TEXAS ADVANCED COMPUTING CENTER

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TEXAS
The University of Texas at Austin

# Cloud Computing

A Basic Introduction to
TACC Resources

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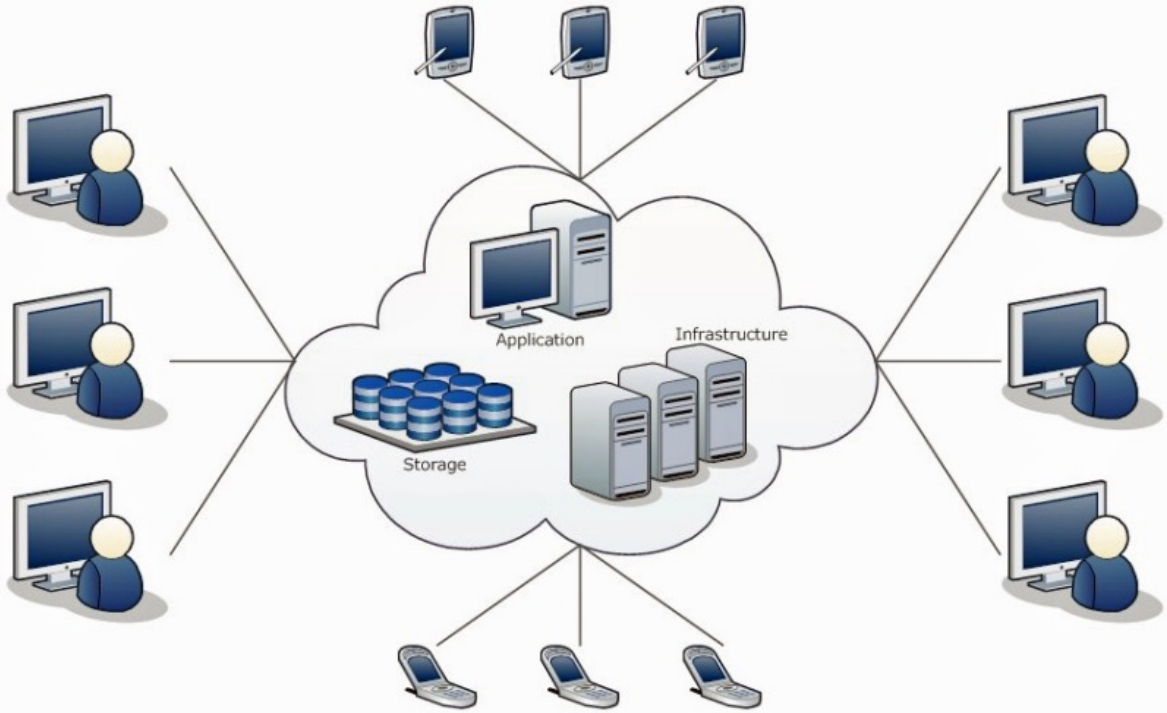
# Overview

- What is Cloud Computing
- What Can I Use It For
- Choosing Systems
- Images vs. Bare Metal
- Using the Resources

# What is a Cloud?

A “cloud” is a computer system that provides users with shared access to on-demand computing resources via the internet.



# Why is it Useful?

- Resource Utilization
- Scalability and Elasticity
- Reproducibility by way of Programmability
- Reliability through redundancy

# Cloud vs. HPC

Cloud

- Availability
- Multi-level API Interactions
- On-demand/Interactive Use
- Using Commodity Components

HPC

- Utilization
- Capability or Capacity Science
- Checkpoint/Restart I/O
- Memory/Network Bandwidth & Latency

# Who Uses Clouds?

System Administrators

- Help automate operations

Software Developers

- Build applications on cloud servers and platforms

Computational Scientists

- Write codes to analyze scientific data that resides in the cloud

# Service Models

Infrastructure-as-a-service (IaaS)

- Virtual servers, networks, firewalls, etc. (AWS, Azure)

Platform-as-a-service (PaaS)

- Deploy application without managing virtual servers (Google App Engine, Heroku)

Software-as-a-service (SaaS)

- Ready to use software applications (Gmail, Office365)

Functions-as-a-service (FaaS)

- Run on demand without knowing the infrastructure (hook.io, AWS Lambda)

# IaaS with Virtual Machines

Emulations

- Gives the appearance of any typical personal machine
- Simulates architectures

Operating Systems

- Generally Linux in scientific communities but proprietary ones available through branded IaaS options

