

Introduction to the Alliance Cloud

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Land Acknowledgement

We would like to acknowledge that

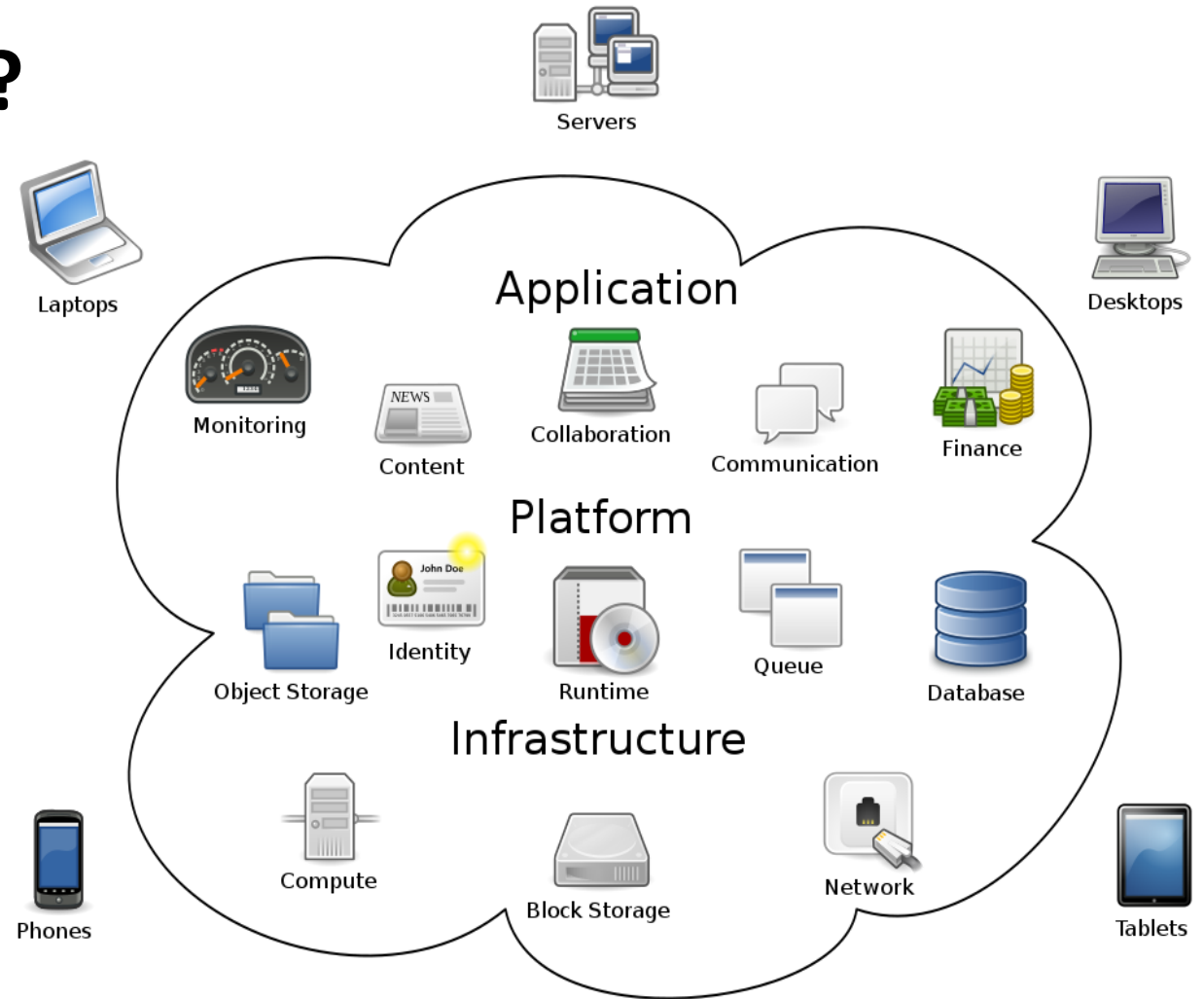
- University of British Columbia, Point Grey Campus (Vancouver) is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) People.
- University of British Columbia, Okanagan Campus (Kelowna) lies on the unceded territory of the Syilx (Okanagan) Peoples

Session Overview

- What is Cloud Computing?
- Community Cloud vs Commercial Cloud
- Digital Research Alliance of Canada
- The Alliance Cloud

What is Cloud Computing?

- Is the on-demand availability of computer system resources
- 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.



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

Author: Sam Johnston

Cloud Services

SOFTWARE AS A SERVICE (SaaS)

E.g., E-mail, Google Docs, Virtual Desktop

PLATFORM AS A SERVICE (PaaS)

E.g., Database, Web Server, Development Tools

INFRASTRUCTURE AS A SERVICE (IaaS)

