Moving your computing tasks and data from personal computer to supercomputers and clouds

Resources, support and training courses

Presented By
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SHARCNET | The Alliance HPC Technical Consultant

SHARCNET

It operates the national supercomputer nibi (“water” in *Anishinaabemowin*) and provides services to academic researchers



Shared
Hierarchical
Academic
Research
Computing
NETwork

Digital Research Alliance of Canada

Canada's Advanced Research Computing Platform

Digital Research Alliance of Canada



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Academic/research computing at York

Campus IT groups - academic computing

- Central IT unit: https://www.yorku.ca/uit/about-uit/
  - Storage: https://www.yorku.ca/uit/student-services/storage-for-students/
  - Computer Labs: https://www.yorku.ca/uit/student-services/computer-labs/
  - Learning Technologies: https://www.yorku.ca/uit/student-services/learning-technologies/

SHARCNET - advanced research computing

- Compute (clusters)
- Storage
- Clouds
- DBaaS, AIaaS, Nextcloud (free personal storage)
- Training on advanced research computing, data science, machine learning
- More https://www.sharcnet.ca/

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Academic/research computing across Canada

Getting an account

Anyone from a Canadian research institution may apply for an account free of charge.
Faulty should apply at https://ccdb.alliancecan.ca/.
Students, postdoctoral fellows, visiting scholars and other individuals may apply for an account sponsored by a faculty member.



YORK U SHARCNET™ Digital Research Alliance of Canada

Academic/research computing across Canada

What you can access

A user with an account from the Digital Research Alliance of Canada has access to all supercomputers, clouds and storage services operated by the Alliance and its members across the country free of charge.
See the services (https://www.alliancecan.ca/en/services) for details.



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Supercomputing at York, SHARCNET and beyond

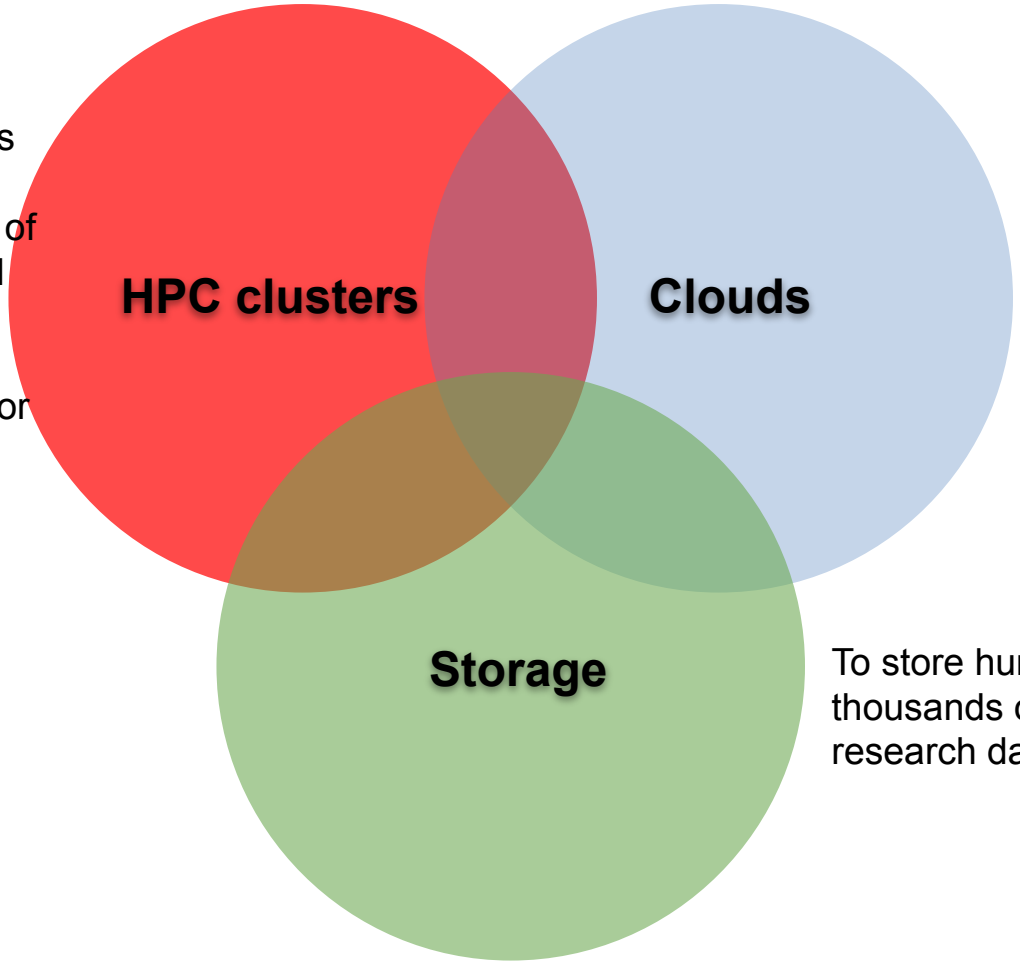
- Supercomputing at York, SHARCNET and beyond
- Requests for compute, storage and cloud resources
- What everyone should know
- Training courses
- Q & A



A tour from here

HPC clusters, clouds and storage

To run large and exascale simulations that need dedicated access to hundreds of thousands CPU and GPU cores and low latency, fast interconnect fabric; or to run hundreds of thousands of simulations simultaneously



To run web services, databases or use virtual machines (VMs) with full control. The CPU and GPU resources are typically over committed, that is, a CPU core or GPU device might be shared by the running VMs.

To store hundreds of thousands of TB of research data

HPC clusters and storage

Resource	Fir	Narval	Nibi	Trillium	Rorqual	Total
CPU cores	166,656	49,664	136,320	235,008	131,712	**719,360**
GPU cores	7,680 H100s	5,068 H100s	6,912 H100s AMD MI300A	5,760 H100s B200s	5,184 H100s	**30,604**
Storage[1]	49PB	19PB	25PB	29PB	68PB	-

Source: https://docs.alliancecan.ca/wiki/National_systems

1. These numbers represent the major storage.

AI specific systems

Pan-Canadian AI Compute Environment (PAICE)

- TamIA at Mila -Québec Artificial Intelligence Institute.
- Killarney at Vector Institute.
- Vulcan at Alberta Machine Intelligence Institute (Amii).

