Introduction to Compute Canada Cloud

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UBC Advanced Research Computing

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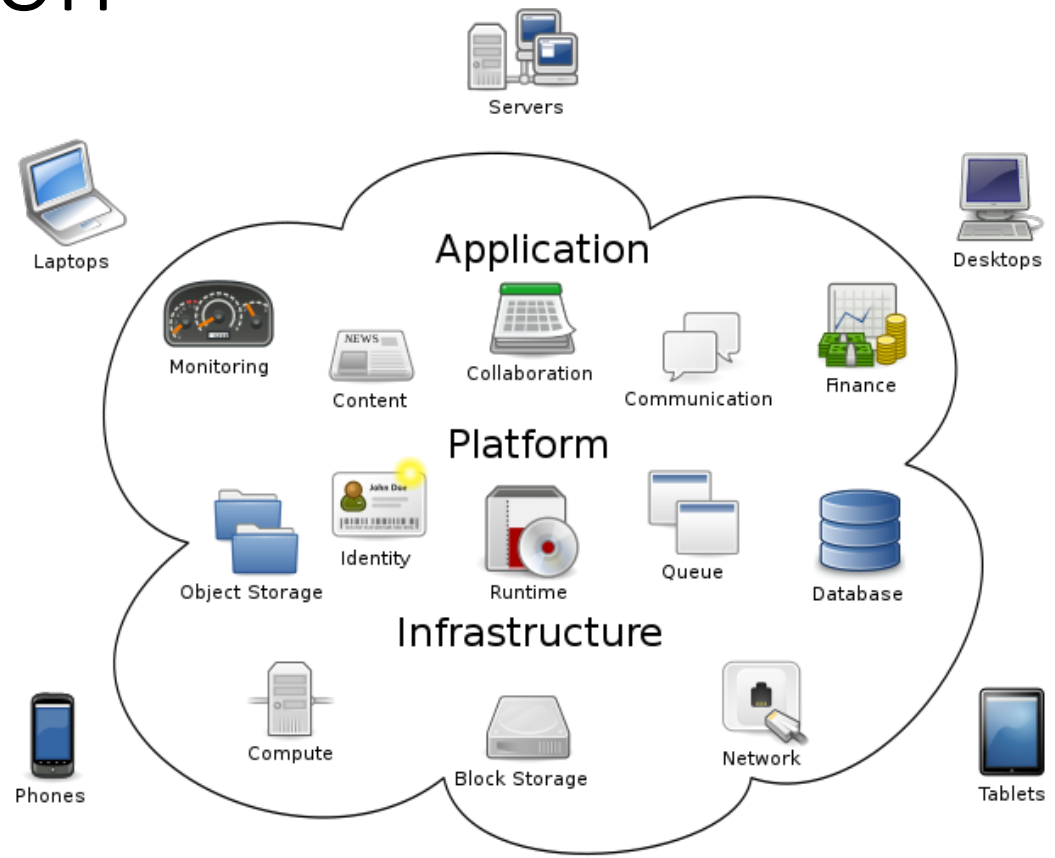
Introduction



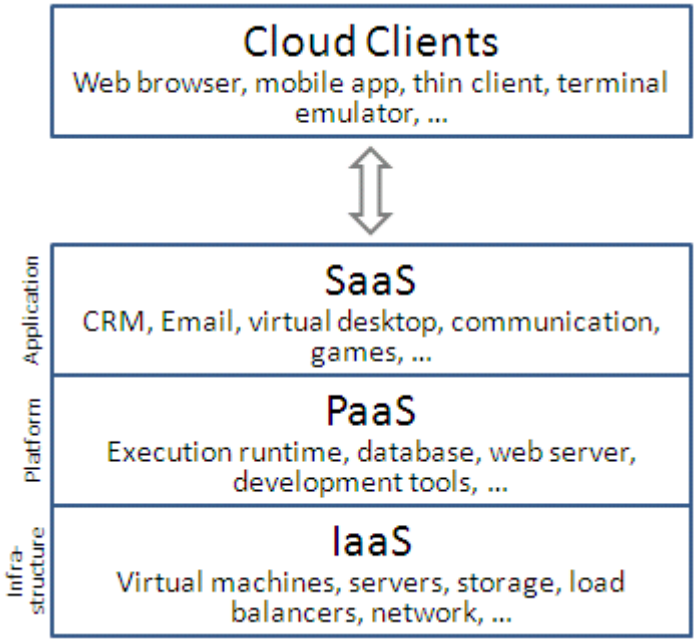
https://commons.wikimedia.org/wiki/File:Cloud_computing.svg

Author: Sam Johnston

Introduction (cont.)