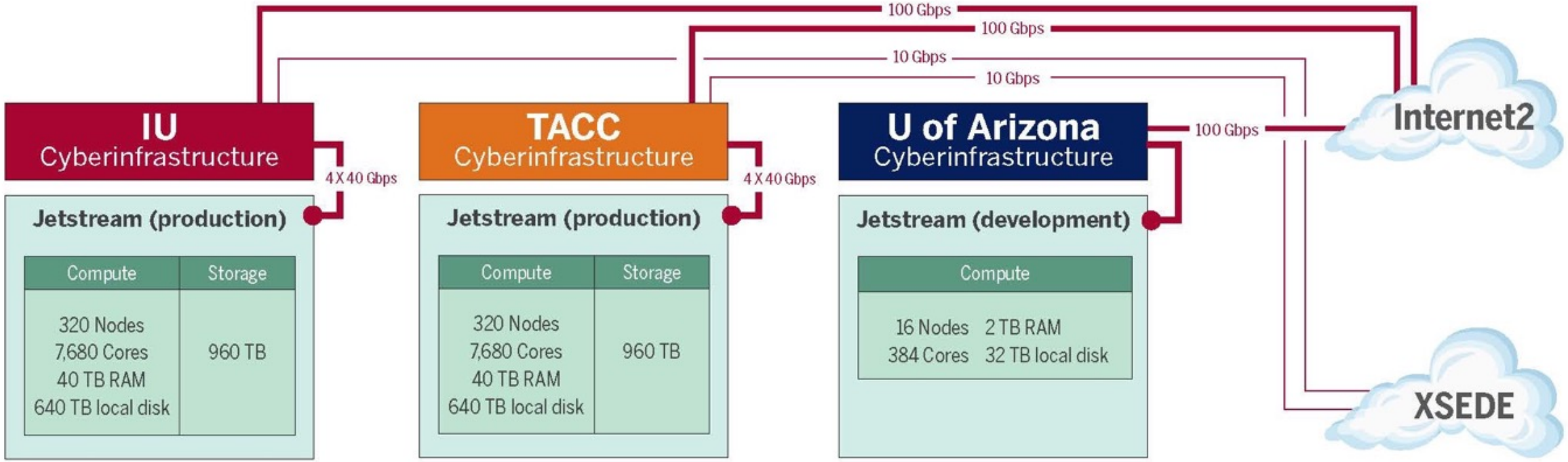
Software

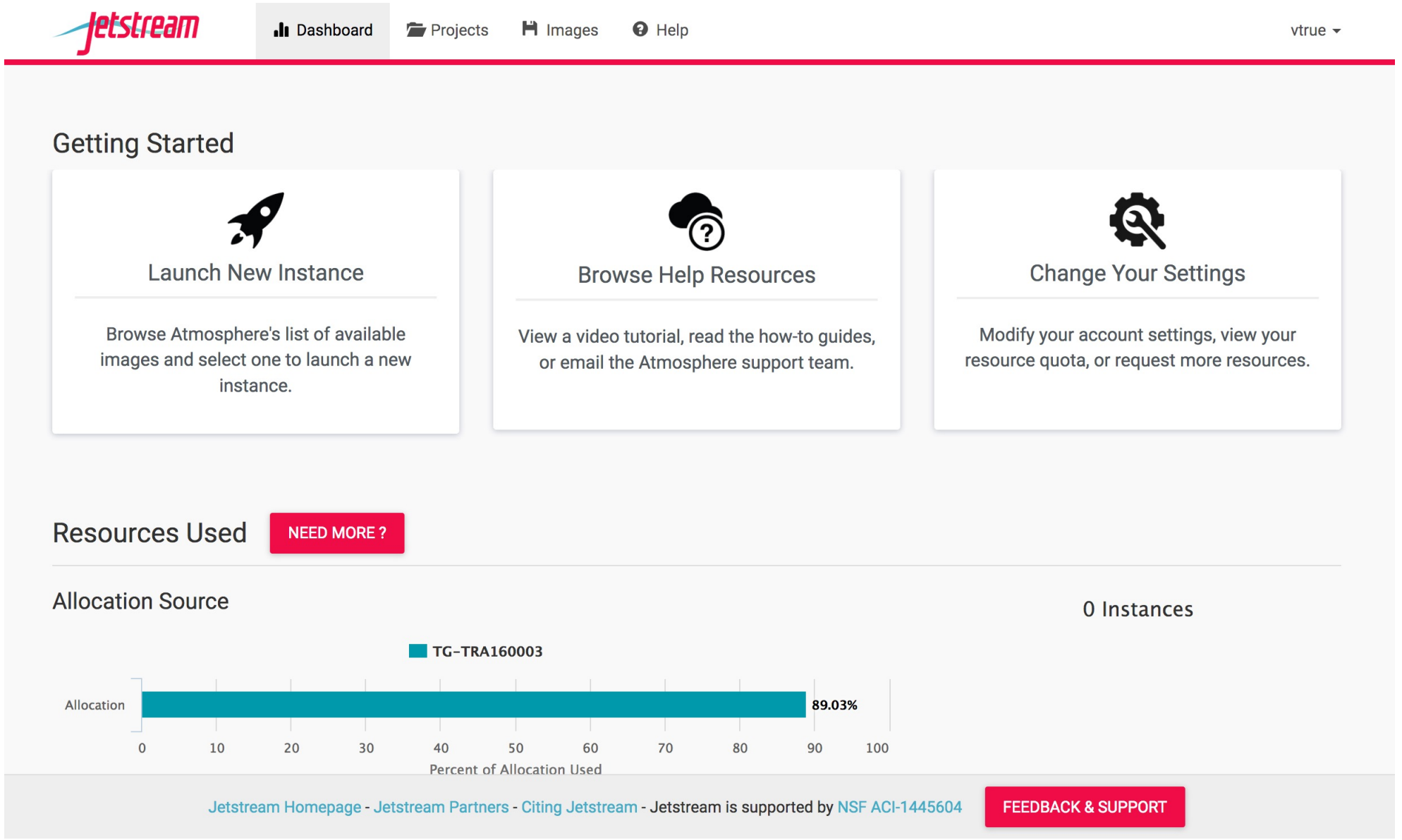
- Allows for installation of software in a way that generally doesn't require building from the binary

# Jetstream

- NSF funded production cloud facility
- On-demand interactive computing and analysis
- Configurable environments
- User-friendly, widely accessible cloud environment
- Library of preconfigured virtual machines

# Architecture Overview




Jetstream
Dashboard
Projects
Images
Help
vtrue
Getting Started
Launch New Instance
Browse Atmosphere's list of available images and select one to launch a new instance.
Browse Help Resources
View a video tutorial, read the how-to guides, or email the Atmosphere support team.
Change Your Settings
Modify your account settings, view your resource quota, or request more resources.
Resources Used
NEED MORE ?
Allocation Source
0 Instances
TG-TRA160003
Allocation
89.03%
0
10
20
30
40
50
60
70
80
90
100
Percent of Allocation Used
Jetstream Homepage - Jetstream Partners - Citing Jetstream - Jetstream is supported by NSF ACI-1445604
FEEDBACK & SUPPORT