Source: https://docs.alliancecan.ca/wiki/National_systems

Why using national resources

If you

- do not have many cores or much memory;
- do not have the GPUs of the type needed;
- need a huge amount of disk space, e.g. hundreds of TB;
- need to run large scale of simulations that need hundreds of cores;
- need to run large amount of simulations concurrently
  need to run a web services;
- need to run a SQL database;
- need to run programs on a cloud;
  need to run AI models at no cost;
- need the compute and storage at no cost.

Getting an account FREE of charge

Sign up for an account for FREE at https://ccdb.alliancecan.ca/

STEP 1	STEP 2	STEP 3	STEP 4
Learn and assess if you need lots of compute and/or storage resources for your research.	If you are not a faculty, talk to your supervisor to get his/her CCDB id (a code like abc-123-02). If your supervisor does not have an account, convince him/her to sign up for an account first.	Go to the website to sign up for an account. Choose an appropriate role that fits you.	Access and explore the resources - clusters, cloud and storage - across Canada, all can be through just a few clicks.

Requests for compute, storage and cloud resources

Default access	Rapid Access Service (RAS)	Resource Allocation Competition (RAC)
Compute: No limit in CPU and GPU cores, but low priority, hence longer wait time. Storage: Limited storage space • 50GB home • 1TB project - work space • 20TB scratch (60 days when over 1TB) - temp space • 10TB nearline (tape) Cloud: Limited cloud resources • 80 VCPU years • persistent 25 VCPU years • 10TB volume and snapshot storage Request: No	Compute: May ask for increase in priority *temporarily*, to improve the throughput of jobs. Storage: Storage • project - up to 40TB across the country • nearline - up to 100TB • Not available at some sites. Cloud: Moderate increase. Request: Any time Email: support@tech.alliancecan.ca	Compute: Best assurance of priority access to allocated number of CPU cores (200+) and GPUs (25 RGUs) throughout a year. Shorter wait time Storage: Guaranteed access to allocated storage spaces: • project (40+ TB) • nearline (100+ TB) Cloud: Guaranteed access to allocated cloud resources Request: Annual application

Requests for compute, storage and cloud resources

2027 Resource Allocation Competition (RAC) - A peer reviewed process

- Deadline
  - November 3, 2026
- Online information:
  - Online info: At https://alliancecan.ca/ look for Resource Allocation Competition
- Show your project needs, the rationale and the execution plan in details.
- Consultation with local staff before you proceed if new.

What is new for RAC 2027?

- Significant improvements to the RRG and RPP form GUIs.
- Expanded RAC guide to improve clarity and transparency.
- Up to 10% increase of CPU and GPU resources allowed via Fast Track and RPP progress reports.
  - no guarantee that the increase will be awarded
- Instructions to provide GPU scalability tests have been included in the RRG and RPP application templates.
- We introduced the “application size” category, can be Small, Medium, Large, and Very Large.

Requests for compute, storage and cloud resources

Type	Resource	Unit	Small	Medium	Large	Very large
HPC	CPU	core-years	≤ 500	> 500 ≤ 2500	> 2500 ≤ 10000	> 10000
HPC	GPU	RGU-years	≤ 50	> 50 ≤ 250	> 250 ≤ 500	> 500
Cloud	vGPU	RGU-years	≤ 5	> 5 ≤ 10	> 10 ≤ 25	> 25
Cloud	Compute Cloud	vCPU-years	≤ 50	> 50 ≤ 250	> 250 ≤ 1000	> 1000
Cloud	Persistent Cloud	vCPU-years	≤ 25	> 25 ≤ 100	> 100 ≤ 250	> 250
HPC	Project storage	TB	≤ 50	> 50 ≤ 250	> 250 ≤ 1000	> 1000
HPC	Nearline storage	TB	≤ 250	> 250 ≤ 1000	> 1000 ≤ 2500	> 2500
Cloud	Volume and snapshot storage	TB	≤ 10	> 10 ≤ 50	> 50 ≤ 250	> 250
Cloud	Object storage	TB	≤ 10	> 10 ≤ 50	> 50 ≤ 250	> 250
Cloud	Shared filesystem storage	TB	≤ 10	> 10 ≤ 50	> 50 ≤ 250	> 250

Requests for compute, storage and cloud resources

- Supercomputing at York, SHARCNET and beyond
- Requests for compute, storage and cloud resources
- What everyone should know
- Training courses
- Q & A

Resources: *How do I access clusters, clouds and storage*

Clusters across the country

- fir.alliancecan.ca
- nibi.alliancecan.ca
- trillium.alliancecan.ca
- rorqual.alliancecan.ca
- narval.alliancecan.ca

Access: via SSH
(from text terminal) or web

ssh nibi.alliancecan.ca

Cloud services

- arbutus.cloud.alliancecan.ca
- cedar.cloud.alliancecan.ca
- nibi.cloud.alliancecan.ca
- beluga.cloud.alliancecan.ca

Access: via web browser

Resources: *Running your applications*

```
nast@nast:~$ ssh nibi.alliancecan.ca
Multifactor authentication is now mandatory:
https://docs.alliancecan.ca/wiki/Multifactor_authentication
=
L'authentification multifacteur est obligatoire:
https://docs.alliancecan.ca/wiki/Multifactor_authentication/fr

(nast@nibi.alliancecan.ca) Duo two-factor login for nast

Enter a passcode or select one of the following options:

 1. Duo Push to nast (Android)

Passcode or option (1-1): 1
Success. Logging you in...
Success. Logging you in...
Last login: Wed Oct  1 11:32:27 2025 from 10.37.127.254
Welcome to the Nibi cluster.

More details about the new system are available:
       https://docs.alliancecan.ca/wiki/Nibi

Accidentally deleted a file? Try the "oops" command to recover from snapshot.
Need an old file version? Try "versions <filename>".

[nast@l2.nibi ~]$ cd projects/def-nastaran/NUS
[nast@l2.nibi NUS]$ sbatch test.sh
Submitted batch job 2328956
[nast@l2.nibi NUS]$ squeue -u nast
             JOBID     USER             ACCOUNT           NAME  ST  TIME_LEFT NODES CPUS TRES_PER_N MIN_MEM NODELIST (REASON)
           2328956     nast        def-nast_cpu        test.sh  PD       5:00     1    1        N/A    200M  (None)
[nast@l2.nibi NUS]$
```