- Delivers high level services and access to system resources over the Internet.
- Services: collaboration (E-mail, calendaring, etc.), web, Dropbox-like file hosting, etc.
- System resources i.e. infrastructure: compute, disk, networking, load balancing, etc.

Introduction (cont.)



https://commons.wikimedia.org/wiki/File:Cloud_computing_layers.png

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Compute Canada Cloud

Arbutus cloud (arbutus.cloud.computecanada.ca)

Node count	CPU	Memory (GB)	Local (ephemeral) storage	Interconnect	GPU	Total CPUs	Total vCPUs
156	2 x Gold 6248	384	2 x 1.92TB SSD in RAID0	1 x 25GbE	N/A	6,240	12,480
8	2 x Gold 6248	1024	2 x 1.92TB SSD in RAID1	1 x 25GbE	N/A	320	6,400
26	2 x Gold 6248	384	2 x 1.6TB SSD in RAID0	1 x 25GbE	4 x V100 32GB	1,040	2,080
32	2 x Gold 6130	256	6 x 900GB 10k SAS in RAID10	1 x 10GbE	N/A	1,024	2,048
4	2 x Gold 6130	768	6 x 900GB 10k SAS in RAID10	2 x 10GbE	N/A	128	2,560
8	2 x Gold 6130	256	4 x 1.92TB SSD in RAID5	1 x 10GbE	N/A	256	512
240	2 x E5-2680 v4	256	4 x 900GB 10k SAS in RAID5	1 x 10GbE	N/A	6,720	13,440
8	2 x E5-2680 v4	512	4 x 900GB 10k SAS in RAID5	2 x 10GbE	N/A	224	4,480
2	2 x E5-2680 v4	128	4 x 900GB 10k SAS in RAID5	1 x 10GbE	2 x Tesla K80	56	112

Location: University of Victoria
Total CPUs: 16,008 (484 nodes)
Total vCPUs: 44,112
Total GPUs: 108 (28 nodes)
Total RAM: 157,184 GB
5.3 PB of Volume and Snapshot **Ceph** storage.
12 PB of Object/Shared Filesystem **Ceph** storage.

Compute Canada Cloud (cont.)

Cedar cloud (cedar.cloud.computecanada.ca)

Node count	CPU	Memory (GB)	Local (ephemeral) storage	Interconnect	GPU	Total CPUs	Total vCPUs
28	2 x E5-2683 v4	256	2 x 480GB SSD in RAID1	1 x 10GbE	N/A	896	1,792
4	2 x E5-2683 v4	256	2 x 480GB SSD in RAID1	1 x 10GbE	N/A	128	2,560

Location: Simon Fraser University

Total CPUs: 1,024

Total vCPUs: 4,352

Total RAM: 7,680 GB

500 TB of persistent **Ceph** storage.

Compute Canada Cloud (cont.)

Graham cloud (graham.cloud.computecanada.ca)

Node count	CPU	Memory (GB)	Local (ephemeral) storage	Interconnect	GPU	Total CPUs	Total vCPUS
6	2 x E5-2683 v4	256	2x 500GB SSD in RAID0	1 x 10GbE	N/A	192	
2	2 x E5-2683 v4	512	2x 500GB SSD in RAID0	1 x 10GbE	N/A	64	
8	2 x E5-2637 v4	128	2x 500GB SSD in RAID0	1 x 10GbE	N/A	256	
8	2 x Xeon(R) Gold 6130 CPU	256	2x 500GB SSD in RAID0	1 x 10GbE	N/A	256	
3	2 x E5-2640 v4	256	2x 500GB SSD in RAID0	1 x 10GbE	N/A	120	
12	2 x Xeon(R) Gold 6248 CPU	768	2x 1TB SSD in RAID0	1 x 10GbE	N/A	480	

Location: University of Waterloo

Total CPUs: 1,368

Total vCPUs:

Total RAM: 15,616 GB

84 TB of persistent **Ceph** storage.

Compute Canada Cloud (cont.)