Virtual Machines, Storage, Load Balancers

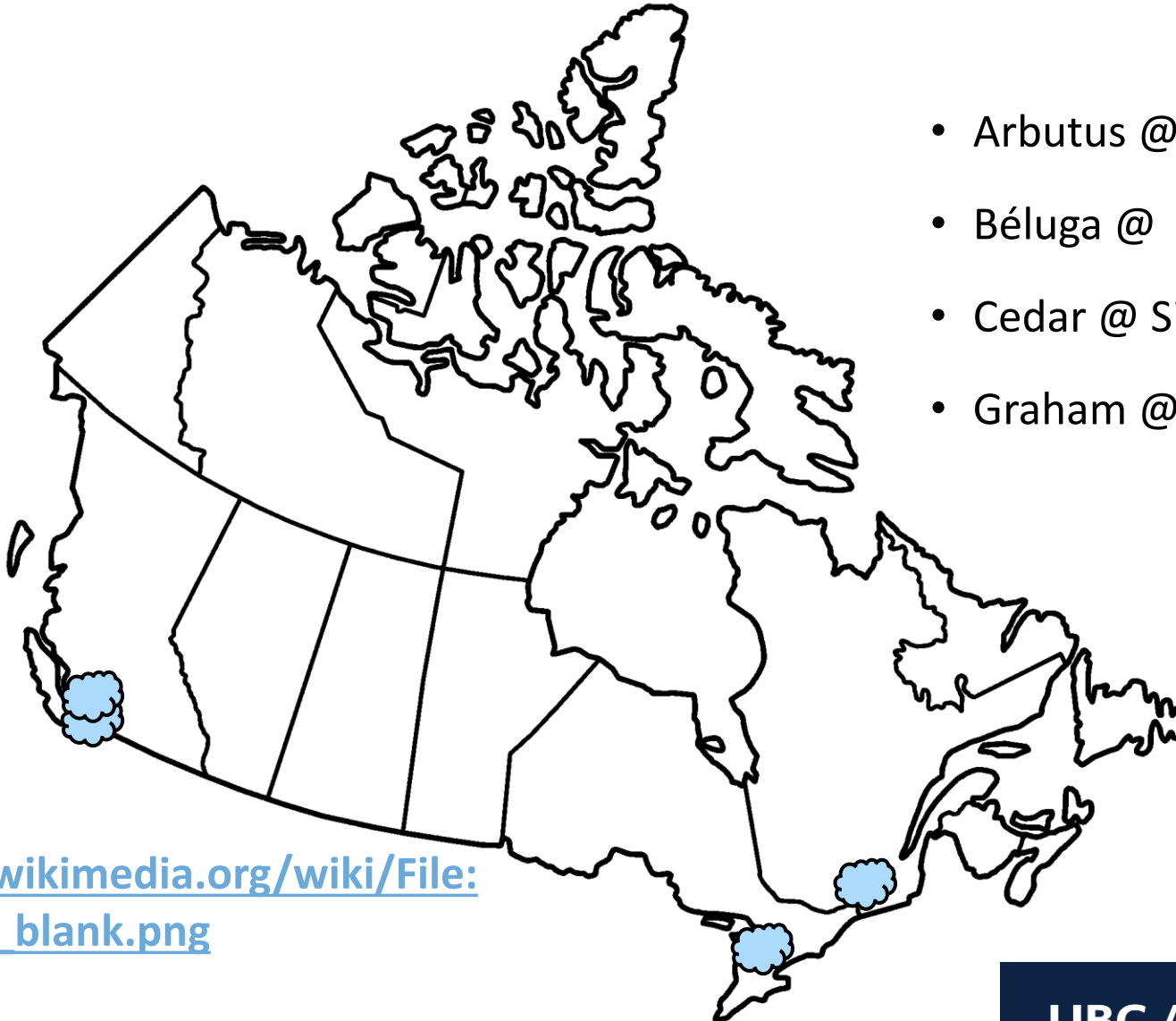
Commercial Cloud

- Examples of Cloud Providers:
 - Amazon Web Services (AWS)
 - Google Cloud Platform (GCP)
 - Microsoft Azure
 - Oracle Cloud
- Pay-as-you-go model

Common Research Use Cases

- Remote Desktop – e.g., Windows, Linux
 - AWS: Virtual Machines (EC2), Amazon Lightsail for Research
 - Microsoft Azure: Virtual Machine Service
- Machine Learning & Artificial Intelligence
 - AWS: Amazon SageMaker, Amazon Bedrock
 - Microsoft Azure: Machine Learning Service, Azure AI services - OpenAI, Vision, Video Indexer
- Database – e.g., MySQL, PostgreSQL, SQL Server, Oracle Database
 - AWS: Amazon Relational Database Service (RDS)
 - Microsoft Azure: Databases on Azure

The Digital Research Alliance of Canada Cloud



- Arbutus @ University of Victoria
- Béluga @ École de Technologie Supérieure
- Cedar @ Simon Fraser University
- Graham @ University of Waterloo

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

Arbutus cloud

Arbutus cloud

Address: 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.

Béluga cloud

Béluga cloud

Address: 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	1,024

Location: École de Technologie Supérieure

Total CPUs: 3,584

Total vCPUs: 7,168

Total RAM: 36,864 GiB

200 TiB of replicated persistent SSD [Ceph](#) storage.

1.7 PiB of erasure coded persistent HDD [Ceph](#) storage.

Cedar cloud

Cedar cloud

Address: 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	256

Location: Simon Fraser University

Total CPUs: 1,024

Total vCPUs: 2,048

Total RAM: 7,680 GB

500 TB of persistent [Ceph](#) storage.

Graham cloud

Graham cloud

Address: graham.cloud.compute.canada.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