Submit

Check

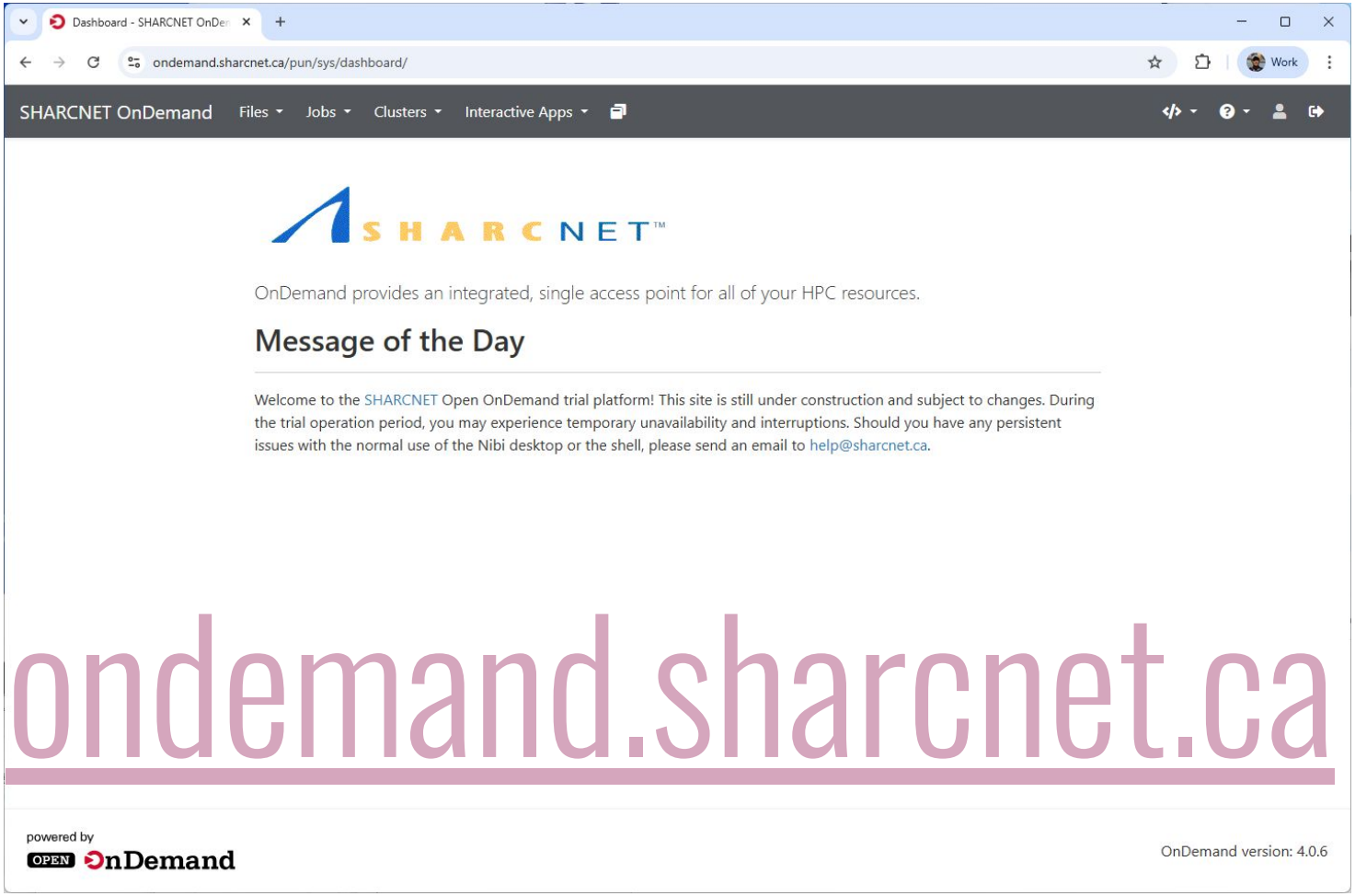
Then you submit your jobs using a script

```
#!/bin/bash
#SBATCH --account=def-nast
#SBATCH --time=00-00:05
#SBATCH --nodes=1
#SBATCH --mem=200M
#SBATCH --mail-user=nastaran.shahparian@sharcnet.ca
#SBATCH --mail-type=ALL
#SBATCH --cpus-per-task=1

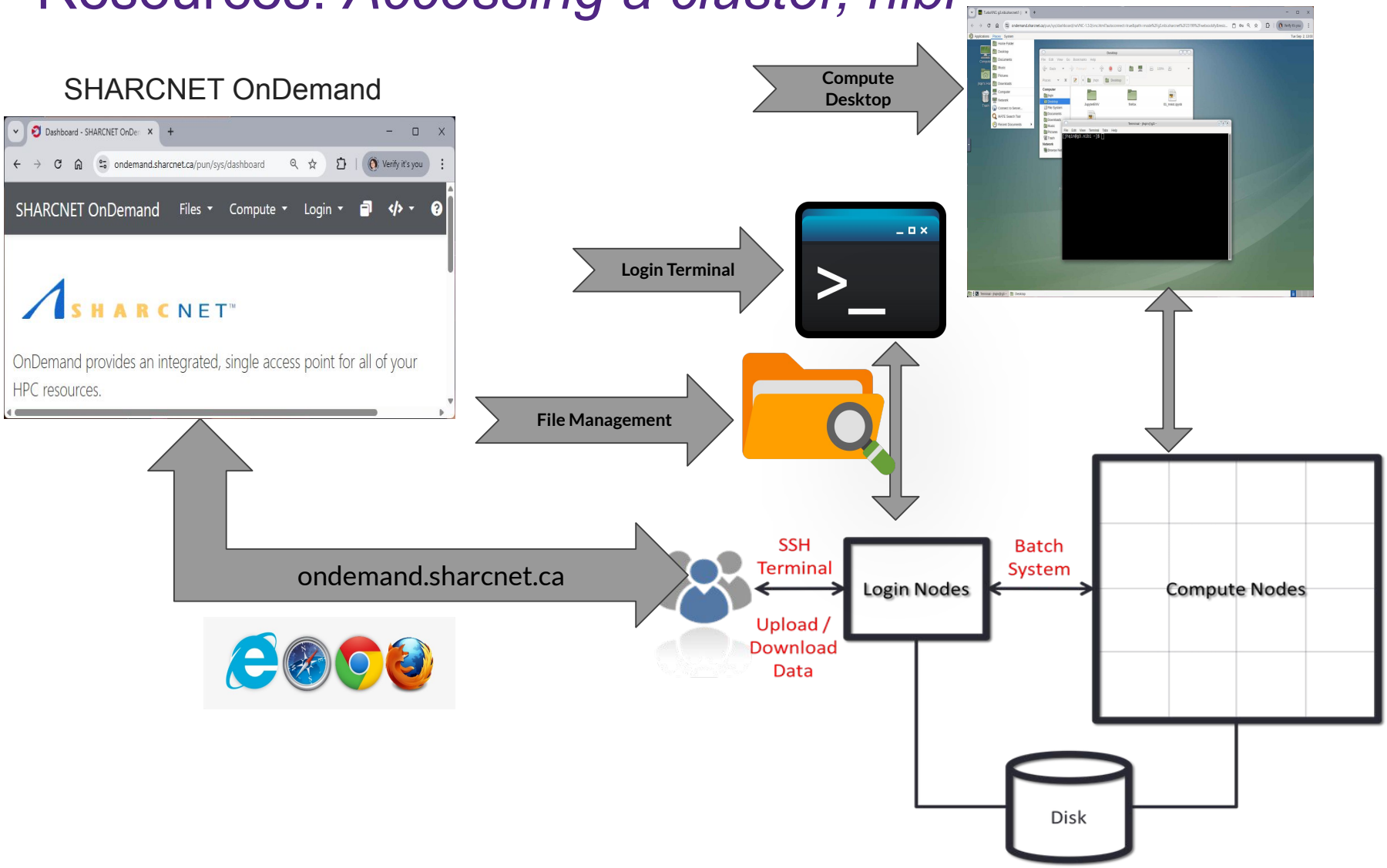

module load python/3.13
python Hello_world.py
```

