



Chameleon Cloud Tutorial

Getting Started with Chameleon Cloud

Program Solicitation # NSF 13-602

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

Getting Started with Chameleon Cloud

High Level Agenda

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.

Tutorial Action	Time Required
Step 1: Register for a Chameleon User Account You will learn how to register for your own Chameleon account, and how to utilize its basic features.	10 minutes
Step 2: Create a Sample Project To begin, we will walk through the Chameleon user interface capabilities, such as reservation, leasing, server provisioning, private/public IP addresses, networks, and more.	5 minutes
Step 3: Add Users to the Project To begin, we will walk through the Chameleon user interface capabilities, such as reservation, leasing, server provisioning, private/public IP addresses, networks, and more.	5 minutes
Step 4: Launch 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.	15 minutes

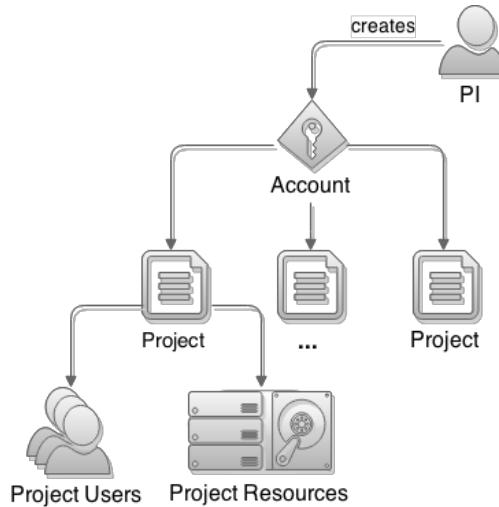
Prerequisites

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

- An SSH client (Windows users: download PuTTY from here: <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, **Go to the Chameleon Cloud homepage, located at: <https://www.chameleoncloud.org/>.**

The screenshot shows the Chameleon Cloud homepage. The header features the Chameleon logo and navigation links for Documentation, News, Talk, About, and a prominent 'Users' button. The main content area has a blue cloud graphic and the text: 'A configurable experimental environment for large-scale cloud research'. Below this are two sections: 'FutureGrid@Chameleon' and 'Getting Started'. The 'FutureGrid@Chameleon' section includes a note about transitioning from FutureGrid to Chameleon. The 'Getting Started' section provides a link to the 'Getting Started' page. At the bottom, there are news items: 'THE CHAMELEON TECHNOLOGY PREVIEW IS READY' (April 08, 2015) and 'THE CHAMELEON EARLY USER PROGRAM IS NOW OPEN!' (March 24, 2015). Logos for the Computation Institute, TACC, iCAIR, The Ohio State University, UTSA, and the University of Texas at Austin are displayed at the bottom.

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.

A configurable experimental environment for large-scale cloud research

[FutureGrid@Chameleon](#)

FutureGrid@Chameleon is a transitional phase allowing Chameleon users to use our legacy FutureGrid cluster, Alamo. New Chameleon hardware and capabilities will become available next year. Please see our project schedule for more information.

<https://www.chameleoncloud.org/register/>

[Getting Started](#)

See our [Getting Started page](#) for information on how to get an account, an allocation, and start using Chameleon. Users can currently try the new Chameleon capabilities using the technology preview or use virtual machines on our legacy clusters via FutureGrid@Chameleon.

Complete the “Contact Information” and “Account Information” forms. You will be given the option called “PI Eligibility”. The PI (or Principal Investigator) of an institute has the ability to create projects. Non-PI users can be added to a project, but cannot create their own projects. **When finished, click on “Save Profile”.** You will soon receive an email notification regarding account creation completion.

