OpenStack Tutorial

Matteo Panella - matteo.panella@lngs.infn.it

Laboratori Nazionali del Gran Sasso - INFN

Cloud Computing Tutorial

Summary

Summary

What is OpenStack

OpenStack is an enterprise-grade open source **IaaS** platform.
It provides:

- computing resources (vCPU, RAM, system images...)
- network resources (L2 networks, virtual routers...)
- storage resources (persistent virtual disk devices, VM snapshots)

Who is behind OpenStack

OpenStack development is overseen by the OpenStack Foundation. The Foundation is backed by 5600 individual members and 850 organizations.
Different companies contribute to OpenStack development:

- AT&T
- Canonical
- HP
- IBM
- Rackspace
- Red Hat, Inc.
- SUSE

. . . and many more!

OpenStack in numbers

Some numbers about OpenStack:

- 3 years of development
- 1278 contributors
- 1289000 lines of code
- more than $10 million in funding

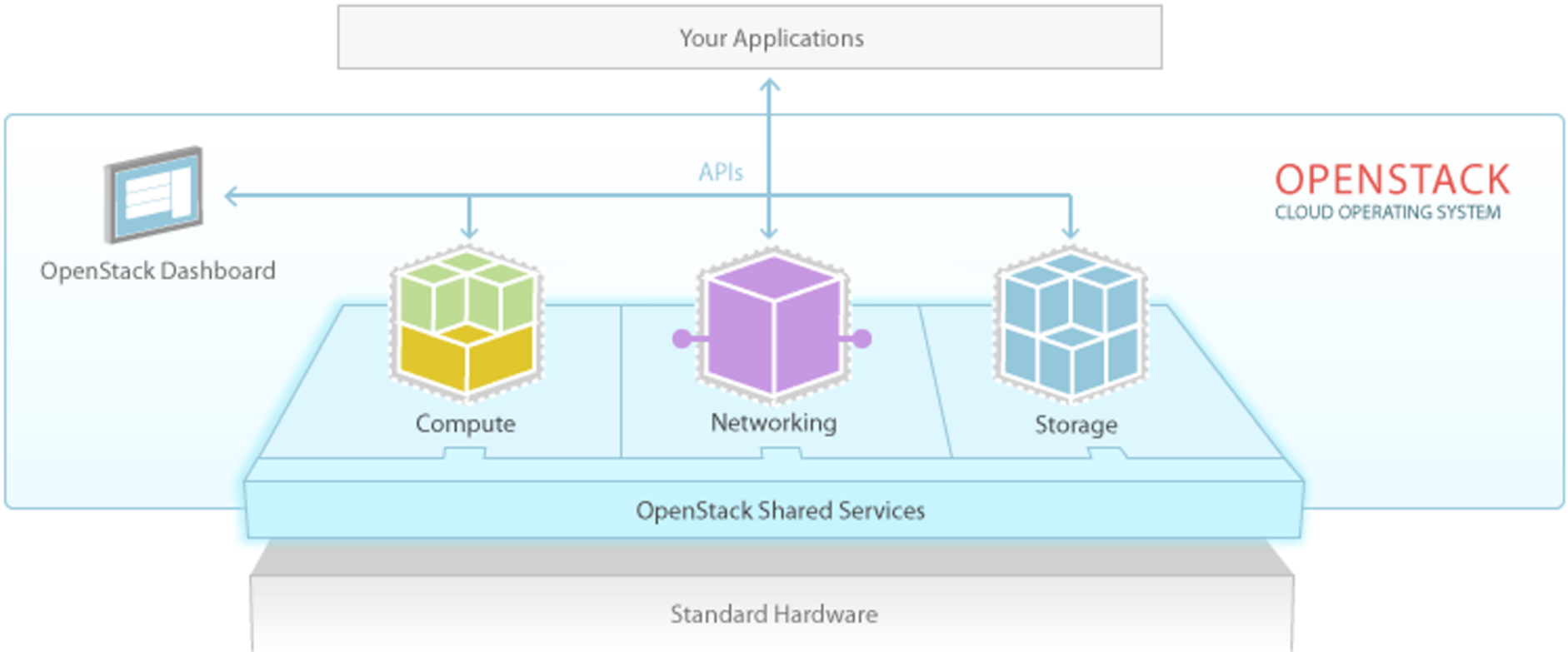
OpenStack is quickly becoming the *de facto* standard for private IaaS clouds.
For more information visit **http://www.openstack.org/**

OpenStack components

OpenStack is composed by 5 different components:

1. identity and authentication service
2. computing service
3. networking service
4. storage service
5. dashboard (web frontend)

OpenStack components



Identity and authentication service

What it does

Authenticates users and verifies project membership.

Authentication and authorization based on:

- username/password pair
- projects (also known as “tenants”)
- roles

Computing service

What it does

Creates, runs and manages instances (virtual machines).

Resources managed by this service:

- instances
- vCPU
- RAM
- instance metadata (hostname, SSH keypairs, boot scripts. . .)

Networking service

What it does

Provides network resources to the computing service.

Resources managed by this service:

- L2 networks
- subnets
- virtual routers
- firewalling rules
- floating IPs

Storage service

What it does

Provides persistent storage to the computing service.

Resources managed by this service:

- volumes (virtual disk devices)
- snapshots
- OS images

Resources recap

Every user has access to the following resources:

- instances
- vCPU
- RAM
- networks
- virtual routers/firewalls
- virtual disks

Resources recap

Every user has access to the following resources:

- instances
- vCPU
- RAM
- networks
- virtual routers/firewalls
- virtual disks

Nota Bene

Resources belong to **projects**, only SSH keypairs belong to users!

Instances

An instance is a self-contained virtual machine:

- resource allocation based on "flavors"
- boots from a **pre-installed system image** or from a **snapshot**
- has a fixed **private** IP address
- can have one or more floating IP addresses
- can have an ephemeral disk
- can have one or more volumes attached

Instances (cont'd)

Instances boot off a standard system image and can be customized upon boot with a **user script**.
Most system images come with SSH enabled out-of-the-box and keyed to a user-specific SSH keypair. **Password-based login is disabled for the default account**.

Instances (cont'd)

Instances boot off a standard system image and can be customized upon boot with a **user script**.
Most system images come with SSH enabled out-of-the-box and keyed to a user-specific SSH keypair. **Password-based login is disabled for the default account**.

Warning

Instances exist as long as they are not terminated. Upon termination the system disk will be **irreversibly** destroyed. To retain system configuration make a **snapshot** or simply **suspend** the instance.

Networks

OpenStack provides isolated L2 networks to each project. Each network can have one or more subnets and virtual routers.
Private IP addresses are **automatically** allocated to instances, while floating IP addresses must be **manually** allocated to projects and assigned to instances.

Networks (cont'd)

The networking service also provides **virtual firewalls** for all instances with multiple independent rulesets.
Each instance can have more than one ruleset attached to it. The rules also apply to traffic **within** the same network.

Volumes

Volumes are persistent virtual disk devices. Each instance can have one or more volumes attached to it and each volume may be attached to one instance at a time.
They are created and destroyed independently from instances, so they are suited for **long-term storage of data**.
When created, volumes are like **empty disks**. They must be partitioned and formatted in order to use them.

Volumes

Volumes are persistent virtual disk devices. Each instance can have one or more volumes attached to it and each volume may be attached to one instance at a time.
They are created and destroyed independently from instances, so they are suited for **long-term storage of data**.
When created, volumes are like **empty disks**. They must be partitioned and formatted in order to use them.

Warning

Due to their nature, volumes are **not** backed up automatically. Users have to arrange backup of volume contents on their own!

Summary

What is Gran Sasso Clouds

Gran Sasso Clouds is the OpenStack environment of LNGS.
It is currently a standalone system. In the future it will be integrated with other computing services like U-LITE.
It is available upon request to experimental collaborations, working groups, LNGS services and individual users.

Available resources

Currently, Gran Sasso Clouds has the following resources available:

- 48 CPU cores
- 80 GB of RAM
- several TB for volume and snapshot storage

Capacity will be expanded as needed as more users start working with it.

Use cases

Gran Sasso Clouds is extremely flexible and can be used for many scenarios:

- internal and public web sites
- wikis
- blogs
- database services
- software development
- data analysis
- Monte Carlo
- prototyping
- ...

Accessing Gran Sasso Clouds

The web frontend

Gran Sasso Clouds can be accessed from **https://stackctl.lngs.infn.it**. All operations can be performed via the web frontend.

Who can access it

Everybody with a standard LNGS account can request access to the Computing and Network Service. CNS staff will enable access for your account and assign it to one or more projects (experiment and/or LNGS service).

Accessing Gran Sasso Clouds (cont'd)

Direct access to Gran Sasso Clouds is required only to **manage** resources (instances, networks, volumes...). Depending on the kind of use case, end users do not require any account at all or just a regular UNIX account on the instances themselves.

Accessing Gran Sasso Clouds (cont'd)

Direct access to Gran Sasso Clouds is required only to **manage** resources (instances, networks, volumes...). Depending on the kind of use case, end users do not require any account at all or just a regular UNIX account on the instances themselves.

What about groups?

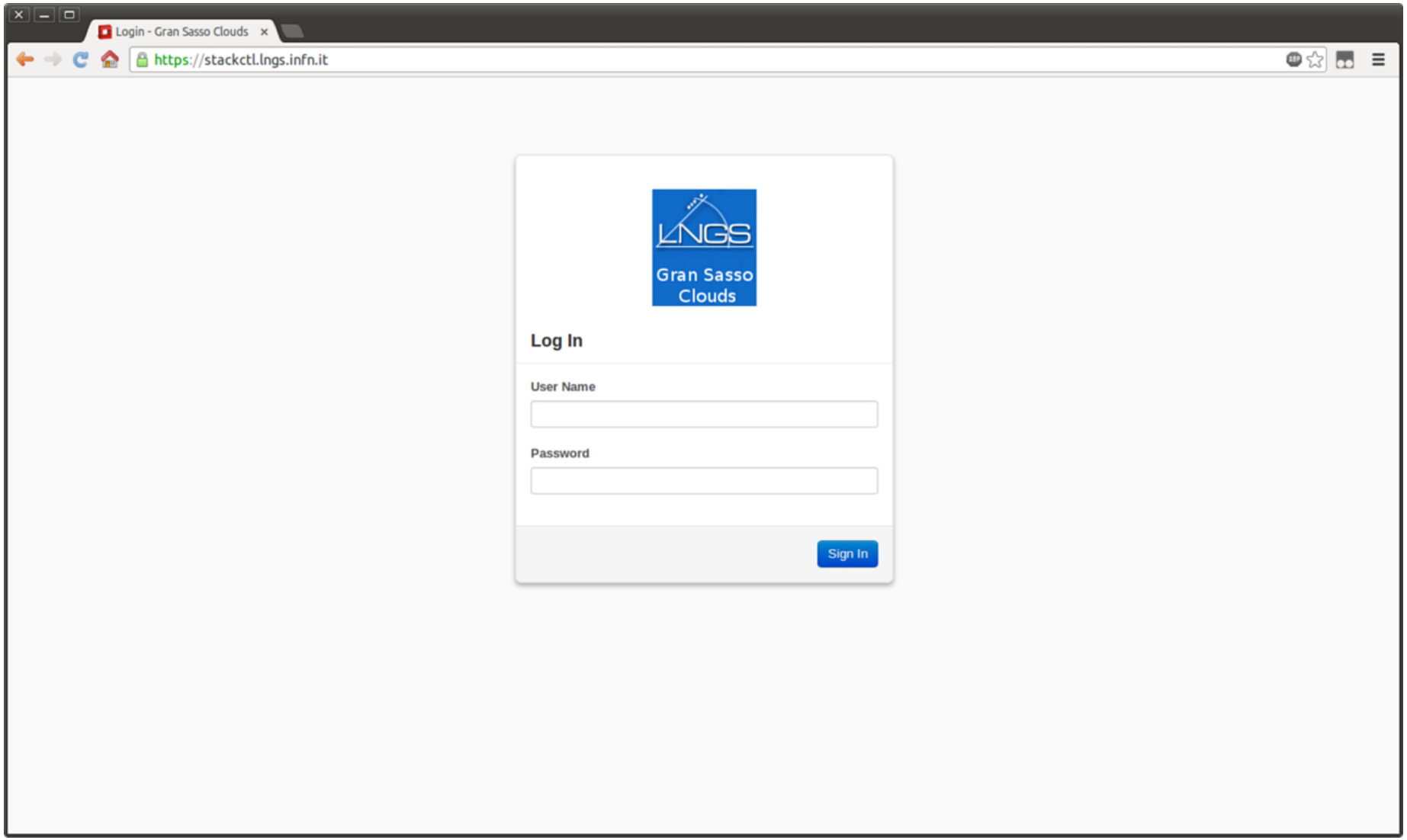
Groups need to designate a few selected individuals that will manage resources.