You need to prepare a submission script

Resources: *Login to a cluster, upload and download files*



Resources: *Accessing a cluster, nibi*



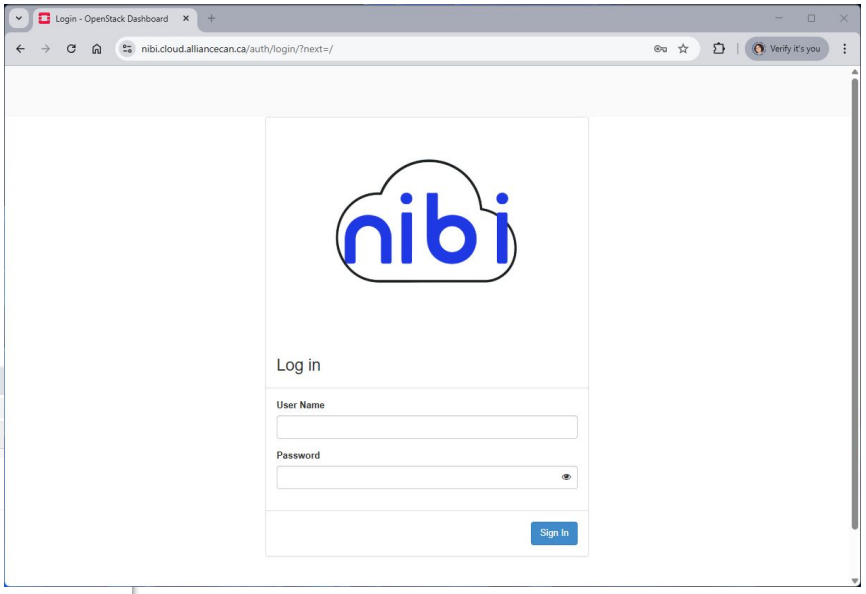
Resources: *Accessing a cloud*

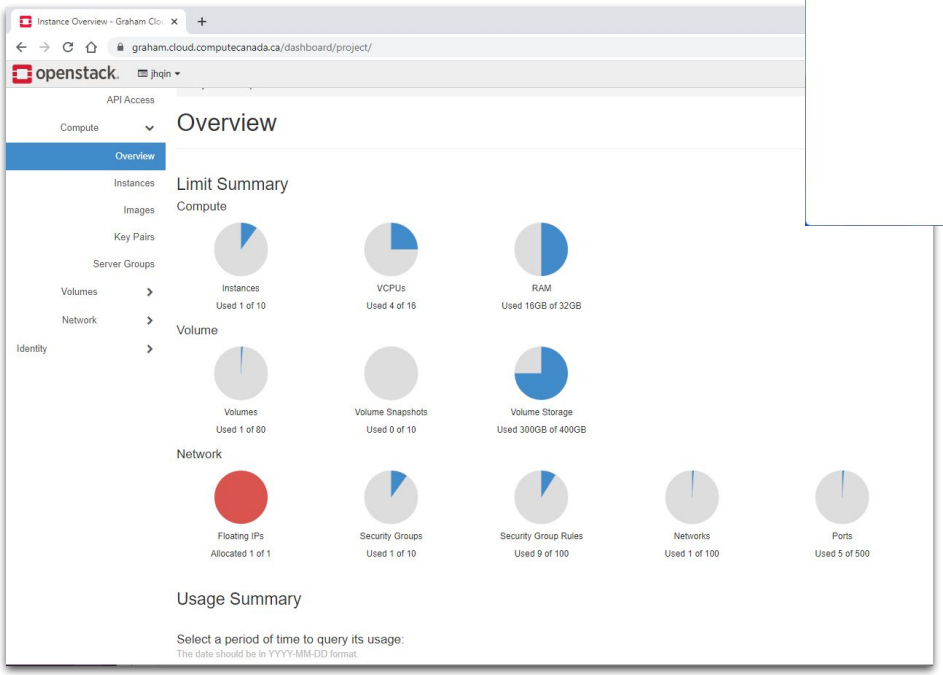
A few notes

- The Alliance provides clouds as an infrastructure as a service (IaaS). Not necessarily seen as a turn-key solution as one might have seen. Users are responsible for running VMs and tasks inside VMs themselves.
- Typical uses of cloud at Alliance: web services, databases, compute intensive applications (small scale), etc.
- Before you proceed, visit the Alliance wiki page on cloud.
- One needs to have a project to use cloud.
- Only a PI can create a cloud project per cloud.
- Once a cloud project is created, user can access individual clouds to *manage their VMs and services*.

