

Chameleon Cloud Tutorial

National Science Foundation

Program Solicitation # NSF 13-602

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

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

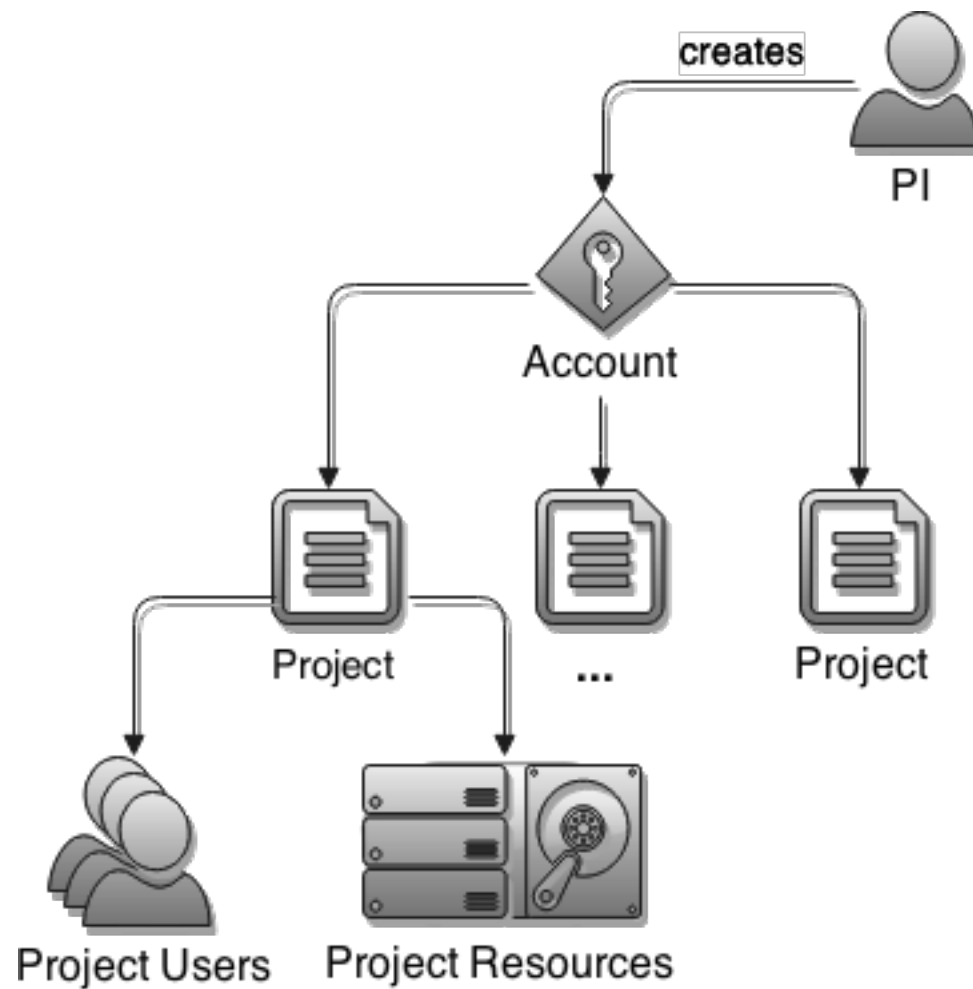
Prerequisites

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

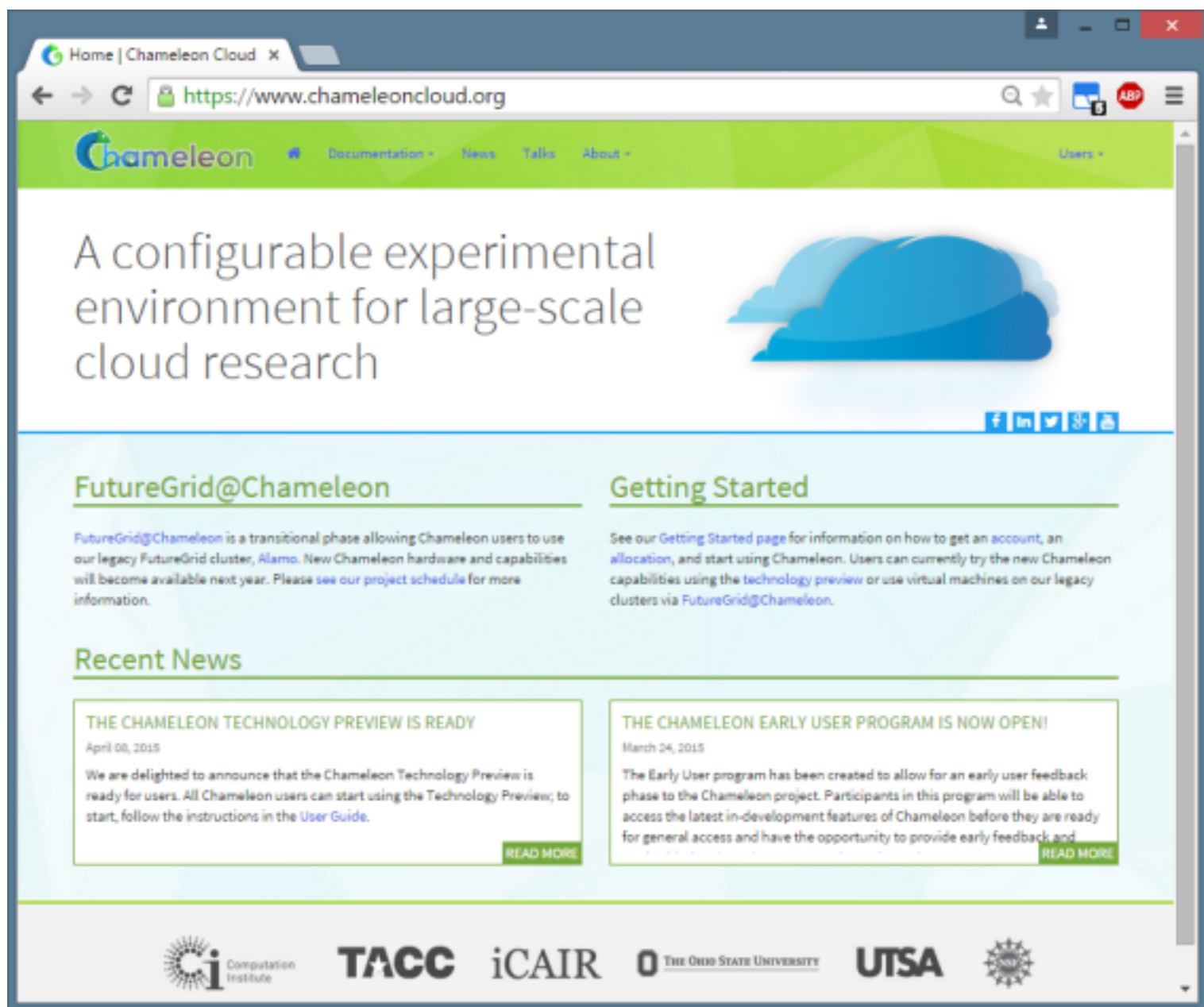
- An SSH client (Windows users can download PuTTY (<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>))
- A basic knowledge of Linux

Step 1: Register for a Chameleon Cloud user account

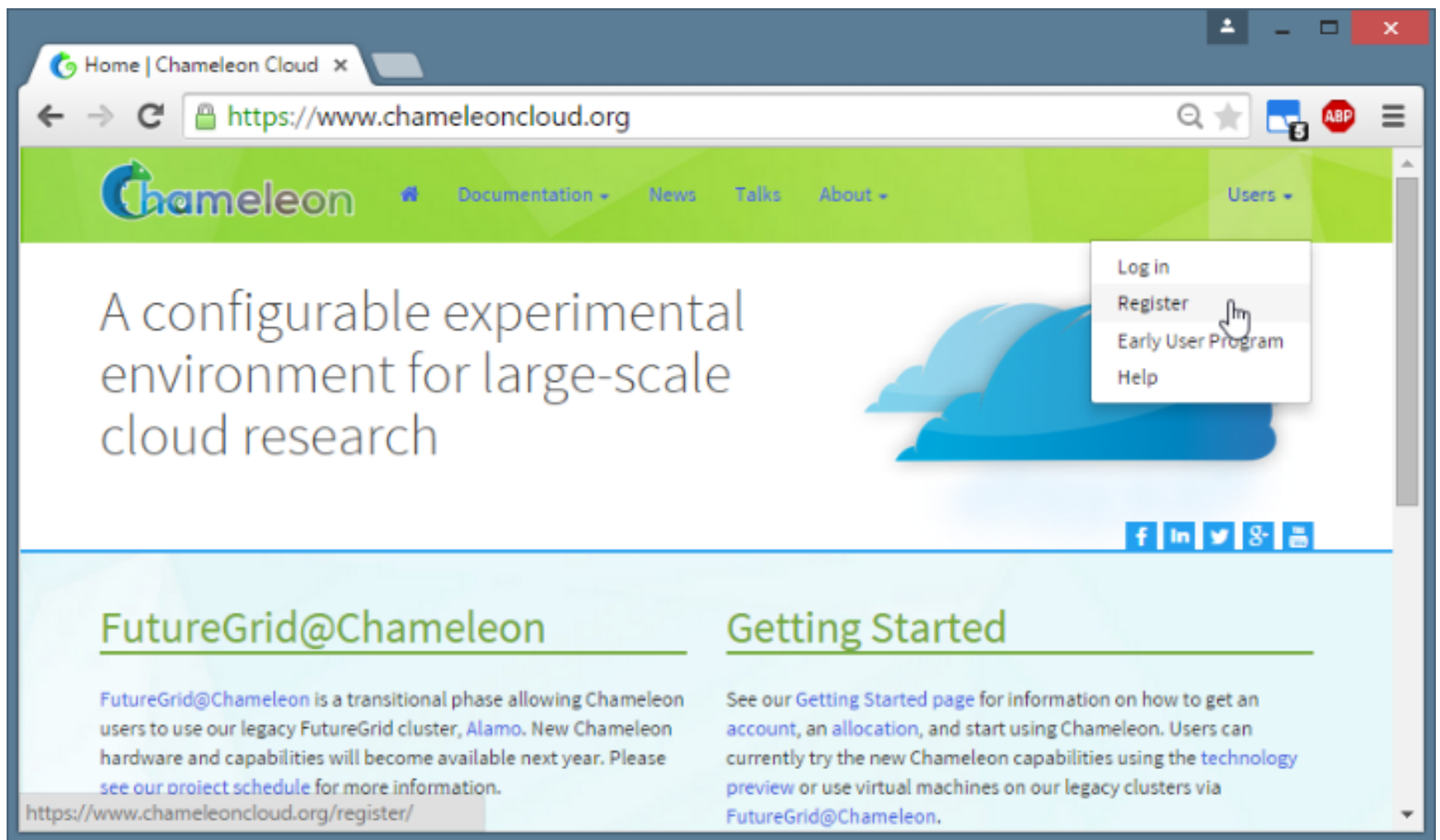
In this step, you will create your very own Chameleon Cloud user account. However, before we begin, it will be useful to define some Chameleon Cloud terminology and the relationship between these entities. A Chameleon user account, which we will register for below, is required to create projects. A project, 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.