# Virtual Machines

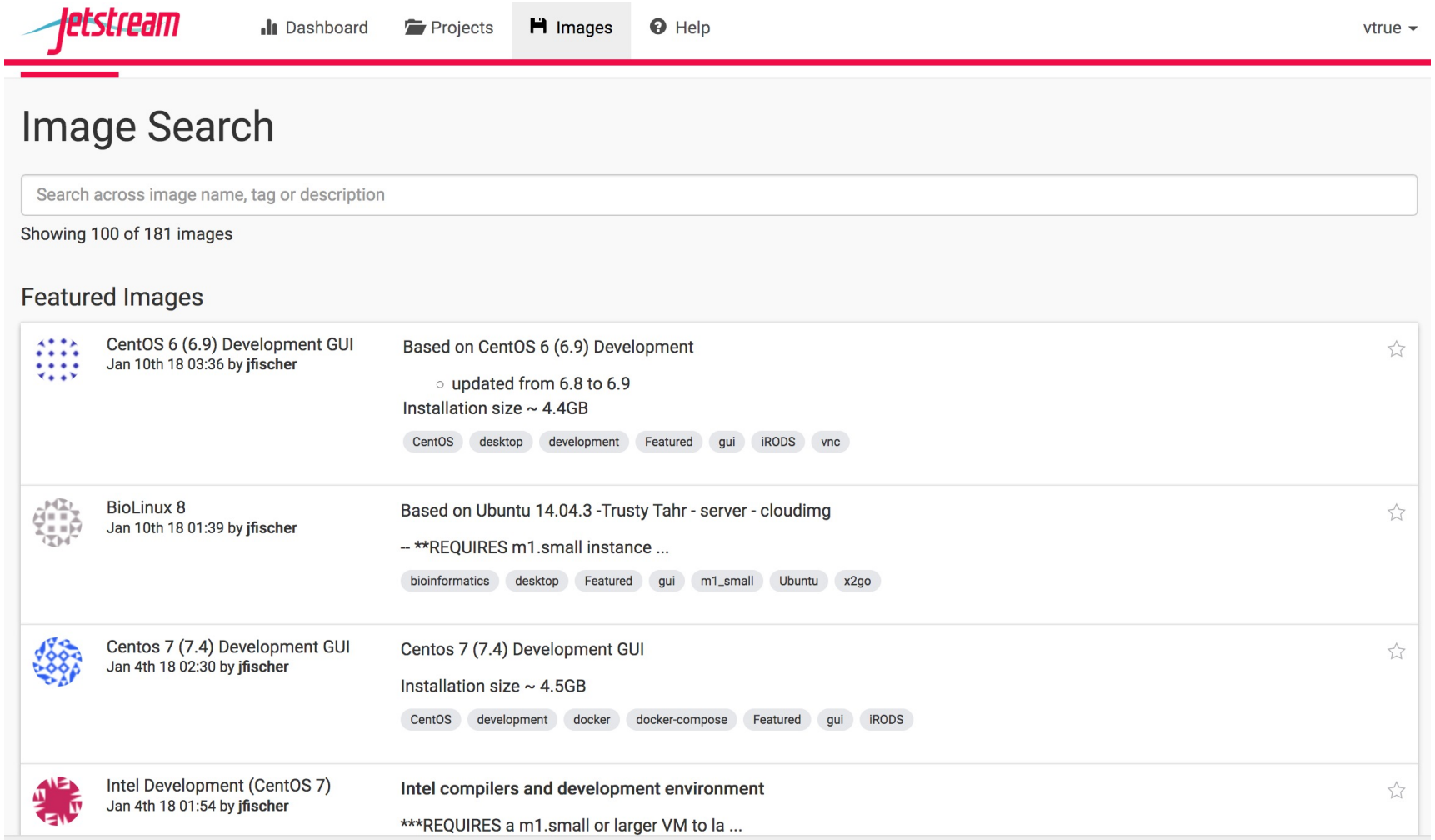
- These configurations are available when choosing a VM.
- You should always request the smallest VM size that can accommodate your work.
- Local storage is ephemeral and will be lost when your session dies.
- For long term storage you will need an XSEDE-allocated Volume.

| VM Size | vCPUs | RAM (GB) | Local Storage (GB) | SU cost per hour* | Can be saved as an *image*? |
|---|---|---|---|---|---|
| m1.tiny | 1 | 2 | 8 | 1 | ✔ yes |
| m1.small | 2 | 4 | 20 | 2 | ✔ yes |
| m1.medium | 6 | 16 | 60 | 6 | ✔ yes |
| m1.large | 10 | 30 | 60 | 10 | ✔ yes |
| m1.xlarge | 24 | 60 | 60 | 24 | ✔ yes |
| m1.xxlarge | 44 | 120 | 60 | 44 | ✔ yes |
| s1.large | 10 | 30 | 120 | 10 | ✘ No |
| s1.xlarge | 24 | 60 | 240 | 24 | ✘ No |
| s1.xxlarge | 44 | 120 | 480 | 44 | ✘ No |

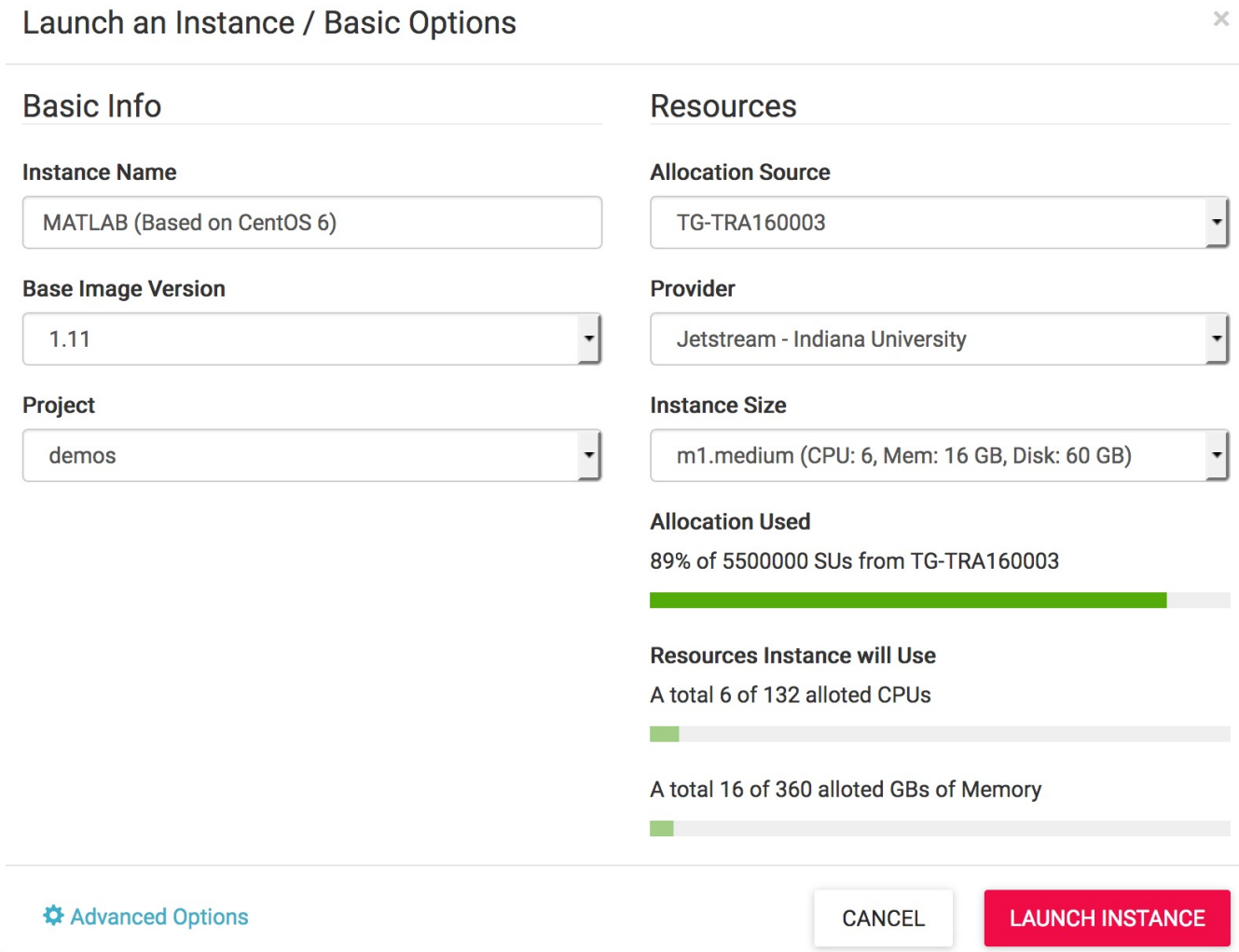
**This allocation information may be subject to changes in the future.**