Networking

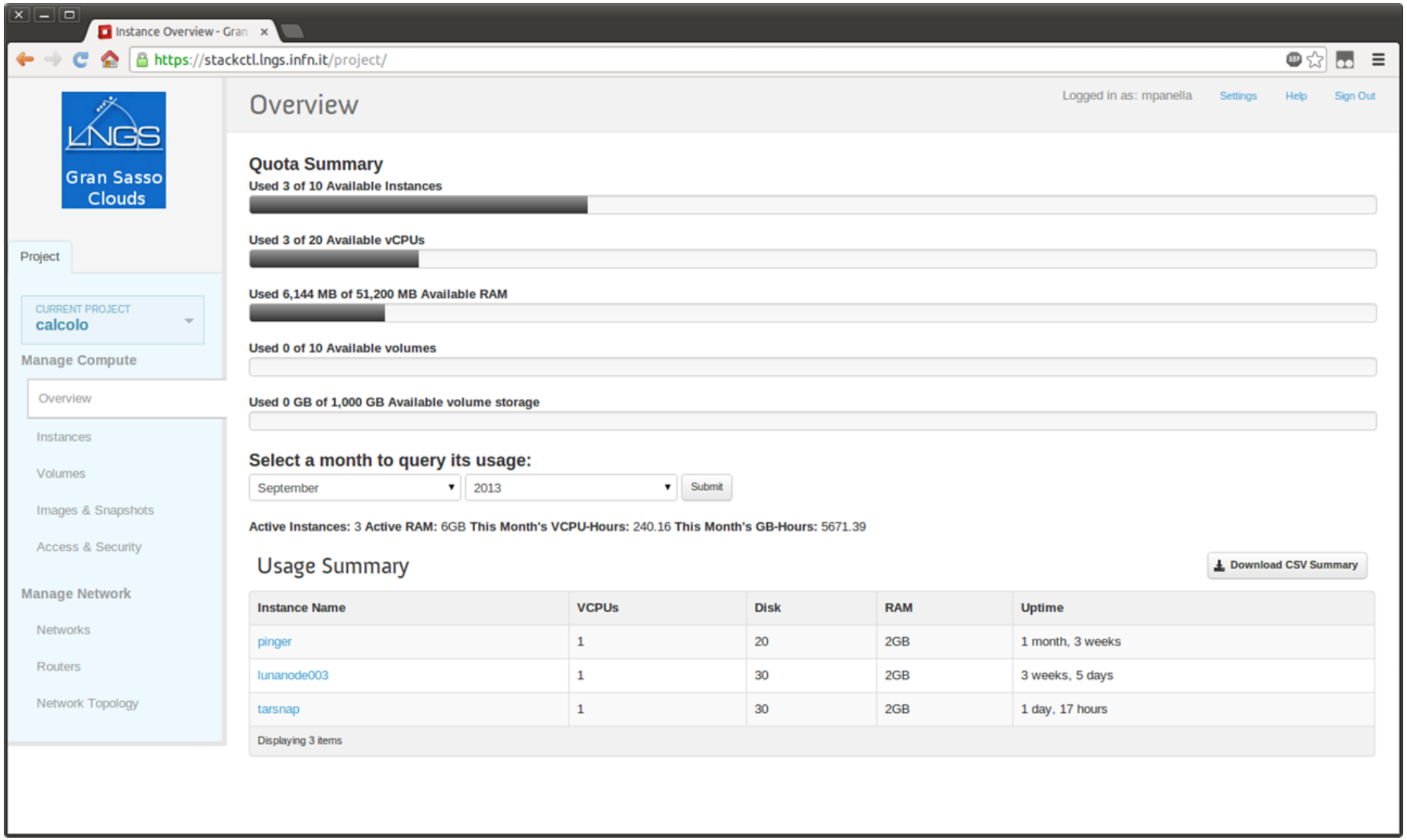
Gran Sasso Clouds supports various network configurations. The standard network configuration **just works** for most users and groups.
Experimental collaborations and working groups that require a more complex network configuration can contact the CNS for more information.

Summary

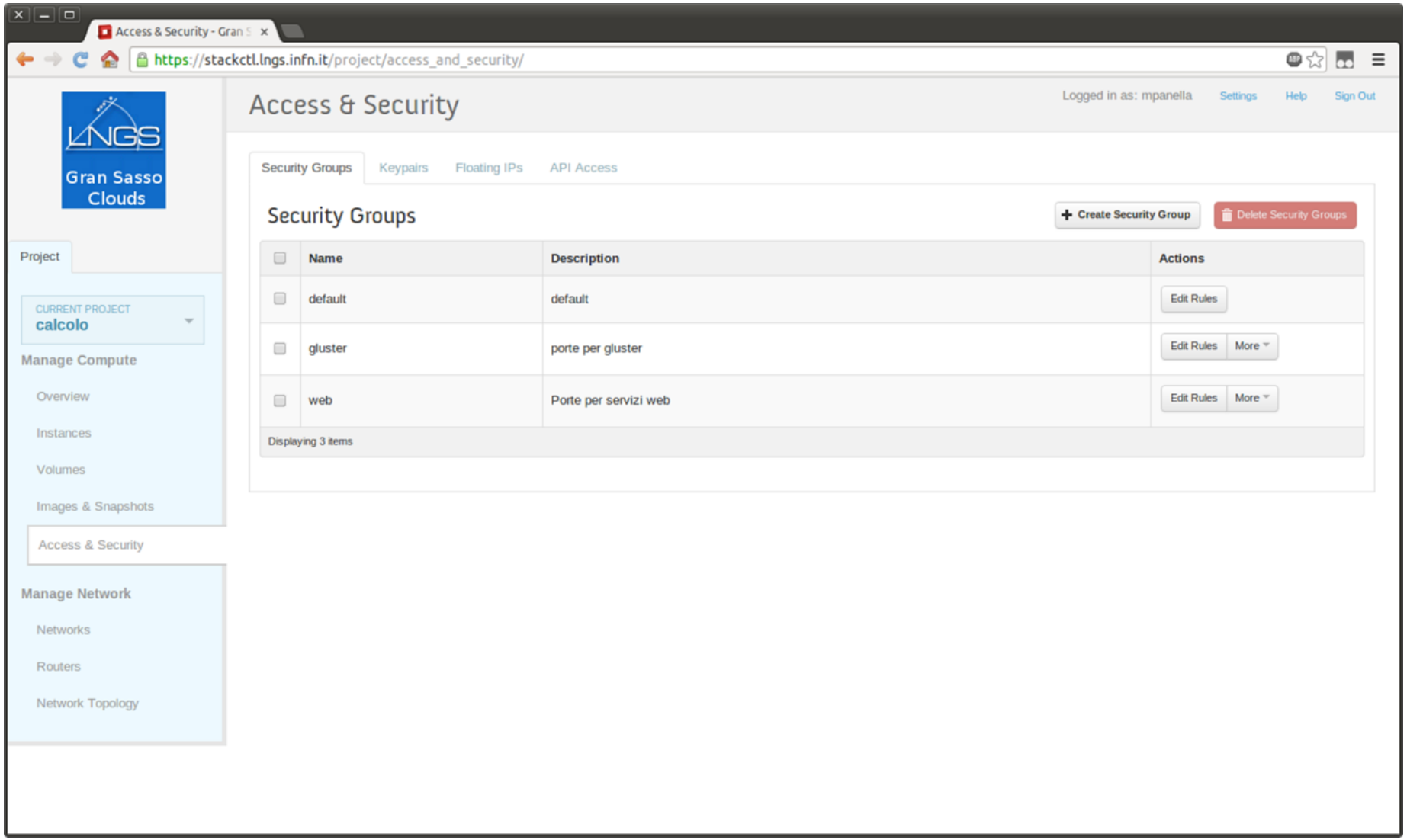
Login screen



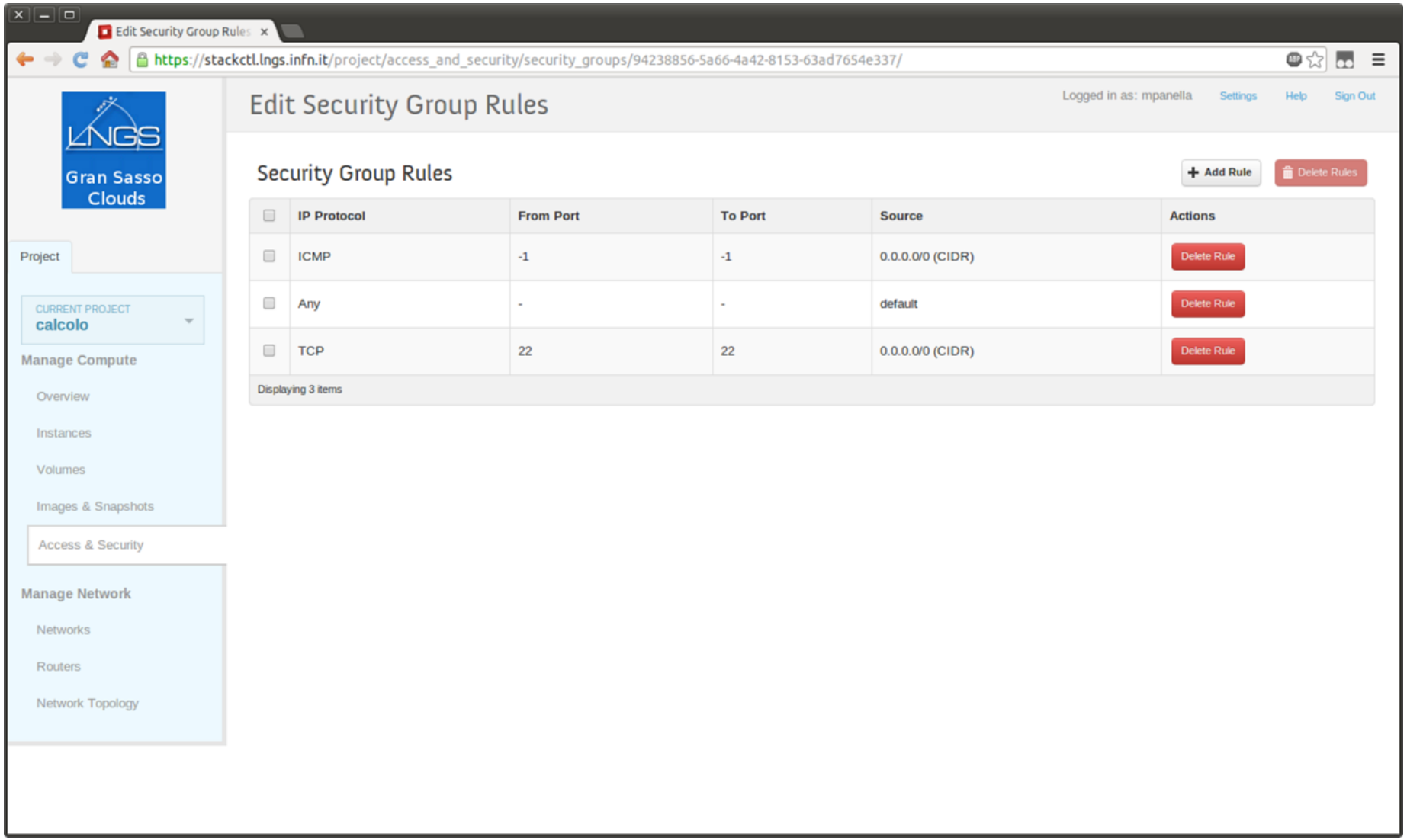
Dashboard


Instance Overview - Gran
https://stackctl.lngs.infn.it/project/
Gran Sasso Clouds
Overview
Logged in as: mpanella
Settings
Help
Sign Out
Project
CURRENT PROJECT
calcolo
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Networks
Routers
Network Topology
Quota Summary
Used 3 of 10 Available Instances
Used 3 of 20 Available vCPUs
Used 6,144 MB of 51,200 MB Available RAM
Used 0 of 10 Available volumes
Used 0 GB of 1,000 GB Available volume storage
Select a month to query its usage:
September
2013
Submit
Active Instances: 3 Active RAM: 6GB This Month's VCPU-Hours: 240.16 This Month's GB-Hours: 5671.39
Usage Summary
Download CSV Summary
Instance Name
VCPUs
Disk
RAM
Uptime
pinger
1
20
2GB
1 month, 3 weeks
lunanode003
1
30
2GB
3 weeks, 5 days
tarsnap
1
30
2GB
1 day, 17 hours
Displaying 3 items