<p>Contact Information</p> <p>First name <input type="text"/></p> <p>Last name <input type="text"/></p> <p>Email address <input type="text"/></p> <p>Institution <input type="text"/></p> <p><input checked="" type="checkbox"/> My institution is not listed</p> <p>Country of Residence <input type="text"/></p> <p>Country of Citizenship <input type="text"/></p> <p>PI Eligibility <input checked="" type="checkbox"/> PI Eligible</p> <p>Faculty and Research Staff from U.S.-based institutions can request PI Eligibility on Chameleon.</p>	<p>Account Information</p> <p>Username <input type="text"/></p> <p>Usernames must be 3-8 characters in length, start with a letter, and can contain only lowercase letters, numbers, or underscore.</p> <p>Password <input type="password"/></p> <p>Confirm Password <input type="password"/></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><input type="button" value="Save Profile"/> <input type="button" value="Cancel"/></p>
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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 Chameleon website's header with links for Documentation, News, Talks, About, and Users. Below the header, a green banner displays the message: "Congratulations! Your account request has been received. Please check your email for account verification." A close button (X) is located at the top right of the banner. The main content area is titled "Email Confirmation". It contains instructions: "Almost finished! Enter the verification code that you received via email and the username you registered with to activate your account." Below these instructions is a text input field containing a long string of characters: "GPXadxYMPRGnLnziQuqaJpifLMqYPmQySWfrvJhiimfSKLFdiJ". There is also a placeholder text input field for the Chameleon Username. At the bottom of the form is a green "Verify" button.

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*

GPXadxYMPRGnLnziQuqaJpifLMqYPmQySWfrvJhiimfSKLFdiJ

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.

Step 2: Create a Sample Project

If not already there, **login to the Chameleon website, located at: <https://chameleoncloud.org/login/>.**

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

Login to Chameleon

Username*

Password*

Log in [Forgot your password?](#)

Upon successful

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

Chameleon Documentation News Talks About Hello, Paul Rad

Please Accept Chameleon User Terms and Conditions

- 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".
- I understand that non-compliance with the terms above will result in suspension of my account.

Accept [Print Terms & Conditions](#)

Each 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.**

Chameleon Documentation News Talks About

Dashboard Projects FutureGrid@Chameleon Outages Help Desk Profile

Dashboard

[Manage your Projects](#) [Help Desk Tickets](#) [Manage Your Account](#)

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

The screenshot shows the Chameleon web interface. At the top, there's a green header bar with the Chameleon logo, navigation links for Documentation, News, Talks, About, and a user profile for 'Hello, Paul Rad'. Below the header, a menu bar includes Dashboard, Projects (which is highlighted in blue), FutureGrid@Chameleon, Outages, Help Desk, and Profile. On the right side of the menu bar is a 'Create a Project' button. The main content area has a light blue background. A large, bold message 'You don't have any projects!' is centered. Below this message, it says 'FutureGrid@Chameleon' and provides instructions: 'At this time, Chameleon is supporting FutureGrid@Chameleon. If you are a former FutureGrid User, you can migrate your project to Chameleon.' At the bottom of this section is a blue button labeled 'Migrate a FutureGrid Project'. The overall layout is clean and modern.

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

The screenshot shows a modal dialog box titled 'Please Accept Project Lead Terms and Conditions'. Inside the dialog, there is a list of terms and conditions that the user must accept. At the bottom left is a green 'Accept' button, and at the bottom right is a 'Print Terms & Conditions' link. The background of the dialog is light blue, and the text is white or black for readability.

You will then need to **complete the “Create a New Project” form** by providing 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”**.



Documentation ▾ News Talks About ▾

Hello, Paul Rad ▾

Dashboard Projects FutureGrid@Chameleon Outages Help Desk Profile

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

CHJ00000X

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.**

Chameleon Documentation News Talks About

Dashboard Projects FutureGrid@Chameleon Outages Help Desk Profile

Your project has been created!

training | CH-816738

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

Project Users

Add a User to Project*

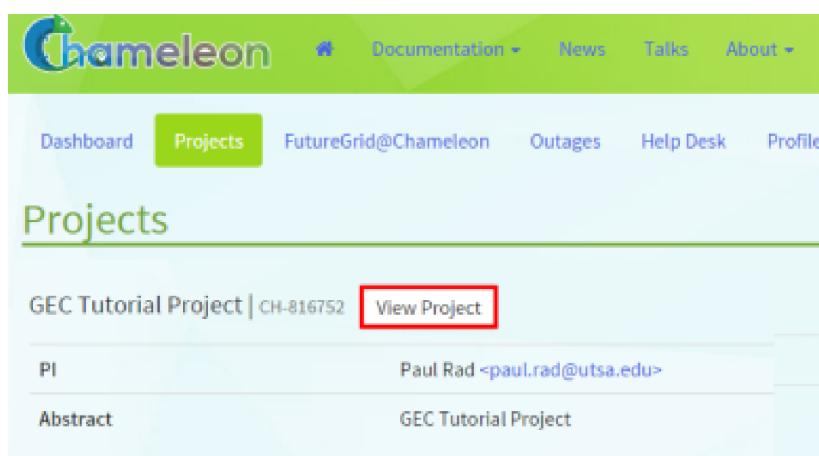
Step 3: Add Users to the Project

If you have not done so already, as a PI user, login to the Chameleon website, located at <https://chameleoncloud.org/login/>.