Resources: *Accessing a cloud*

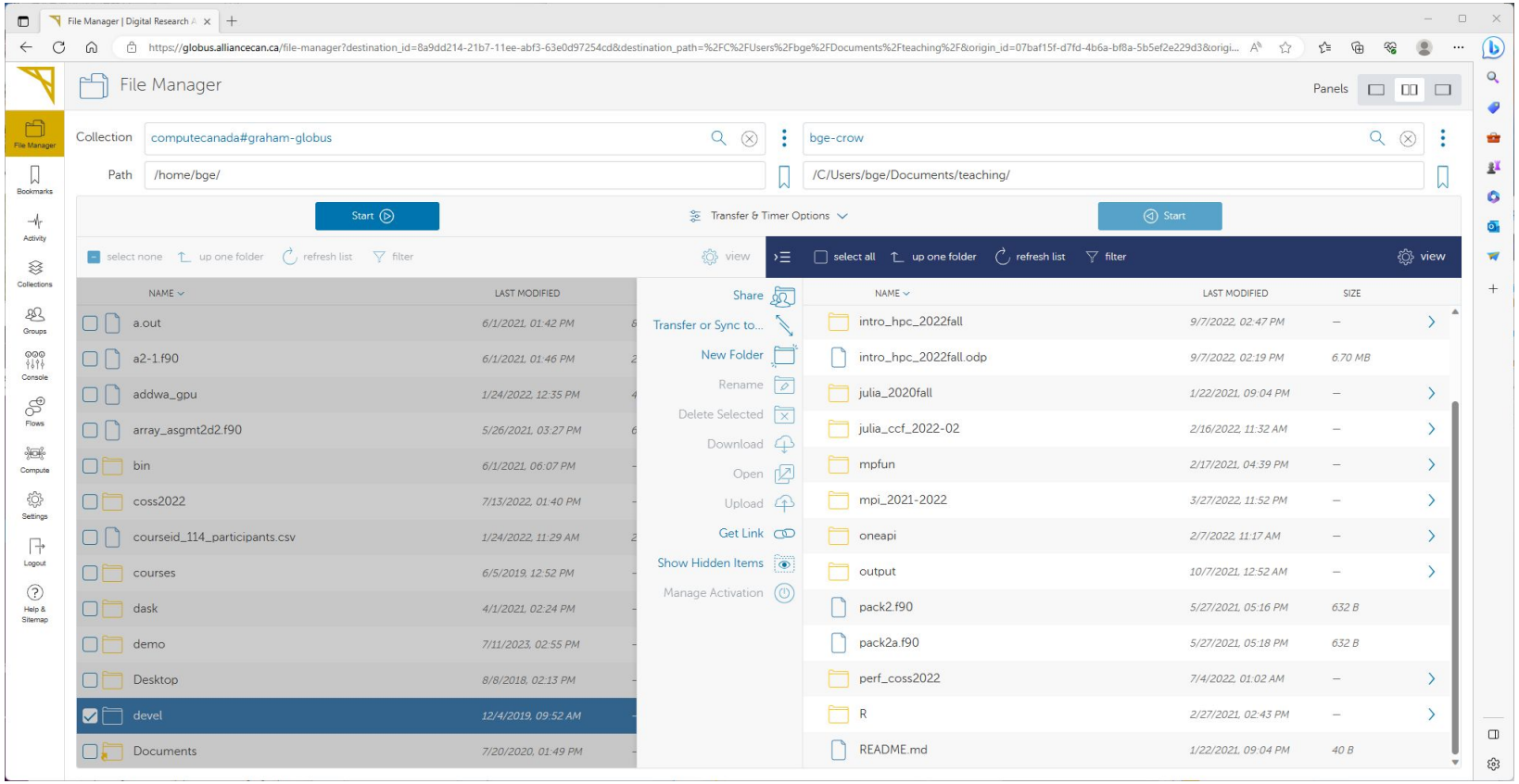
- arbutus.cloud.alliancecan.ca
- cedar.cloud.alliancecan.ca
- nibi.cloud.alliancecan.ca
- beluga.cloud.alliancecan.ca





- One needs a project
- No Windows images, all VMs are Linux.
- Up to 80 virtual CPU cores.
- May have virtual GPUs.
- Up to 10 TB storage.
- Up to 25 persistent CPU cores.

Resources: *Transferring files via Globus*[1]



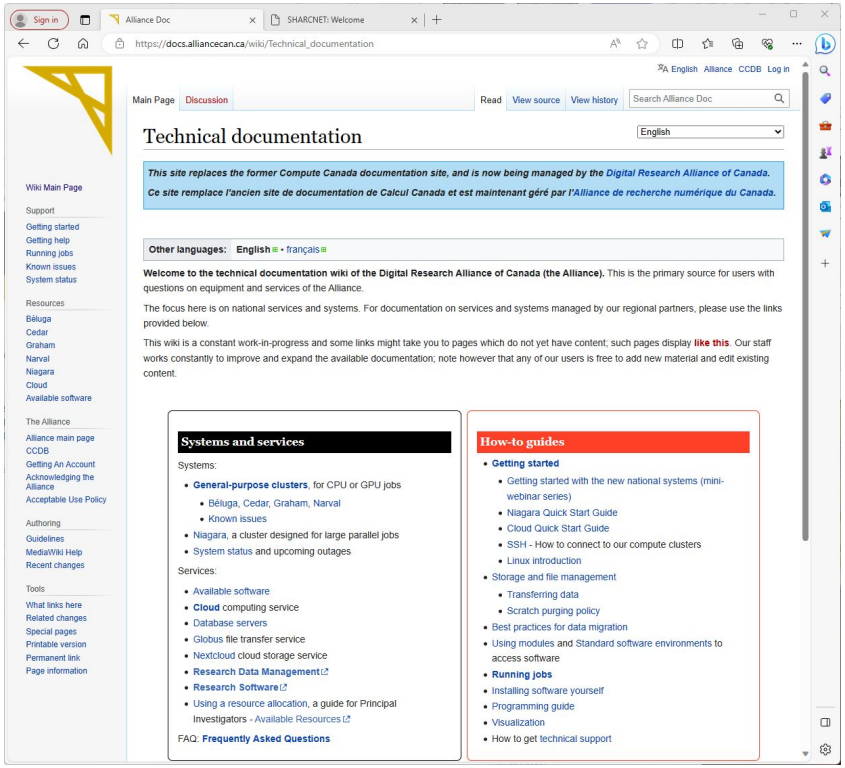
1. Check https://docs.alliancecan.ca/wiki/Globus.
2. Go to https://globus.alliancecan.ca/ and follow the instructions