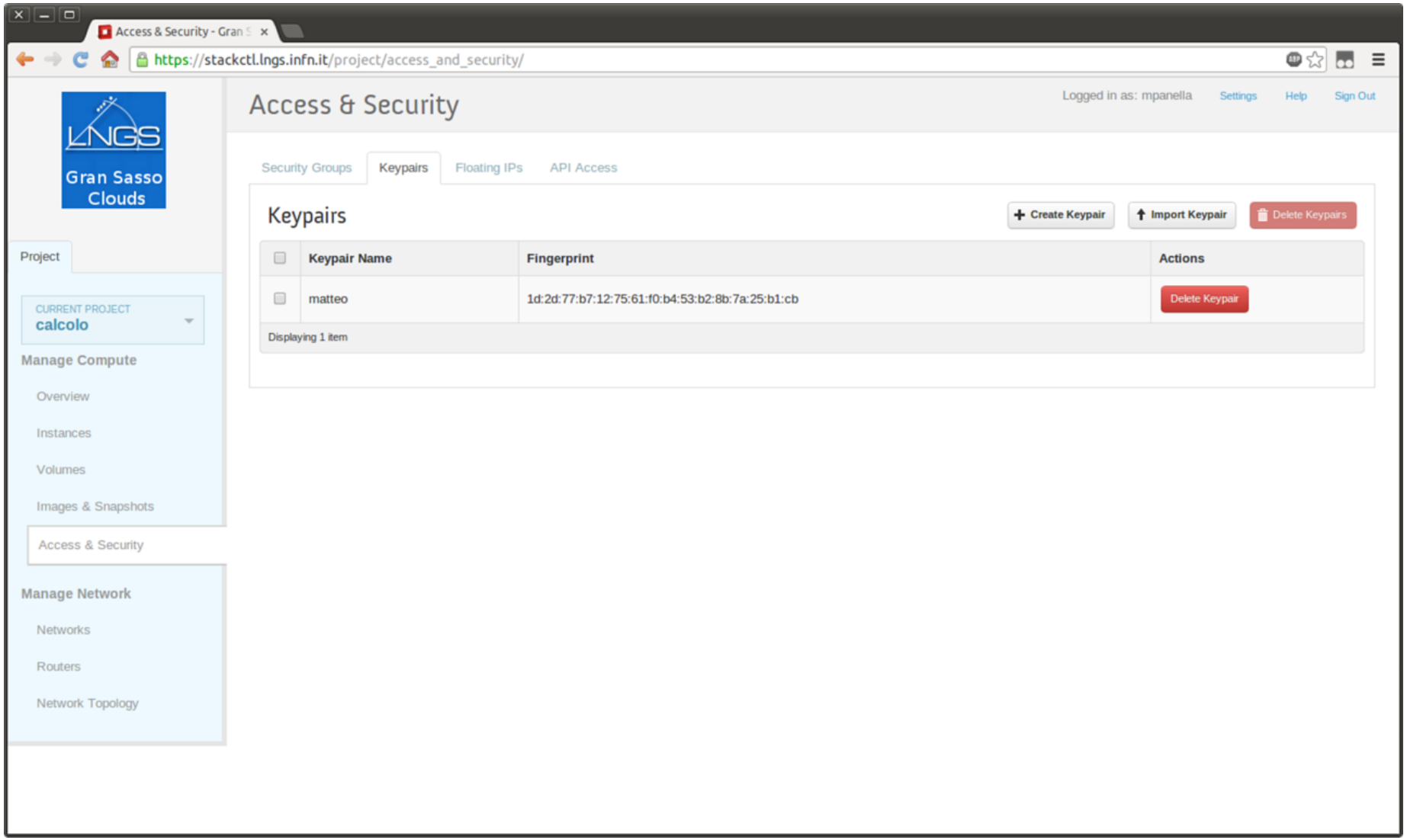
Security groups



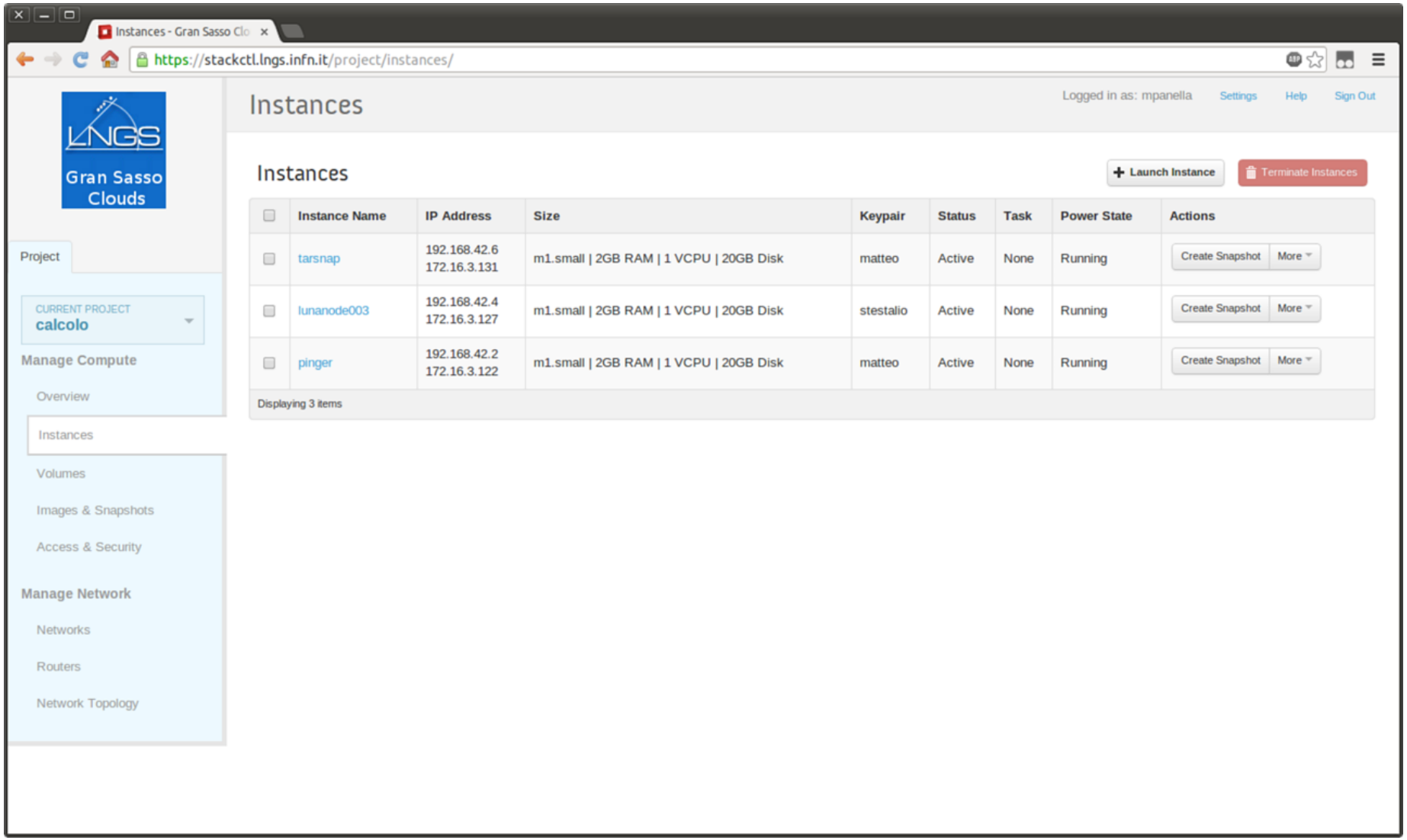
Security group rules



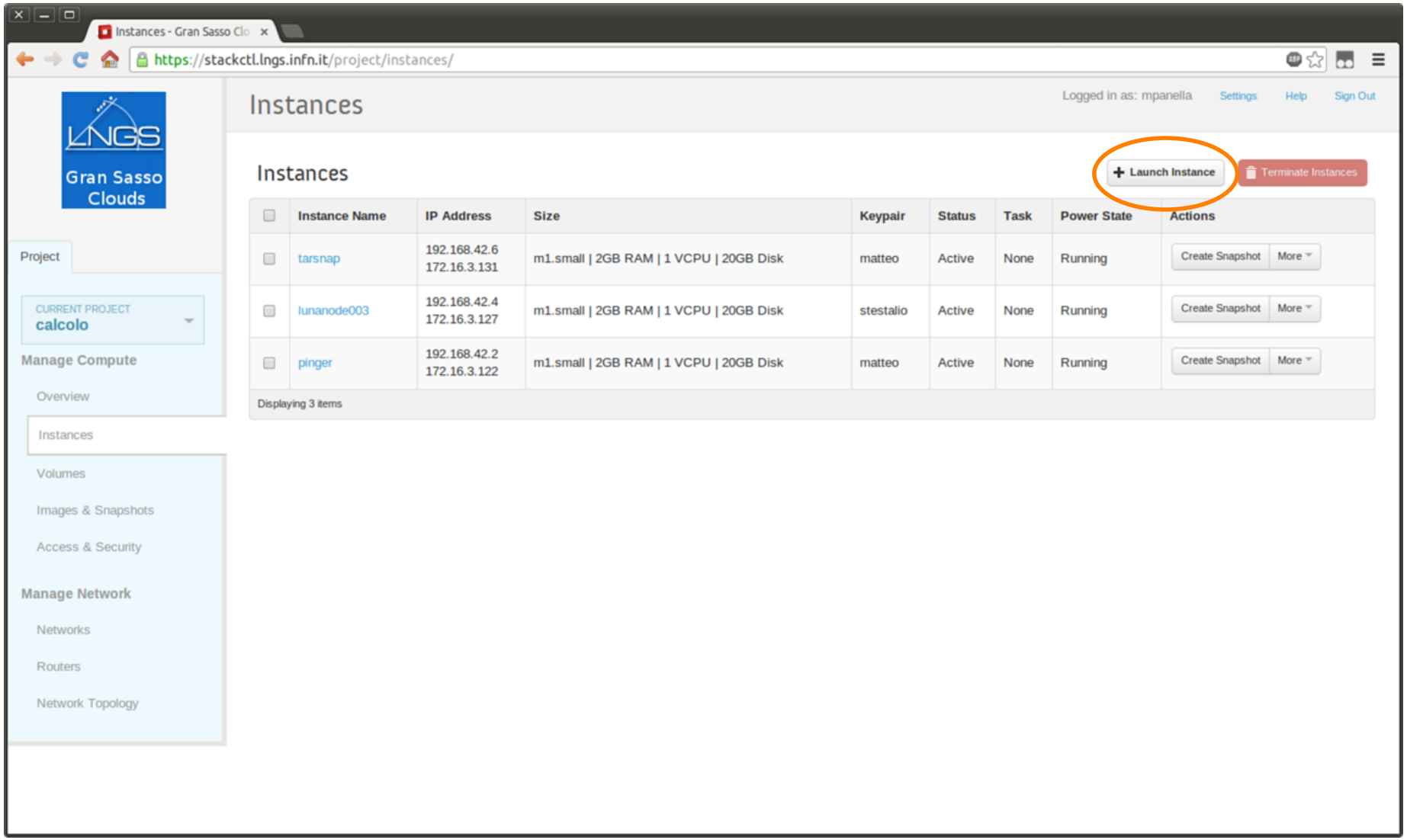
Keypair management



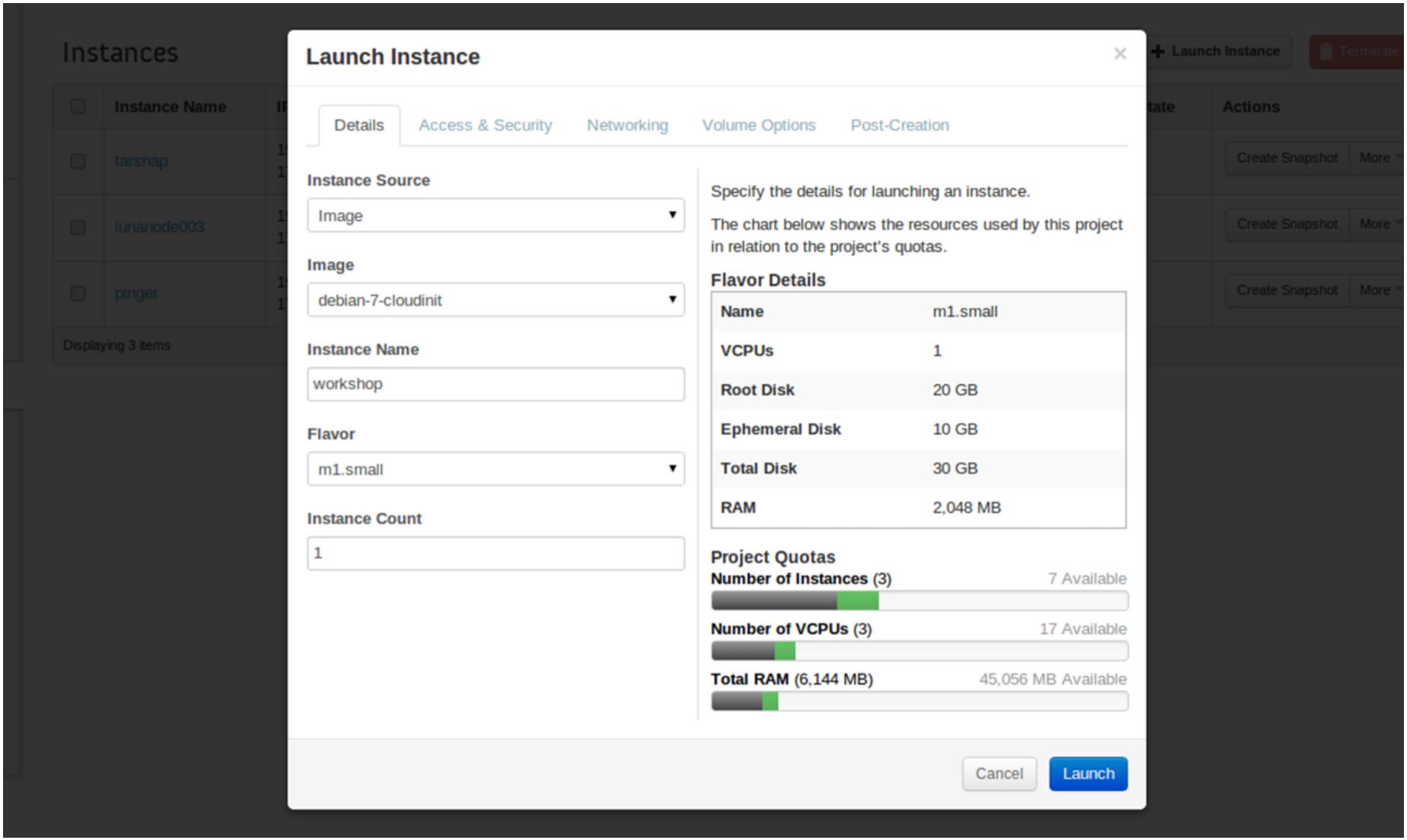
Running instances



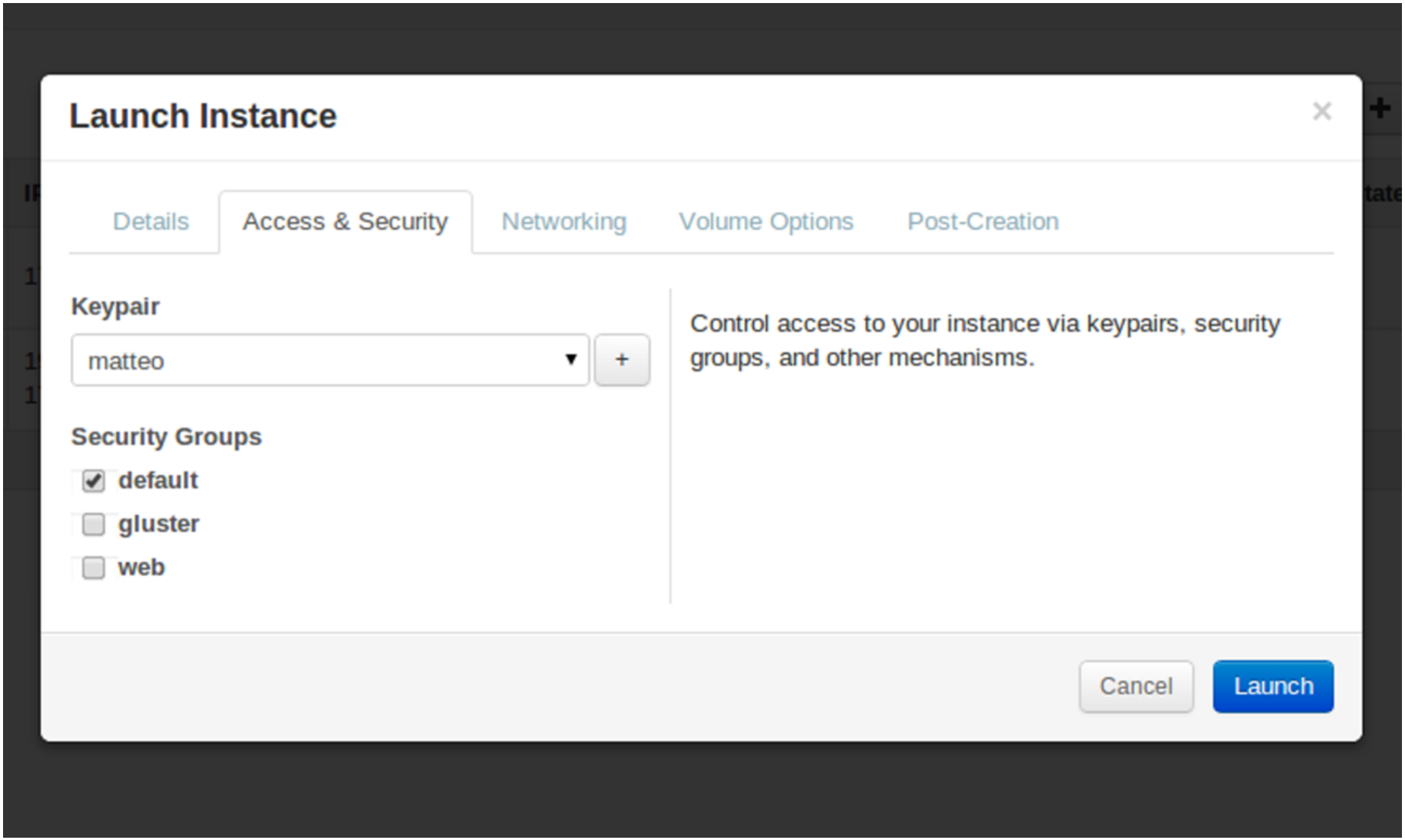
Running instances



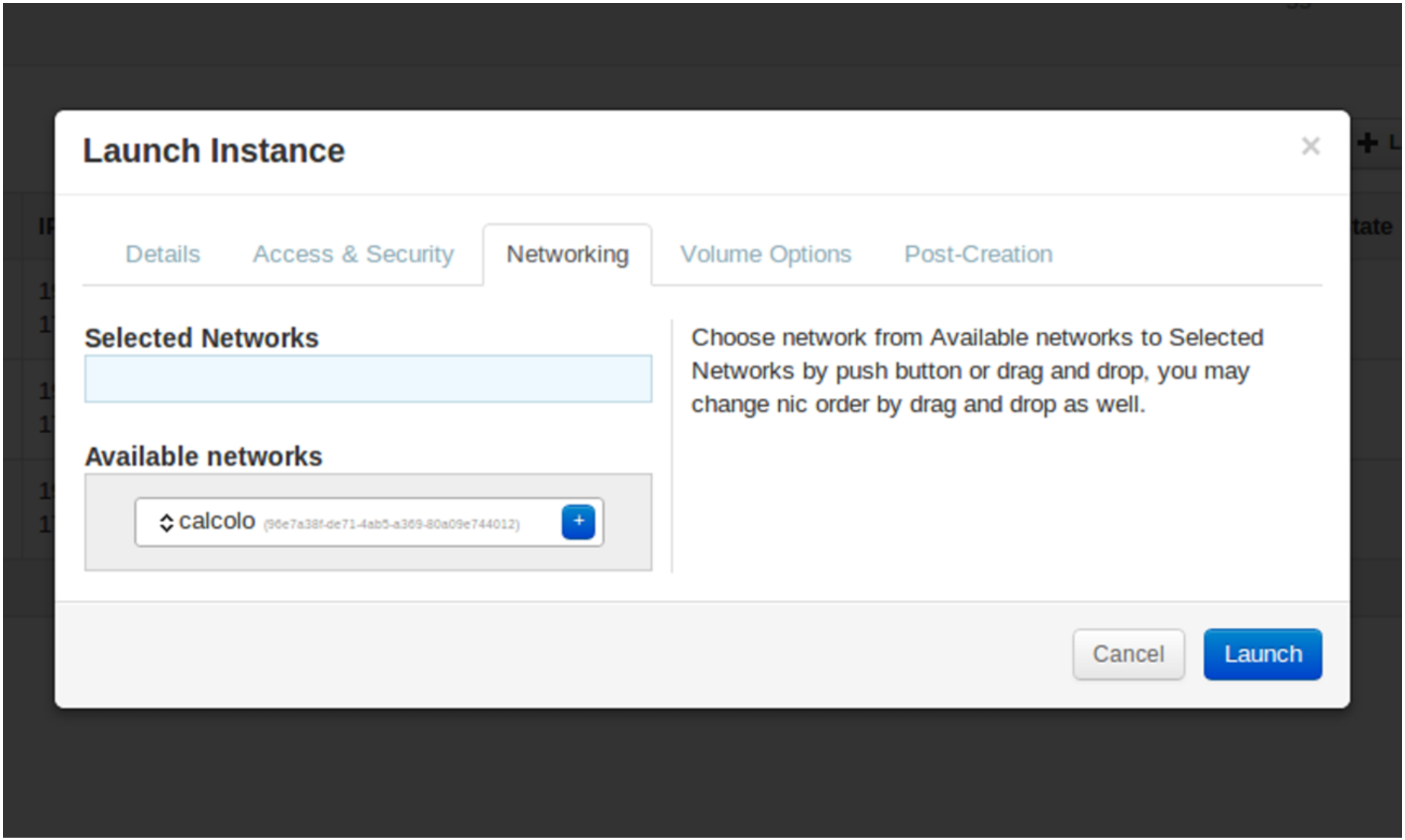
Launching an instance



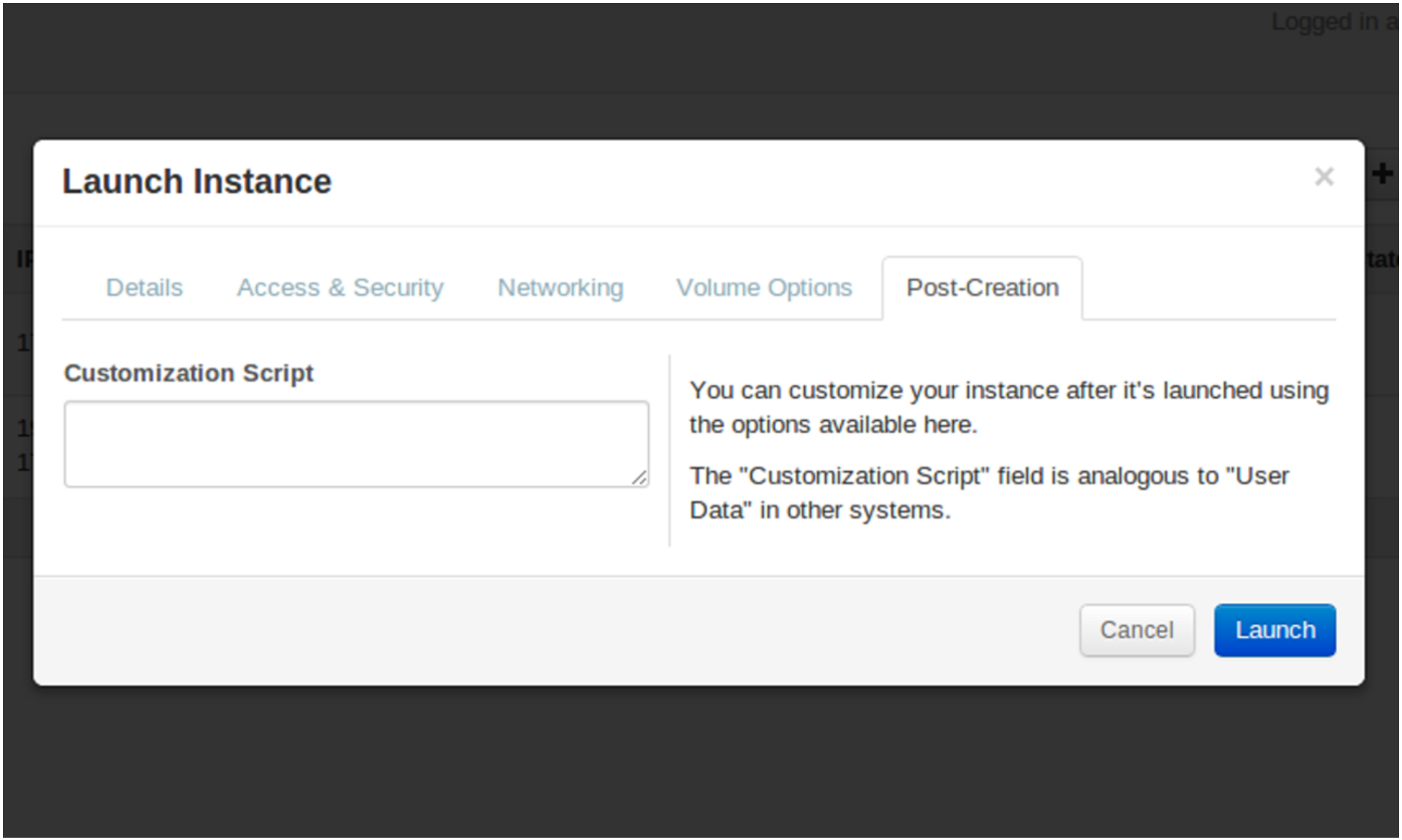
Access & Security



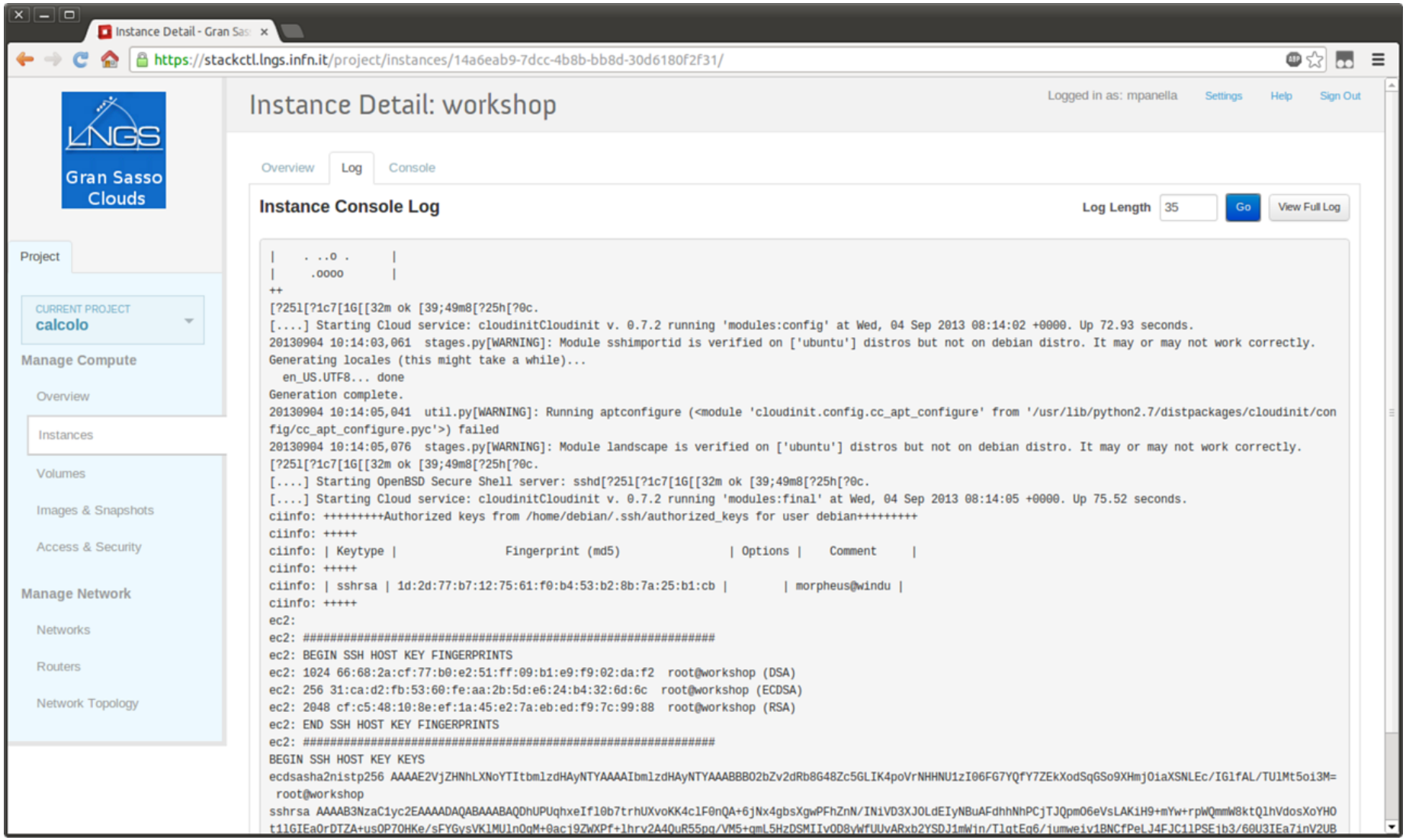
Instance networking



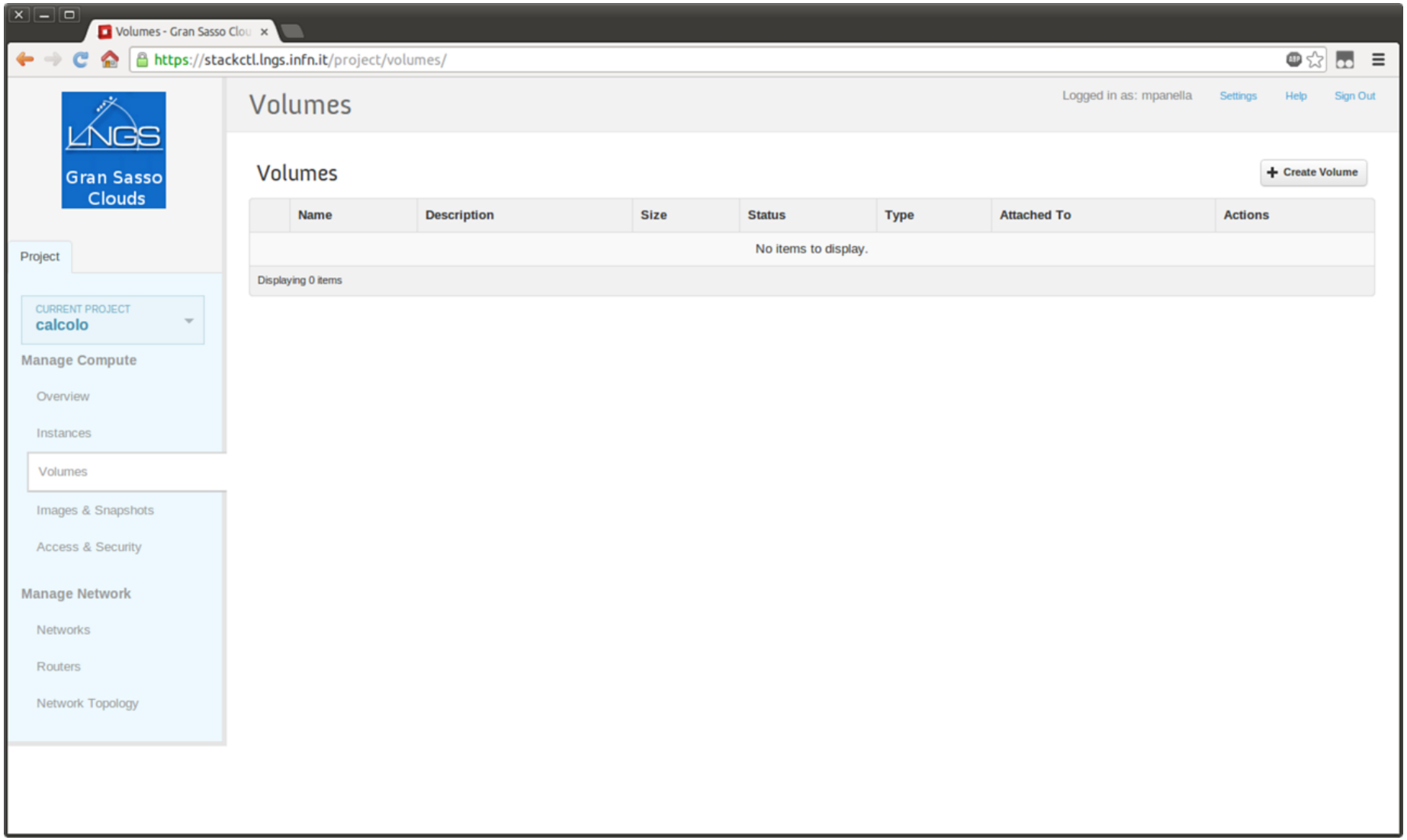
Post-boot customization



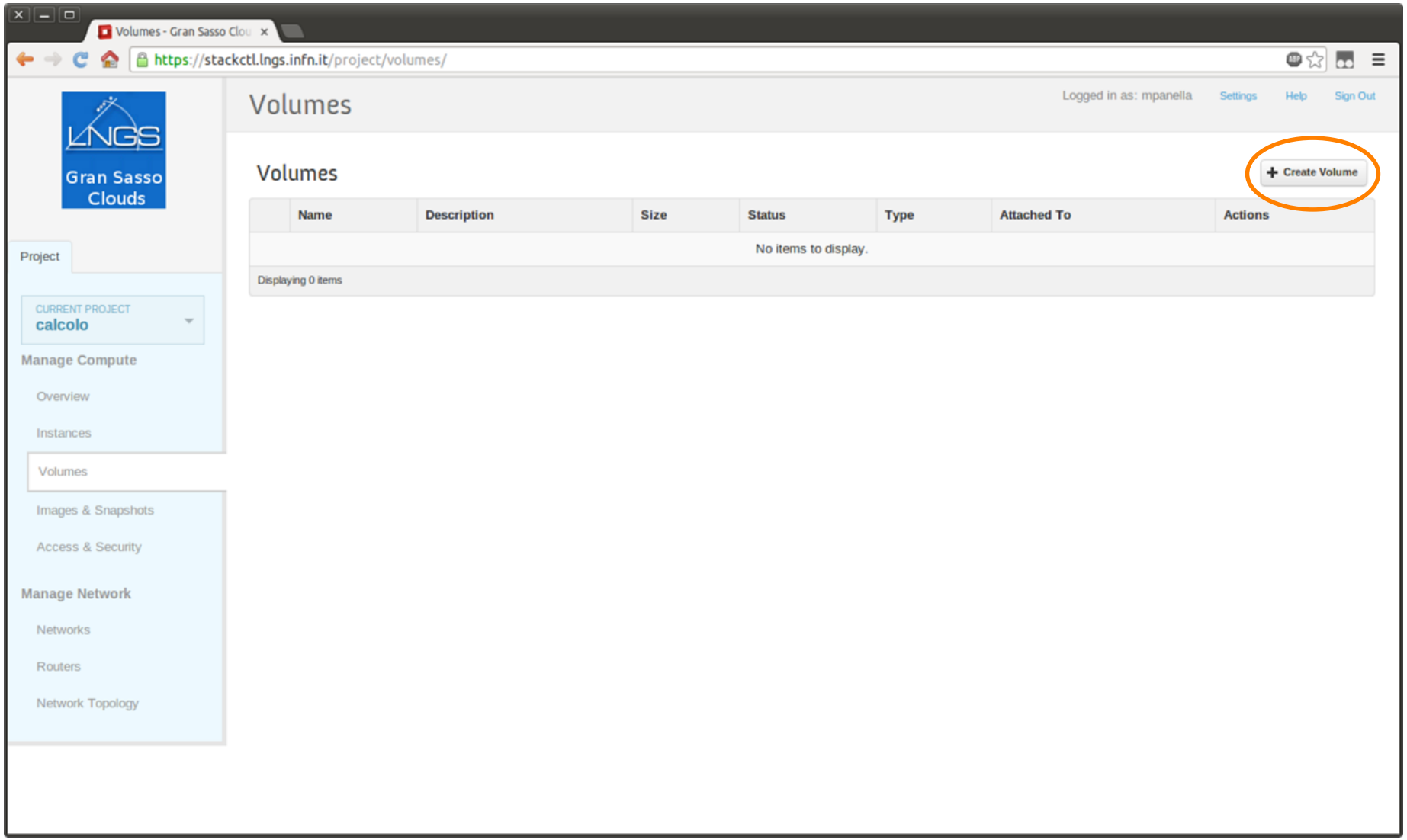
Boot log


Instance Detail - Gran Sas
https://stackctl.lngs.infn.it/project/instances/14a6eab9-7dcc-4b8b-bb8d-30d6180f2f31/
Gran Sasso Clouds
Instance Detail: workshop
Logged in as: mpanella
Settings
Help
Sign Out
Overview
Log
Console
Instance Console Log
Log Length
35
Go
View Full Log
Project
CURRENT PROJECT
calcolo
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Networks
Routers
Network Topology
| . ..o . |
| .oooo |
++
[?25l[?1c7[1G[[32m ok [39;49m8[?25h[?0c.