On your Dashboard, click on the “Manage Your Projects” button.



Click on the desired project’s “View Project” button.



Scroll down to view the “Project Users” area. In the textbox labeled “Add a User to Project”, enter the **username** of the user you would like to add to the project, then click the “Add user” button.

GEC Tutorial Project | CH-816752

PI	Paul Rad < paul.rad@utsa.edu >, University of Texas at San Antonio
Abstract	GEC Tutorial Project
Type	Research
Field of Science	COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)
Allocation	Chameleon Pending

Project Users

Add a User to Project

Current Users

paulrad (PI)

Repeat this process as necessary until all desired users have been added to the project.

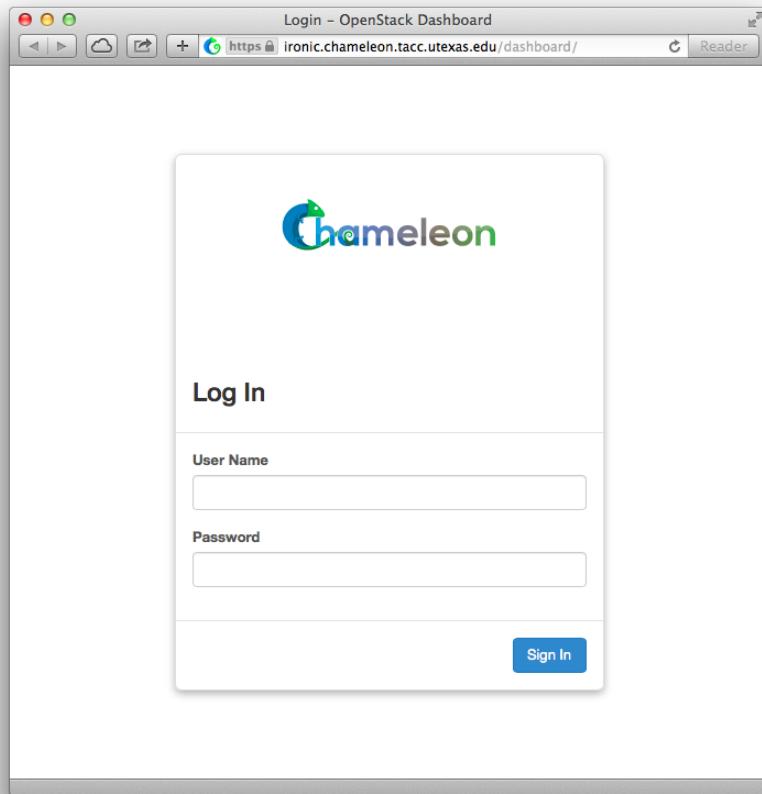
Step 4: Launch a Chameleon Cloud Bare Metal Server

In this section, we will show you how to launch your own bare metal servers on Chameleon. 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:

4.1) Create a reservation lease

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.

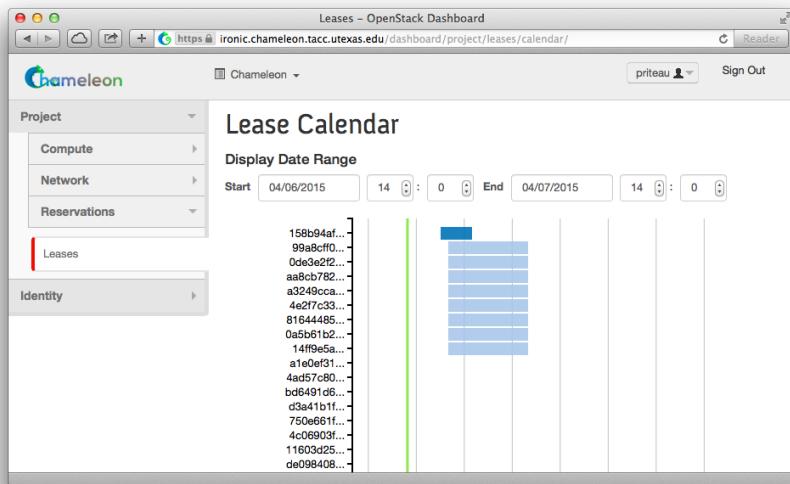
To begin, **login to Chameleon Resource Provisioning Dashboard, located at <https://ironic.chameleon.tacc.utexas.edu/dashboard/auth/login/>**



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”.