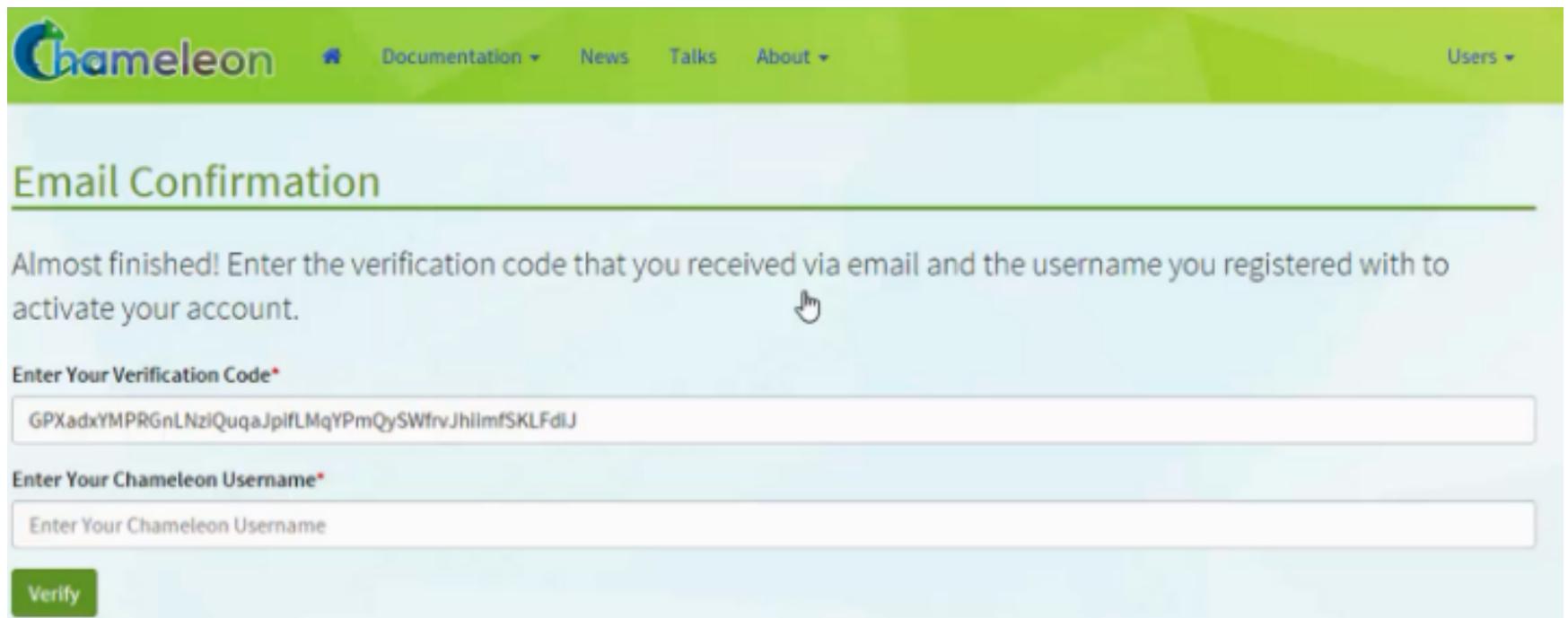
You will be required to complete two sections: “Contact Information” and “Account Information”.

Contact Information	Account Information
<p>First name</p> <input type="text"/>	<p>Username</p> <input type="text"/>
<p>Last name</p> <input type="text"/>	<p>Username must be 3-8 characters in length, start with a letter, and can contain only lowercase letters, numbers, or underscore.</p>
<p>Email address</p> <input type="text"/>	<p>Password</p> <input type="password"/>
<p>Institution</p> <p>Choose one</p> <p>My institution is not listed</p>	<p>Confirm Password</p> <input type="password"/>
<p>Country of Residence</p> <p>Choose one</p>	<p>Passwords must meet the following criteria:</p> <ul style="list-style-type: none">• Must not contain your account name or parts of your full name• Must be a minimum of 8 characters in length• Must contain characters from at least three of the following: uppercase letters, lowercase letters, numbers, symbols
<p>Country of Citizenship</p> <p>Choose one</p>	<p>Save Profile Cancel</p>
<p>PI Eligibility</p> <p>PI Eligible</p> <p>Faculty and Research Staff from U.S.-based institutions can request PI Eligibility on Chameleon.</p>	

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 image shows the 'Email Confirmation' page of the Chameleon website. At the top, there is a green navigation bar with the Chameleon logo and links for 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 value 'GPXadxYMPRGnLNziQuqaJpifLMqYPmQySWfrvJhilmfSKLFdIJ' and 'Enter Your Chameleon Username*' with the placeholder 'Enter Your Chameleon Username'. A green 'Verify' button is at the bottom left.

Chameleon Documentation News Talks About Users

Email Confirmation

Almost finished! Enter the verification code that you received via email and the username you registered with to activate your account.

Enter Your Verification Code*

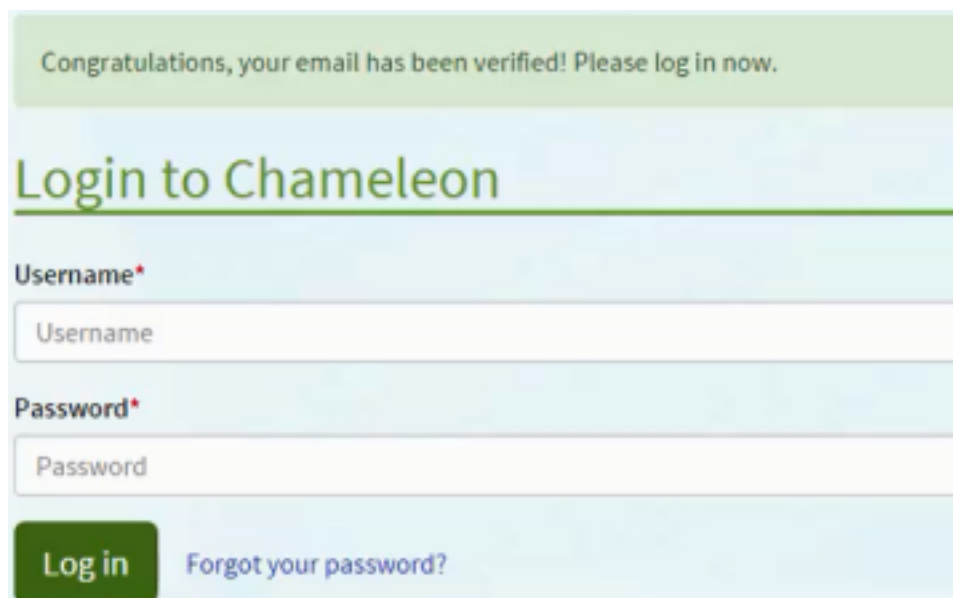
GPXadxYMPRGnLNziQuqaJpifLMqYPmQySWfrvJhilmfSKLFdIJ

Enter Your Chameleon Username*

Enter Your Chameleon Username

Verify

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 image shows the 'Login to Chameleon' page. At the top, a green message box says 'Congratulations, your email has been verified! Please log in now.' The main heading is 'Login to Chameleon'. Below it, 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.

Congratulations, your email has been verified! Please log in now.

Login to Chameleon

Username*

Username

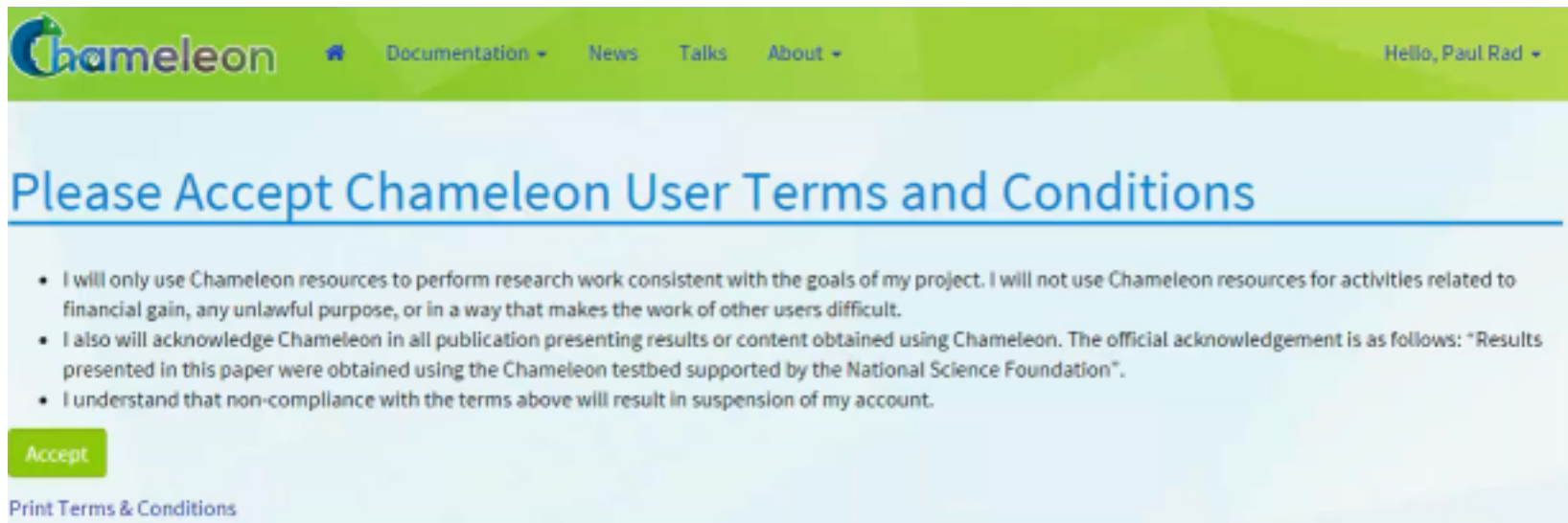
Password*

Password

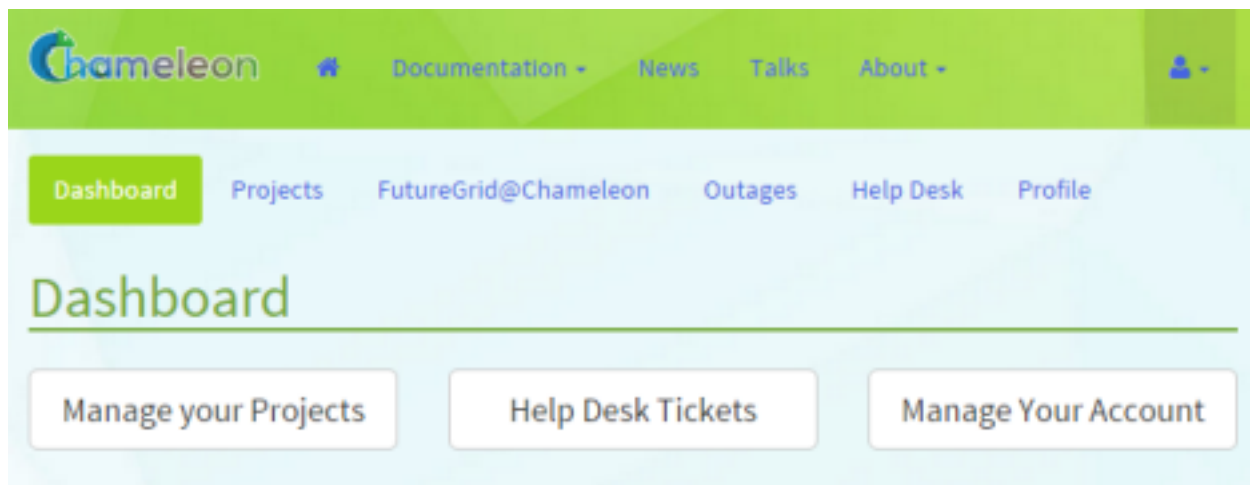
Log in

[Forgot your password?](#)

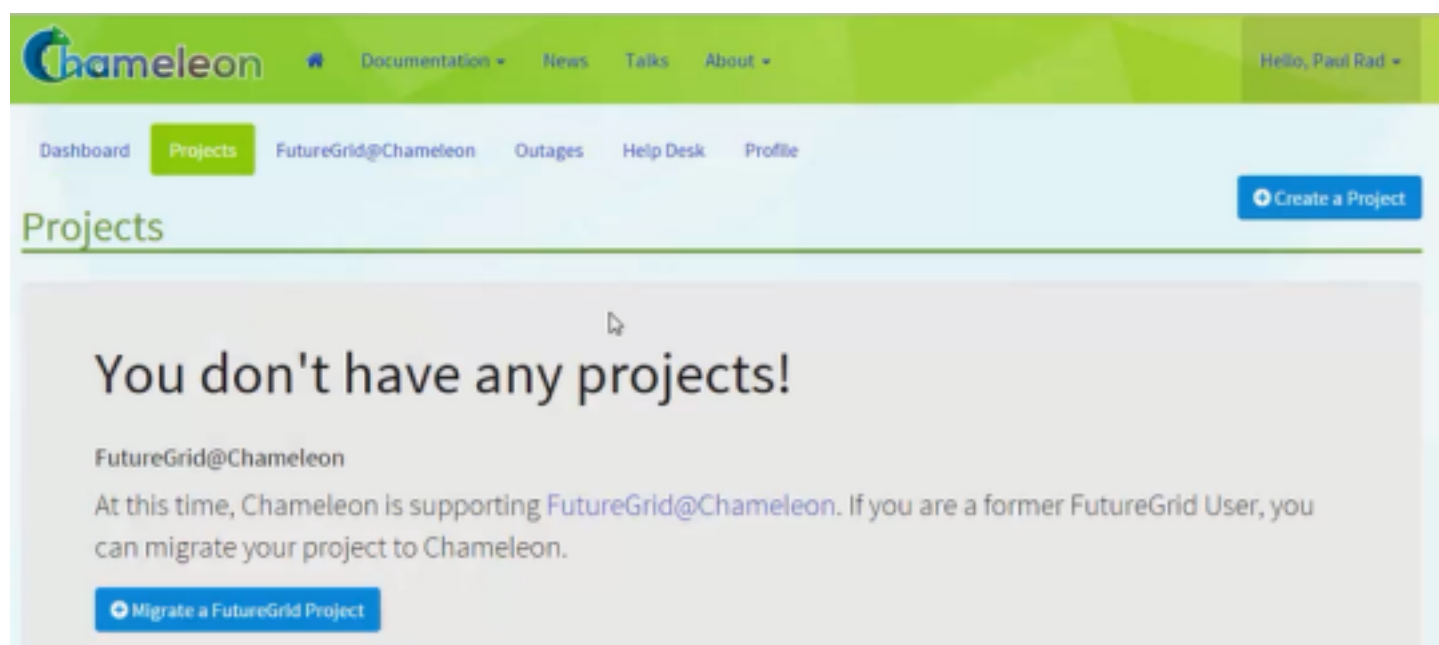
Upon successfully logging in, you will be asked to accept the Chameleon User Terms and Conditions. Click “Accept” to proceed.