***Please note that s1.* based customized instances will NOT be able to be used to create images in Atmosphere.***

# Images


jetstream
Dashboard
Projects
Images
Help
vtrue
Image Search
Search across image name, tag or description
Showing 100 of 181 images
Featured Images
CentOS 6 (6.9) Development GUI
Jan 10th 18 03:36 by jfischer
Based on CentOS 6 (6.9) Development
updated from 6.8 to 6.9
Installation size ~ 4.4GB
CentOS desktop development Featured gui iRODS vnc
BioLinux 8
Jan 10th 18 01:39 by jfischer
Based on Ubuntu 14.04.3 -Trusty Tahr - server - cloudimg
-- **REQUIRES m1.small instance ...
bioinformatics desktop Featured gui m1_small Ubuntu x2go
Centos 7 (7.4) Development GUI
Jan 4th 18 02:30 by jfischer
Centos 7 (7.4) Development GUI
Installation size ~ 4.5GB
CentOS development docker docker-compose Featured gui iRODS
Intel Development (CentOS 7)
Jan 4th 18 01:54 by jfischer
Intel compilers and development environment
***REQUIRES a m1.small or larger VM to la ...

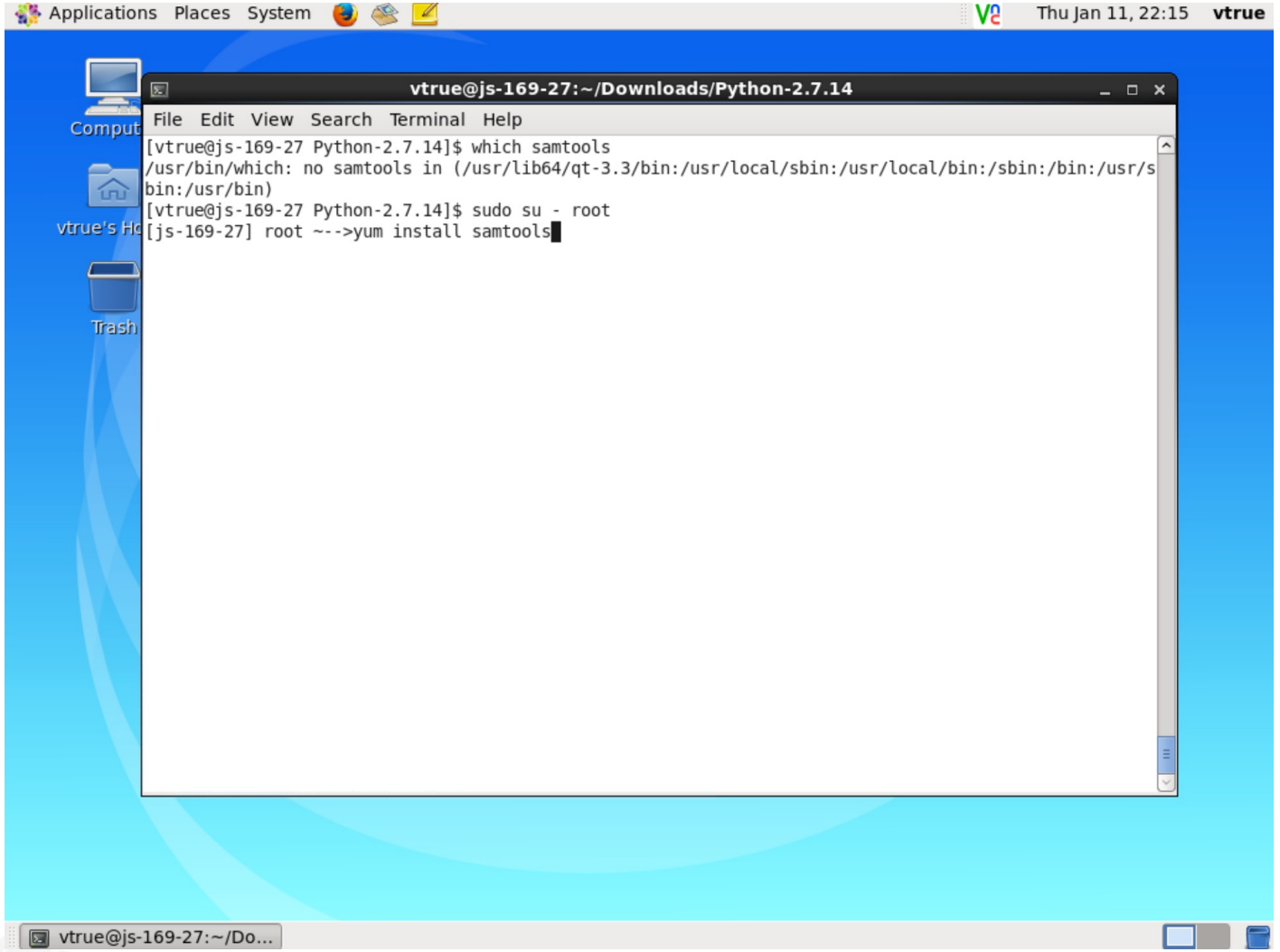
# Images cont.


Launch an Instance / Basic Options
Basic Info
Instance Name
MATLAB (Based on CentOS 6)
Base Image Version
1.11
Project
demos
Resources
Allocation Source
TG-TRA160003
Provider
Jetstream - Indiana University
Instance Size
m1.medium (CPU: 6, Mem: 16 GB, Disk: 60 GB)
Allocation Used
89% of 5500000 SUs from TG-TRA160003
Resources Instance will Use
A total 6 of 132 alloted CPUs
A total 16 of 360 alloted GBs of Memory
Advanced Options
CANCEL
LAUNCH INSTANCE