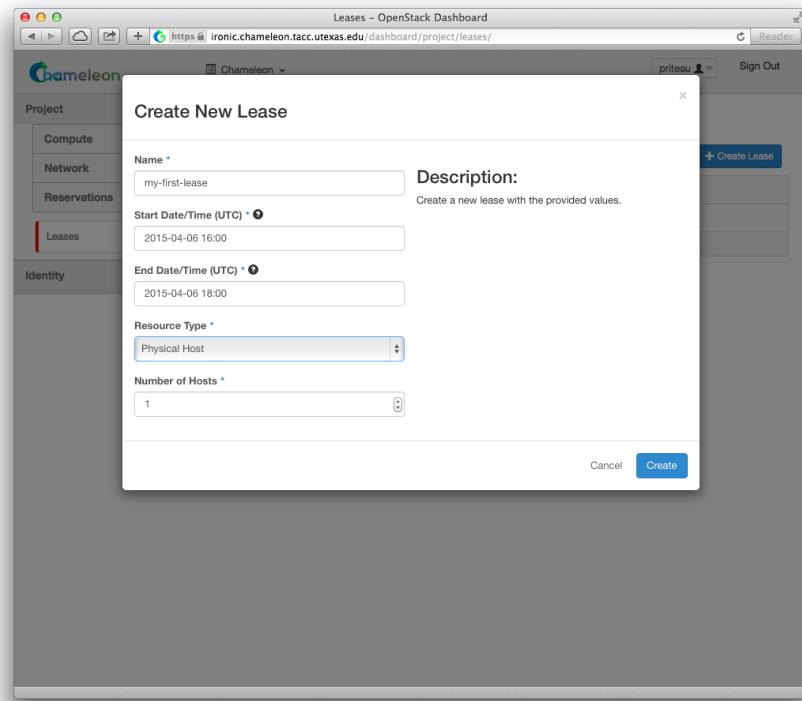
To discover when resources are available, you may access the lease calendar. This will display a Gantt chart of the reservations which allows you to find when resources are available. The Y axis represents the different physical nodes in the system and the X axis represents time.



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:

Name *	<input type="text"/>	Description:
Start Date/Time (UTC) *	<input type="text"/>	Create a new lease with the provided values.
End Date/Time (UTC) *	<input type="text"/>	
Resource Type *	<input type="text"/>	
Number of Hosts *	<input type="text"/> 1	

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. **After completing the “Create New Lease” form, click on the “Create” button.**



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.

The screenshot shows a web browser window titled "Lease Detail – OpenStack Dashboard". The URL in the address bar is <https://ironic.chameleon.tacc.utexas.edu/dashboard/project/leases/c9c980bb-a13b-4a89-a8ad-ebc8f6797f1c/>. The main content area is titled "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
physicalhost
Id: 59fa6bde-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
<i>Status: Undone</i>
<i>Created at: -</i>
<i>Updated at: -</i>
end_lease
<i>Status: Undone</i>
<i>Created at: -</i>
<i>Updated at: -</i>
Reservations
physical:host
<i>Id: 58fa6bde-bb27-4759-b5b2-422f5ee108c8</i>
<i>Status: Pending</i>
<i>Resource Id: 135</i>
<i>Created at: -</i>
<i>Updated at: -</i>

4.2) Import Public Key Pair

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. **Click on the “Access & Security” section, then click the “Key Pairs” tab.**

