

# Overview of SciNet and Computational Resources in Canada

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June 20, 2022

# What is SciNet?



- The SciNet High Performance Computing Consortium is the supercomputing centre at the University of Toronto in Canada.
- We run massively parallel computers to meet the needs of academic researchers across Canada.
- We also do a lot of training.

<https://www.scinethpc.ca>

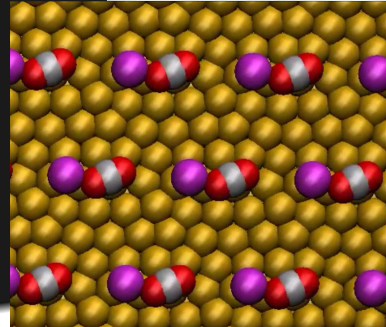
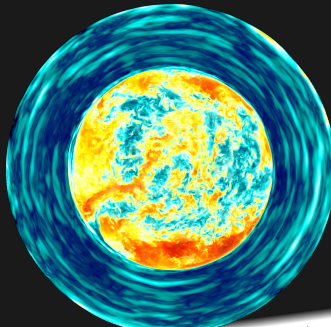
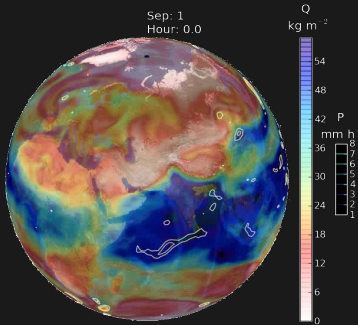
<https://scinet.courses>

# SciNet History

- 2004: SciNet founded by U. Toronto researchers (phys/chem/eng/astro... ) and hospitals.
- 2008: First supercomputer in operation. TCS: 3,300 cores / 49 TF
- 2009: Second supercomputer in operation. GPC: 30,240 cores / 169 TF
- 2012: Network upgrade of GPC. GPC: 30,240 cores / 262 TF
- 2012: Hosting a third supercomputer (owned by SOSCIP). BGQ: 32,768 cores / 358 TF
- 2014: Expansion of BGQ (owned by SOSCIP & LKSAVI). BGQ: 65,536 cores / 716 TF
- 2018: New supercomputer (TCS and GPC retired). Niagara: 61,920 cores / 3.1 PF
- 2019: BGQ retired
- 2020: Niagara expanded  
New Mist GPU Cluster Niagara: 80,960 cores / 3.6 PF  
Mist: 216 GPUs / 1.6 PF

# Research Topics

- Astronomy
- Astrophysics
- Material Science
- Particle Physics
- Chemical Physics
- Computational Chemistry
- Bioinformatics
- Medical Science
- Biochemistry
- Forestry
- Climate Science, ...

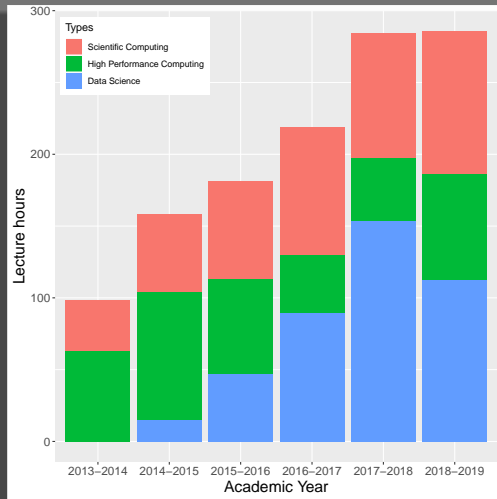




# SciNet Training and Education

## Training Evolution

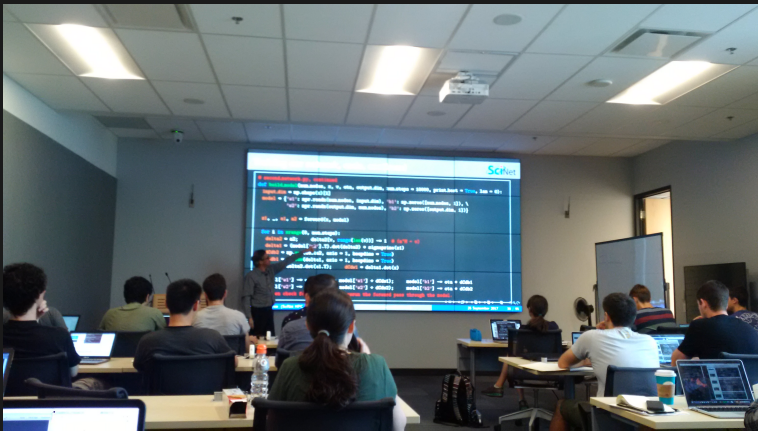
- Well-trained users can make more use out of oversubscribed resources.
- SciNet has been training and educating users from the start.
- Sponsoring of the IHPCSS is part of that.
- But there is also a lot of local demand for training, which we try to accomodate.



In 2020-2021, training was all virtual, with all the challenges that that brings.

# SciNet Training Topics

- Parallel Programming (MPI, OpenMP, CUDA)
- Scientific Computing
- Data Science
- Machine learning
- Computational statistics
- Python, R, C++
- I/O
- Software Engineering
- Visualization



Three semester-long graduate courses have spun off of our training efforts, one in Physics, one in Medical Science, and one in Biology.

# SciNet within the Canadian Landscape

- There are 6 similar consortia in Canada that provide Advanced Research Computing (ARC) and High Performance Computing (HPC) resources to Canadian academic researchers and their collaborators.

**ACENET, Calcul Quebec, DRI Priaries, BC DRI Group, SHARCNET, CAC.**

- Starting in 2022, the **Digital Research Alliance of Canada**, coordinates national advanced research computing, reach data management, and software development.
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- Member institutions own the infrastructure and employ the sysadmins and analysts that run and support the facilities.
  - These provide resources and support for advanced research computing for **all** Canadian academic researchers.

# Current ARC and HPC Systems

## Cedar (2017/2018)

- General purpose cluster
- 58,416 CPU cores
- 584 GPU devices

## Graham (2017)

- General purpose cluster
- 33,448 CPU cores
- 320 GPU devices

## Béluga (2019)

- General purpose cluster
- 34,880 CPU cores
- 688 GPU devices

## Narval (2021)

- General purpose cluster
- 80,912 CPU cores
- 192 GPU devices

## Arbutus (2016)

- Cloud system
- 7640 cores

## Niagara (2018/2020)

- Large parallel jobs.
- 80,960 CPU cores
- High-speed interconnect

## Mist (2020)

- 1728 CPU cores (IBM Power9)
- 108 GPU devices

<https://docs.alliancecan.ca>

# How to Get Access

[alliancecan.ca/en/services/advanced-research-computing/account-management/apply-account](http://alliancecan.ca/en/services/advanced-research-computing/account-management/apply-account)

- Any Canadian academic researcher can request a Compute Canada Database (CCDB) account, and then request an account with the local consortia.  
Researchers can sponsor their group members, as well as (international) collaborators.
- There is no cost to the researchers.
- An account gets you *rapid access status*, so you can run at modest scale and low priority.
- PI can submit to the annual Resource Allocation Competition to request compute (or project) resources; when granted, this translates in priority in the queue and increased limits on number of cores, storage etc.
- [support@computecanada.ca](mailto:support@computecanada.ca) or [support@scinet.utoronto.ca](mailto:support@scinet.utoronto.ca)