Béluga cloud (beluga.cloud.computecanada.ca)

Node count	CPU	Memory (GB)	Local (ephemeral) storage	Interconnect	GPU	Total CPUs	Total vCPUs
96	2 x Intel Xeon Gold 5218	256	N/A, ephemeral storage in ceph	1 x 25GbE	N/A	3,072	6,144
16	2 x Intel Xeon Gold 5218	768	N/A, ephemeral storage in ceph	1 x 25GbE	N/A	512	10,240

Location: École de Technologie Supérieure

Total CPUs: 3,584

Total vCPUs: 16,384

Total RAM: 36,864 GiB

200 TiB of replicated persistent SSD **Ceph** storage.

1.7 PiB of erasure coded persistent HDD **Ceph** storage.

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Compute Canada Cloud (cont.)

- There is also the NextCloud service which provides 50GB of backed up Dropbox-like storage (https://docs.computecanada.ca/wiki/Nextcloud).

Compute Canada Cloud (cont.)

- The IaaS clouds are built on OpenStack.
- OpenStack is an open-source software platform for deploying clouds i.e. build your own cloud environment.
- Can work with a variety of hardware, network switches, hypervisors.

Compute Canada Cloud (cont.)

- Various commercial vendors provide OpenStack:
  - SUSE
  - Redhat
  - Ubuntu
  - Mirantis

- Also exists a free implementation called OpenStack-Ansible which is in use by Compute Canada:
  - https://github.com/openstack/openstack-ansible

Cloud Resources

Attributes	Compute Cloud[1]	Persistent Cloud[1]
Who can request	PIs only	PIs only
VCPUs (see VM flavours)	80	25
Instances[2]	20	10
Volumes[2]	2	10
Volume snapshots[2]	2	10
RAM (GB)	300	50
Floating IP	2	2
Persistent storage (TB)	10	
Object storage (TB)[3]	10	
Shared filesystem storage (TB)[3]	10	
Default duration	1 year[4], with 1 month wall-time	1 year (renewable)[4]
Default renewal	April[4]	April[4]

Cloud Resources (cont.)

- You can request resources via the Rapid Access Service (RAS) or Resource Allocation Competition (RAC):

- https://www.computecanada.ca/research-portal/accessing-resources/rapid-access-service/

Other Free Services

- https://www.infoworld.com/article/3179785/aws-vs-azure-vs-google-cloud-which-free-tier-is-best.html

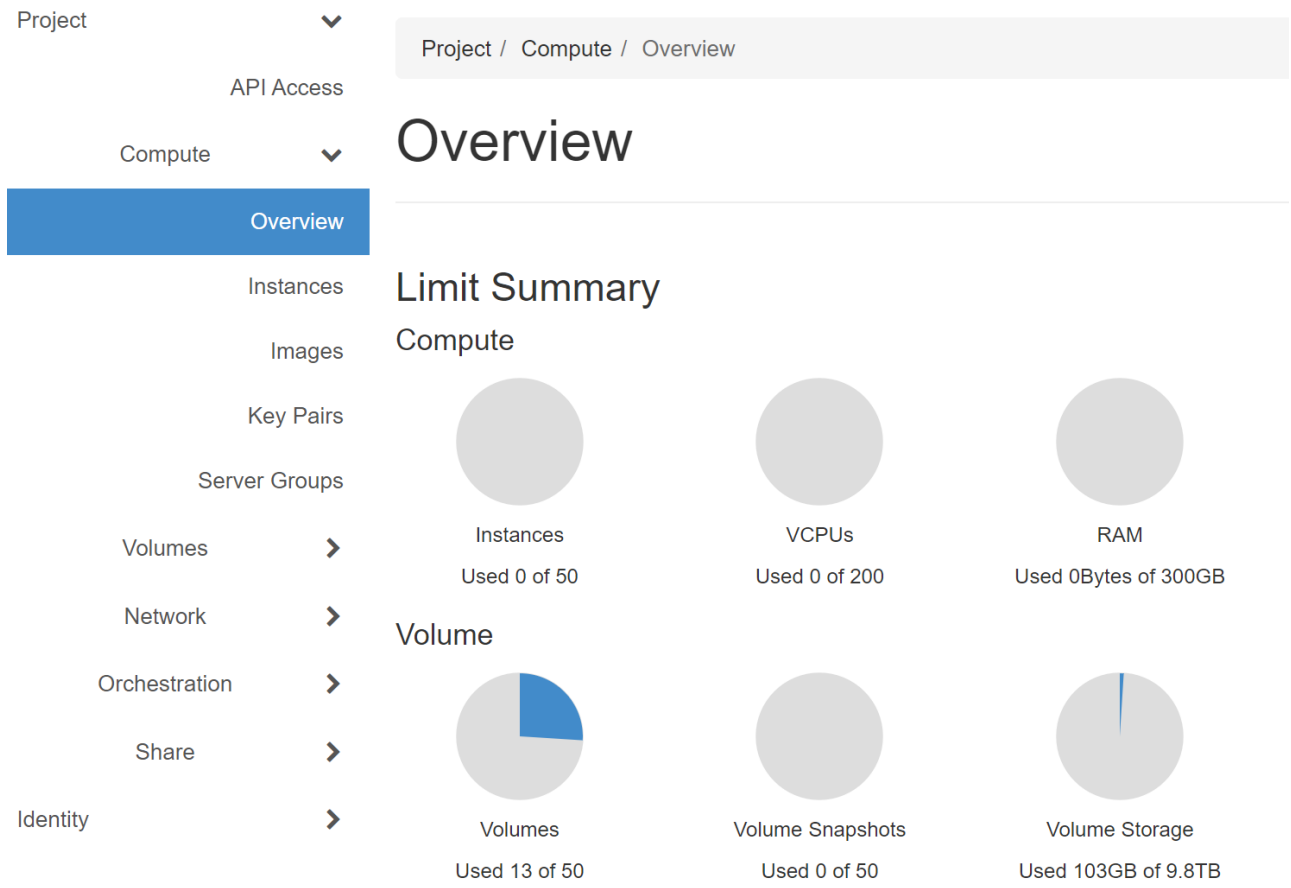
- Amazon Web Services: https://aws.amazon.com/free/; 1-2 VCPU free for 12 months (t2.micro or t3.micro instances depending on region).