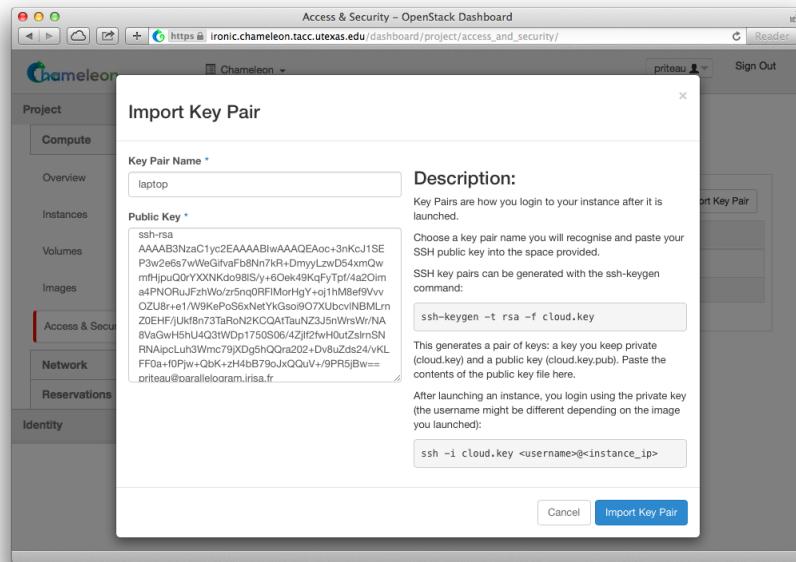
The screenshot shows the Chameleon OpenStack Dashboard with the URL https://ironic.chameleon.tacc.utexas.edu/dashboard/project/access_and_security/. The left sidebar has a 'Project' dropdown set to 'Compute' with options for Overview, Instances, Volumes, Images, and Access & Security (which is highlighted with a red box). Under Access & Security, there are links for Network, Reservations, and Identity. The main content area is titled 'Access & Security' and contains tabs for Security Groups, Key Pairs (which is selected and highlighted in blue), Floating IPs, and API Access. The 'Key Pairs' tab displays a table with columns 'Key Pair Name', 'Fingerprint', and 'Actions'. A message at the top right of the table says '+ Create Key Pair' and 'Import Key Pair'. Below the table, it says 'No items to display.' and 'Displaying 0 items'.

Here you can either get Chameleon 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"](#).

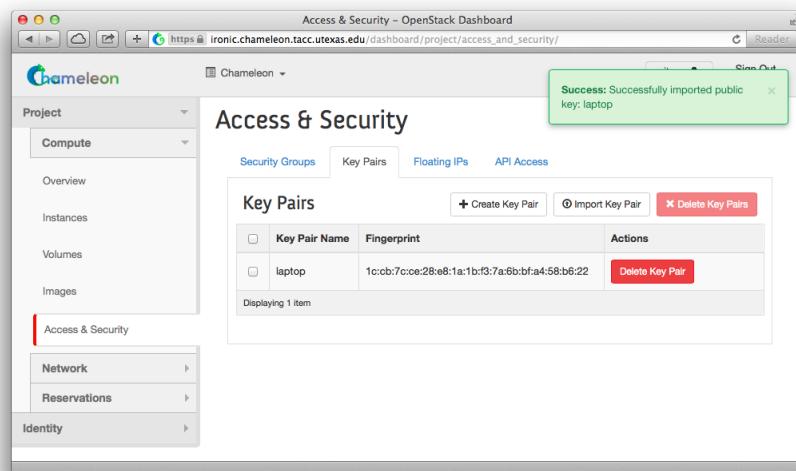
Enter a name for the key pair, for example "laptop". In the "Public Key" box, copy the content of your SSH public key. Typically it will be at `~/.ssh/id_rsa.pub`. To create your own key pair, execute the command:

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

Copy the contents of the `cloud.key.pub` file, then simply paste into the "Public Key" box and click on "Import Key Pair".



You should now see a list of known key pairs, with the one you just added.



4.3) Launch an Instance using Public Key Pair

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

The screenshot shows the Instances page with a sidebar on the left containing tabs for Overview, Instances (which is selected and highlighted with a red box), Volumes, Images, Access & Security, Network, and Reservations. The main area displays a table of instances:

Instance Name	Image Name	IP Address	Size	Key Pair
hadoop-test	CC-CentOS7	10.12.0.184 129.114.34.107	baremetal	Pub
proxy	CC-CentOS7	10.12.0.183 129.114.34.106	baremetal	Sam Silvestro
server	CC-CentOS7	10.12.0.169 129.114.34.108	baremetal	Sam Silvestro

Next, click on the “Launch Instance” button.