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.

Please Accept Project Lead Terms and Conditions

- As a project lead I take responsibility for ensuring that users conducting work on the Chameleon testbed as part of my project observe the user terms and conditions.
- I further agree to provide the Chameleon team with reports on the progress of my project as requested (at most bi-annually).
- I understand that non-compliance with the terms above will result in suspension of my project and suspension of access to all the users holding allocations under this project.

[Accept](#) [Print Terms & Conditions](#)

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 Chameleon web interface. The top navigation bar includes the Chameleon logo, links for Documentation, News, Talks, and About, and a user greeting 'Hello, Paul Rad'. Below this is a secondary navigation bar with links for Dashboard, Projects (highlighted), FutureGrid@Chameleon, Outages, Help Desk, and Profile. The main heading is 'Create a New Project'. The form contains several fields: 'Title*' with a placeholder 'Research into how...', 'Abstract*' with a placeholder 'We propose to...', 'Type*' with a dropdown menu currently showing 'Choose One' and a note 'Please select the project type.', and 'Field of Science*' with a dropdown menu showing 'COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)' and a note 'Please indicate a primary field of science for this research'. Below these is a 'Project ID' field showing 'CH-XXXXXX' with a note 'Project ID will be assigned upon creation'. At the bottom are two buttons: 'Create Project' and 'Cancel'.

Create a New Project

Title*
Research into how...

Abstract*
We propose to...

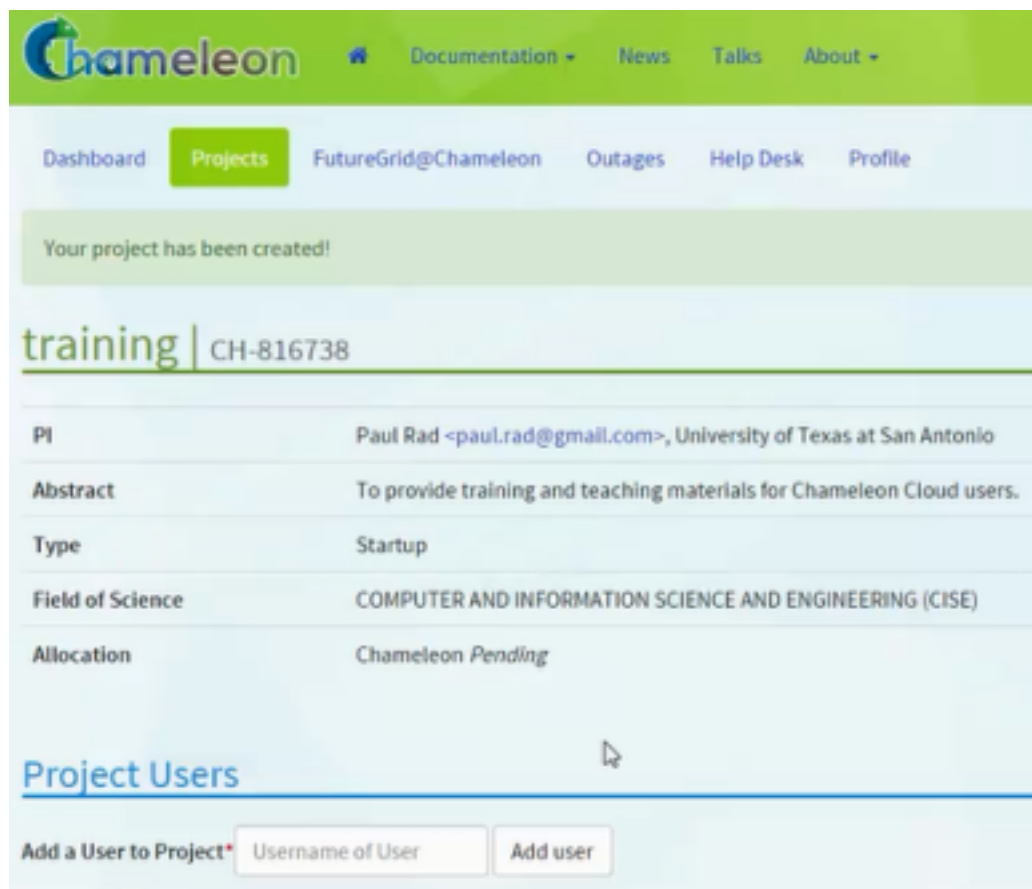
Type*
Choose One
Please select the project type.

Field of Science*
COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)
Please indicate a primary field of science for this research

Project ID
CH-XXXXXX
Project ID will be assigned upon creation

[Create Project](#) [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.

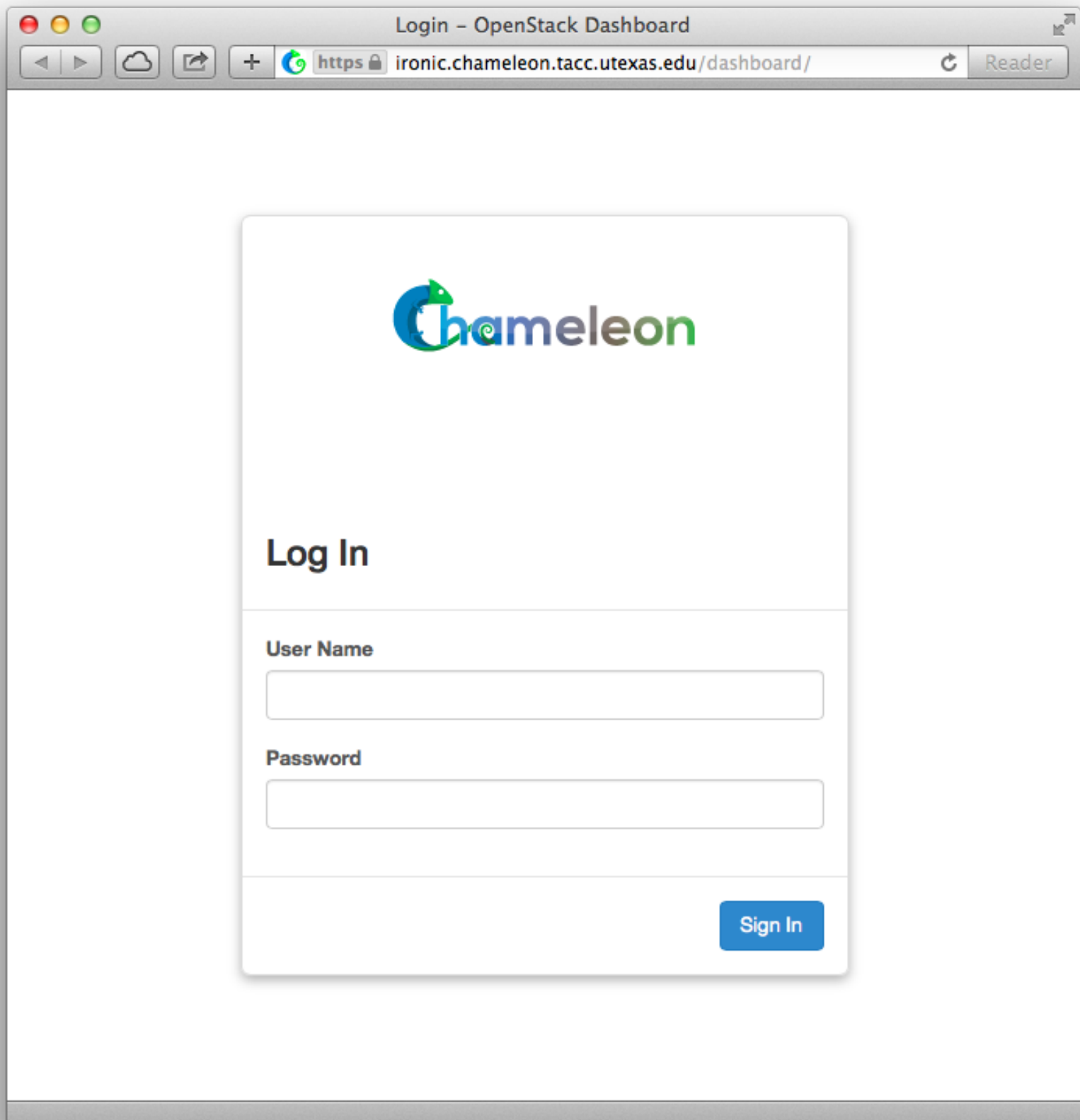


Step 2: Chameleon user interface quick overview

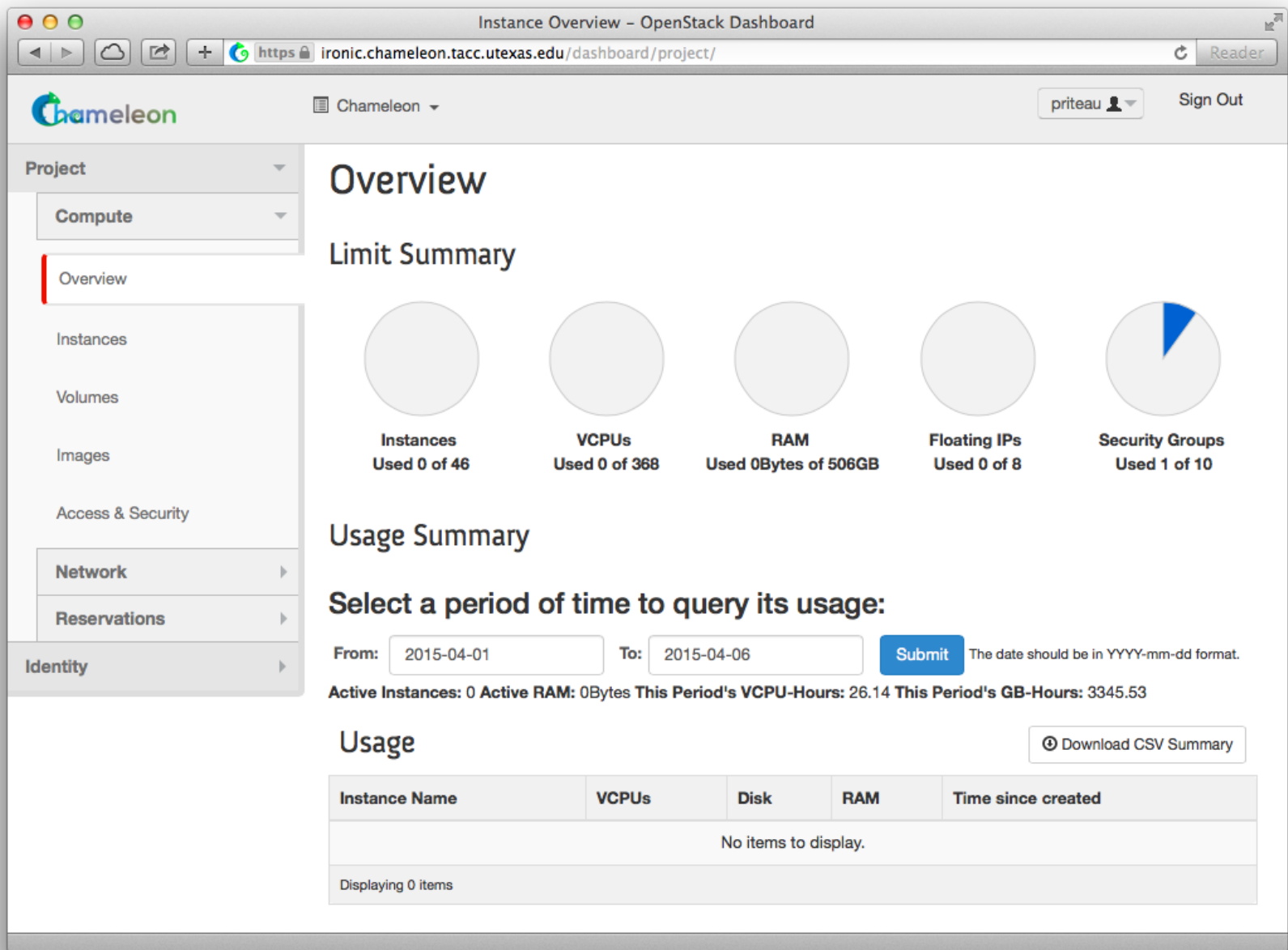
In this section, we will show you the features of the Chameleon technology preview. The technology preview of Chameleon gives access to bare-metal compute resources on which users can have administrative access to run cloud computing experiments with a high degree of customization and repeatability.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