[....] Starting Cloud service: cloudinitCloudinit v. 0.7.2 running 'modules:config' at Wed, 04 Sep 2013 08:14:02 +0000. Up 72.93 seconds.
20130904 10:14:03,061 stages.py[WARNING]: Module sshimportid is verified on ['ubuntu'] distros but not on debian distro. It may or may not work correctly.
Generating locales (this might take a while)...
en_US.UTF8... done
Generation complete.
20130904 10:14:05,041 util.py[WARNING]: Running aptconfigure (<module 'cloudinit.config.cc_apt_configure' from '/usr/lib/python2.7/distpackages/cloudinit/config/cc_apt_configure.pyc'>) failed
20130904 10:14:05,076 stages.py[WARNING]: Module landscape is verified on ['ubuntu'] distros but not on debian distro. It may or may not work correctly.
[?25l[?1c7[1G[[32m ok [39;49m8[?25h[?0c.
[....] Starting OpenBSD Secure Shell server: sshd[?25l[?1c7[1G[[32m ok [39;49m8[?25h[?0c.
[....] Starting Cloud service: cloudinitCloudinit v. 0.7.2 running 'modules:final' at Wed, 04 Sep 2013 08:14:05 +0000. Up 75.52 seconds.
ciinfo: +++++++++Authorized keys from /home/debian/.ssh/authorized_keys for user debian+++++++++