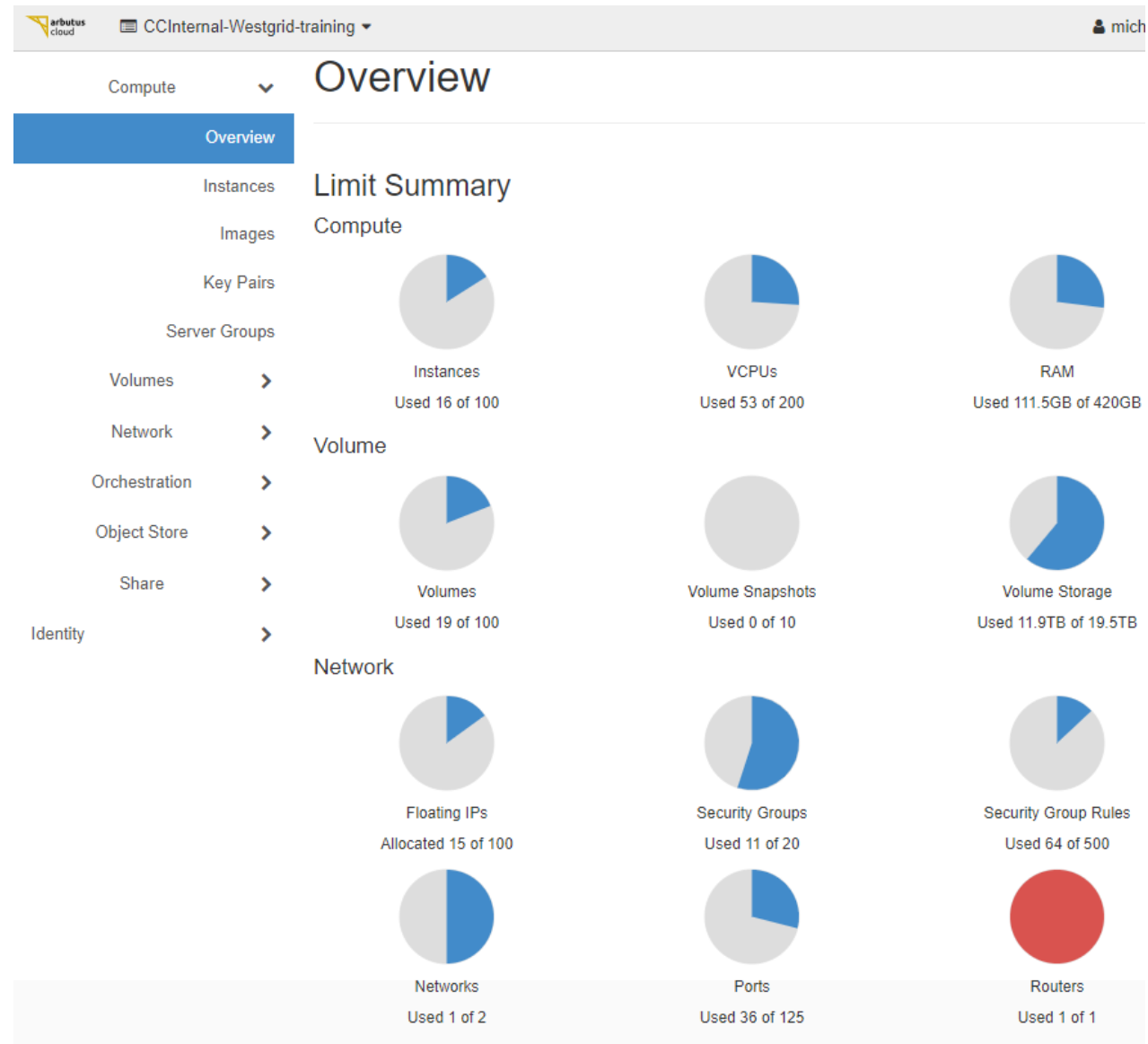
Total CPUs: 1,368

Total vCPUs:

Total RAM: 15,616 GB

84 TB of persistent [Ceph](#) storage.

Interfaces



Rapid Access Service (RAS)

Cloud RAS resources limits [\[edit\]](#)

- [Application Form](#)

Attributes	Compute instances ^[1]	Persistent instances ^[1]
May be requested by	PIs only	PIs only
vCPUs (see VM flavours)	80	25
vGPUs ^[2]	1	
Instances ^[3]	20	10
Volumes ^[3]	2	10
Volume snapshots ^[3]	2	10
RAM (GB)	300	50
Floating IP	2	2
Persistent storage (TB)	10	
Object storage (TB) ^[2]	10	
Shared filesystem storage (TB) ^[2]	10	
Default duration	1 year ^[4] , with 1 month wall-time	1 year (renewable) ^[4]
Default renewal	April ^[4]	April ^[4]

Rapid Access Service (RAS)

Alliance Email *

This should be an email that you have registered with your account on the Alliance Data Base (CCDB).

john.smith@ubc.ca

Alliance username *

Your Alliance username, this is likely the same name you selected when you created your Alliance account, and will be the username as given in the CCDB.

johnsmith

Are you a Principal Investigator? *

Answer "Yes" if you currently have an active Alliance Faculty, Adjunct Faculty, or Librarian role.

Yes

What do you want to request?

What would you like to request? *

- ☒ New project + RAS request
- ☐ RAS request for existing project
- ☐ Access to an existing project

Rapid Access Service (RAS)

New project RAS request

Project Type

Compute projects will have access to "c" flavors and persistent projects will have access to "p" flavors.

For more information about VM flavors see:
https://docs.alliancecan.ca/wiki/Virtual_machine_flavors .

For more information about RAS allocation limits for persistent and compute projects see:
https://docs.alliancecan.ca/wiki/Cloud_RAS_Allocations .

Choose

Compute

Persistent

Project name suffix

To identify your project from other projects you might have access to on the Alliance cloud you can choose a suffix to be appended to the end of your cloud project name. Common project suffixes are "dev" (short for development) and "prod" (short for production).

dev ▼

Rapid Access Service (RAS)

Persistent RAS request

Request the total allocation you would like for your previous the RAS request are described in more detail here:

https://docs.alliancecan.ca/wiki/Cloud_RAS_Allocations .

VCPUs *

Between 1 and 25

Your answer

Instances *

Between 1 and 10

Your answer

Volumes *

Between 1 and 10

Your answer

Volume snapshots *

Between 0 and 10

Your answer

RAM (GB) *

Between 1.5 and 50

Your answer

Floating IPs *

1 or 2

Your answer

Persistent storage (GB) *

Between 20 and 10000

Your answer

Object storage (GB)

Between 0 and 10000

Your answer

Shared filesystem storage (GB)

Between 0 and 10000

Your answer

Rapid Access Service (RAS)

Explain why you need cloud resources *

Your answer

Explain why the various Alliance HPC clusters are not suitable for your needs *

Your answer

Rapid Access Service (RAS)

Explain what your plan is for efficiently using the cloud resources requested *

Your answer

Describe your plans for maintenance and security upkeep *









Some basic security considerations when running VMs in the cloud are listed here:
https://docs.alliancecan.ca/wiki/Security_considerations_when_running_a_VM .

Your answer

What are Virtual Machines?

- "a **virtual machine (VM)** is the virtualization or emulation of a computer system. Virtual machines are based on computer architectures and provide the functionality of a physical computer" - https://en.wikipedia.org/wiki/Virtual_machine
- Common Use Cases:
 - Portals
 - Applications
 - Larger computer
 - Testing


Persistent Flavours

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
> p1-1.5gb	1	1.5 GB	20 GB	20 GB	0 GB	No	
> p2-3gb	2	3 GB	20 GB	20 GB	0 GB	No	
> p4-4gb	4	4 GB	20 GB	20 GB	0 GB	No	
> p4-6gb	4	6 GB	20 GB	20 GB	0 GB	No	
> p4-8gb	4	8 GB	20 GB	20 GB	0 GB	No	
> p8-8gb	8	8 GB	20 GB	20 GB	0 GB	No	
> p8-12gb	8	 12 GB	20 GB	20 GB	0 GB	No	