- Data egress is typically charged.

Time to login

- https://arbutus.cloud.computecanada.ca
- Use the guest account “wgtrainingXX”.
- Password will be provided in class.
- Don’t use Safari; use Firefox or Chrome.

Hands-On


Project
API Access
Compute
Overview
Instances
Images
Key Pairs
Server Groups
Volumes
Network
Orchestration
Share
Identity
Project / Compute / Overview
Overview
Limit Summary
Compute
Instances
Used 0 of 50
VCPUs
Used 0 of 200
RAM
Used 0Bytes of 300GB
Volume
Volumes
Used 13 of 50
Volume Snapshots
Used 0 of 50
Volume Storage
Used 103GB of 9.8TB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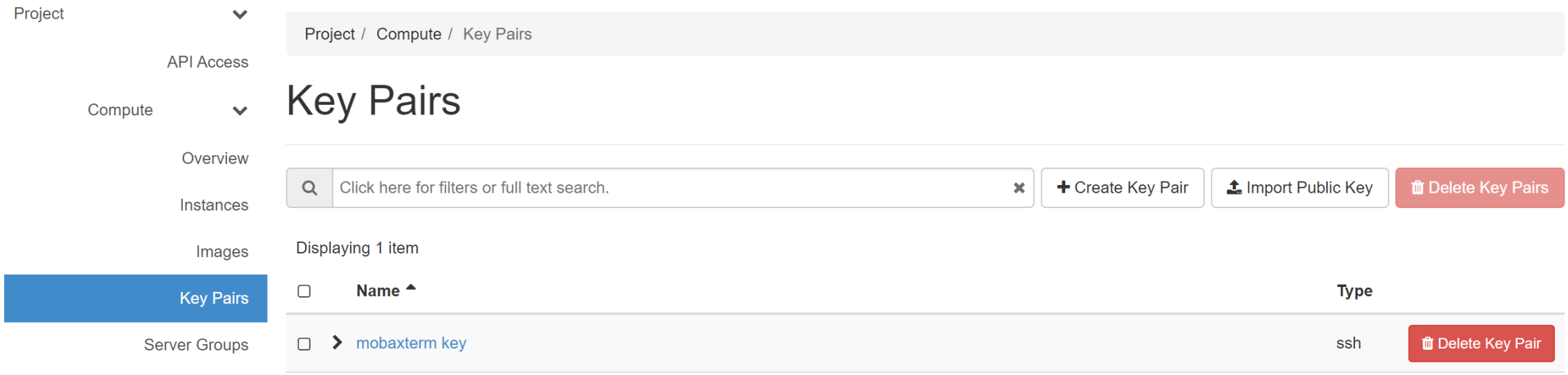
Create SSH Key Pair and Download Private Key



Create Key Pair

Key Pairs are how you login to your instance after it is launched. Choose a key pair name you will recognize. Names may only include alphanumeric characters, spaces, or dashes.

