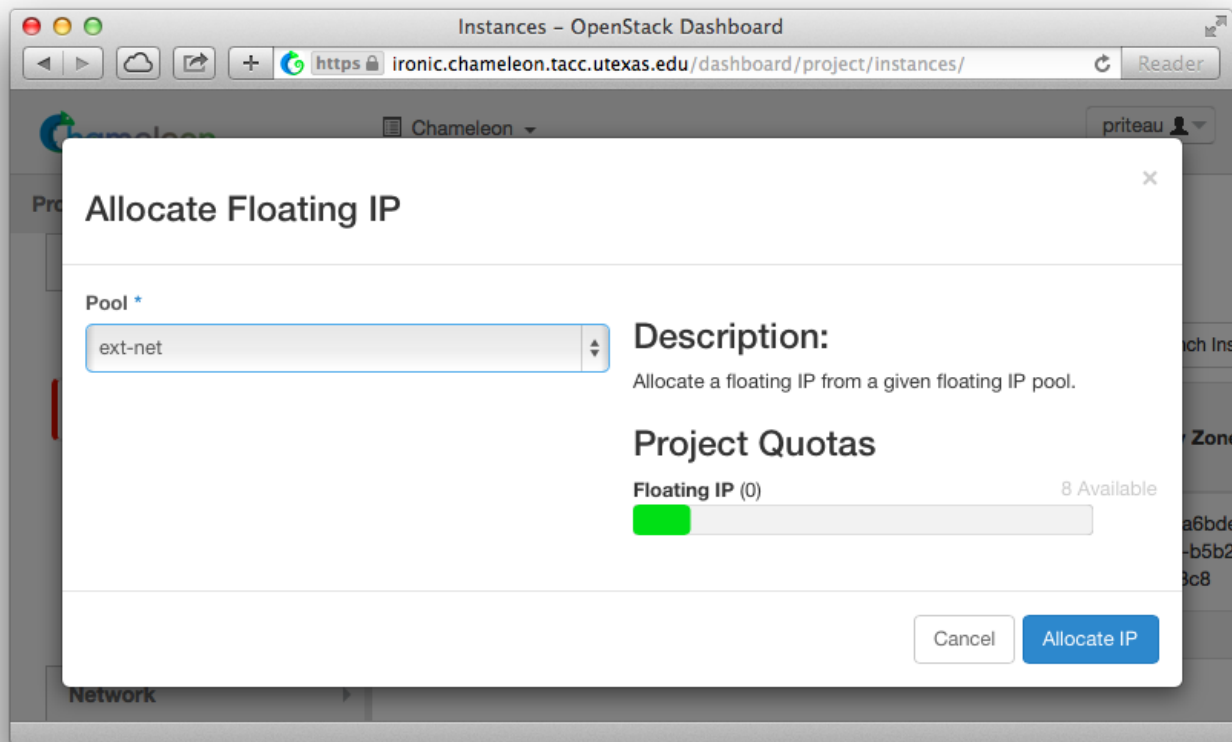
After a few minutes the instance should become in "Active" status and the Power State should be "Running."



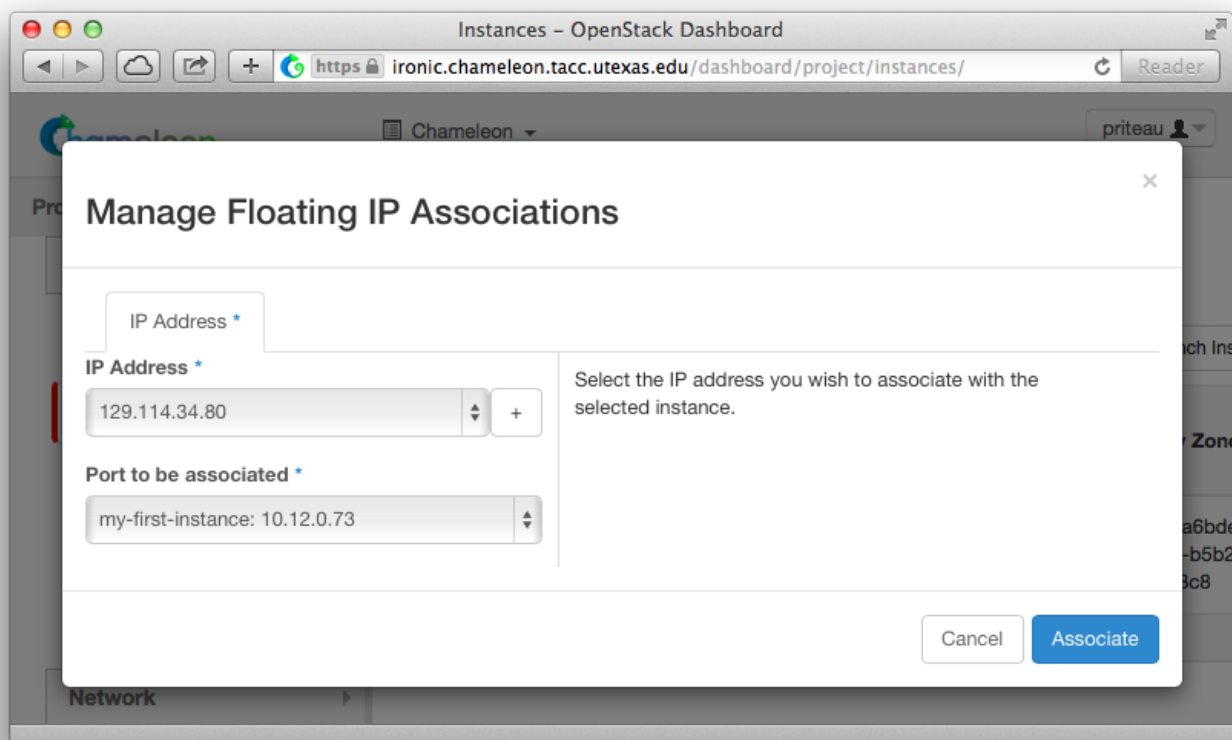
At this point the instance might still be booting: it might take a minute or two to actually be accessible on the network and accept SSH connections. In the meantime, you can attach a floating IP to the instance. Click on the "Associate Floating IP" button. You should get a screen like the one below:



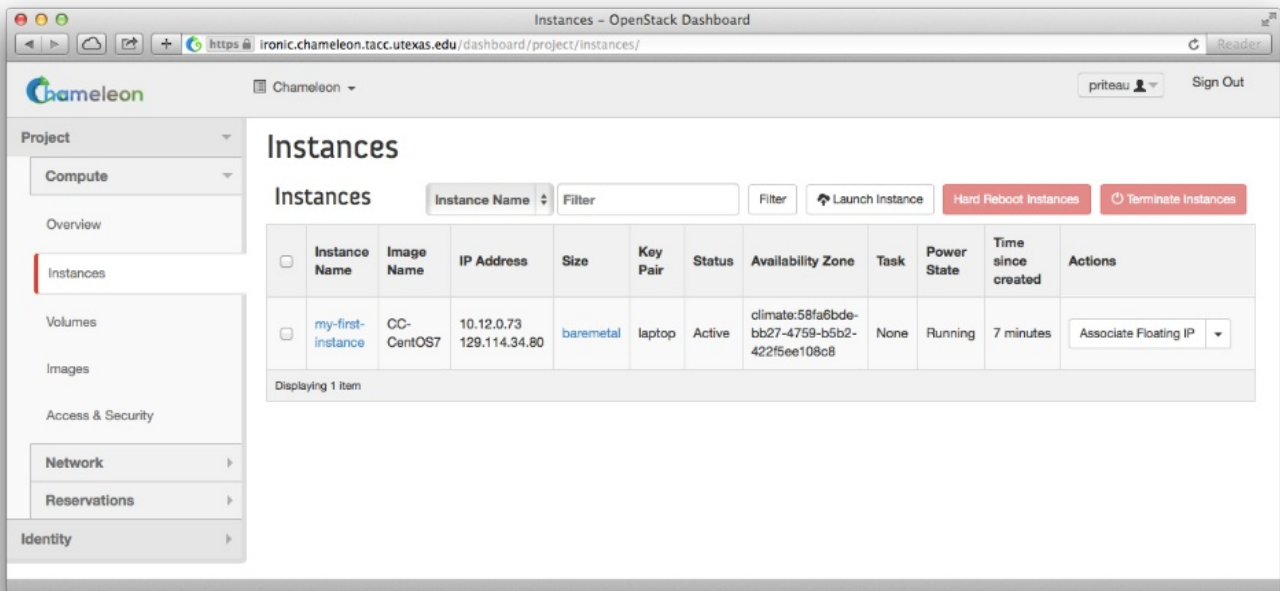
If there are no unused floating IP already allocated to your project, click on the + button. In the window that opens, select the ext-net pool if not already selected by default and click on the blue Allocate IP button.



You will be returned to the previous window. The correct value for “Port to be associated” should already be selected, so you only have to click on “Associate”.