Reserving resources

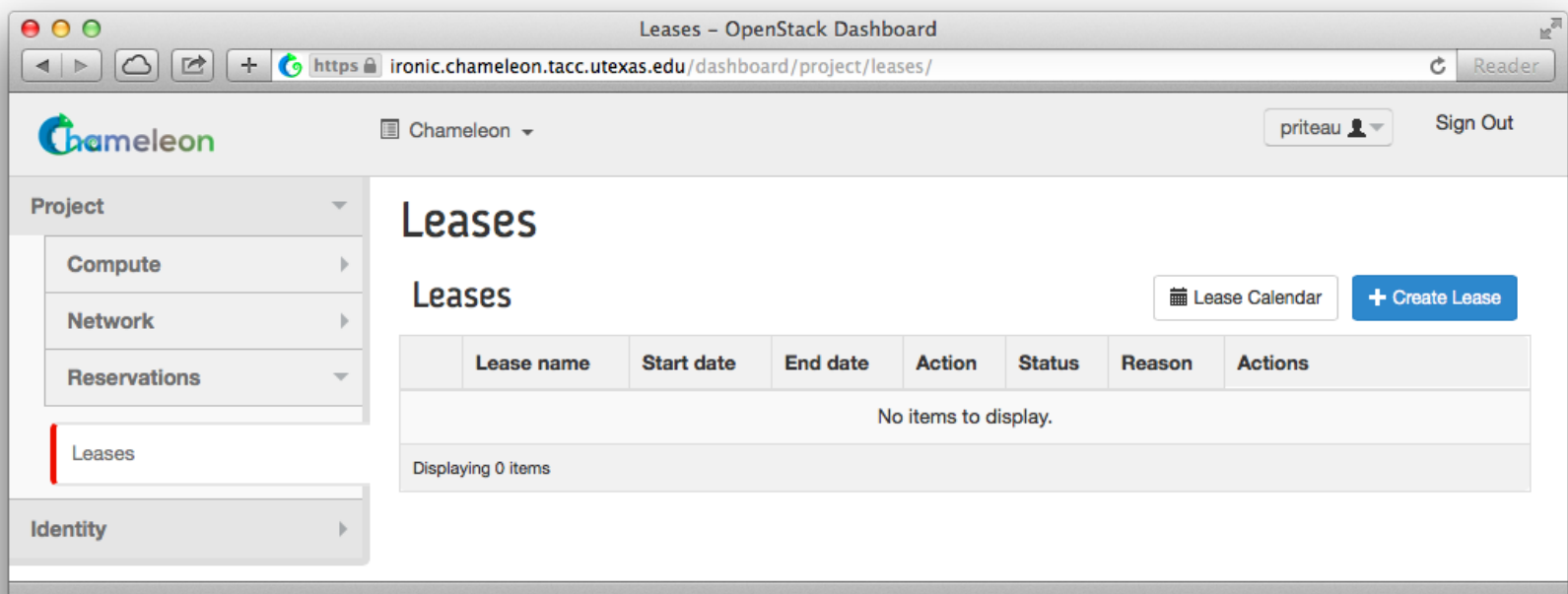
Physical resources on the Chameleon technology preview must be reserved before using them for an experiment. Once a reservation has been accepted, users are guaranteed that resources will be available at the time they chose (except in extraordinary circumstances such as hardware or platform failures),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



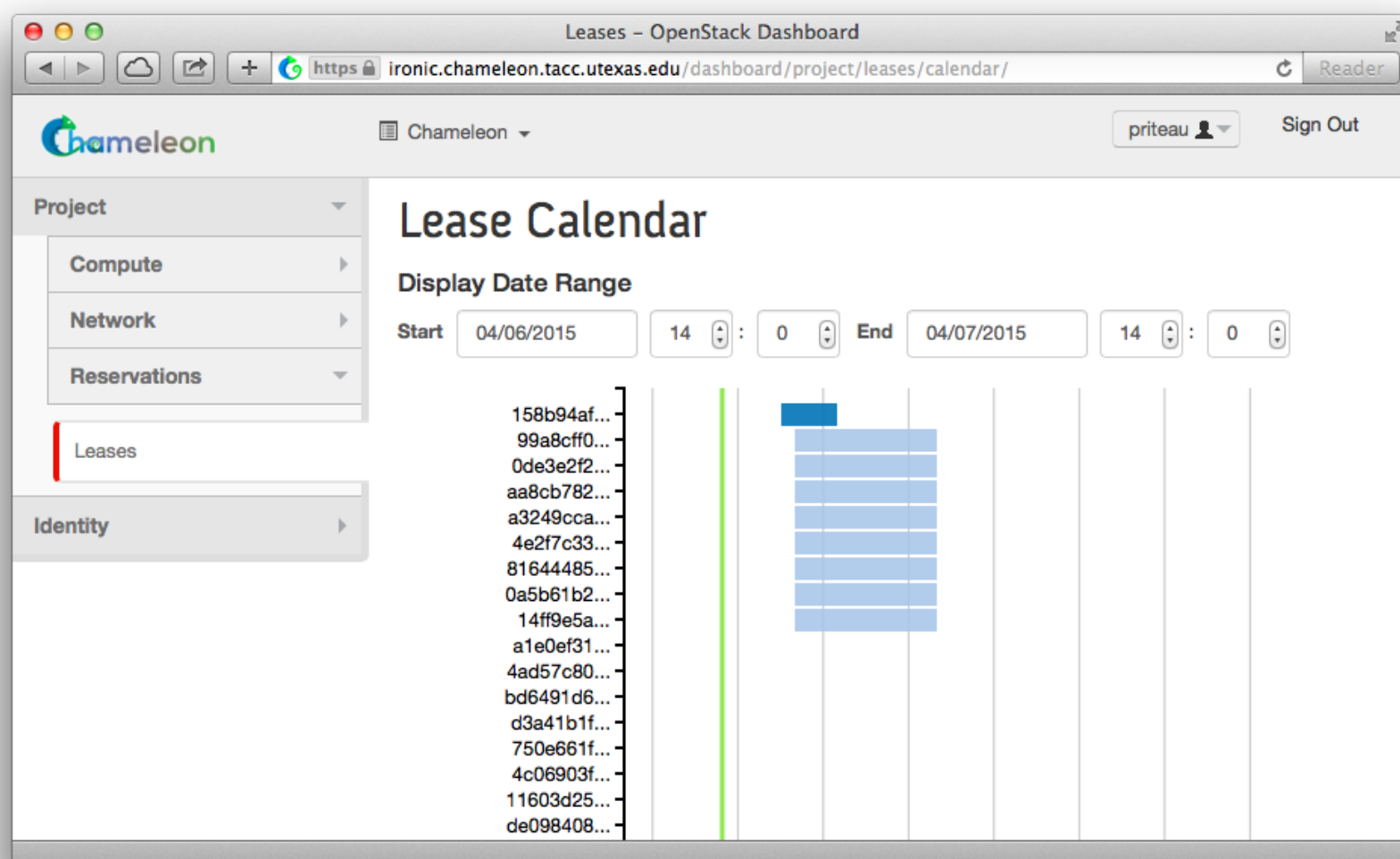
You should land on the Compute overview page for your default project. The pie charts on the page will show you what the current usage of things like instances and floating IPs is relative to the limit for your project. The usage summary will show historical usage of your project for a time period that 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 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 for "Project", "Compute", "Network", "Reservations", "Leases", and "Identity". The "Leases" link is highlighted. The main content area displays a "Create New Lease" modal dialog box. This dialog has a title bar with a close button (X). It contains several input fields: "Name" (required, marked with an asterisk), "Start Date/Time (UTC)" (required, marked with an asterisk and a help icon, with a placeholder "yyyy-mm-dd hh:mm"), "End Date/Time (UTC)" (required, marked with an asterisk and a help icon, with a placeholder "yyyy-mm-dd hh:mm"), "Resource Type" (a dropdown menu currently showing "Physical Host"), and "Number of Hosts" (a numeric input field with a value of "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.

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". The address bar shows the URL "https://ironic.chameleon.tacc.utexas.edu/dashboard/project/leases/". The page has a sidebar with a "Project" menu containing "Compute", "Network", "Reservations", and "Leases" (which is highlighted). Below "Project" is an "Identity" section. The main content area is partially obscured by a modal dialog titled "Create New Lease".

The modal dialog contains the following fields and controls:

- Name ***: A text input field containing "my-first-lease".
- Description:**: A section header followed by the text "Create a new lease with the provided values."
- Start Date/Time (UTC) * ?**: A date/time input field containing "2015-04-06 16:00".
- End Date/Time (UTC) * ?**: A date/time input field containing "2015-04-06 18:00".
- Resource Type ***: A dropdown menu with "Physical Host" selected.
- Number of Hosts ***: A numeric input field with a spinner, containing the value "1".
- At the bottom right of the modal are two buttons: "Cancel" and "Create".

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

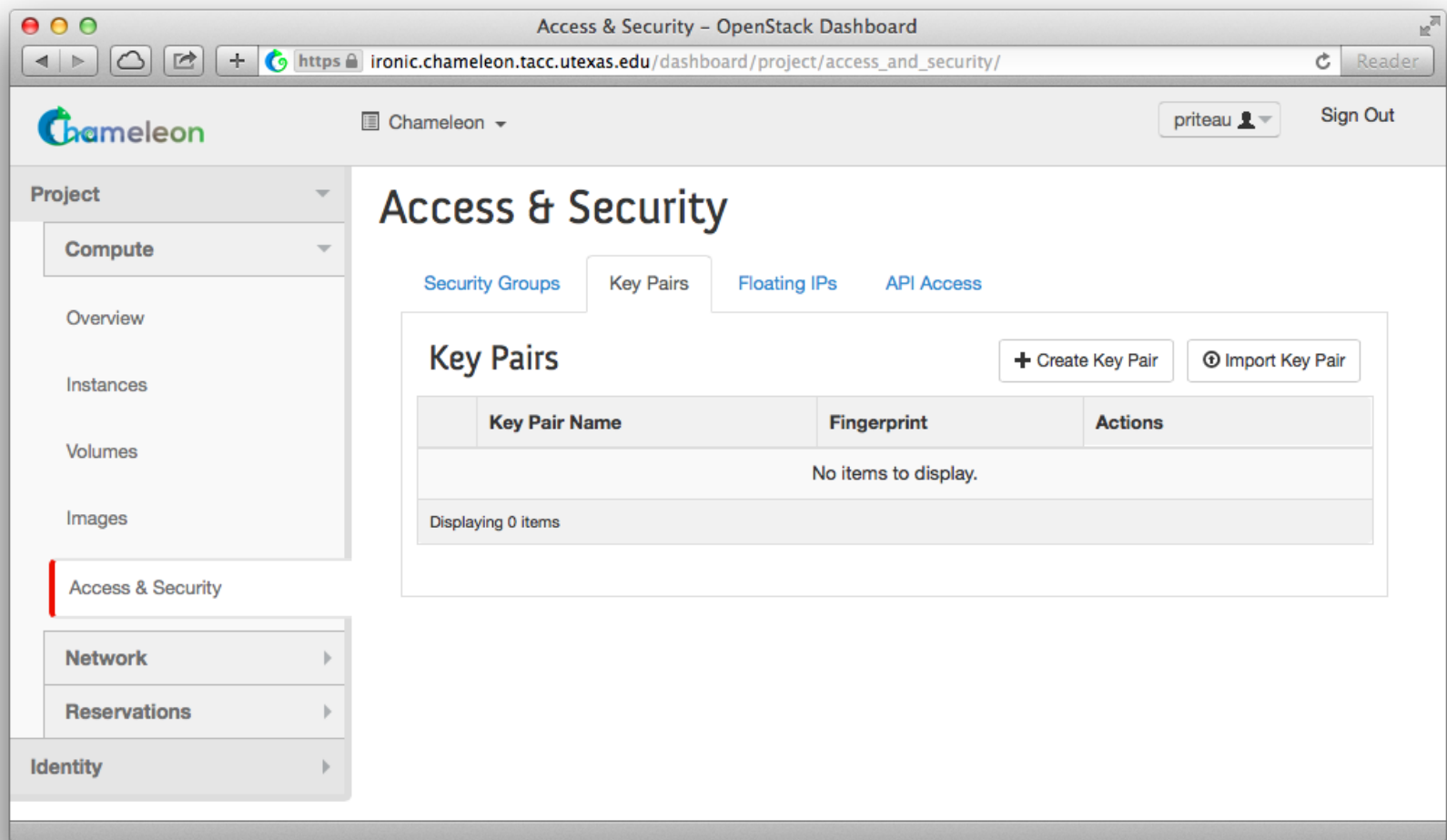
start_lease
Status: Undone
Created at: -
Updated at: -
end_lease
Status: Undone
Created at: -
Updated at: -