ciinfo: +++++
ciinfo: | Keytype | Fingerprint (md5) | Options | Comment |
ciinfo: +++++
ciinfo: | sshrsa | 1d:2d:77:b7:12:75:61:f0:b4:53:b2:8b:7a:25:b1:cb | | morpheus@windu |
ciinfo: +++++
ec2:
ec2: ###
ec2: BEGIN SSH HOST KEY FINGERPRINTS
ec2: 1024 66:68:2a:cf:77:b0:e2:51:ff:09:b1:e9:f9:02:da:f2 root@workshop (DSA)
ec2: 256 31:ca:d2:fb:53:60:fe:aa:2b:5d:e6:24:b4:32:6d:6c root@workshop (ECDSA)
ec2: 2048 cf:c5:48:10:8e:ef:1a:45:e2:7a:eb:ed:f9:7c:99:88 root@workshop (RSA)
ec2: END SSH HOST KEY FINGERPRINTS
ec2: ###
BEGIN SSH HOST KEY KEYS
ecdsasha2nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBO2bZv2dRb8G48Zc5GLIK4poVrNHHNU1zI06FG7YQfY7ZEkXodSqGSo9XHmjOiaXSNLEc/IGlfAL/TUlMt5oi3M=
root@workshop
sshrsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDhUPUqhxeIfl0b7trhUXvoKK4clF0nQA+6jNx4gbsXgwPFhZnN/INiVD3XJOLdEIyNBuAFdhhNhPCjTJQpmO6eVsLAKiH9+mYw+rpWQmmW8ktQlhVdosXoYHO
t1lGIEaOrDTZA+usOP7OHKe/sFYGysVKlMUlnOqM+0aci9ZWXPf+lhrv2A4QuR55pq/VM5+qmL5HzDSMIIvOD8vWfUUvARxb2YSDJ1mWin/TlqtEq6/jumweiv1BNCfPeLJ4FJC1lPSEjb3/60U3IEa7inV2UB