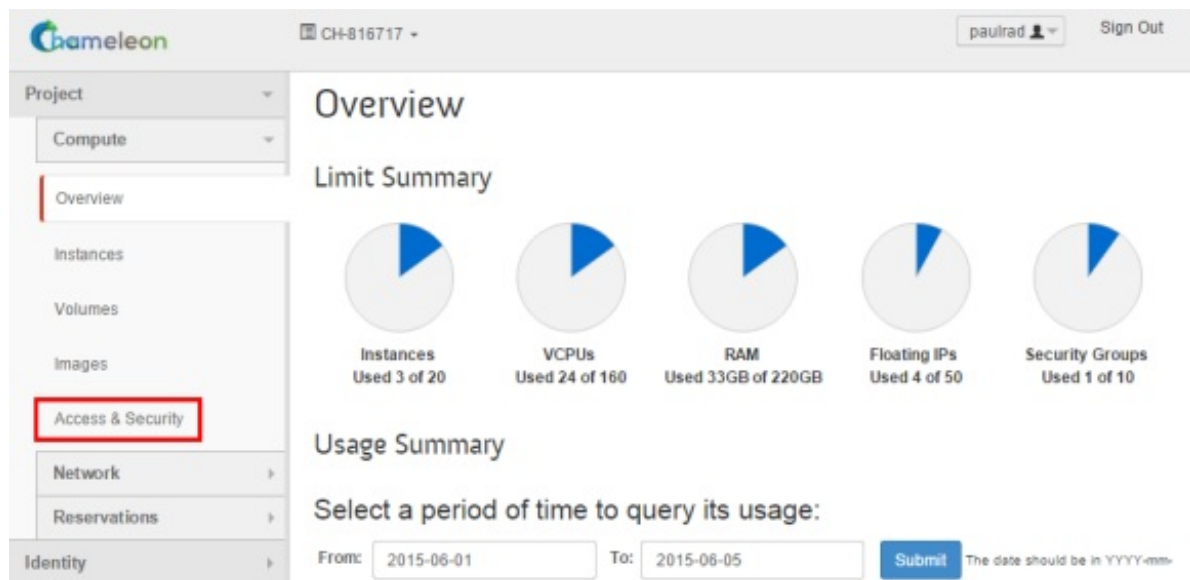


This should send you back to the instance list, where you can see the floating IP attached to the instance.

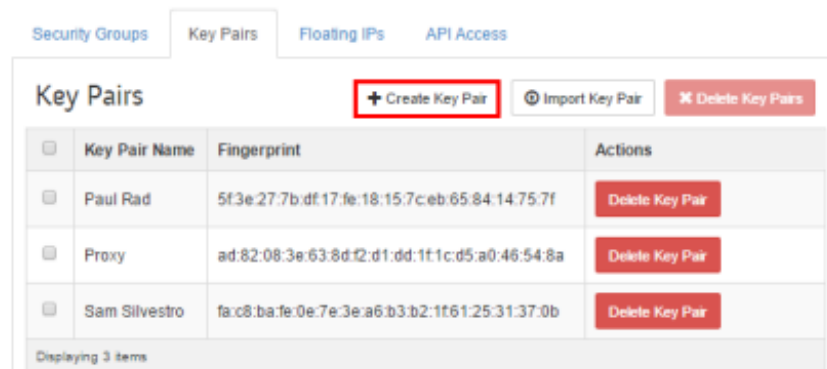


Step 3: Create a Chameleon Cloud Bare Metal Server

Log in to Ironic (<https://ironic.chameleon.tacc.utexas.edu/dashboard/project/instances/>) using the credentials we created previously. Before we begin, we must add or create a key pair to be used to gain access to any servers we create. If you do not presently have a key pair, first click on the "Access & Security" tab, then click on the "Create Key Pair" button.



Access & Security



Create Key Pair

Key Pair Name *

MyNewKeyPair

Description:

Key pairs are ssh credentials which are injected into images when they are launched. Creating a new key pair registers the public key and downloads the private key (a .pem file).

Protect and use the key as you would any normal ssh private key.

Cancel Create Key Pair

Enter a name for your new key pair and click on “Create Key Pair”. Your new key public key will then be added to the project automatically, and your private key should begin downloading to your local computer. You should also see the message below.

Download Key Pair

The key pair "MyNewKeyPair" should download automatically. If not use the link below.

[Download key pair "MyNewKeyPair"](#)

If, instead, you already have a pre-existing key pair you would like to use, you may add your public key to the project by clicking on the “Import Key Pair” button on the “Access & Security” tab.

Access & Security

Security Groups Key Pairs Floating IPs API Access

Key Pairs

+ Create Key Pair Import Key Pair Delete Key Pairs

<input type="checkbox"/>	Key Pair Name	Fingerprint	Actions
<input type="checkbox"/>	Paul Rad	5f3e:27:7b:df:17:fe:18:15:7c:eb:65:84:14:75:7f	Delete Key Pair
<input type="checkbox"/>	Proxy	ad:82:08:3e:63:8d:f2:d1:dd:1f:1c:d5:a0:46:54:8a	Delete Key Pair
<input type="checkbox"/>	Sam Silvestro	fa:c8:ba:fe:0e:7e:3e:a6:b3:b2:1f:61:25:31:37:0b	Delete Key Pair

Displaying 3 items

Provide a name for your key pair, and paste your public key into the space provided. Click “Import Key Pair” to continue.