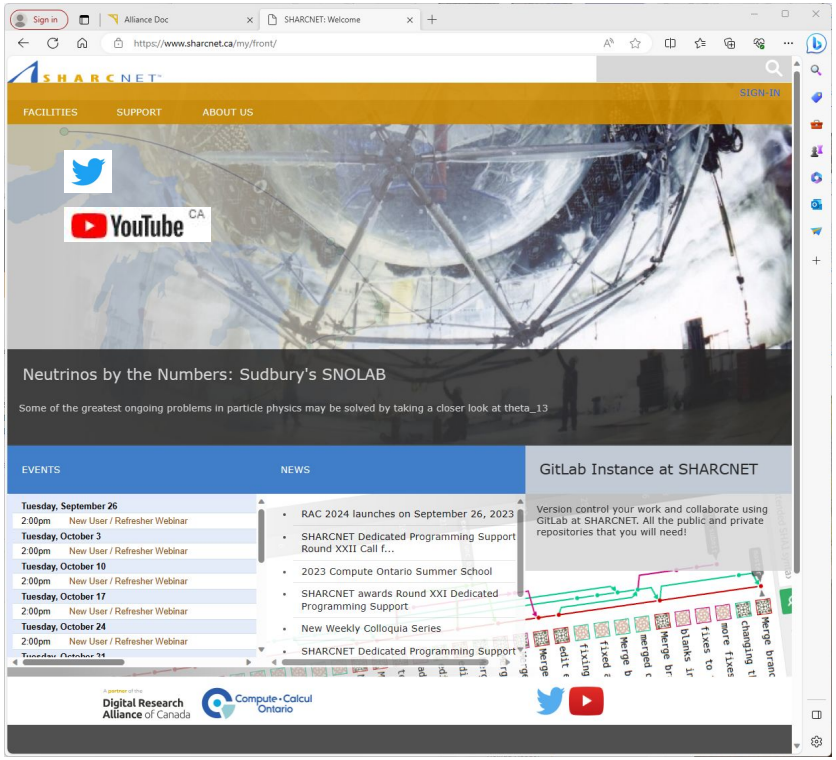
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Resources: *Getting help online*





https://docs.alliancecan.ca/

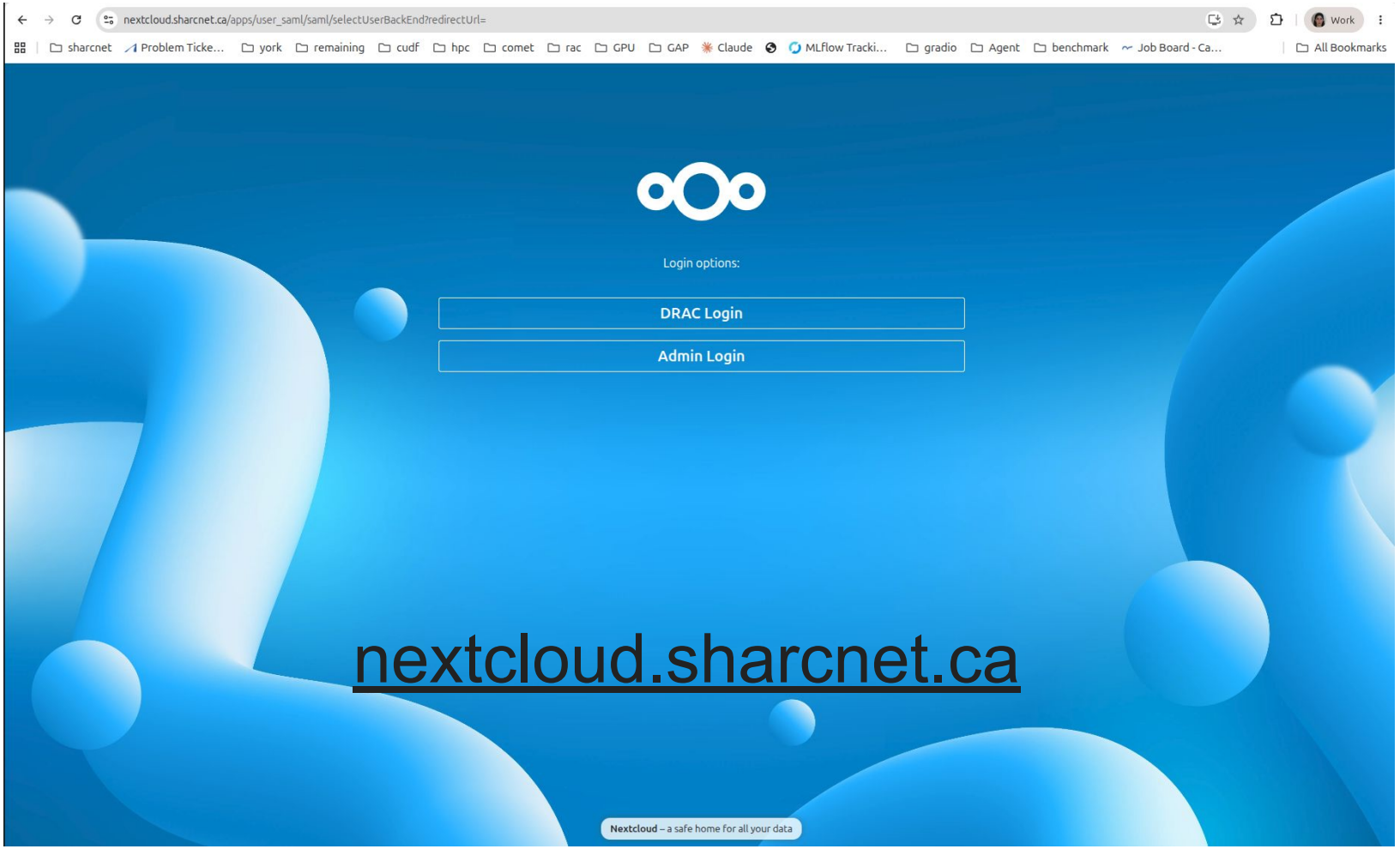
https://www.sharcnet.ca/

Resources: New Services

Services

- DBaaS - PIs to request at help@sharcnet.ca
- AIaaS - Users to request at help@sharcnet.ca
- Nextcloud https://nextcloud.sharcnet.ca/ SSO to access, like OneDrive, but free