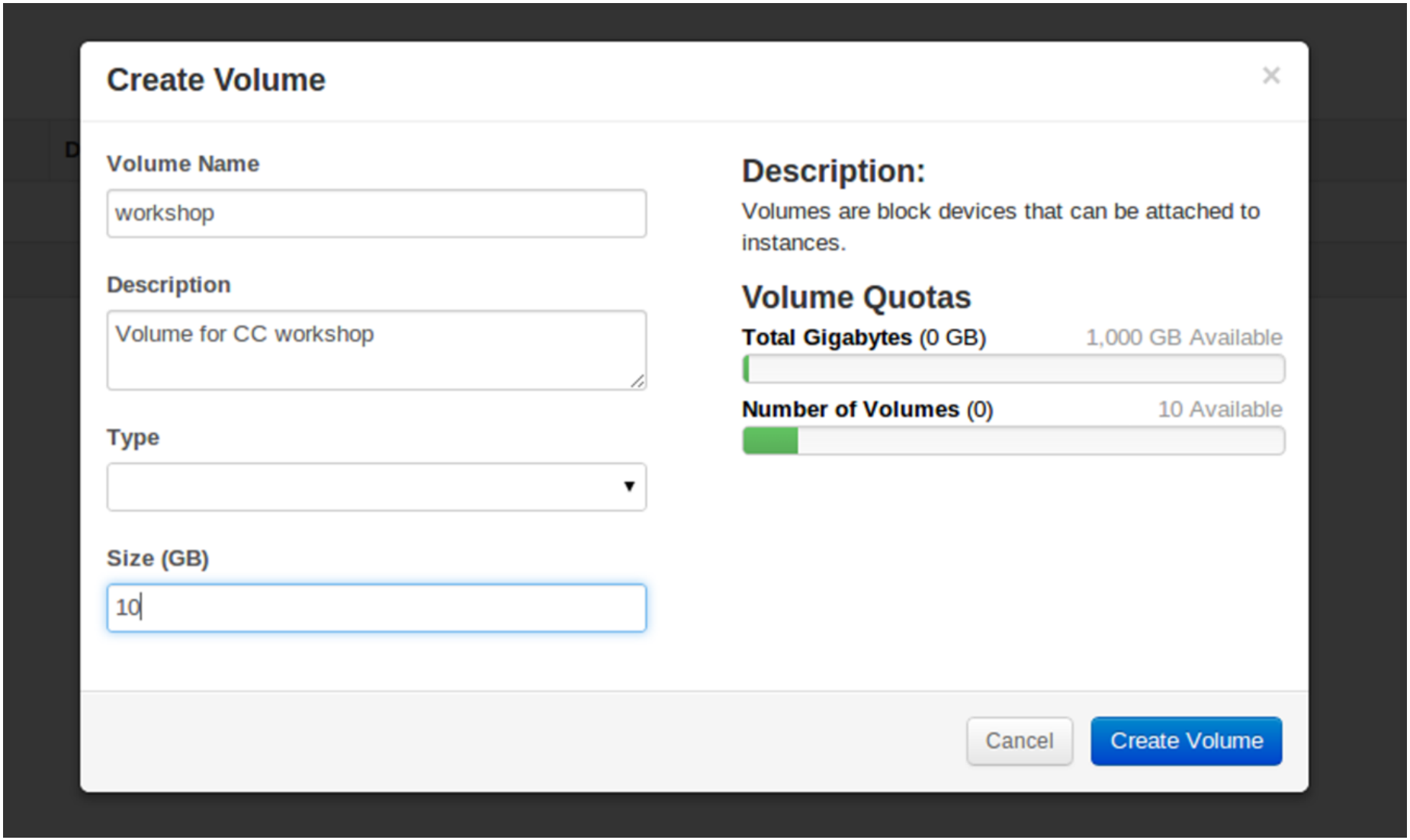
Volumes


Volumes - Gran Sasso Clou
https://stackctl.lngs.infn.it/project/volumes/
Gran Sasso Clouds
Volumes
Logged in as: mpanella
Settings
Help
Sign Out
Volumes
+ Create Volume
Name
Description
Size
Status
Type
Attached To
Actions
No items to display.
Displaying 0 items
Project
CURRENT PROJECT
calcolo
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Networks
Routers
Network Topology

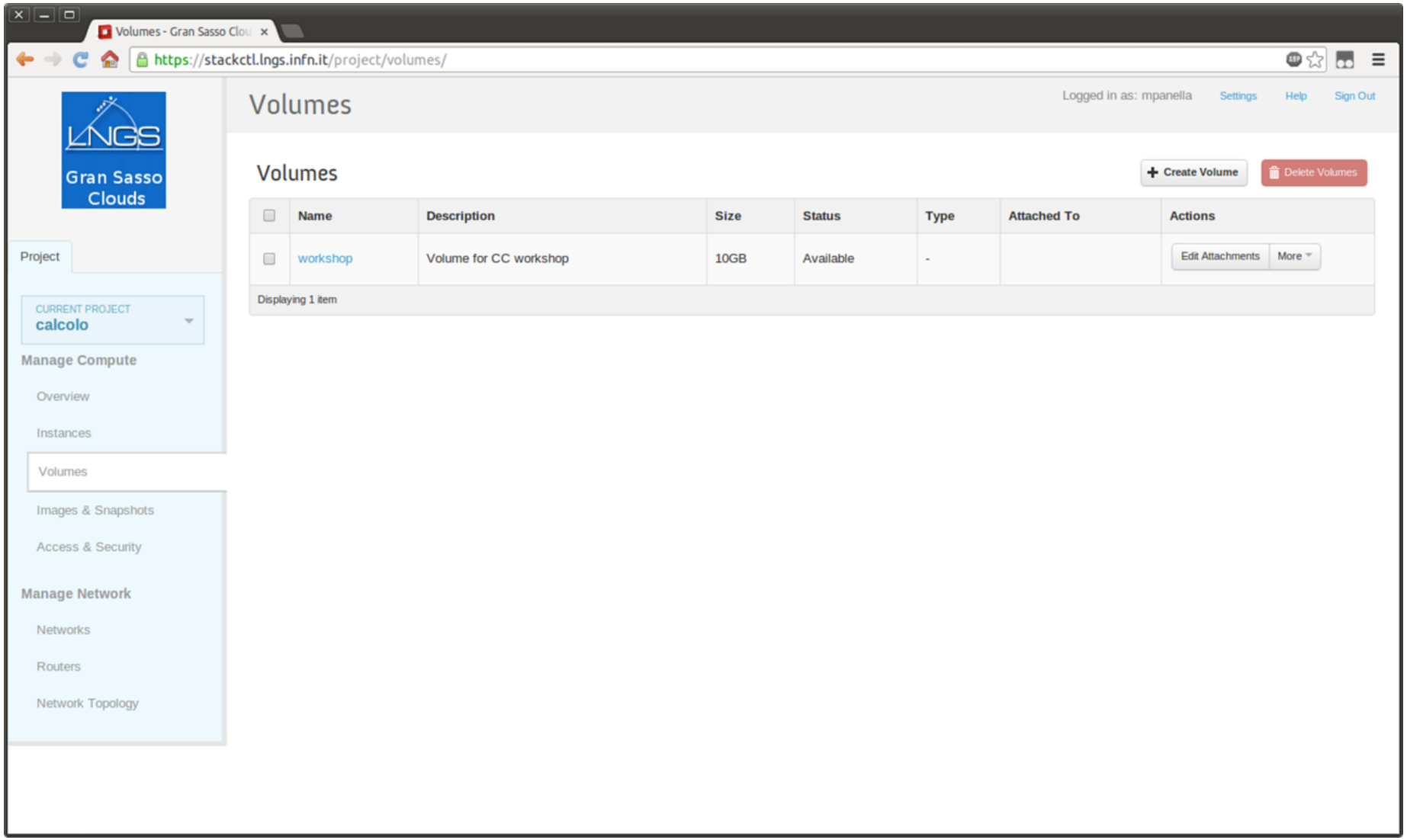
Volumes


Volumes - Gran Sasso Clou
https://stackctl.lngs.infn.it/project/volumes/
Gran Sasso Clouds
Volumes
Logged in as: mpanella
Settings
Help
Sign Out
Volumes
+ Create Volume
Name
Description
Size
Status
Type
Attached To
Actions
No items to display.
Displaying 0 items
Project
CURRENT PROJECT
calcolo
Manage Compute
Overview
Instances
Volumes
Images & Snapshots
Access & Security
Manage Network
Networks
Routers
Network Topology