Import Key Pair

Key Pair Name *

Public Key *

Description:

Key Pairs are how you login to your instance after it is launched.

Choose a key pair name you will recognise and paste your SSH public key into the space provided.

SSH key pairs can be generated with the ssh-keygen command:

```
ssh-keygen -t rsa -f cloud.key
```

This generates a pair of keys: a key you keep private (cloud.key) and a public key (cloud.key.pub). Paste the contents of the public key file here.

After launching an instance, you login using the private key (the username might be different depending on the image you launched):

```
ssh -i cloud.key <username>@<instance_ip>
```

Cancel Import Key Pair

If successful, your key pair should now appear in the “Key Pairs” list under the “Access & Security” tab.

Now that we have a valid key pair published, we can proceed with creating a new server. Click on the “Instances” tab, where we can create, manage, and delete servers on demand.

Overview
Instances
Volumes
Images
Access & Security
Network
Reservations

Instances

Instance Name ▼ Filter

	Instance Name	Image Name	IP Address	Size	Key Pair
<input type="checkbox"/>	hadoop-test	CC-CentOS7	10.12.0.184 129.114.34.107	baremetal	Pro
<input type="checkbox"/>	proxy	CC-CentOS7	10.12.0.183 129.114.34.106	baremetal	Sam Sil
<input type="checkbox"/>	server	CC-CentOS7	10.12.0.169 129.114.34.108	baremetal	Sam Sil

Next, click on the “Launch Instance” button.

Instances

Instance Name ▼ Filter

Launch Instance Hard Reboot Instances

	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created
<input type="checkbox"/>	hadoop-test	CC-CentOS7	10.12.0.184 129.114.34.107	baremetal	Proxy	Active	climate:0923ee8b-92ca-4736-bf7b-41b68aa05ffc	None	Running	4 days, 22 hours
<input type="checkbox"/>	proxy	CC-CentOS7	10.12.0.183 129.114.34.106	baremetal	Sam Silvestro	Active	climate:0923ee8b-92ca-4736-bf7b-41b68aa05ffc	None	Running	4 days, 22 hours
<input type="checkbox"/>	server	CC-CentOS7	10.12.0.169 129.114.34.108	baremetal	Sam Silvestro	Active	climate:0923ee8b-92ca-4736-bf7b-41b68aa05ffc	None	Running	1 week, 2 days

Create a Chameleon server with the following attributes.

1. Instance name: ****test****
2. Availability zone: **Any Availability Zone**
3. Reservation: **any reservation listed**

4. Flavor: **baremetal**
5. Instance count: **1**
6. Instance boot source: **Boot from image**
7. Image name: **CC-CentOS7**
8. Click on the “Access & Security” tab
9. Select *your key pair* from the list.
10. Click: **Launch**

Launch Instance

Details *

Access & Security *

Networking *

Post-Creation

Availability Zone

Any Availability Zone

Reservation ?

TestLease (c0fec26-6765-4785-8af5-54

Instance Name *

Hadoop-test

Flavor * ?

baremetal

Instance Count * ?

1

Instance Boot Source * ?

Boot from image

Image Name

CC-CentOS7 (749.5 MB)

Specify the details for launching an instance.

The chart below shows the resources used by this project in relation to the project's quotas.

Flavor Details

Name	baremetal
VCPUs	8
Root Disk	128 GB
Ephemeral Disk	0 GB
Total Disk	128 GB
RAM	11,264 MB

Project Limits

Number of Instances2 of 20 Used

Number of VCPUs16 of 160 Used

Total RAM22,528 of 225,280 MB Used

Cancel

Launch

Launch Instance

Details *

Access & Security *

Networking *

Post-Creation

Key Pair ?

Proxy

Security Groups * ?

☒ default

Control access to your instance via key pairs, security groups, and other mechanisms.

Cancel

Launch

The Chameleon Cloud server will begin building. When the server becomes available, click on the “Associate Floating IP” button at the end of its row. Select an available IP address from the list and click on “Associate”. Make note of this new IP address, as we will need it to complete the next step.

×

Manage Floating IP Associations

IP Address *

IP Address *

Select an IP address ▼

Select an IP address

129.114.34.107

129.114.34.109

na000p. 10.12.0.175

+

Select the IP address you wish to associate with the selected instance.

Cancel

Associate

Now SSH into your new server using the new floating IP address.

```
proxyuser@proxy ~$ ssh cc@your.floating.ip.address
The authenticity of host <your.floating.ip.address> can't be established.
ECDSA key fingerprint is 3d:4e:d1:a0:e8:d9:e6:19:a2:8a:79:48:66:c5:01:1d.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added <your.floating.ip.address> (ECDSA) to the list of known hosts.
```

Ensure you are logging in using the cc account on any servers you create using this method.