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.

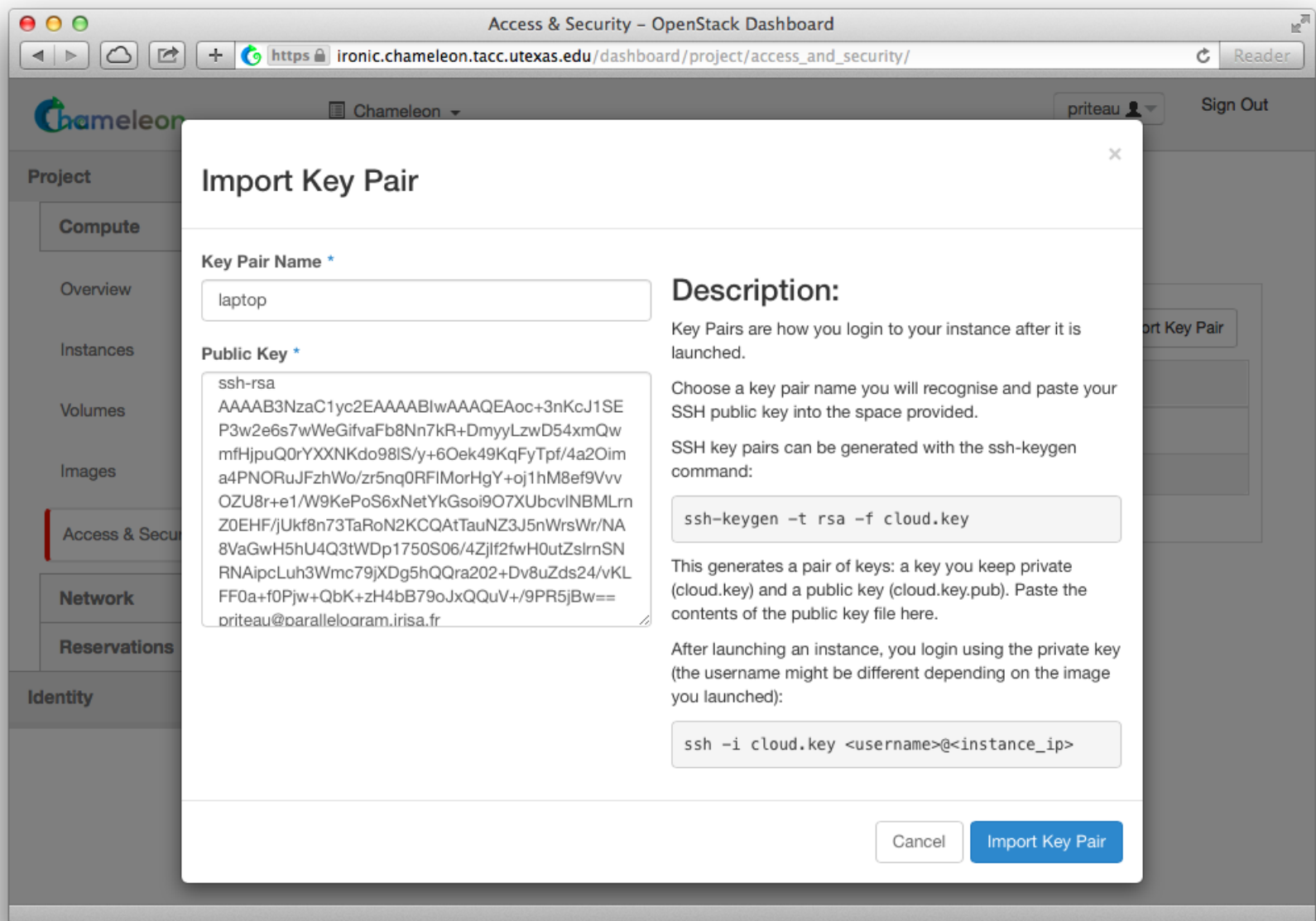


Here you can either get OpenStack to create an SSH key pair for you via the “Create Key Pair” button. If you already have an SSH key pair on your machine and are happy to use it, click on “Import Key Pair”.