Key Pair Name *

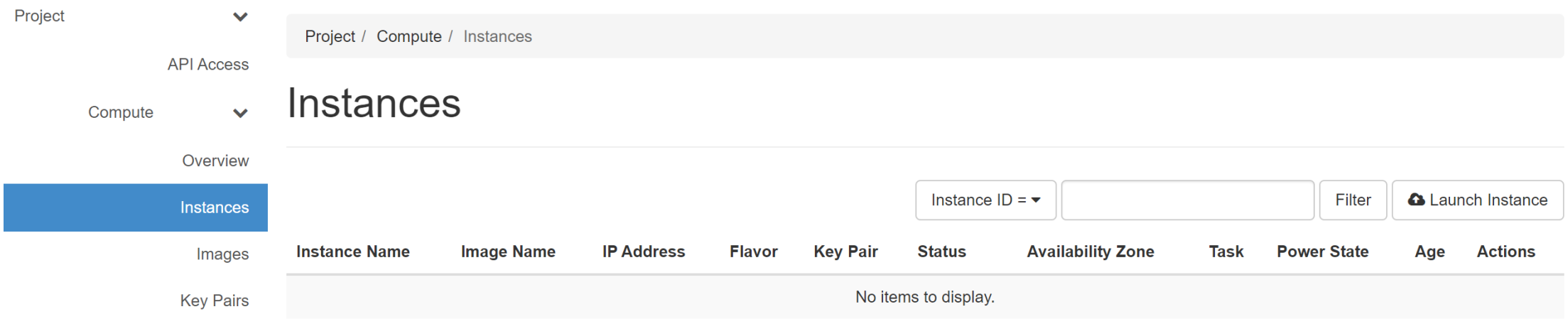
coursekey

Key Type *

SSH Key

Create Keypair | Copy Private Key to Clipboard | Done

Launch Instance of a Virtual Machine



Launch Instance

- Details
- Source *
- Flavor *
- Networks
- Network Ports
- Security Groups
- Key Pair
- Configuration

Please provide the initial hostname for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings.

Instance Name *

myinstance

Description

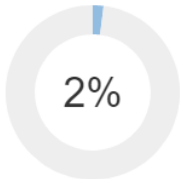
Availability Zone

Any Availability Zone

Count *

1

Total Instances
(50 Max)



0 Current Usage
1 Added
49 Remaining

Launch Instance

- Details
- Source
- Flavor *
- Networks
- Network Ports
- Security Groups

Instance source is the template used to create an instance. You can use an image, a snapshot of an instance (image snapshot), a volume or a volume snapshot (if enabled). You can also choose to use persistent storage by creating a new volume.

Select Boot Source

Image

Create New Volume

Yes | No

Allocated

Name	Updated	Size	Type	Visibility
CentOS-7-x64-2020-11	5/26/21 4:01 PM	847.81 MB	qcow2	Public

Launch Instance

Details

Source

Flavor

Networks

Flavors manage the sizing for the compute, memory and storage capacity of the instance.

Allocated

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public
p1-1.5gb	1	1.5 GB	20 GB	20 GB	0 GB	No

Launch Instance

Details

Source *

Flavor *

Networks

Network Ports

Security Groups

Key Pair

Configuration

Server Groups

A key pair allows you to SSH into your newly created instance. You may select an existing key pair, import a key pair, or generate a new key pair.