Compute Flavours

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
> c1-7.5gb-36	1	7.5 GB	56 GB	20 GB	36 GB	No	↑
> c2-7.5gb-36	2	7.5 GB	56 GB	20 GB	36 GB	No	↑
> c2-15gb-72	2	15 GB	92 GB	20 GB	72 GB	No	↑
> c4-15gb-144	4	15 GB	164 GB	20 GB	144 GB	No	↑
> c8-30gb-288	8	30 GB	308 GB	20 GB	288 GB	No	↑
> c4-30gb-144	4	30 GB	164 GB	20 GB	144 GB	No	↑
> c4-45gb-144	4	45 GB	164 GB	20 GB	144 GB	No	↑
> c8-60gb-288	8	60 GB	308 GB	20 GB	288 GB	No	↑

vGPU

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
➤ g1-8gb-c4-22gb	4	22 GB	80 GB	80 GB	0 GB	No	

Operating Systems

Name	Updated	Size	Type	Visibility	
➤ AlmaLinux-8.9-x64-2023-11	2/24/24 12:24 AM	665.13 MB	QCOW2	Public	↑
➤ AlmaLinux-9.3-x64-2023-11	12/13/23 12:43 AM	578.81 MB	QCOW2	Public	↑
➤ CentOS-7-x64-2021-11	4/3/23 7:01 PM	855.81 MB	QCOW2	Public	↑
➤ Debian-10.13-Buster-x64-2023-02	3/1/23 11:19 PM	217.63 MB	QCOW2	Public	↑
➤ Debian-11.8-Bullseye-x64-2023-10	12/13/23 12:43 AM	247.56 MB	QCOW2	Public	↑
➤ Debian-12.2-Bookworm-x64-2023-10	12/13/23 12:43 AM	267.25 MB	QCOW2	Public	↑
➤ Fedora-39-1.5-x64-2023-11	12/13/23 12:43 AM	519.38 MB	QCOW2	Public	↑
➤ Rocky-8.9-x64-2023-11	12/15/23 10:26 PM	1.84 GB	QCOW2	Public	↑
➤ Rocky-9.3-x64-2023-11	12/13/23 12:43 AM	1.01 GB	QCOW2	Public	↑
➤ Ubuntu-20.04.6-Focal-x64-2023-11	12/13/23 12:44 AM	592.38 MB	QCOW2	Public	↑
➤ Ubuntu-22.04.3-Jammy-x64-2023-11	12/13/23 12:44 AM	612.88 MB	QCOW2	Public	↑

Storage


- Volume storage: The standard storage unit for cloud computing; can be attached to and detached from an instance.
- Ephemeral/Disk storage: Virtual local disk storage tied to the lifecycle of a single instance.
- Object storage: Non-hierarchical storage where data is created or uploaded in whole-file form.
- Shared filesystem storage: Private network attached storage space (similar to NFS/SMB shares); must be configured on each instance where it is mounted.

Snapshots

Instances

Instance Name =

Displaying 2 items

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Age	Actions
<input type="checkbox"/>	ubuntu-2004-mt	-	192.168.254.88, 206.12.96.220	p1-1.5gb	alliance-key-mt-20231218	Shutoff	Persistent_02	None	Shut Down	1 month, 2 weeks	<input type="button" value="Start Instance"/> 
<input type="checkbox"/>	ubuntu-mt	-	192.168.254.19, 206.12.93.156	p1-1.5gb	alliance-key-mt-20231218	Active	Persistent_01	None	Running	4 months, 2 weeks	<input type="button" value="Create Snapshot"/> <input type="button" value="Disassociate Floating IP"/> <input type="button" value="Attach Interface"/> <input type="button" value="Detach Interface"/>

Snapshots

- Includes: the operating system, all the configurations, and data
- Stored under Compute --> Images
- Use cases:
 - to migrate the instance to another cloud – e.g., other Alliance Cloud
 - to back up a virtual machine you configured perfectly
- Recommend shutting the virtual machine before taking the snapshot

Floating IP

Manage Floating IP Associations ✕

IP Address *

206.12.101.183 ▼

+

Port to be associated *

Select a port ▼

Cancel

Associate

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

Security Groups

Compute >

Volumes >

Network >

Network Topology

Networks

Routers

Security Groups

Floating IPs

Security Groups

[+ Create Security Group](#) [Delete Security Groups](#)

Displaying 1 item

<input type="checkbox"/>	Name	Security Group ID	Description	Actions
<input type="checkbox"/>	default	41a05cc7-8018-4b24-9b75-8a3183db0f4b	Default security group	Manage Rules

Displaying 1 item

Security Groups

<input type="checkbox"/>	Direction	Ether Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security Group	Description	Actions
<input type="checkbox"/>	Egress	IPv4	Any	Any	0.0.0.0/0	-	-	Delete Rule
<input type="checkbox"/>	Egress	IPv6	Any	Any	:::/0	-	-	Delete Rule
<input type="checkbox"/>	Ingress	IPv4	TCP	22 (SSH)		-		Delete Rule
<input type="checkbox"/>	Ingress	IPv4	TCP	22 (SSH)		-		Delete Rule

SSH Keys

Compute

▼

Overview

Instances

Images

Key Pairs

Server Groups

Key Pairs

🔍

Click here for filters or full text search ✕

+

Create Key Pair

📁

Import Public Key

🗑️

Delete Key Pairs

Displaying 4 items

☐

Name ▲

☐

> alliance-key-mt

🗑️

Delete Key Pair

Privacy & Security

- Confirm the **security settings** are appropriate to the data you wish to store, process, or transmit through the cloud service
- Confirm you are complying with your local legislations and your institution's policies and security standards. E.g., Privacy Impact Assessment, Security Threat and Risk Assessment (STRA)

Privacy & Security

- Apply Security Updates

- Ubuntu:

sudo apt-get update

sudo apt-get upgrade

sudo reboot

- Rocky

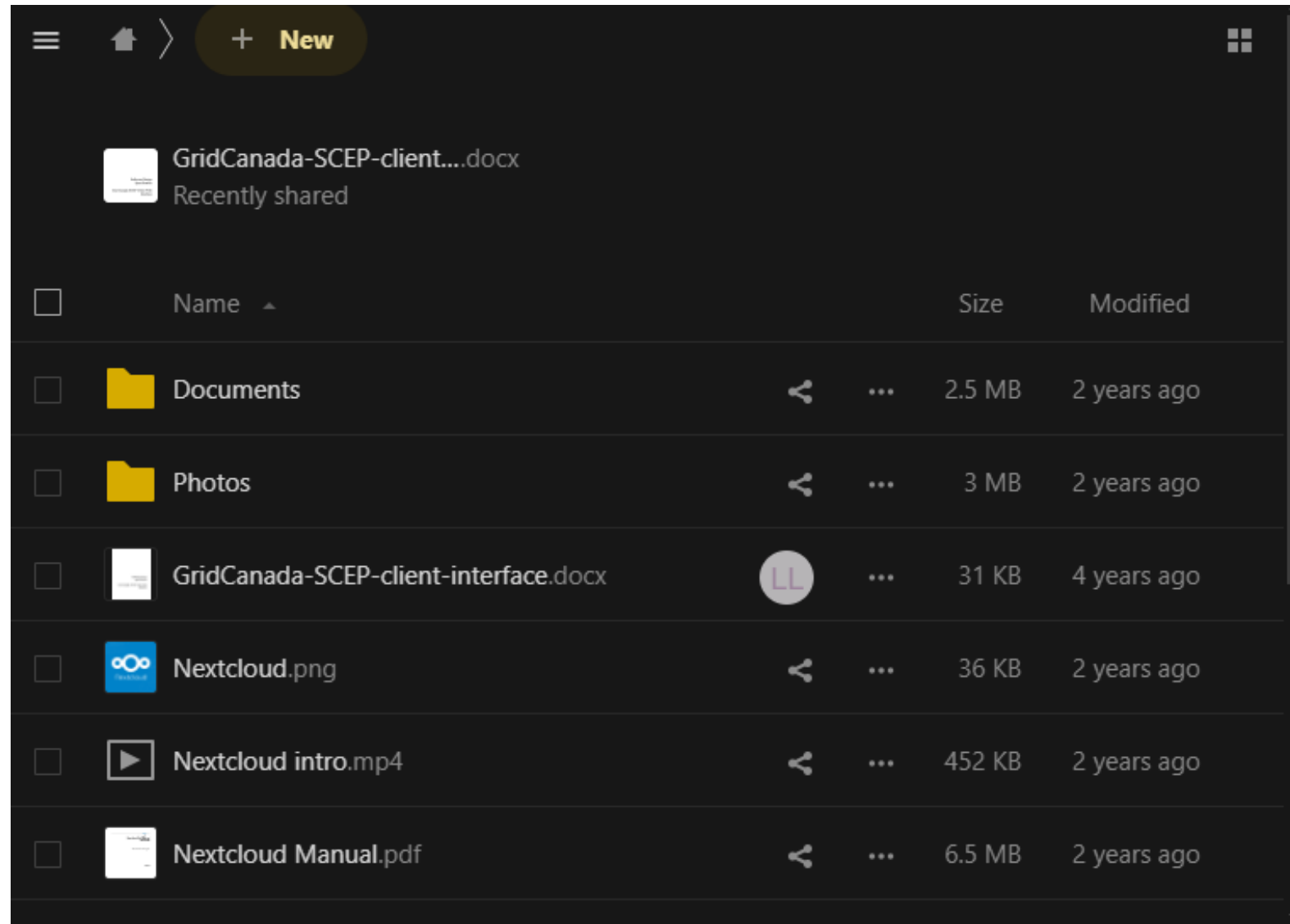
sudo dnf update

sudo reboot

Nextcloud

- Dropbox-like cloud storage service
- Available to all Alliance users
- Quota: 100 GB per user
- Interfaces: Web Browser, Desktop Sync Client, Nextcloud mobile app, Command line tool, Mount to your computer (WebDAV)
- Sharing: other Alliance users, CCDB group name (e.g., lab), non-Alliance users

Nextcloud



Use Cases

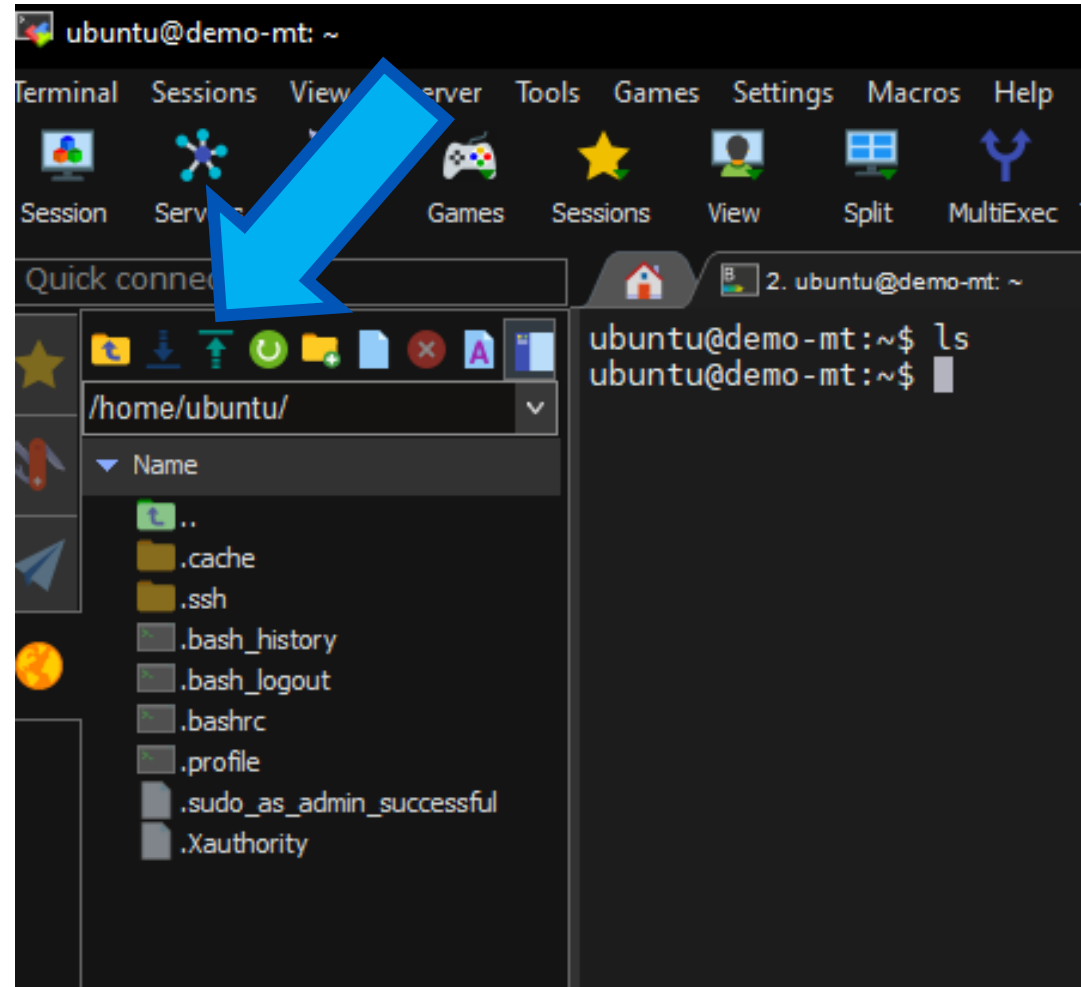
- Data Transfer
- Web Applications
 - Web Portals
 - JupyterLab
 - RStudio
- Linux Desktop
- Database server