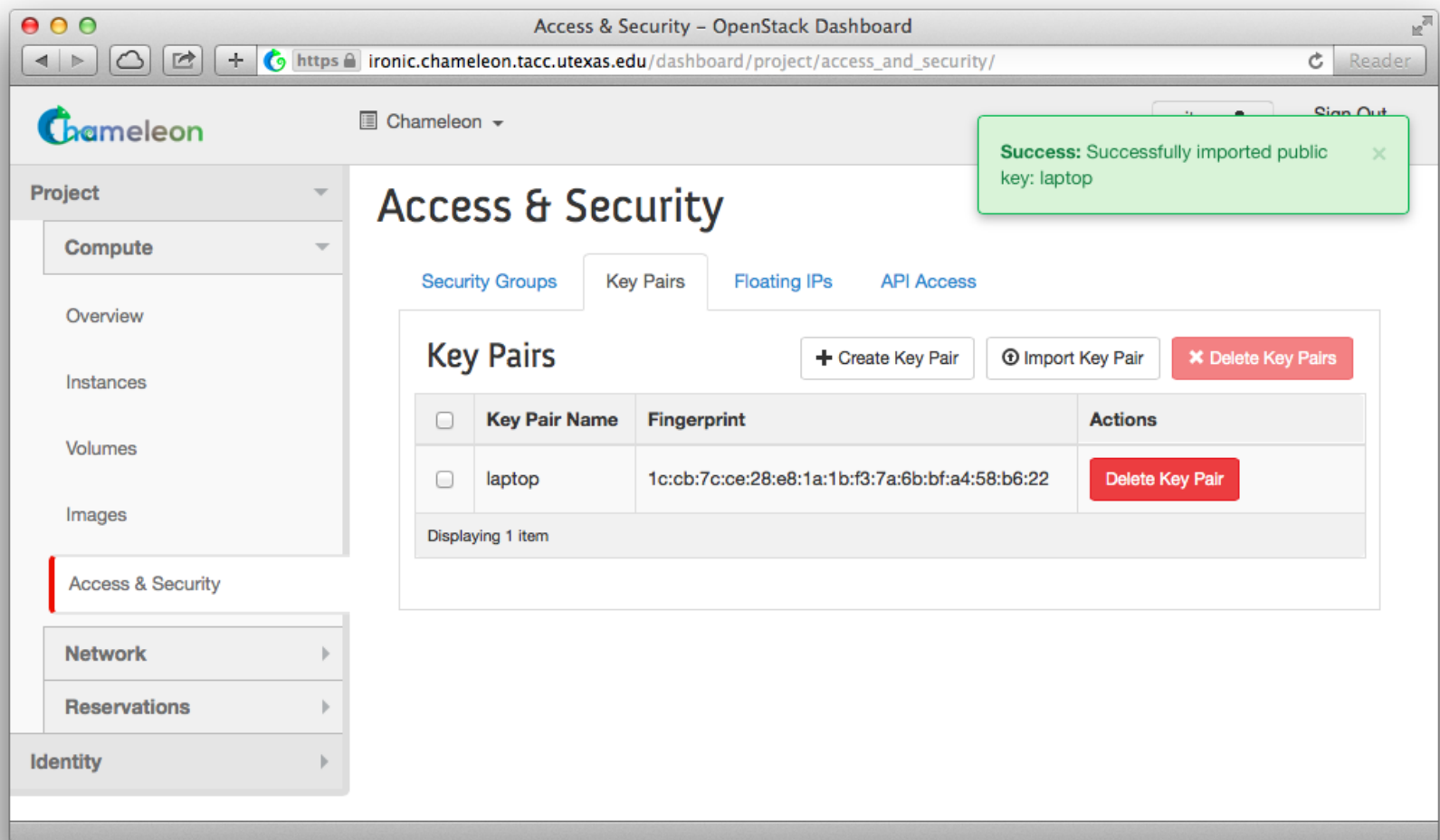
Enter a name for the key pair, for example laptop. In the “Public Key” box, copy the content of your SSH public key. Typically it will be at `~/.ssh/id_rsa.pub`. On Mac OS X, you can run in a terminal:

```
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.

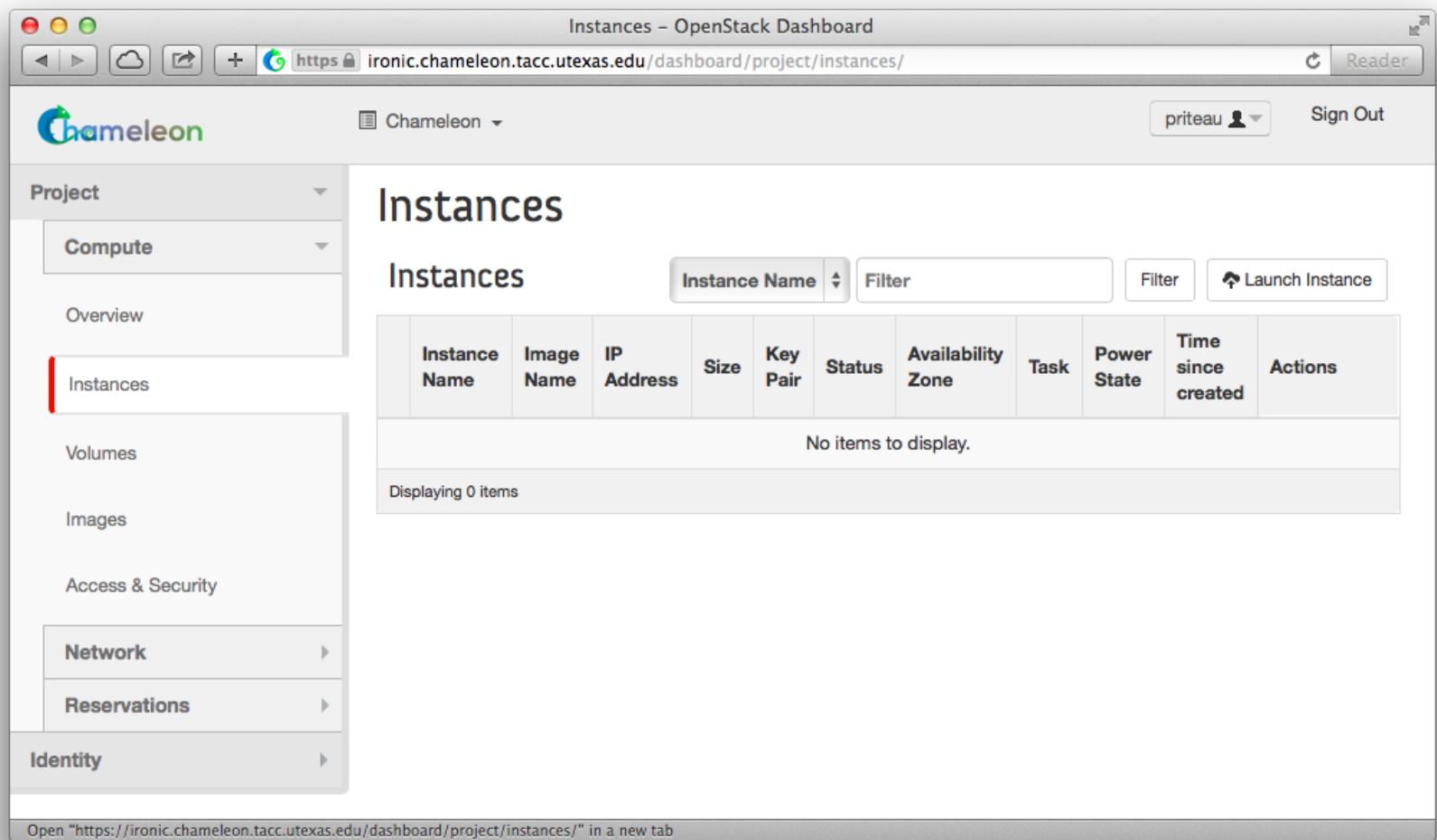


Then, click on the blue “Import Key Pair” button. This should show you the list of key pairs, with the one you just added.

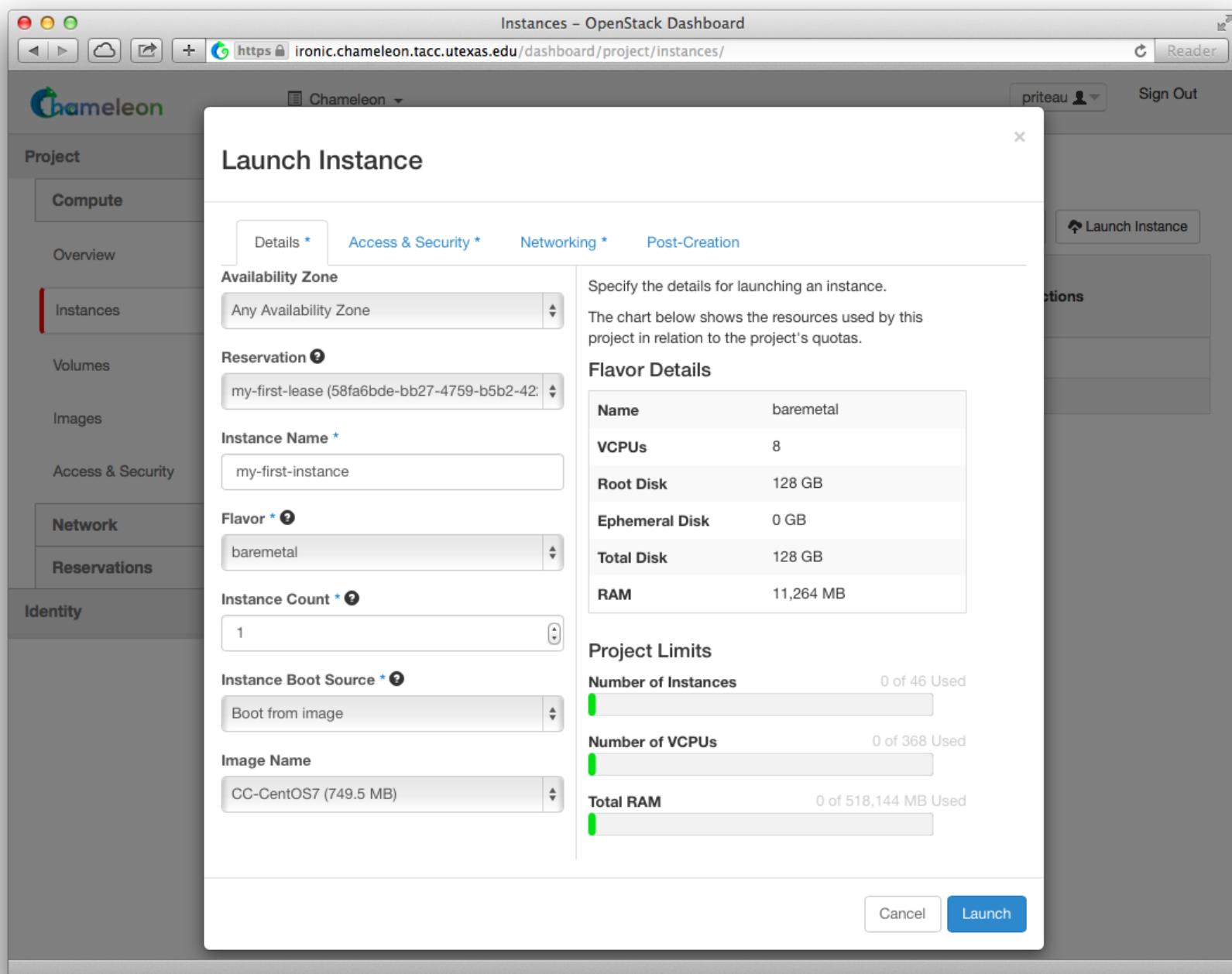


For those already familiar with OpenStack, note that Security Groups are not currently functioning. All instances are open to the outside world; Security Group rules are not respected. Chameleon staff are working to resolve this bug.

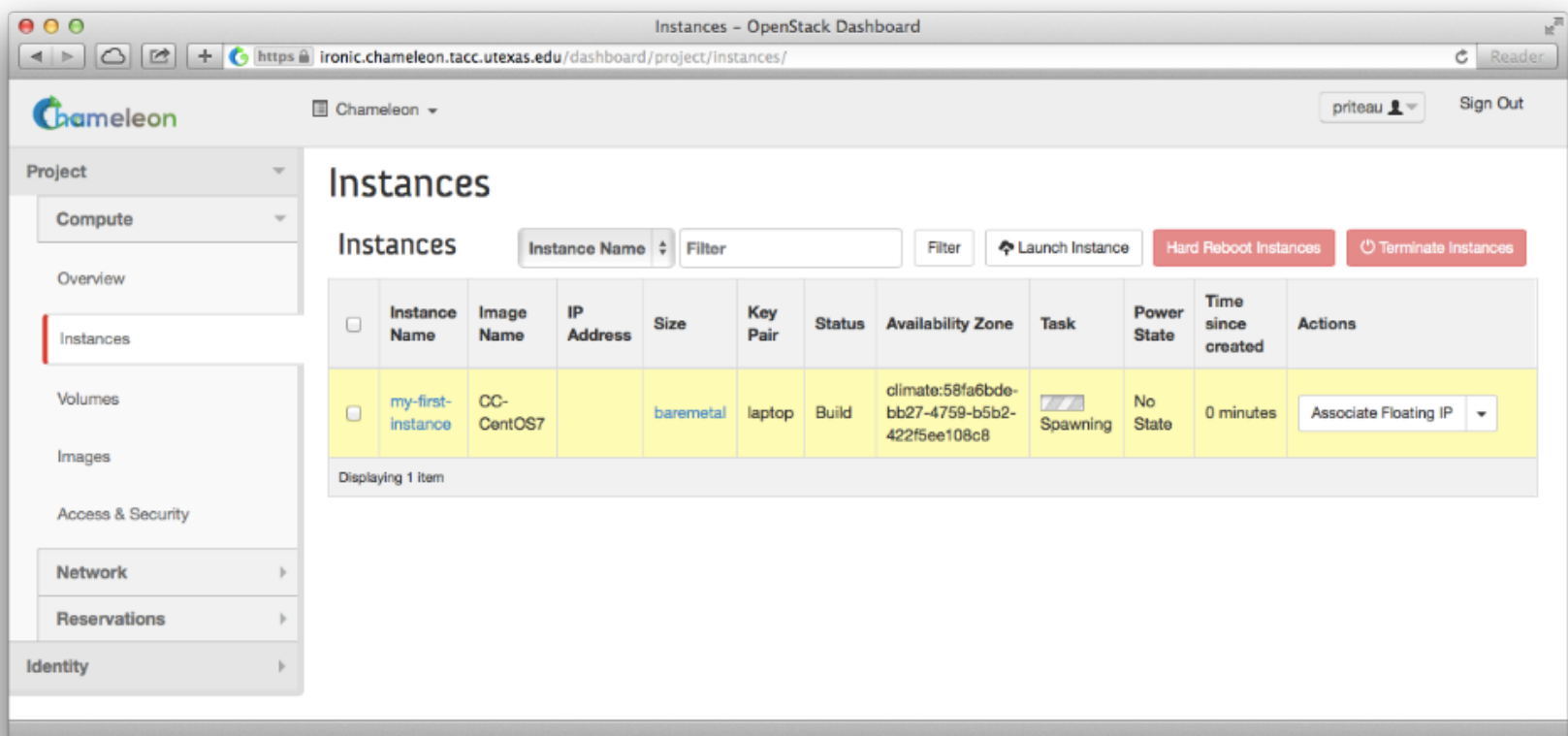
Now, go to the “Instances” panel.



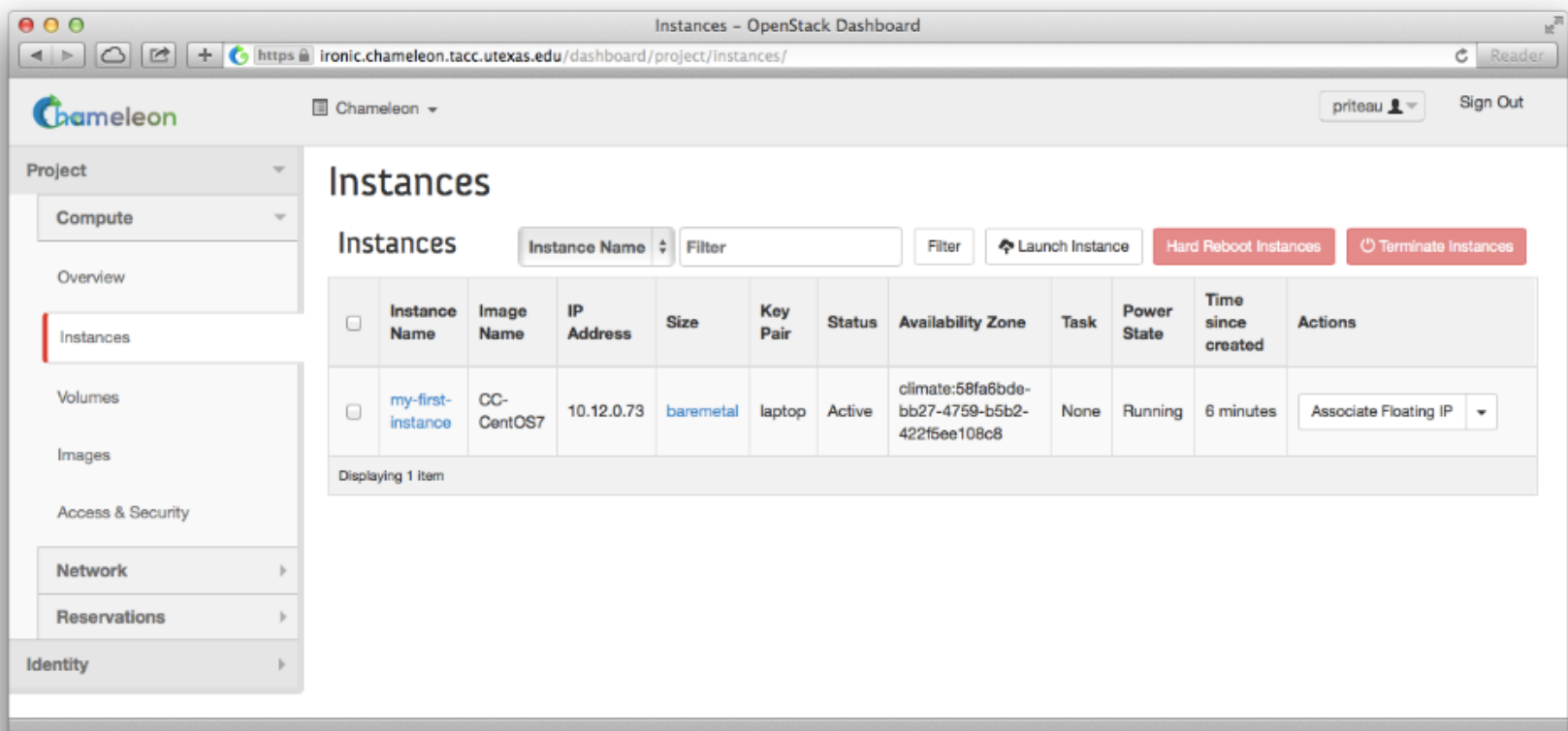
Click on the “Launch Instance” button in the top right corner. Select a reservation in the Reservation box, pick an instance name (in this example my-first-instance) and in the Image Name list select our default environment named CC-CentOS7. If you have multiple key pairs registered, you need to select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



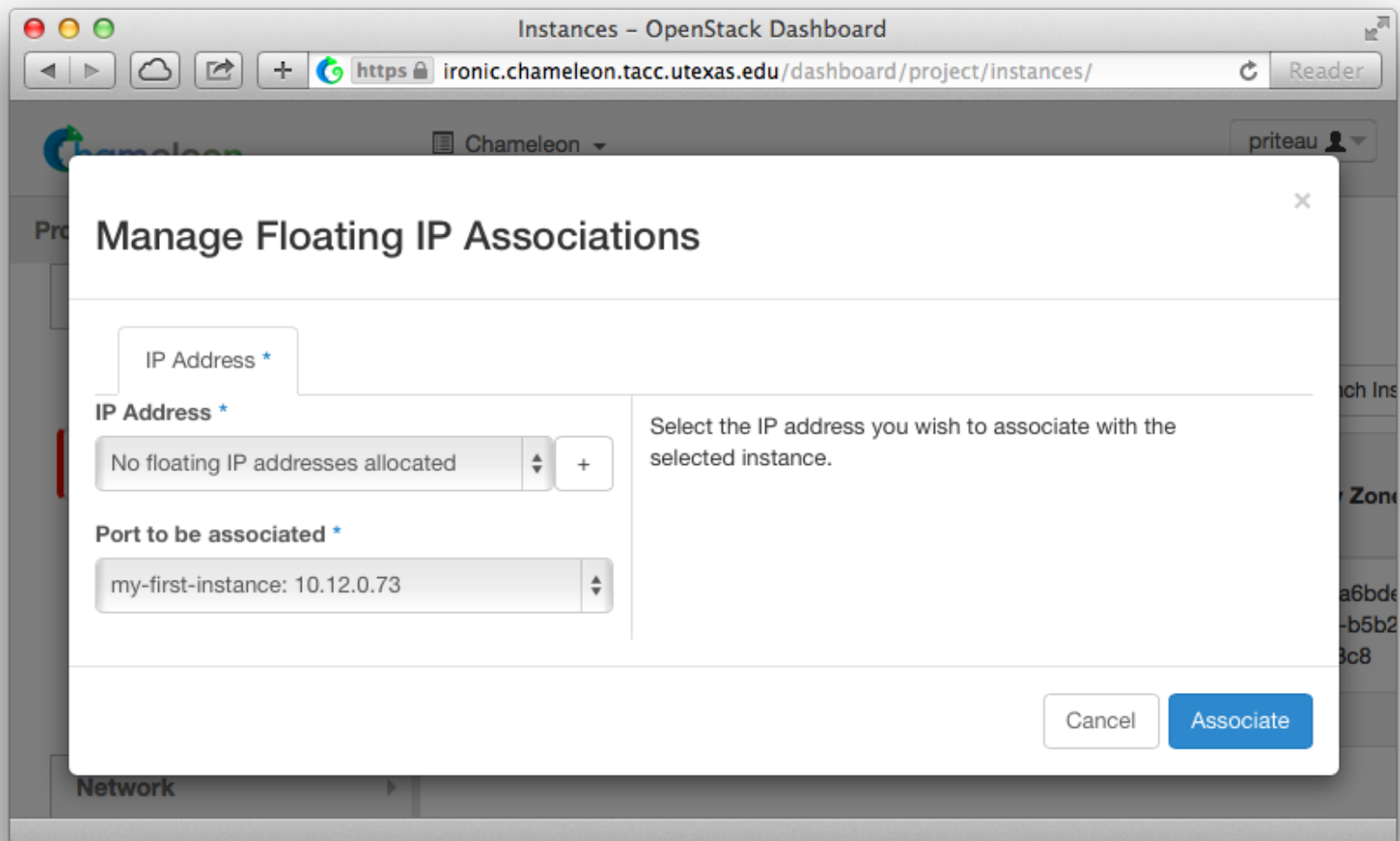
The instance will show up in the instance list, at first in Build status. It takes a few minutes to deploy the instance on bare-metal hardware and reboot the machine.



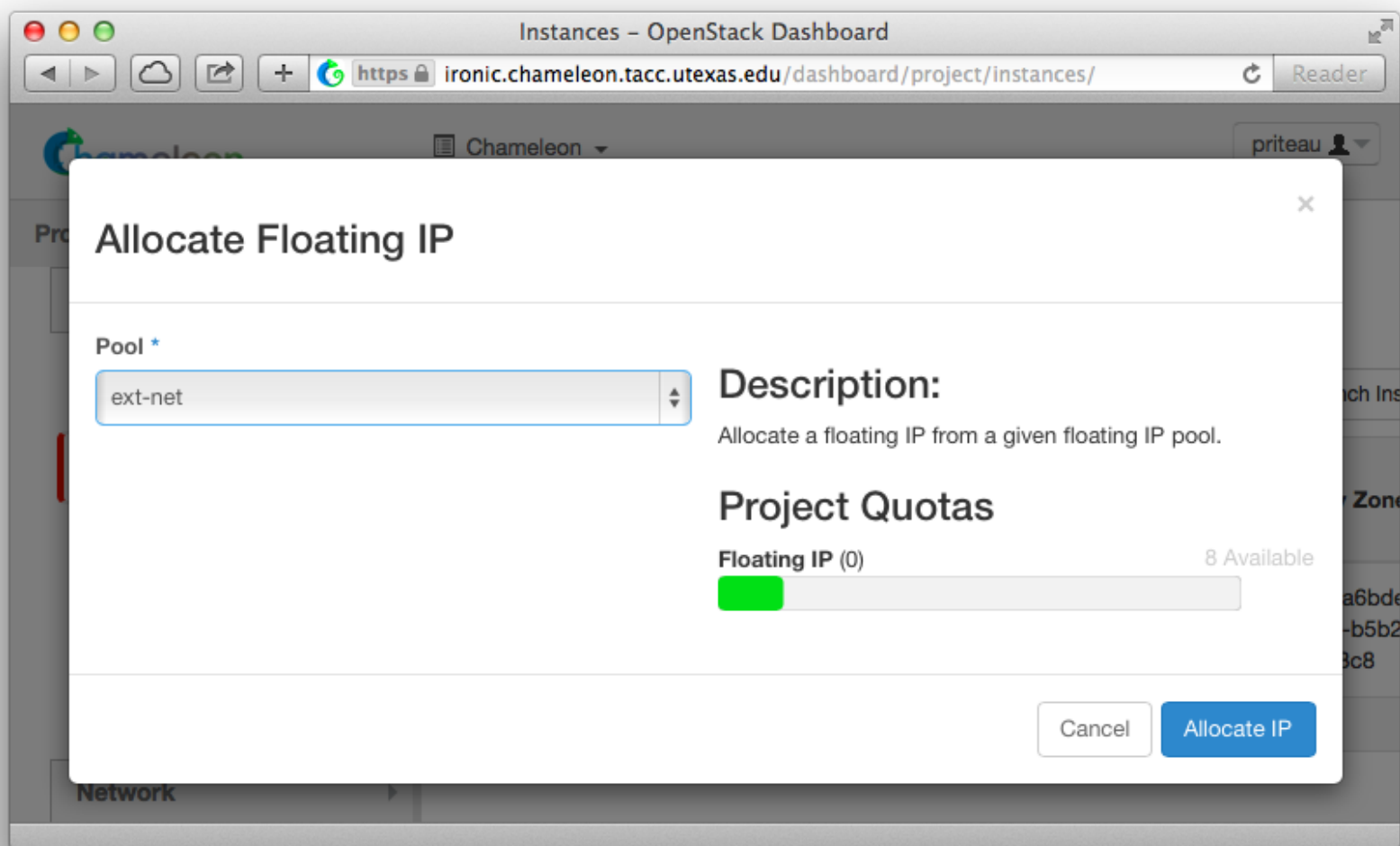
After a few minutes the instance should become in “Active” status and the Power State should be “Running.”



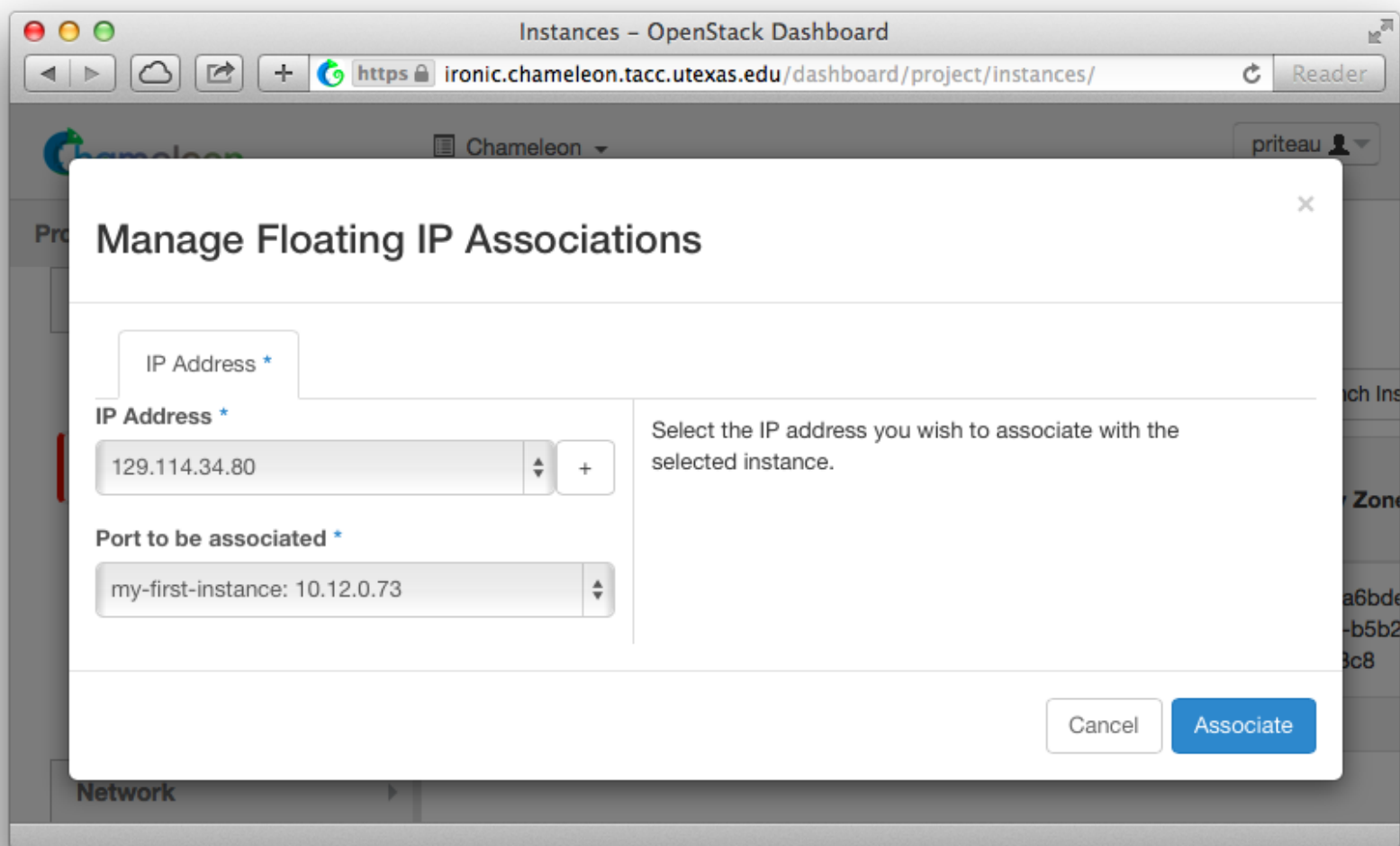