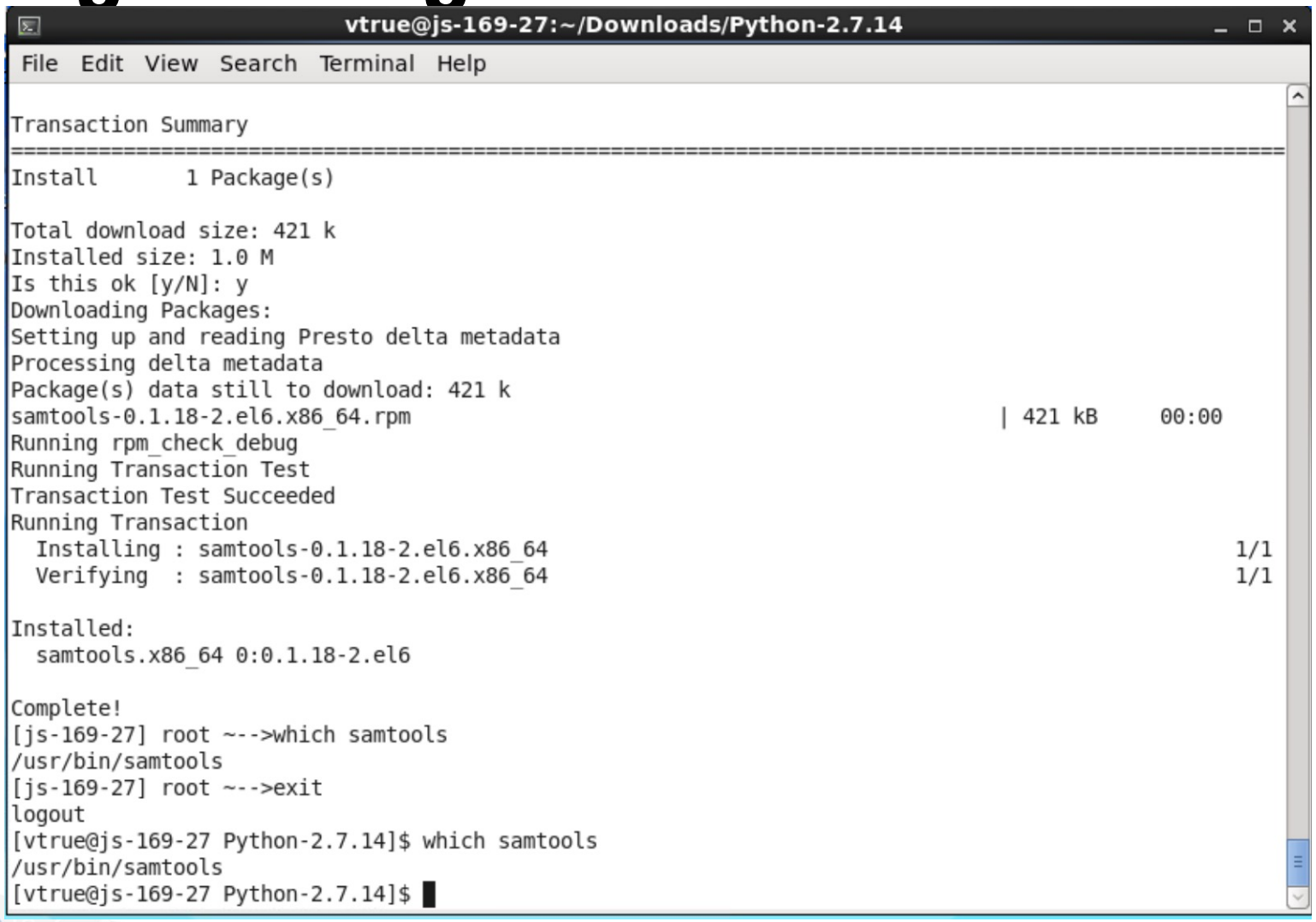
# Images cont.


Applications
Places
System
Wed Jan 10, 22:25
vtrue
Computer
vtrue's Home
Trash
Matlab
CYVERSE
Atmosphere

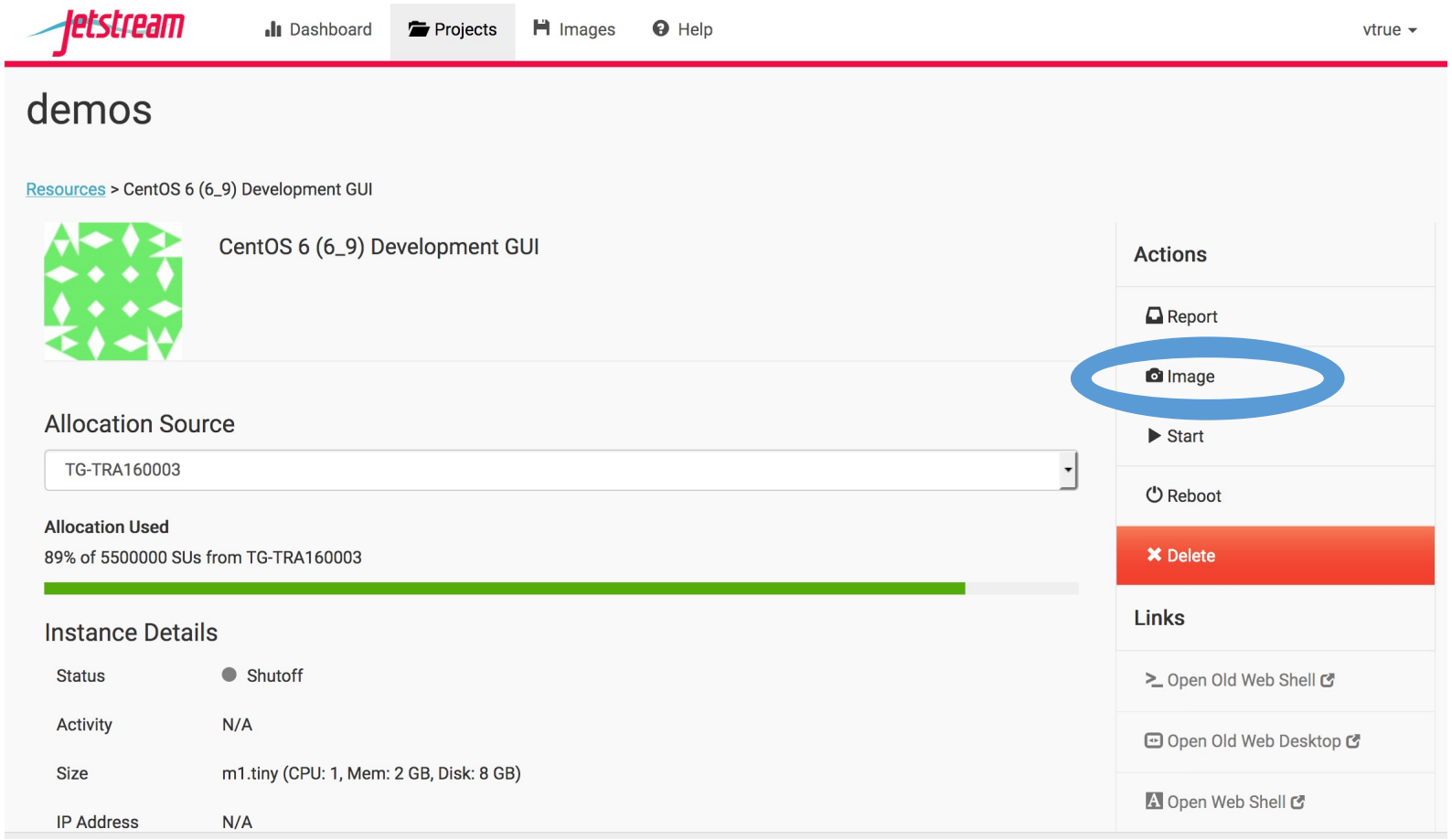
# Modifying an Image



# Modifying an Image cont.



# Saving an Image



# In Summary

- The longer your instance runs the more SUs you consume
- Be aware that you are on a shared resource
- You have root access, but the original image stays intact
- This is only the basic level of what you can do with Jetstream; there are many more options available in the Wiki