Resources: *Nextcloud - your free OneDrive*



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Resources: *AI as a service (AIaaS)*

Brine (https://brine.sharcnet.ca/), an always-on, OpenAI-compatible API (on NVIDIA H200s) for hosted models that support chat, tool calling, and audio transcription, etc.
Models include DeepSeek-V4-Flash-0731, Qwen3.8-27B, gpt-oss-120b, North-Mini-Code-1.0, etc. Typical work cases:

- Retrieval-augmented generation systems
- Agents or workflow automation
- Document-processing pipelines
- Code assistance
- Audio transcription
- Workloads that currently use a commercial API or a locally hosted model

Resources: *AI as a service (AIaaS)*

- This is a pilot project at the moment
- Any DRAC researcher can apply (not just PI, not just SHARCNET sites)
- To apply, submit a ticket with the request (help@sharcnet.ca)
- Once the account is set up, can be used right away (no queue wait time like on clusters)

Note: Your data stay in SHARCNET, Canada, don't go elsewhere.

Resources: *Getting help from local staff*



HPCTC,
Machine Learning, Deep learning
nastaran.shahparian@sharcnet.ca

Resources: *Getting help*

- Weekly online Q&A, Tue, 2pm:
  https://www.sharcnet.ca/my/news/calendar
- Check online video recordings at
  https://youtube.sharcnet.ca/
- Ticketing system (most recommended):
  support@tech.alliancecan.ca
- Staff contact info to email or phone:
  https://www.sharcnet.ca/



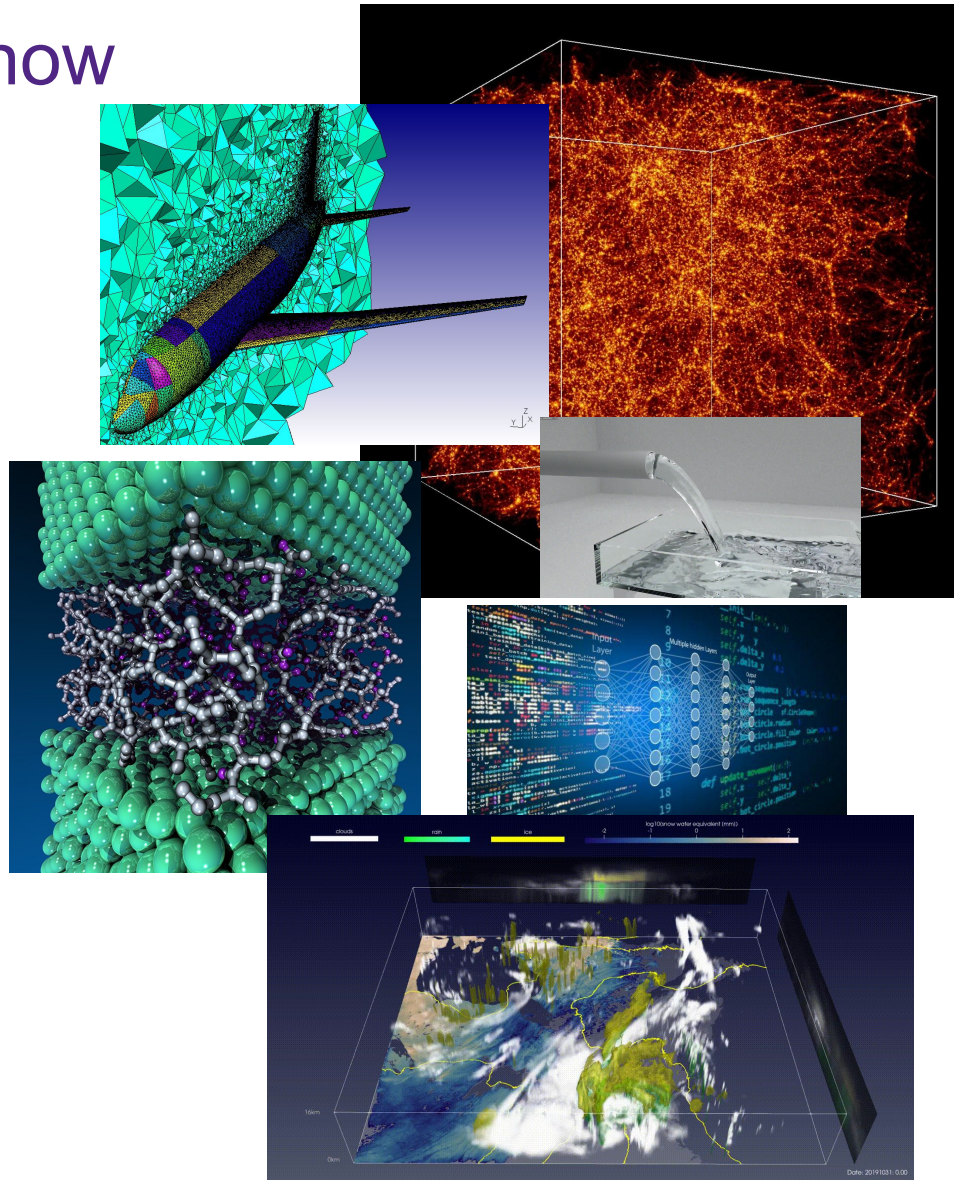
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What everyone should know

- Supercomputing at York, SHARCNET and beyond
- Requests for compute, storage and cloud resources
- What everyone should know
- Training courses
- Q & A