+ Create Key Pair | Import Key Pair

Allocated

Displaying 1 item

Name	Type
mobaxterm key	ssh

Displaying 1 item

Available 0

Select one

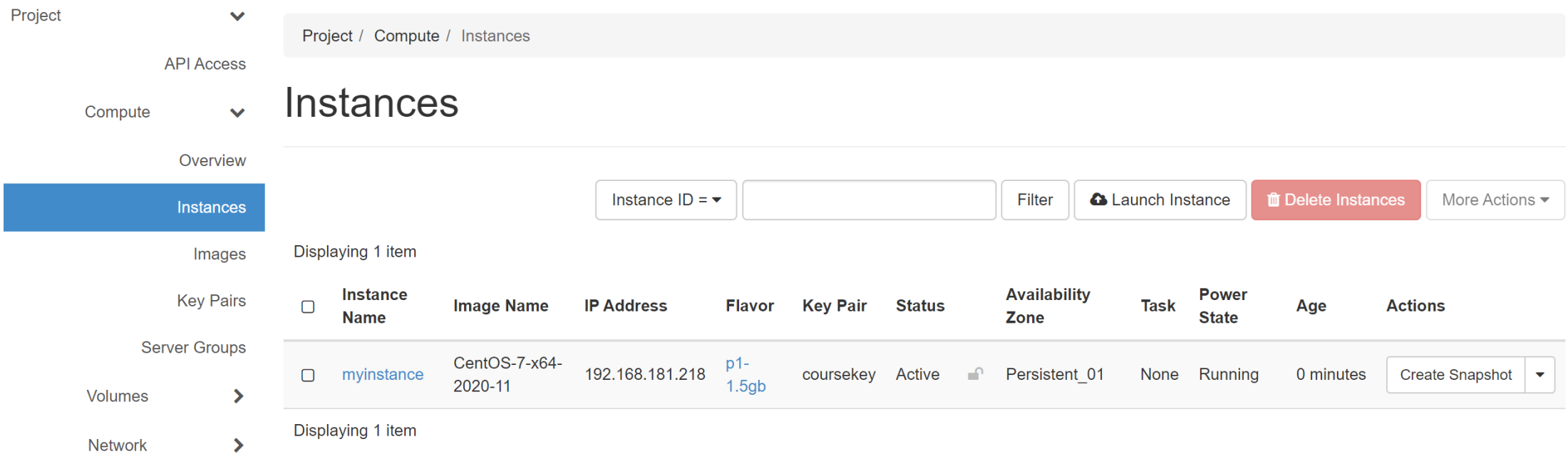
Click here for filters or full text search.

Displaying 0 items

Launch the Instance

- Click Launch Instance to launch the virtual machine. Make sure to note the name of your instance.
- OpenStack will boot the VM and insert the SSH key into it.
- Once the VM is booted, we can try to access it remotely.
- But need to configure security and public networking first.

Configuring Remote Access



	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status		Availability Zone	Task	Power State	Age	Actions
☐	myinstance	CentOS-7-x64-2020-11	192.168.181.218	p1-1.5gb	coursekey	Active	🔓	Persistent_01	None	Running	0 minutes	Create Snapshot ▾

Displaying 1 item

- Associate Floating IP
- Attach Interface
- Detach Interface
- Edit Instance
- Attach Volume
- Detach Volume
- Update Metadata
- Retrieve Password
- Edit Security Groups
- Edit Port Security Groups

Manage Floating IP Associations

IP Address *

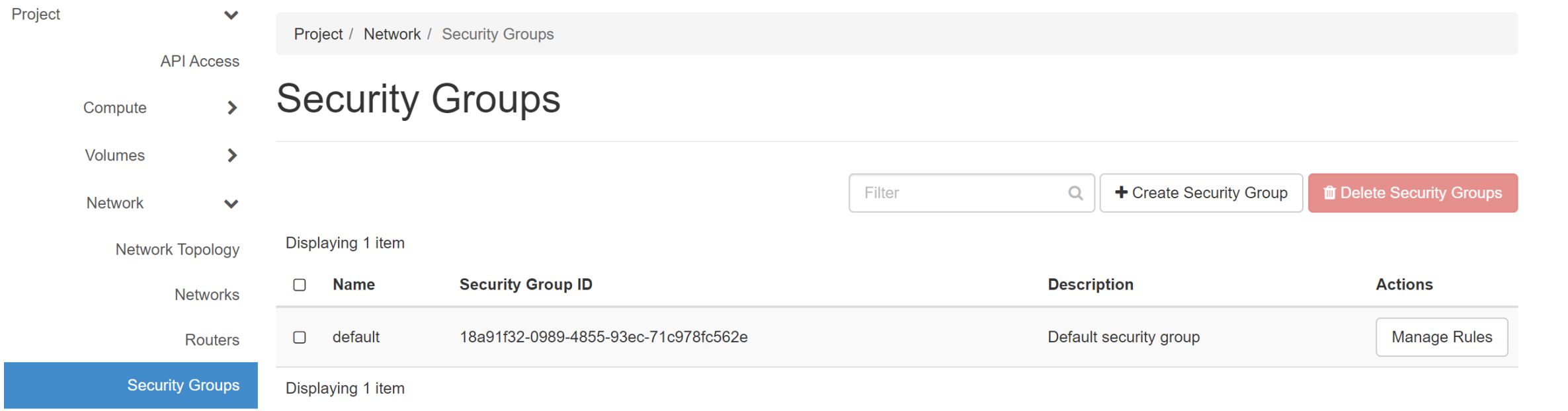
206.12.88.135 +

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

Port to be associated *

myinstance: 192.168.181.218

Cancel Associate


Project
API Access
Compute
Volumes
Network
Network Topology
Networks
Routers
Security Groups
Project / Network / Security Groups
Security Groups
Filter
+ Create Security Group
Delete Security Groups
Displaying 1 item
Name
Security Group ID
Description
Actions
default
18a91f32-0989-4855-93ec-71c978fc562e
Default security group
Manage Rules
Displaying 1 item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Add Rule