# IaaS with Bare Metal

Direct access to the node

- Choose how you want to interact with the system

Build your own interface

- Select and install your own OS
- Install software to your exact specifications

OpenStack

- Cloud based OS to help control your environment
- Provides dashboard based management in addition to command line

# Chameleon

Select the hardware you want

- Instead of images you can select ‘flavors’ to determine memory, cpus, root disk, etc

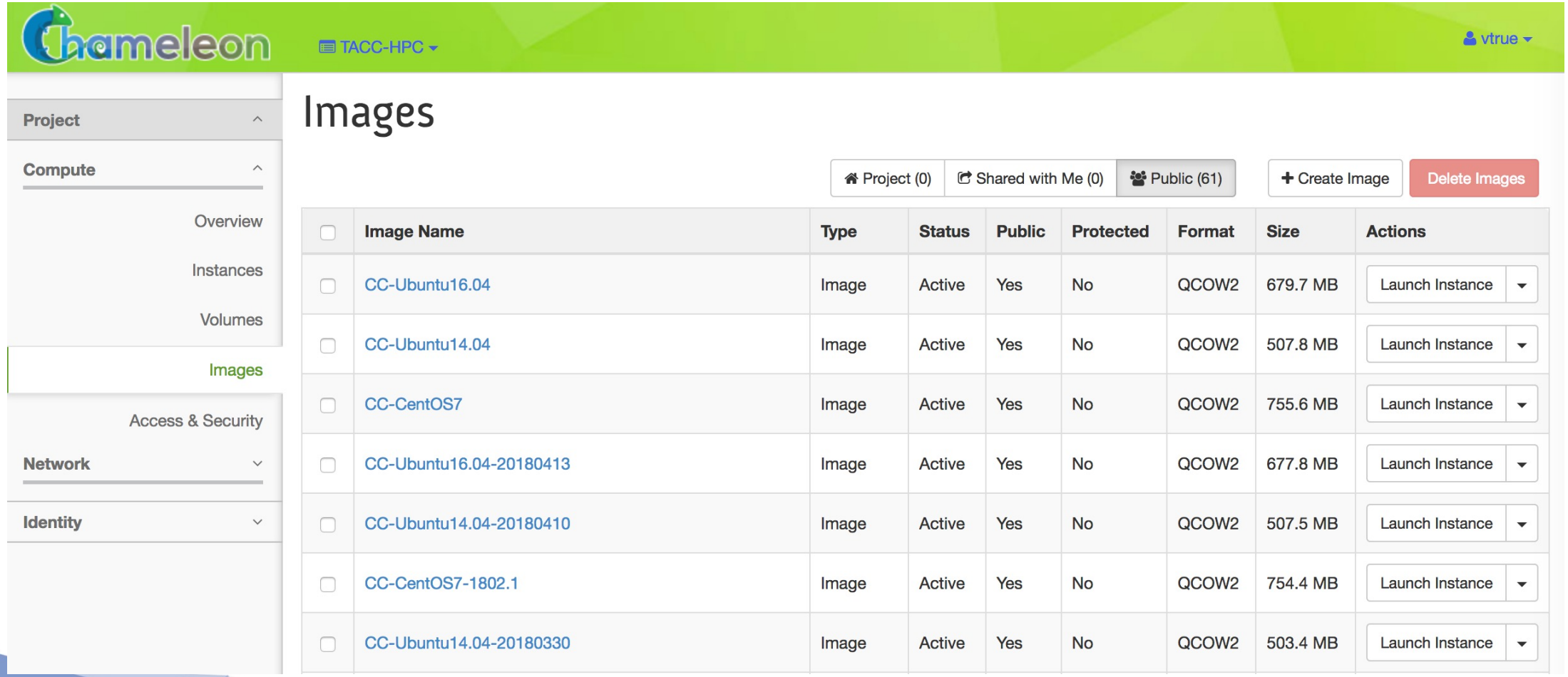
Network options

- Generate IPs for external access

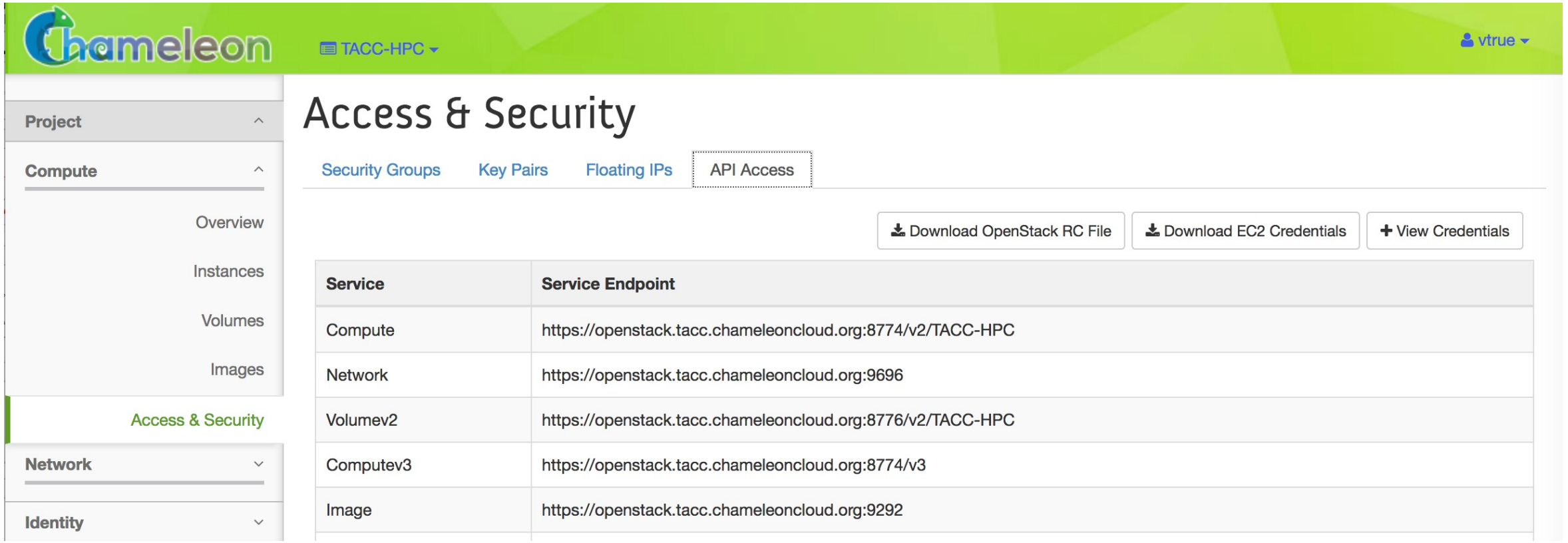
Develop APIs

- Use APIs to provide dashboards, monitor activity, etc

# OpenStack


Chameleon
TACC-HPC
vtrue
Project
Compute
Overview
Instances
Volumes
Images
Access & Security
Network
Identity
Images
Project (0)
Shared with Me (0)
Public (61)
+ Create Image
Delete Images
Image Name
Type
Status
Public
Protected
Format
Size
Actions
CC-Ubuntu16.04 Image Active Yes No QCOW2 679.7 MB Launch Instance
CC-Ubuntu14.04 Image Active Yes No QCOW2 507.8 MB Launch Instance
CC-CentOS7 Image Active Yes No QCOW2 755.6 MB Launch Instance
CC-Ubuntu16.04-20180413 Image Active Yes No QCOW2 677.8 MB Launch Instance
CC-Ubuntu14.04-20180410 Image Active Yes No QCOW2 507.5 MB Launch Instance
CC-CentOS7-1802.1 Image Active Yes No QCOW2 754.4 MB Launch Instance
CC-Ubuntu14.04-20180330 Image Active Yes No QCOW2 503.4 MB Launch Instance

# APIs, SSH, and IPs



# Command Line Access

## Install OpenStack

- Install python
- `pip install python-openstackclient`

## Download an RC File

- Pull from your Chameleon account
- `source <path/to/openstack_rc_file>`
- If you are a Windows user you'll need to manually provide environment variables