At this point the instance might still be booting: it might take a minute or two to actually be accessible on the network and accept SSH connections. In the meantime, you can attach a floating IP to the instance. Click on the “Associate Floating IP” button. You should get a screen like the one below:



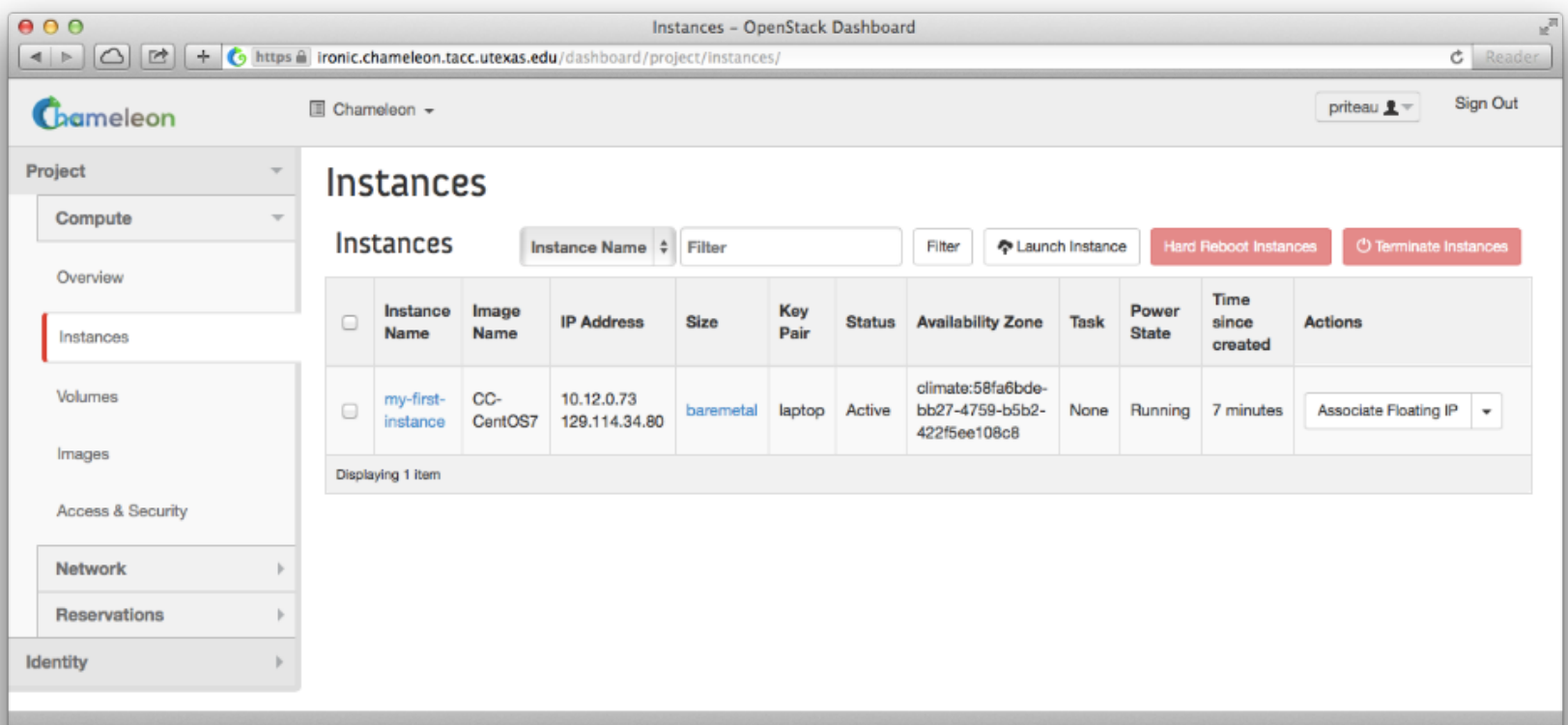
If there are no unused floating IP already allocated to your project, click on the + button. In the window that opens, select the ext-net pool if not already selected by default and click on the blue Allocate IP button.



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”.

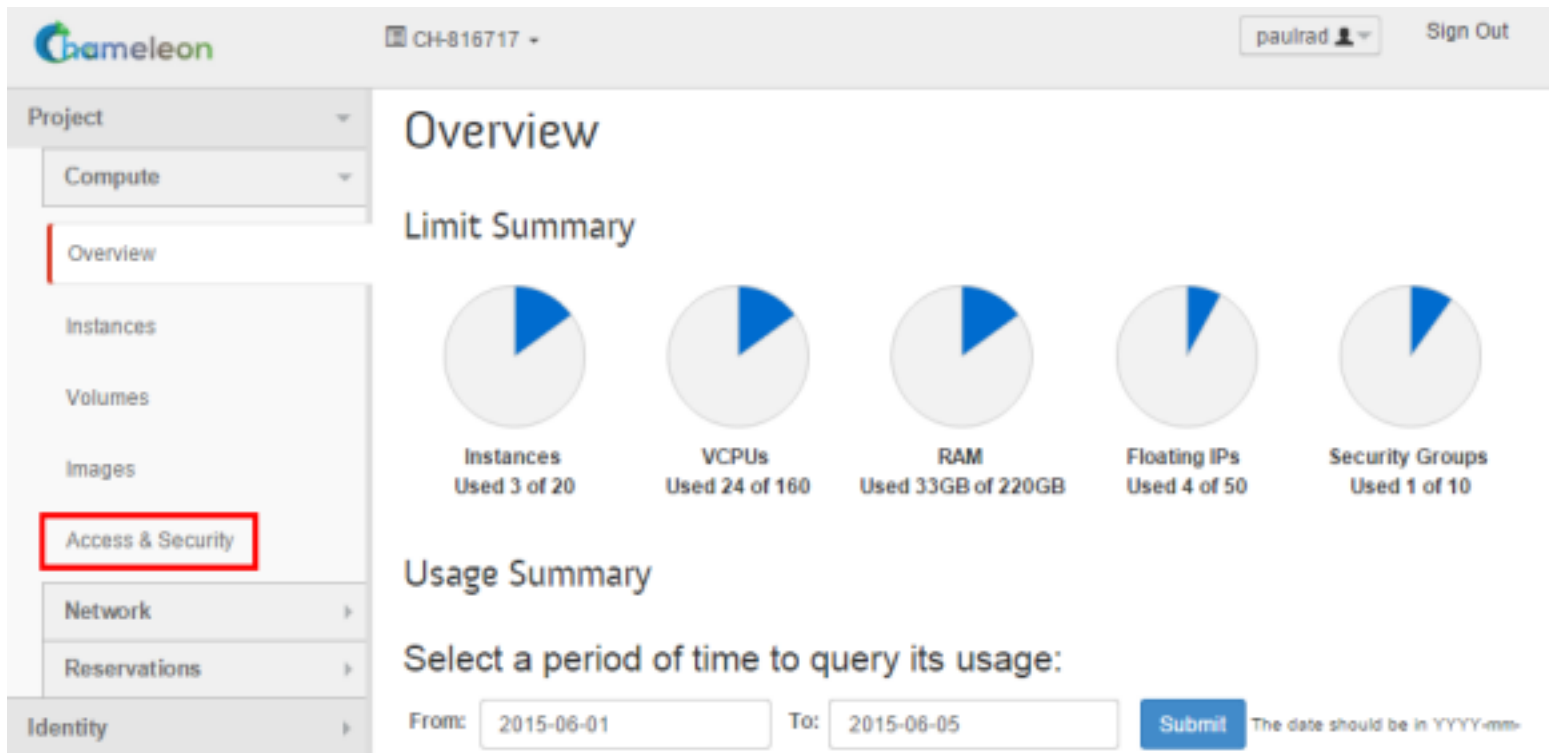


This should send you back to the instance list, where you can see the floating IP attached to the instance.



Step 3: Create a Chameleon Cloud Bare Metal Server

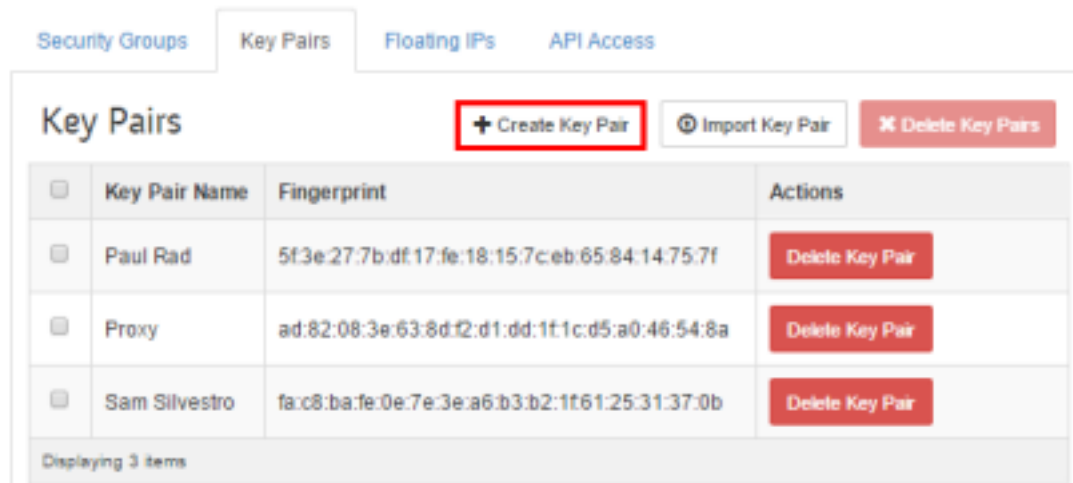
Log in to Ironic (<https://ironic.chameleon.tacc.utexas.edu/dashboard/project/instances/>) using the credentials we created previously. Before we begin, we must add or create a key pair to be used to gain access to any servers we create. If you do not presently have a key pair, first click on the “Access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



The screenshot shows the Chameleon Cloud dashboard. The left sidebar has a menu with 'Access & Security' highlighted. The main area is titled 'Overview' and shows a 'Limit Summary' with five pie charts representing usage of various resources. Below this is a 'Usage Summary' section with a date range selector and a 'Submit' button.

Resource	Used	Limit
Instances	3	20
VCPUs	24	160
RAM	33GB	220GB
Floating IPs	4	50
Security Groups	1	10

Access & Security



The screenshot shows the 'Access & Security' page with the 'Key Pairs' tab selected. A table lists existing key pairs. A red box highlights the '+ Create Key Pair' button.