Data Transfer

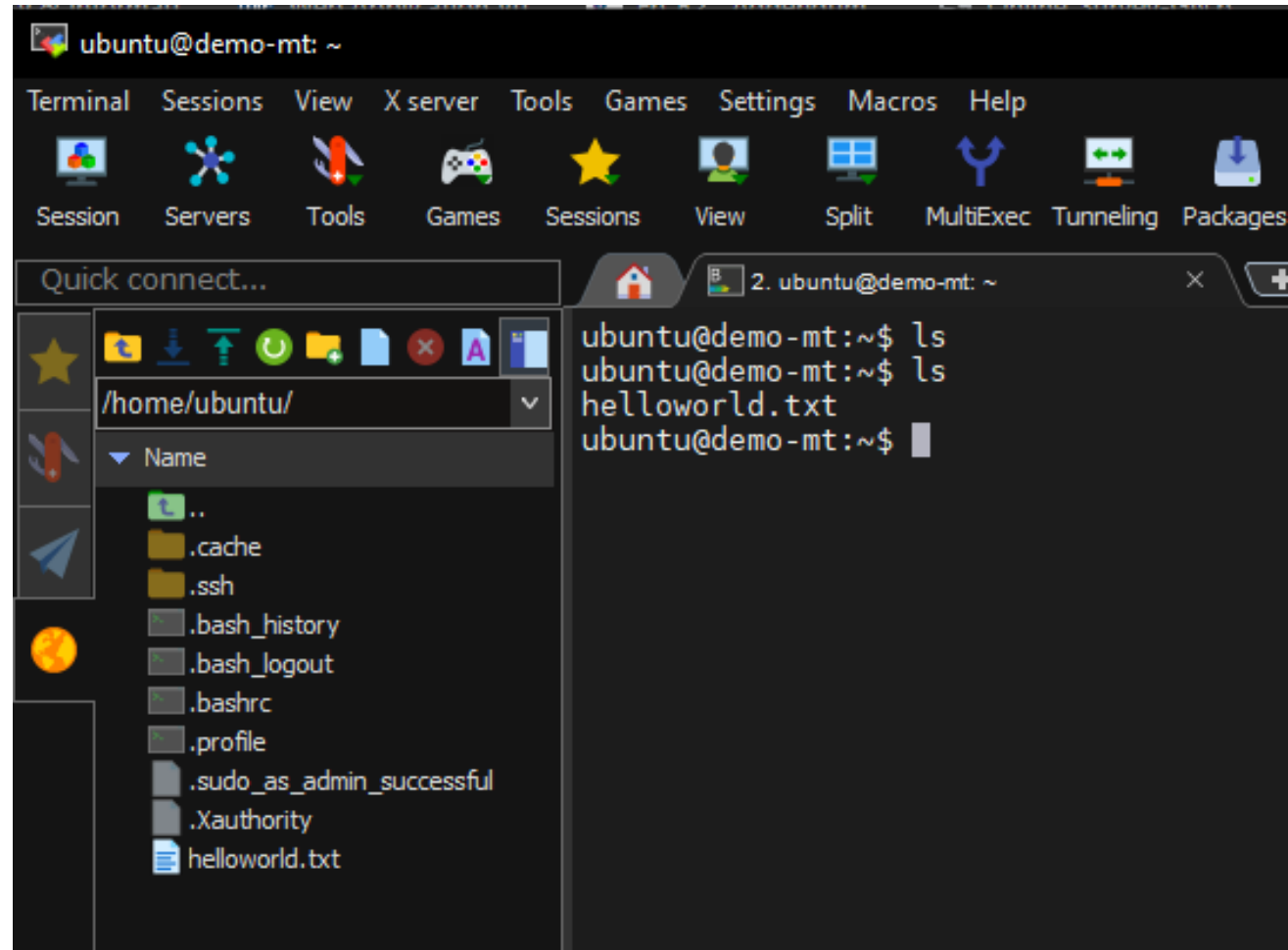
- `scp -i <ssh-key>.pem <file name> <username>@<IP Address>:/home/<username>`

```
13/06/2024 10:43.23 /mnt/c/Users/mike910/My Documents/Training/SummerSchool2024/demo scp -i alliance-key-mt-20  
231218.pem helloworld.txt ubuntu@206.12.93.156:/home/ubuntu  
helloworld.txt 100% 14 0.6KB/s 00:00 ✓
```

Data Transfer



Data Transfer



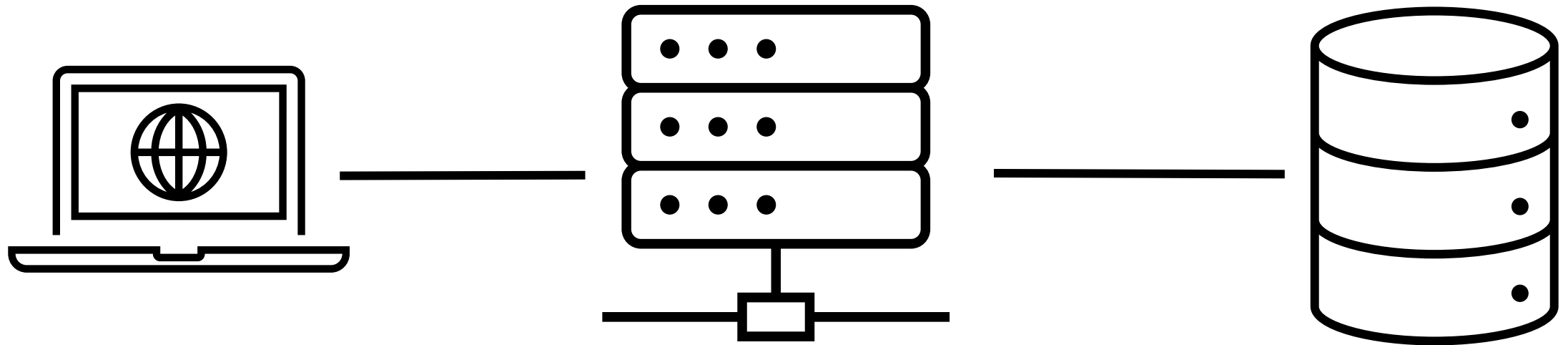
Data Transfer

- Larger amount of data?
 - Globus
 - Rsync (command line)