# For Mac

```
vtrue-mbpr:~ vtrue$ python --version
Python 2.7.15
vtrue-mbpr:~ vtrue$ pip install python-openstackclient
Collecting python-openstackclient
  Downloading
https://files.pythonhosted.org/packages/33/84/c739b13aacc47d887cae58acc7dd921240918aa20a9
add6ab64d932d1a6a/python_openstackclient-3.15.0-py2.py3-none-any.whl (823kB)
    100% |████████████████████████████████| 829kB 8.0MB/s
Collecting oslo.utils>=3.33.0 (from python-openstackclient)
  Downloading
https://files.pythonhosted.org/packages/6c/bb/308293b06400625b721795657c0c50c8a5942fde58d
9532b40f57758a158/oslo.utils-3.36.2-py2.py3-none-any.whl (91kB)
    100% |████████████████████████████████| 92kB 4.6MB/s
Collecting osc-lib>=1.8.0 (from python-openstackclient)
  Downloading
https://files.pythonhosted.org/packages/de/b7/91ed1a58756390fa006a5777ceb44578f021a9b67ff
ec0729f5037fff51a/osc_lib-1.10.0-py2-none-any.whl (81kB)
    100% |████████████████████████████████| 81kB 17.4MB/s
Collecting python-glanceclient>=2.8.0 (from python-openstackclient)
```

# For Windows

```
openstack --os-auth-url <OS_AUTH_URL> \
--os-project-id <OS_PROJECT_ID> \
--os-project-name <OS_PROJECT_NAME> \
--os-user-domain-name <OS_USER_DOMAIN_NAME> \
--os-username <OS_USERNAME> \
--os-password <OS_PASSWORD> \
--os-region-name <OS_REGION_NAME> \
--os-interface <OS_INTERFACE> \
--os-identity-api-version <OS_IDENTITY_API_VERSION>
```

# On the Command Line

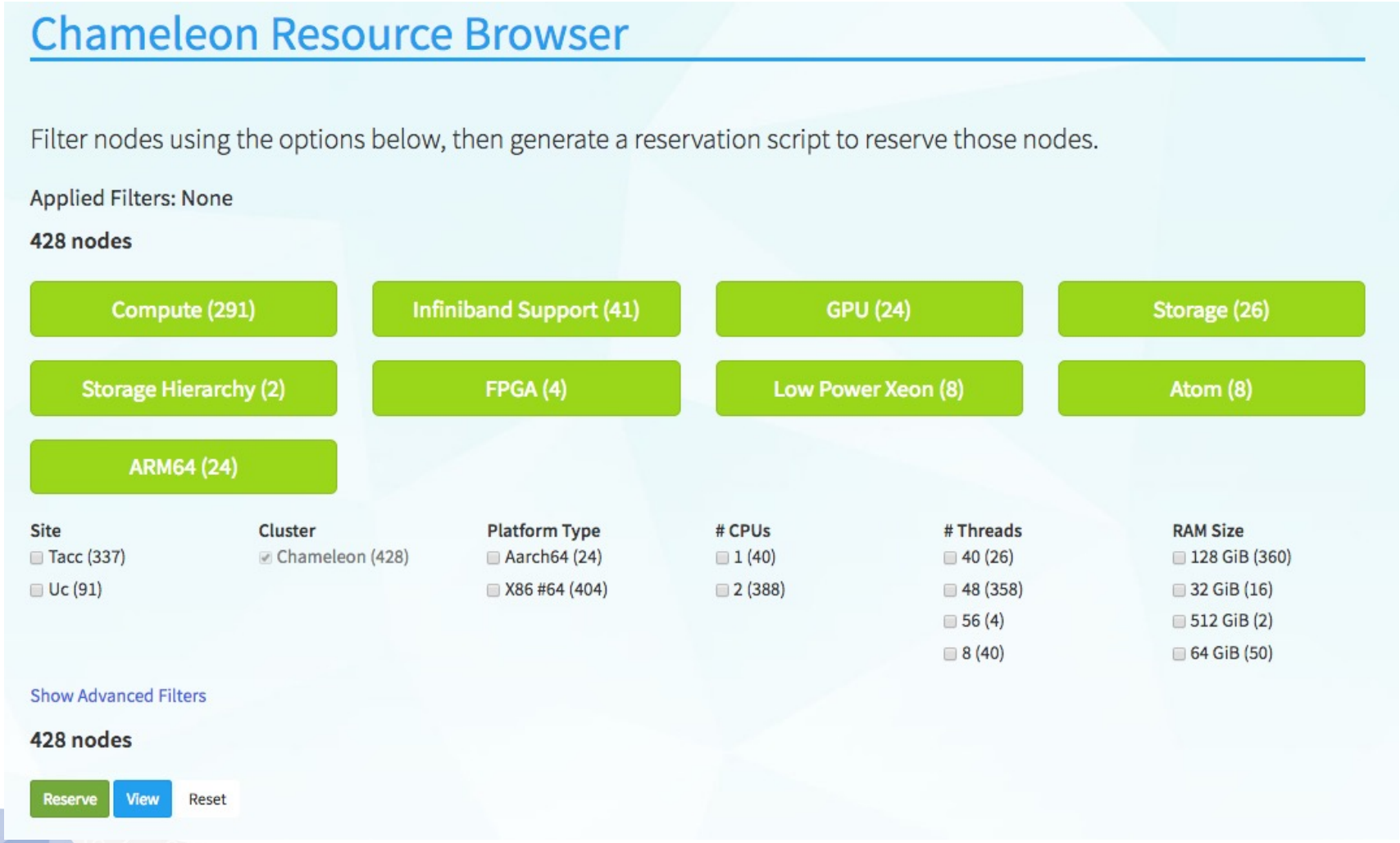
```
vtrue-mbpr:~ vtrue$ openstack
Readline features including tab completion have been disabled since no
supported version of readline was found. To resolve this, install
pyreadline on Windows or gnureadline on Mac.


(openstack)
```