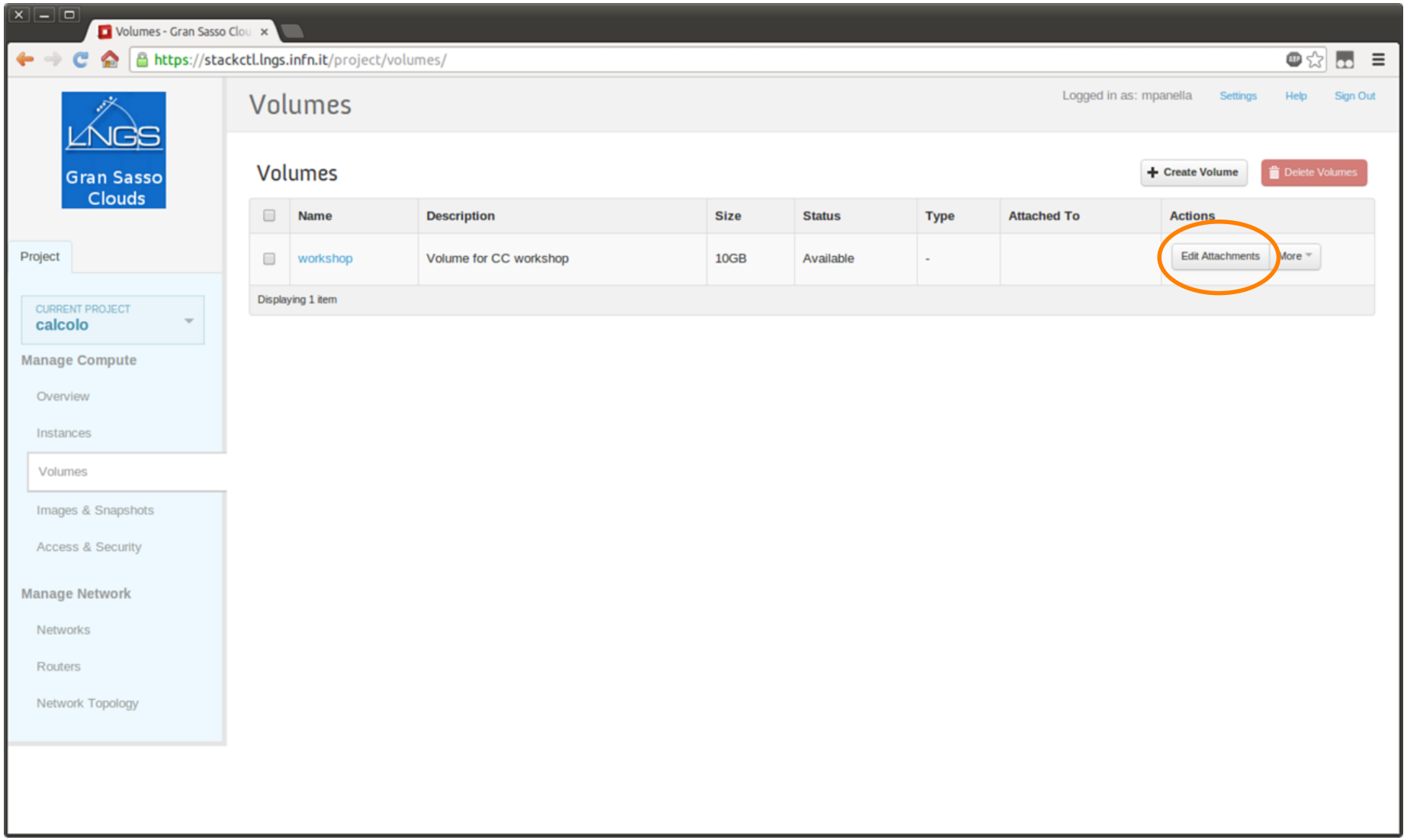
Creating a volume



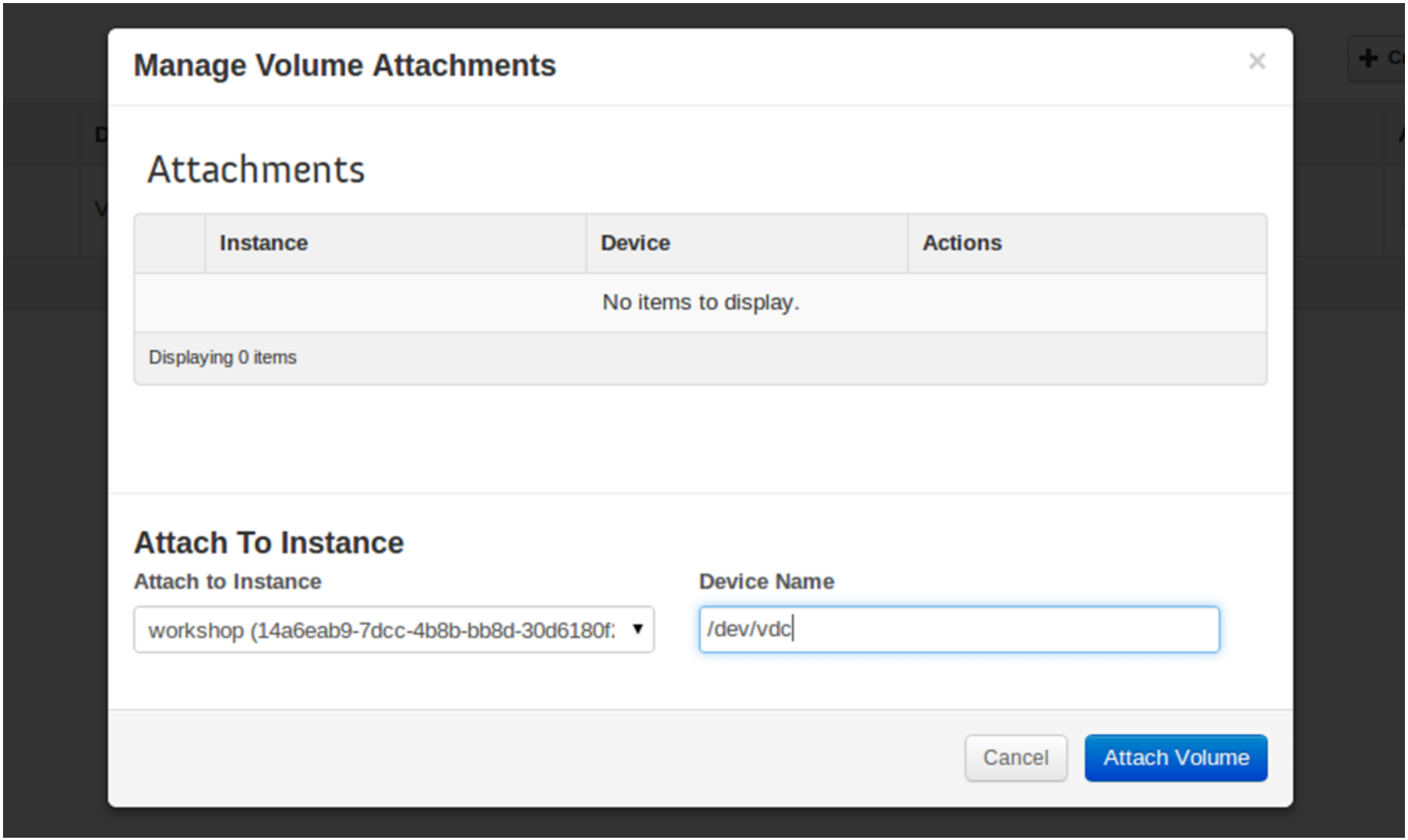
Volumes (cont'd)



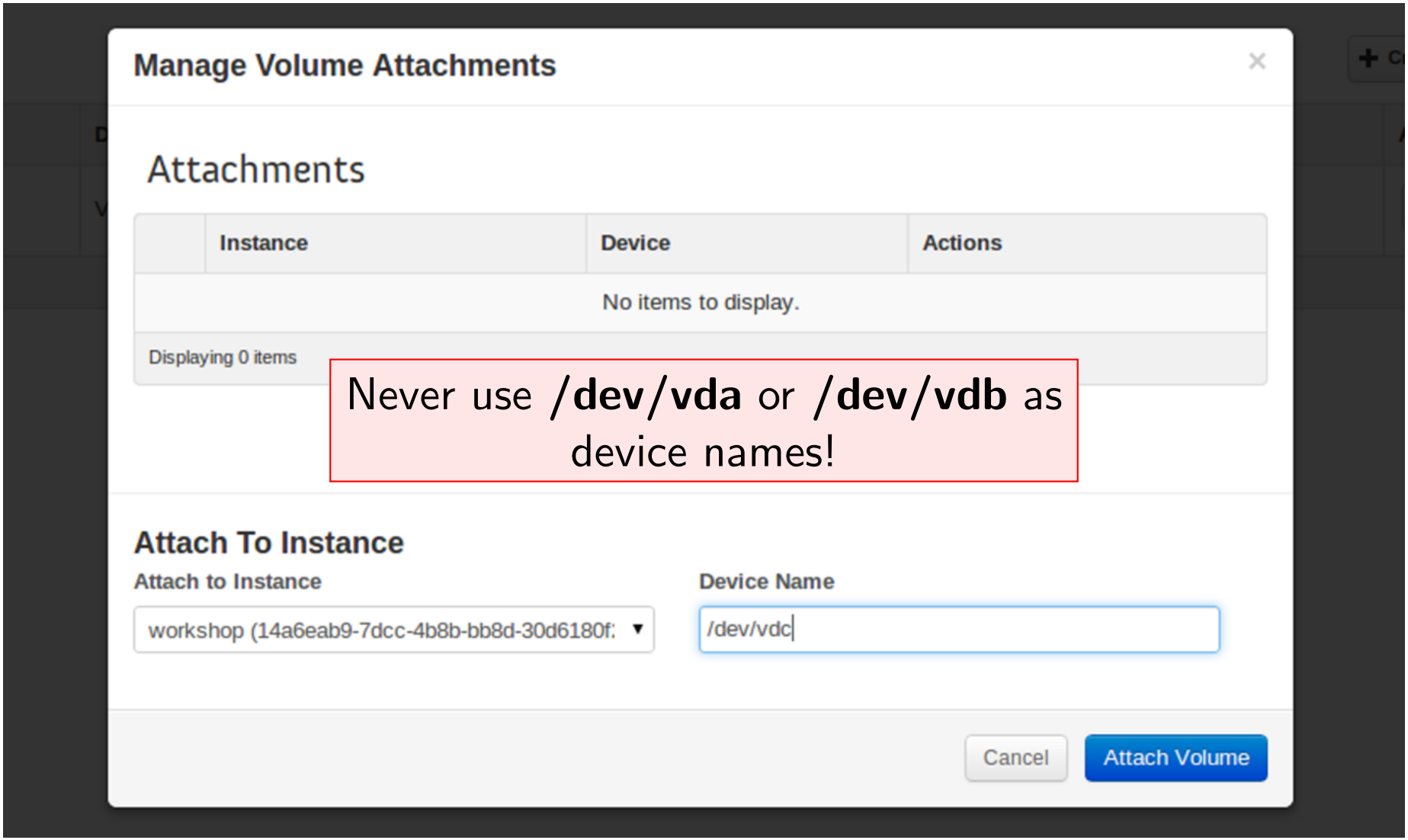
Volumes (cont'd)