Rule *

SSH

Remote * ?

CIDR

CIDR ?

0.0.0.0/0

Description:

Rules define which traffic is allowed to instances assigned to the security group. A security group rule consists of three main parts:

Rule: You can specify the desired rule template or use custom rules, the options are Custom TCP Rule, Custom UDP Rule, or Custom ICMP Rule.

Open Port/Port Range: For TCP and UDP rules you may choose to open either a single port or a range of ports. Selecting the "Port Range" option will provide you with space to provide both the starting and ending ports for the range. For ICMP rules you instead specify an ICMP type and code in the spaces provided.

Remote: You must specify the source of the traffic to be allowed via this rule. You may do so either in the form of an IP address block (CIDR) or via a source group (Security Group). Selecting a security group as the source will allow any other instance in that security group access to any other instance via this rule.

Add

- Network
  - Network Topology
  - Networks
  - Routers
  - Security Groups
  - Floating IPs
- Orchestration
- Share
- Identity

+ Add Rule | Delete Rules

Displaying 7 items

Direction	Ether Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security Group	Description	Actions
Egress	IPv4	Any	Any	0.0.0.0/0	-	-	Delete Rule
Egress	IPv6	Any	Any	::/0	-	-	Delete Rule
Ingress	IPv4	Any	Any	-	default	-	Delete Rule
Ingress	IPv4	TCP	22 (SSH)	0.0.0.0/0	-	-	Delete Rule
Ingress	IPv4	TCP	80 (HTTP)	0.0.0.0/0	-	-	Delete Rule
Ingress	IPv4	TCP	443 (HTTPS)	0.0.0.0/0	-	-	Delete Rule
Ingress	IPv6	Any	Any	-	default	-	Delete Rule

Displaying 7 items

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Connect to the Instance via SSH

```
ssh -i <key>.pem centos@<public ip>
```

If using MobaXTerm, see:

https://docs.computecanada.ca/wiki/Connecting_with_MobaXTerm#Using_a_Key_Pair

If using Windows Subsystem for Linux, you may need to do:

```
chmod 600 <name of private key file>
```

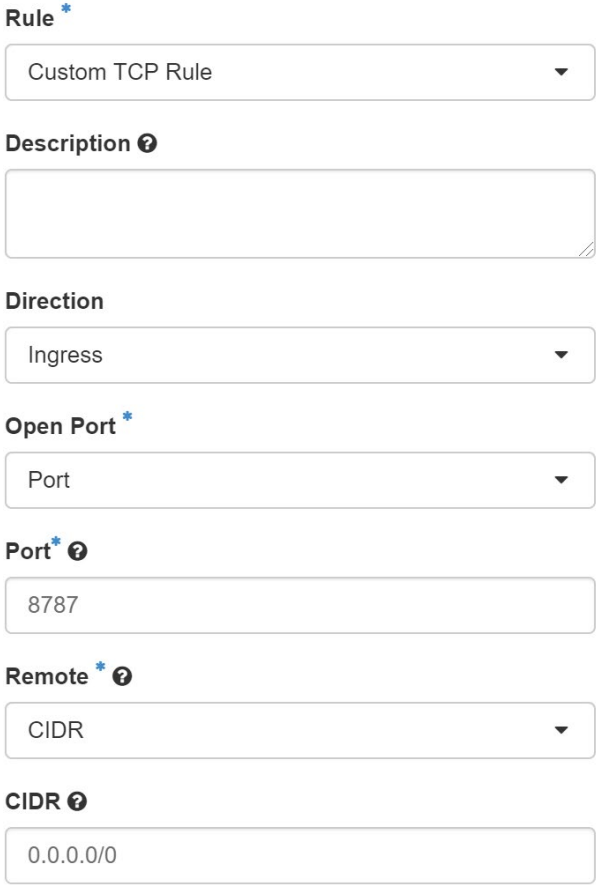
Installing RStudio

```
sudo yum install epel-release -y
sudo yum install R -y
<< will take a while >>
```

```
sudo yum install wget -y
wget https://download2.rstudio.org/server/centos7/x86_64/rstudio-server-rhel-1.4.1717-x86_64.rpm
sudo yum install rstudio-server-rhel-1.4.1717-x86_64.rpm -y
```

```
sudo systemctl status rstudio-server.service
sudo systemctl enable rstudio-server.service
```