The screenshot shows the Instances page with the Launch Instance button highlighted with a red box. The table of instances is identical to the one above:

Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created
hadoop-test	CC-CentOS7	10.12.0.184 129.114.34.107	baremetal	Proxy	Active	climate:0823ee8b-02ca-4738-bf7b-41b88aa05fffc	None	Running	4 days, 22 hours
proxy	CC-CentOS7	10.12.0.183 129.114.34.106	baremetal	Sam Silvestro	Active	climate:0823ee8b-02ca-4738-bf7b-41b88aa05fffc	None	Running	4 days, 22 hours
server	CC-CentOS7	10.12.0.169 129.114.34.108	baremetal	Sam Silvestro	Active	climate:0823ee8b-02ca-4738-bf7b-41b88aa05fffc	None	Running	1 week, 2 days

Create a Chameleon server with the following attributes.

1. Instance name: **test-<your name>**
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 (c0fecd26-6765-4785-8af5-5e)

Instance Name *
Hadoop-test

Flavor *
baremetal

Instance Count *
1

Instance Boot Source *
Boot from image

Image Name
CC-CentOS7 (749.5 MB)

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 *
 +

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

Security Groups *
 default

Cancel Launch

Your Chameleon Cloud server will begin building.

4.4) Assign Floating IP for Public Access

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.

The screenshot shows a user interface titled "Manage Floating IP Associations". A dropdown menu is open under the heading "IP Address *". The menu contains the following options:

- Select an IP address
- 129.114.34.107
- 129.114.34.109** (This option is highlighted with a blue selection bar)
- hadoop-10.12.0.175