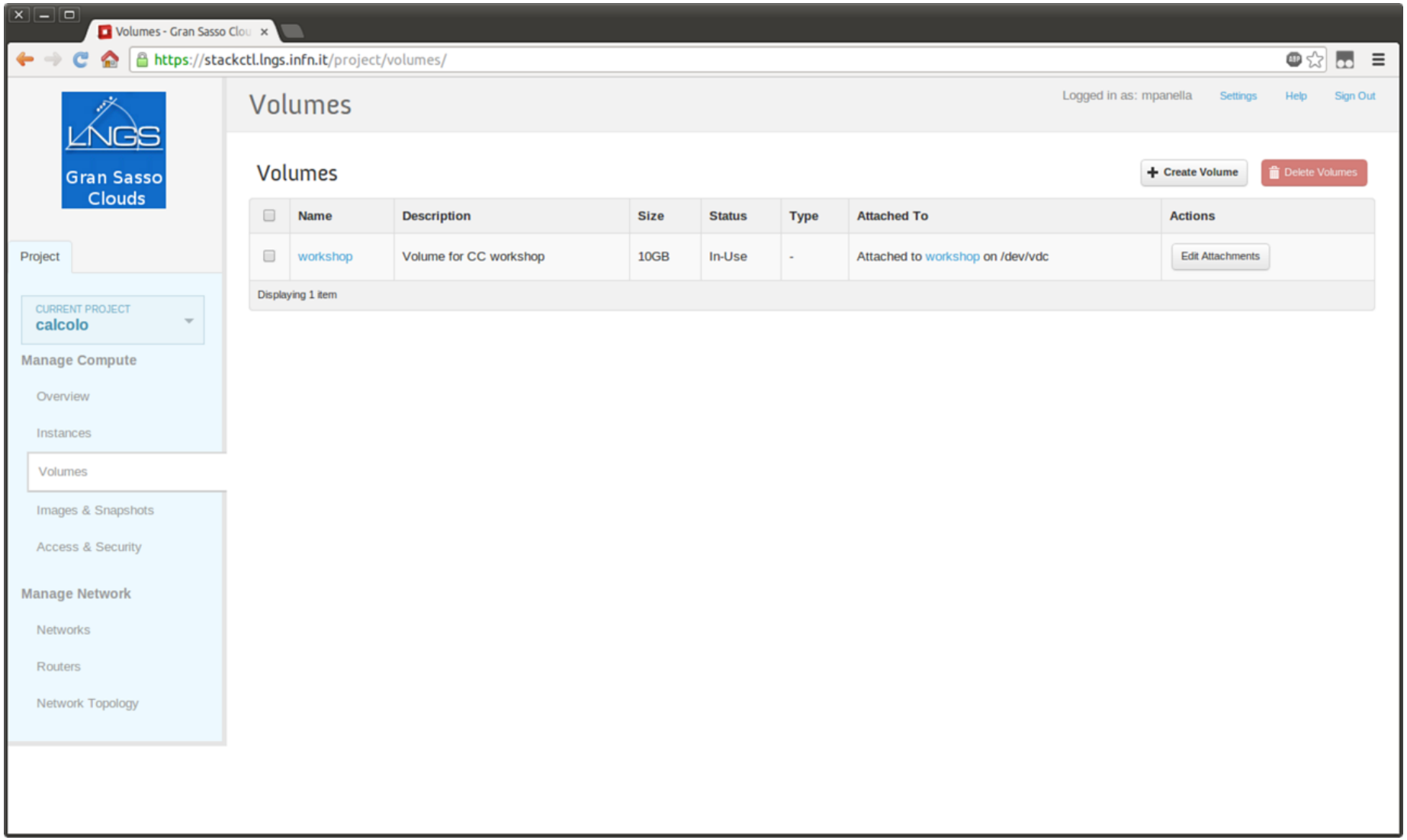
Attaching a volume



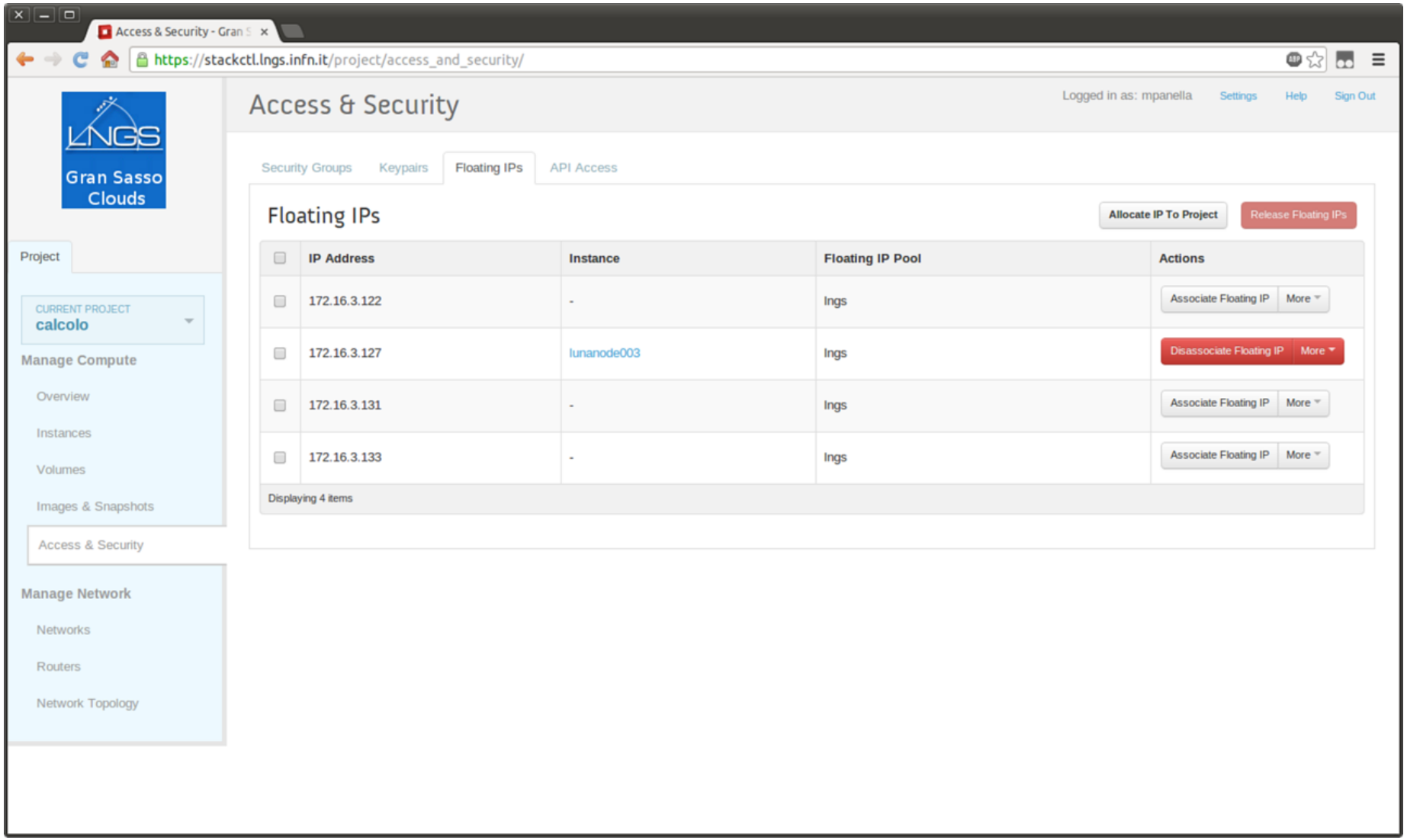
Attaching a volume



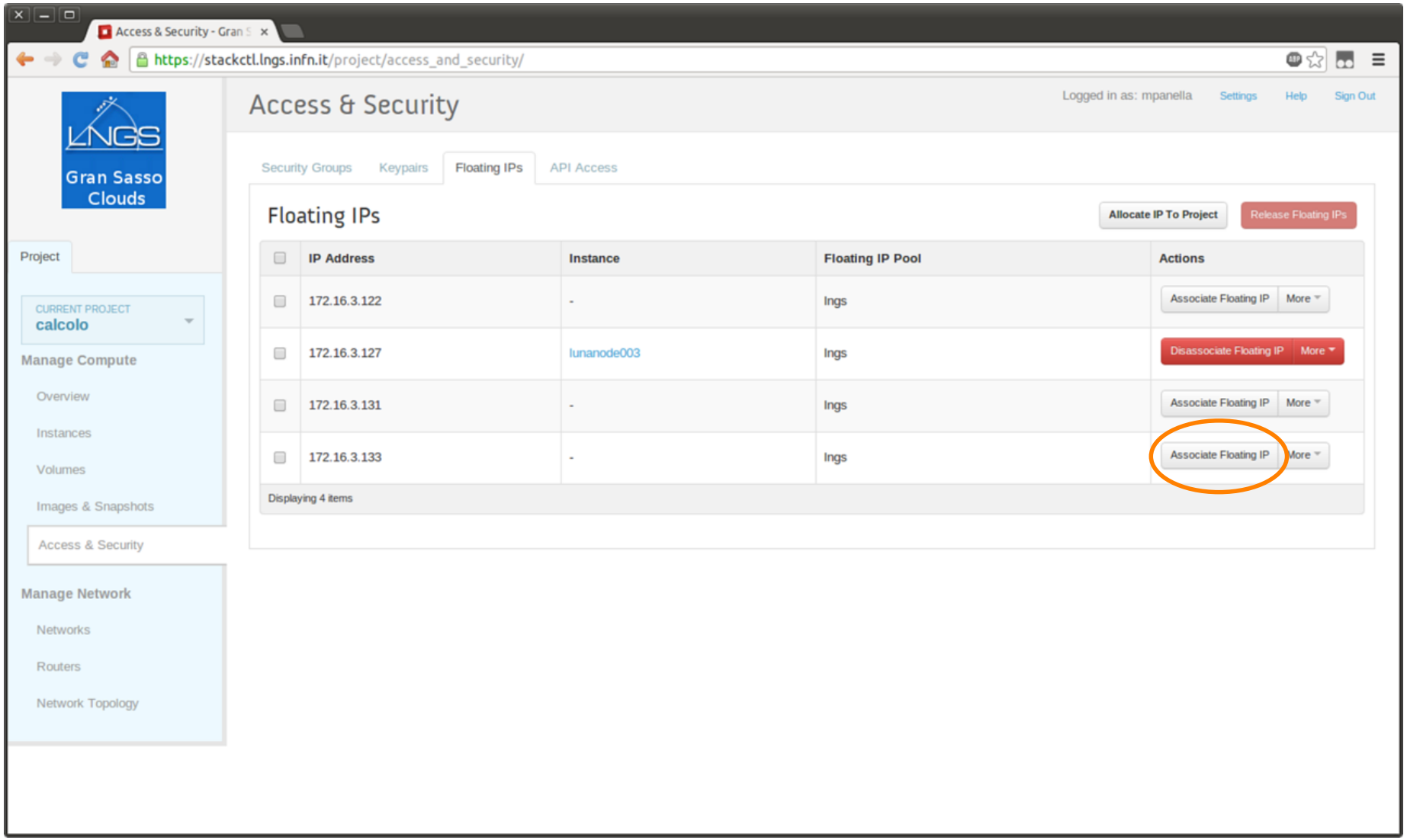
Attaching a volume



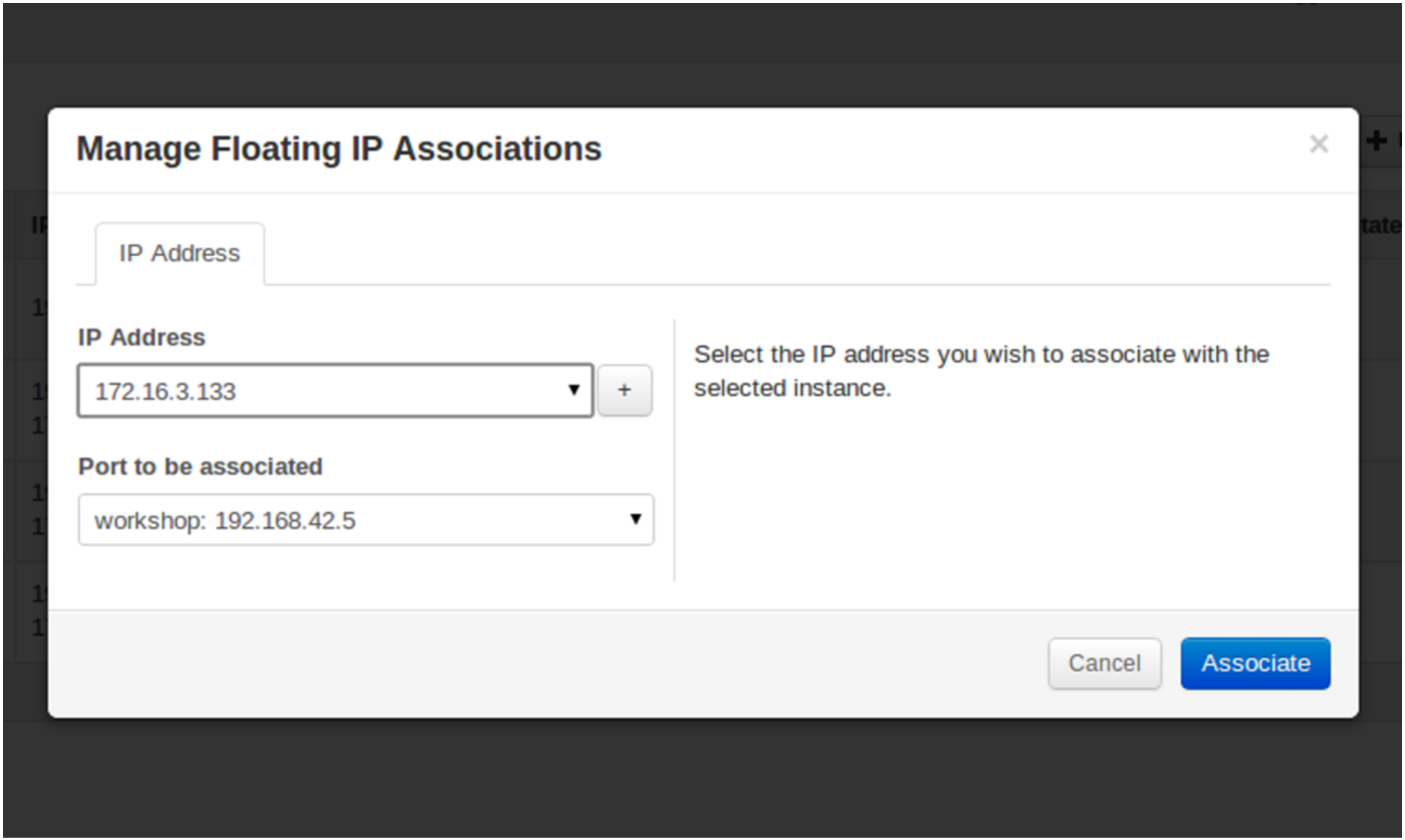
Floating IPs



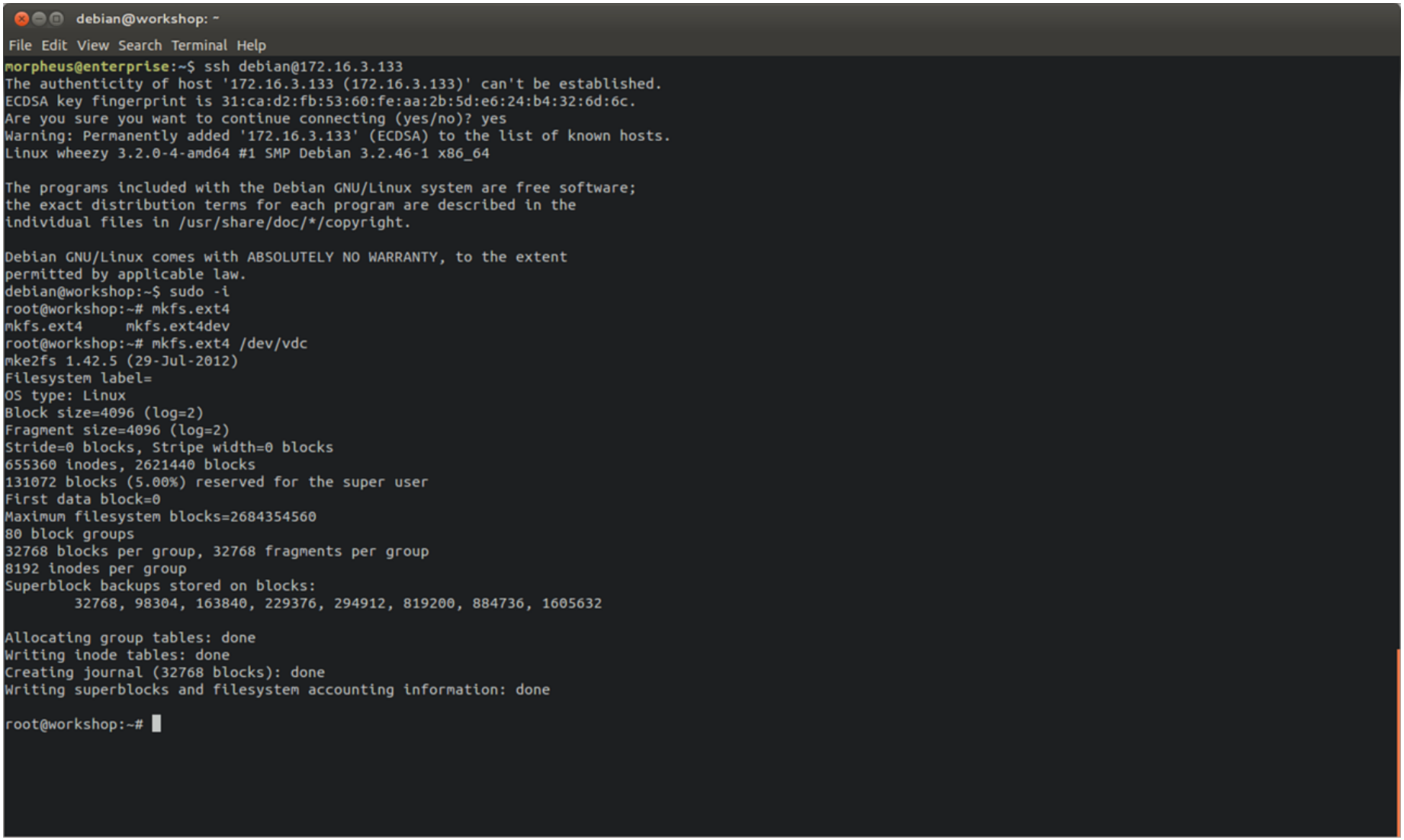
Floating IPs



Associating a floating IP



Inside the VM



Questions?