Add Security Rule



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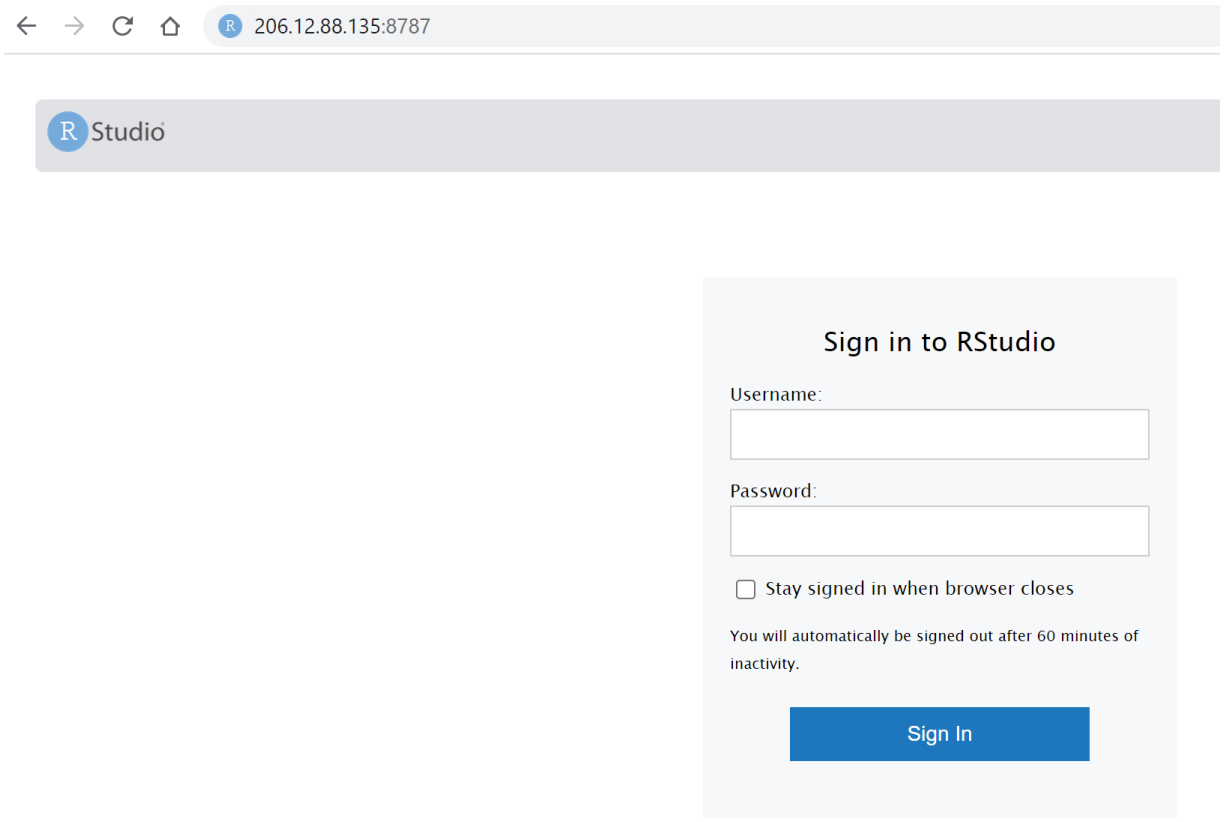
Add User

```
sudo useradd rstudiouser

sudo passwd rstudiouser
```

Done



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Maintaining Your Instance

- Install updates to the OS, e.g. for CentOS do “yum -y update”.

- Install application updates regularly for RStudio and other applications.

Resources

- Compute Canada Cloud
  - https://www.computecanada.ca/research-portal/national-services/compute-canada-cloud/
  - https://docs.computecanada.ca/wiki/Creating_a_Linux_VM

- UBC Advanced Research Computing
  - https://www.arc.ubc.ca

- WestGrid
  - https://www.westgrid.ca