Reference:

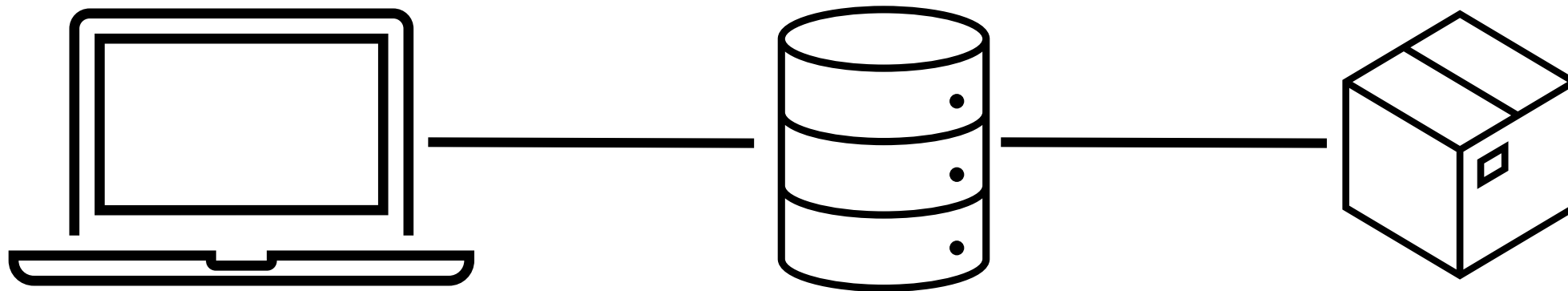
[https://docs.alliancecan.ca/wiki/Arbutus Migration Guide/en#Methods to copy data](https://docs.alliancecan.ca/wiki/Arbutus_Migration_Guide/en#Methods_to_copy_data)