To the right of the dropdown, there is a descriptive text: "Select the IP address you wish to associate with the selected instance." At the bottom right of the interface are two buttons: "Cancel" and "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 (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.
[cc@Hadoop-test ~]$
```

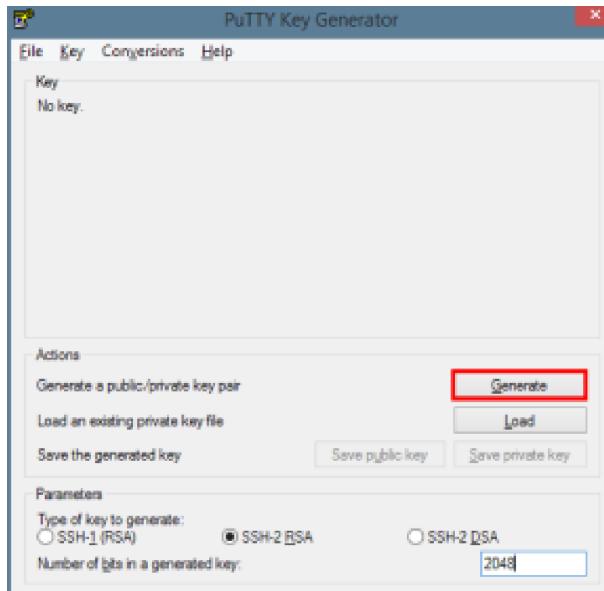
Ensure you are logging in using the cc account on any servers you create using this method.

Appendix A: Generating and Using SSH Key Pairs on Windows Platforms

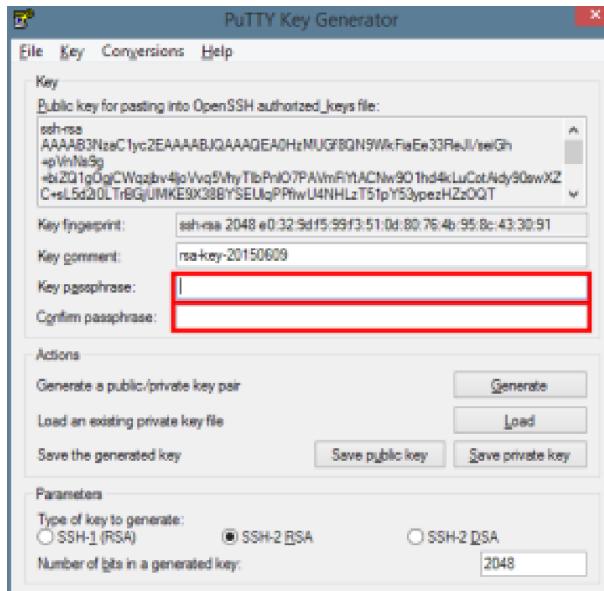
First, we will need to download tools to generate our key pair, as well as an SSH client that can make use of them. These tools are called PuTTYGen and PuTTY, respectively.

The location to download PuTTYGen is: <http://the.earth.li/~sgtatham/putty/latest/x86/puttygen.exe>
The location to download PuTTY is: <http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe>

Download and run the PuTTYGen executable:

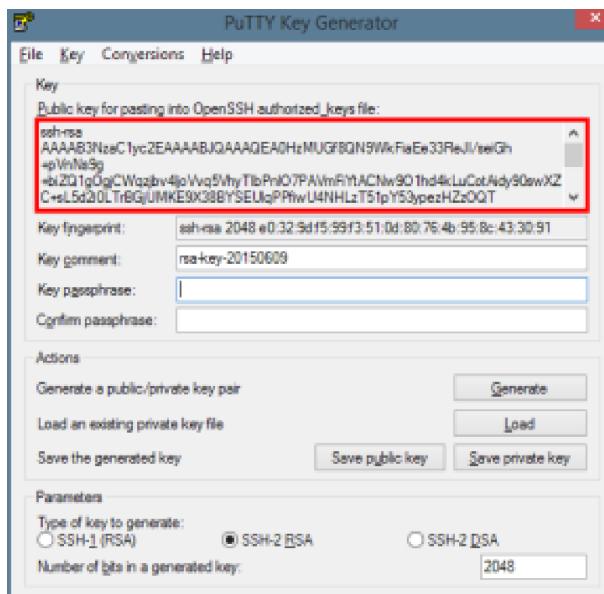


Click on the “Generate” button and move your mouse as indicated in order to generate enough random movement with which to help create your new key pair. When the process has completed, you may enter a password into the “Key passphrase” input box in order to protect your private key.

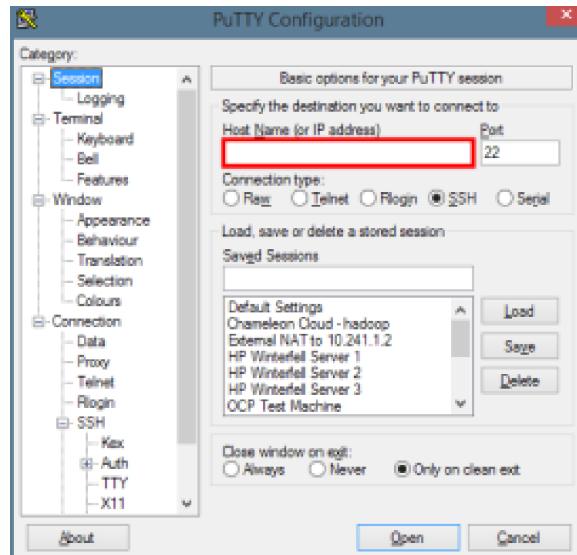


Click on the “Save private key” button and save this file to a location you can easily recall later.

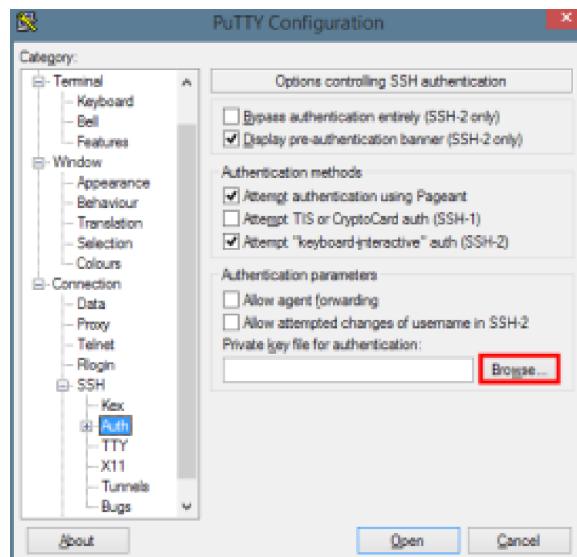
Copy the text in the “Public key for pasting into OpenSSH authorized_keys file:” input field. This is your public key that will be input into the Chameleon cloud web interface.



To connect to a Chameleon server, download and execute the PuTTY tool. Enter the public IP address into the “Host Name (or IP address)” input box.



Next, in order to specify a private key file, click on the Connection -> SSH -> Auth menu item on the left. Click on the “Browse” button and select your private key file.



Finally, click the “Open” button to connect using this key.