There are options available in the command line that are not available in the GUI

- Gnocchi metrics
- Advanced networking

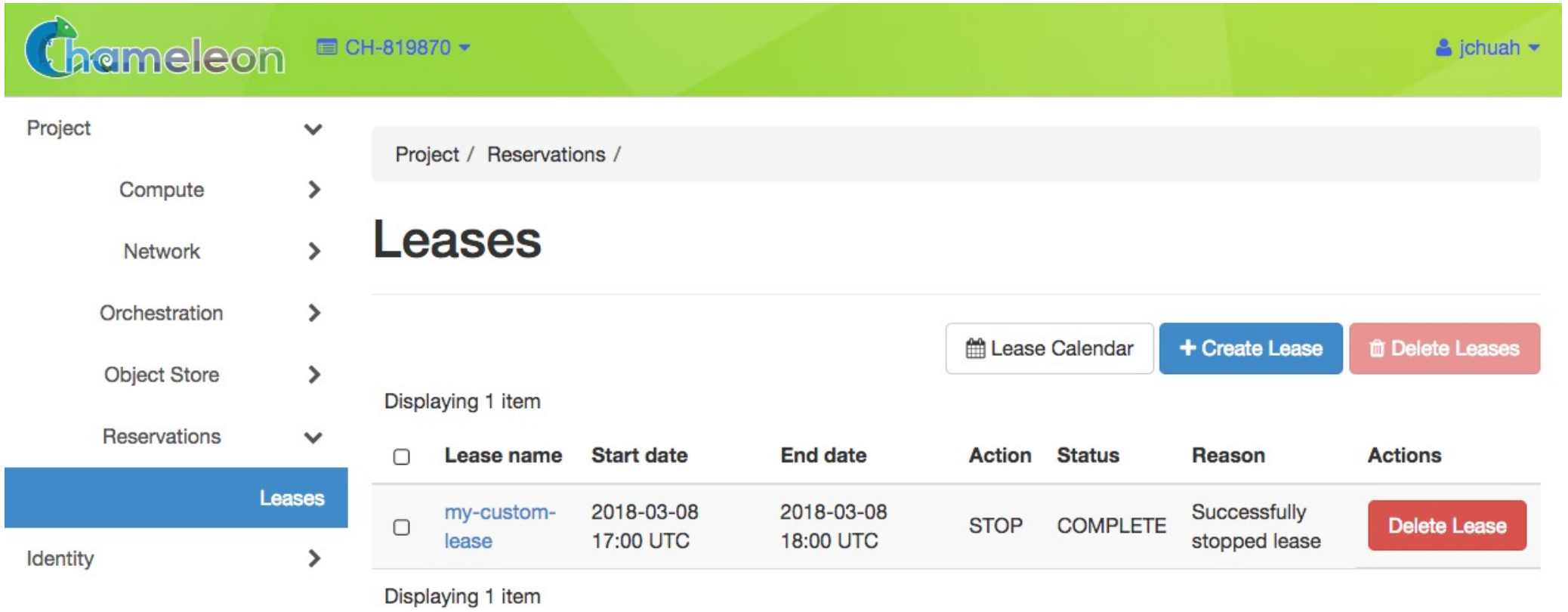
# Selecting Hardware



# Check on Resources with REST API

```
vtrue-mbpr:~ vtrue$ curl -i https://api.chameleoncloud.org/
HTTP/1.1 200 OK
Server: nginx/1.6.2
Date: Tue, 12 Jun 2018 22:35:34 GMT
Content-Type: application/vnd.grid5000.item+json; charset=utf-8
Content-Length: 757
Connection: keep-alive
Allow: GET
...
{"type":"grid","uid":"chameleoncloud","version":"0aa787fa5c97c34bd0b7a583d4
e2fab693010daa","release":"3.5.7","timestamp":1528842934,"links":[{"rel":"s
ites","href":"/sites","type":"application/vnd.grid5000.collection+json"},{"
rel":"self","type":"application/vnd.grid5000.item+json","href":"/"
```

# Reservations



# Complex Appliances

*Complex Appliances* allow you to specify not only what image you want to deploy but also on how many nodes you want to deploy that image, what roles the deployed instances should boot into (such as e.g., head node and worker node in a cluster), what information from a specific instance should be passed to another instance in that *Complex Appliance*, and what scripts should be executed on boot so that this information is properly used for configuring the “one click” cluster.

Chameleon | Documentation | Appliances | Hardware | News | About | Blog

# Appliance Catalog

Add an appliance

Search by name, description or author.

AND

Search by keywords

Search | Reset

## ARM64 (Ubuntu 16.04)

Chameleon-supported Ubuntu 16.04 LTS image for ARM64 machines

## CentOS 7

The default Chameleon appliance

## COMPSs 1.3

COMPSs is a task based programming model for distributed platforms.

## CUDA 7.5

CUDA appliance based on CentOS 7

# Managing and Monitoring

- Need to be launched the same way an Image is
- Select the Stack from the GUI once it is up
- SSH to it with a floating IP just like with an Image
- You can also do this from the command line with OpenStack

# Q&A

https://chameleoncloud.readthedocs.io/en/latest/technical/index.html

https://iujetstream.atlassian.net/wiki/spaces/JWT/pages/17465367/System+Overview