Web Applications

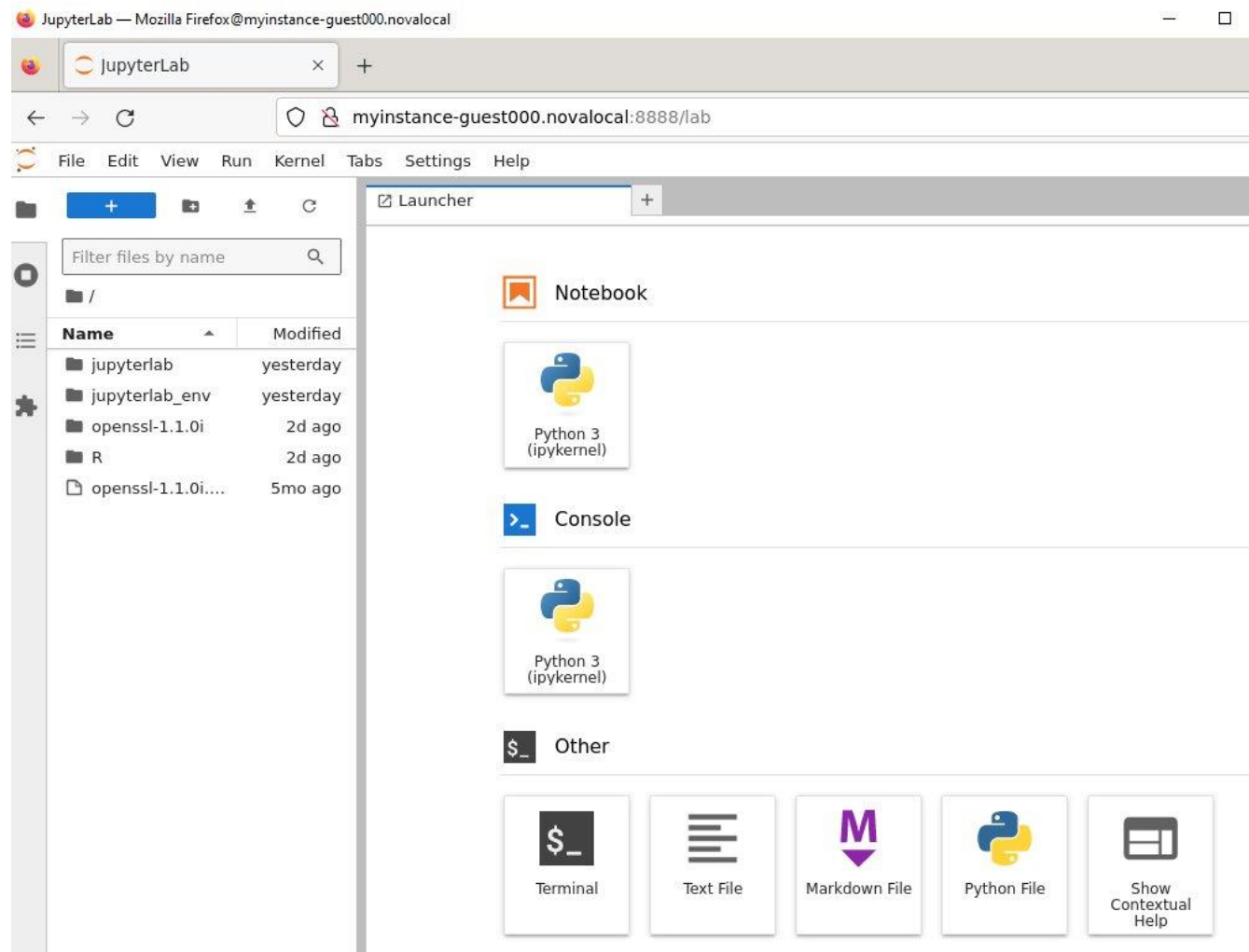


Web Portals

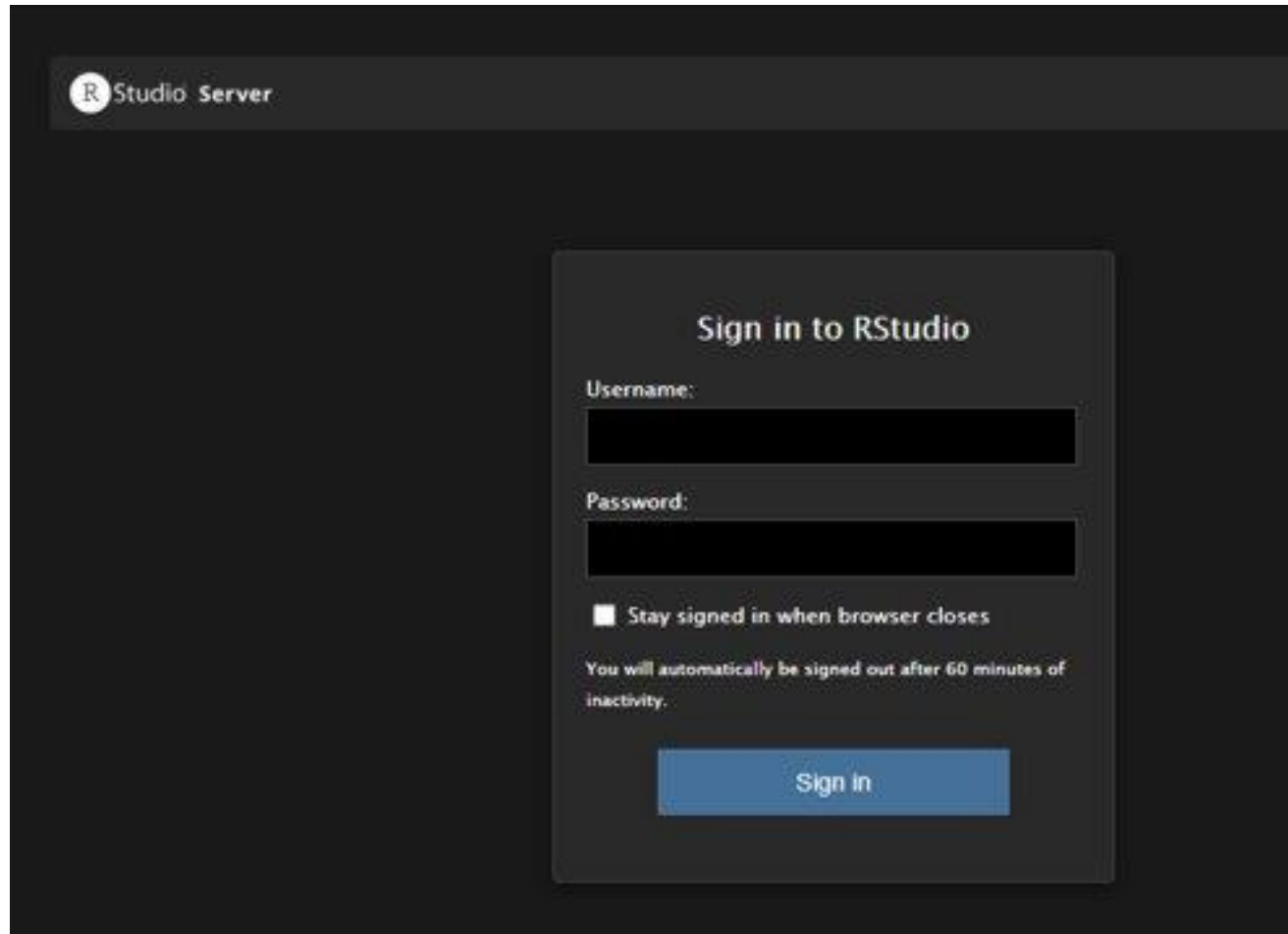
- Data Collection
- Data Sharing
- Sharing Research



JupyterLab



RStudio



The image shows the RStudio Server login page. At the top left, there is a header bar with the R logo and the text "Studio Server". In the center, a dark gray box contains the login form. The form has the title "Sign in to RStudio". Below the title, there are two input fields: "Username:" and "Password:". Below the password field, there is a checkbox labeled "Stay signed in when browser closes". Below the checkbox, there is a note: "You will automatically be signed out after 60 minutes of inactivity." At the bottom of the form, there is a blue button labeled "Sign in".

R Studio Server

Sign in to RStudio

Username:

Password:

☐ Stay signed in when browser closes

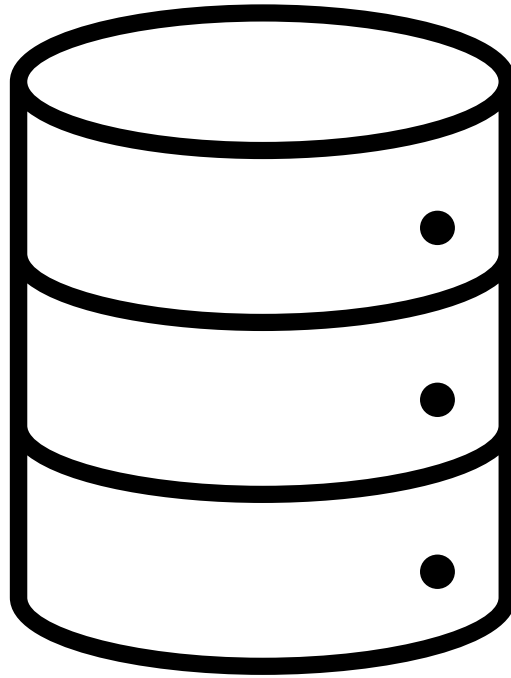
You will automatically be signed out after 60 minutes of inactivity.

Sign in

Linux Desktop



Database



More Information / Links

- Cloud Quick Start Guide: https://docs.alliancecan.ca/wiki/Cloud_Quick_Start
- Rapid Access Service (RAS): https://docs.alliancecan.ca/wiki/Cloud_RAS_Allocations
- Nextcloud:
 - <https://nextcloud.computecanada.ca/>
 - <https://docs.alliancecan.ca/wiki/Nextcloud>
- Cloud Status / Health: <https://status.alliancecan.ca/>



THE UNIVERSITY OF BRITISH COLUMBIA