Key Pair Name	Fingerprint	Actions
Paul Rad	5f3e27:7b:df:17:fe:18:15:7c:eb:65:84:14:75:7f	Delete Key Pair
Proxy	ad:82:08:3e:63:8d:f2:d1:dd:1f:1c:d5:a0:46:54:8a	Delete Key Pair
Sam Silvestro	fa:c8:ba:fe:0e:7e:3e:a6:b3:b2:1f:61:25:31:37:0b	Delete Key Pair

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	<div>Delete Key Pair</div>
<input type="checkbox"/>	Proxy	ad:82:08:3e:63:8d:f2:d1:dd:1f:1c:d5:a0:46:54:8a	<div>Delete Key Pair</div>
<input type="checkbox"/>	Sam Silvestro	fa:c8:ba:fe:0e:7e:3e:a6:b3:b2:1f:61:25:31:37:0b	<div>Delete Key Pair</div>

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

Identity

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	Sar Silv
<input type="checkbox"/>	server	CC-CentOS7	10.12.0.169 129.114.34.108	baremetal	Sar Silv

Next, click on the “Launch Instance” button.

Instances

Instance Name ▼		Filter		Filter		Launch Instance	Hard Reboot Instances			
<input type="checkbox"/>	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-4738-bf7b-41b88aa95ffc	None	Running	4 days, 22 hours
<input type="checkbox"/>	proxy	CC-CentOS7	10.12.0.183 129.114.34.108	baremetal	Sam Silvestro	Active	climate:0923ee8b-92ca-4738-bf7b-41b88aa95ffc	None	Running	4 days, 22 hours
<input type="checkbox"/>	server	CC-CentOS7	10.12.0.189 129.114.34.108	baremetal	Sam Silvestro	Active	climate:0923ee8b-92ca-4738-bf7b-41b88aa95ffc	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 (c0fec26-6765-4785-8af5-5c

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 Instances

2 of 20 Used

Number of VCPUs

16 of 160 Used

Total RAM

22,528 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

floating.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 ho
sts.
```

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