What to know: *Diverse user groups*



Kannan, Rahul

Astronomy



Deborah Harris

Physics



Neil Tandon

Environmental, Earth Science



Elham Dolatabadi

Computer, Information Science



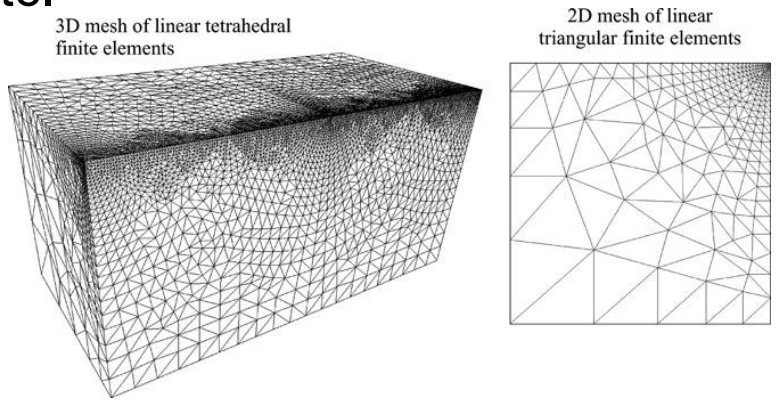
Kohitij Kar

Biology and neuroscience

What to know: *Applications*

What people do on supercomputers

- CFD, environmental simulations, other engineering computations
- Astrophysics simulations
- Coupled simulations
- Material science
- Applications of AI and machine/deep learning
- Economics, finance studies, etc.



What to know: *Knowledge*

A **supercomputer** has a lot of computers, not a super fast computer

- Thousands of computers with CPU cores, GPUs, and disks
- Requires **concurrent processing** to get work done faster

Research supercomputers run **Linux** and not Windows

- Software has to support Linux to run on the supercomputer
- Linux is a publicly developed Operating System freely available

Background theory

- Computer architecture
- Algorithms and numerical methods

High performance programming is hard

- Efficient programs, algorithms, and **libraries** take decades – use them

What to know: Linux and tools

Using Linux

- Moving around.
- Using shell, automating tasks.
- Remember, the core utilities of Linux are very fast.
- Connecting to other computers via Secure Shell (SSH).
- Access to file systems.
- Running programs.

Using git

- To manage your research project files.
- To access, create git repositories.

What to know: *Popular and lesser known items*

Programming languages

- Higher level: Python, R, Matlab
- Lower level: C/C++, Fortran
- New takes: Julia, Chapel

Libraries

- Parallel programming: OpenMPI, OpenMP, OpenCL, CUDA/HIP
- Numerics classic: BLAS, LAPACK, ScaLAPACK, FFTW
- Numerics exascale/accelerators: magma, slate, heFFTe

Tools

- vi, emacs, nano, VS Code
- Compilers (gcc, Intel), interpreters (python, R), and just in time compilers
- Debuggers and profilers (gdb, DDT, MAP, etc.)

What to know: *Popular and lesser known items*

Data science/data wrangling:

- python: numpy, pandas, matplotlib, plotnine, sklearn , dask, rapids
- R: data frames, tidyverse (dplyr, simplr, ggplot, etc.)
- SQL

Machine learning and AI

- TensorFlow
- Keras and PyTorch

Visualization

- ParaView and VisIt

… and more …

Learning is a lifelong journey…

Supercomputing at York, SHARCNET and beyond

- Supercomputing at York, SHARCNET and beyond
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- What every graduate student should know
- Training courses
- Q & A

Training courses

Format and schedule

- Events calendar: https://www.sharcnet.ca/my/news/calendar
- Q&A for new users every Tuesday at 2pm Eastern time
- Biweekly General Interest Seminars at noon on Wednesdays
- Live lectures, workshops fall and winter semesters.(“Introduction to ARC”)
- Self-driven, grading offline courses with course materials, recorded videos, quizzes and assignments.
- Compute Ontario Summer School (June)

How to enroll

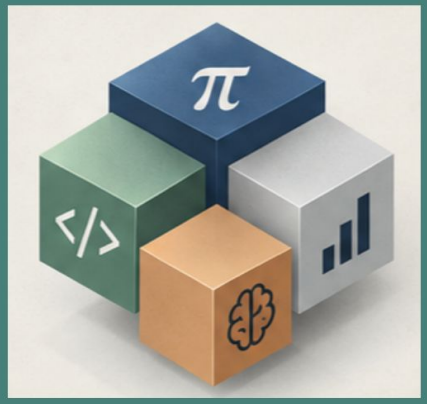
- Sign up for the courses at https://training.sharcnet.ca/

Outcome

- Certificates of completion.

Training courses

Live courses: fall 2026



In Fall 2026 / Winter 2027 semesters, the bulk of training provided by SHARCNET to our users is comprised of a series of independent, self-contained workshops on a wide range of topics pertaining to Advanced Research Computing. The courses are delivered online live. (Some of these courses are also available as self-paced courses.) An Alliance account is required to register for and attend these courses. All our courses are **free**.

Upcoming live courses:

- **Introduction to CMake: Sept. 29, Oct. 1**
- Introduction to GPU Programming: Oct. 6, 9, 13, 16
- Mastering GPU Efficiency: Oct. 20, 23
- Python for High Performance Computing: Oct. 27, 30, Nov. 3, 6
- Introduction to AI agents in research: Nov. 10, 13
- Engineering Software: Nov. 17, 20
- Working with Jupyter on the Clusters: Nov. 24, 27
- Tidyverse: Data Science with R: Dec. 1, 4, 8
- Mastering the Alliance Job Scheduler: Dec. 11, 15, 18

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Training courses

Live courses: winter 2027

- A Practical Guide to Windows Subsystem for Linux (WSL): Jan. 12, 15
- High Performance Computing C++: Jan. 19, 22, 26, 29
- Efficient Deep Learning with PyTorch: Feb. 2, 5, 9, 12
- Fundamentals of Retrieval-Augmented Generation: Feb. 16, 19, 23
- Visualization: Feb. 26, Mar. 2
- Using Apptainer Containers: Mar. 5, 9
- Fundamentals and practice of advanced research computing: Mar. 16 - Apr. 15



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Training courses

Self paced courses

- New User Course
- Introduction to GPU Programming
- Introduction to Machine Learning
- Introduction to SQL
- Introduction to the Shell
- Mastering GPU Efficiency
- Mastering the Alliance job scheduler
- Bioinformatics



Q & A

- SHARCNET https://www.sharcnet.ca/
- Digital Research Alliance of Canada https://alliancecan.ca/
- Help: help@sharcnet.ca