

# Quick Intro to MSI

Ju Sun (Computer Science & Engineering)

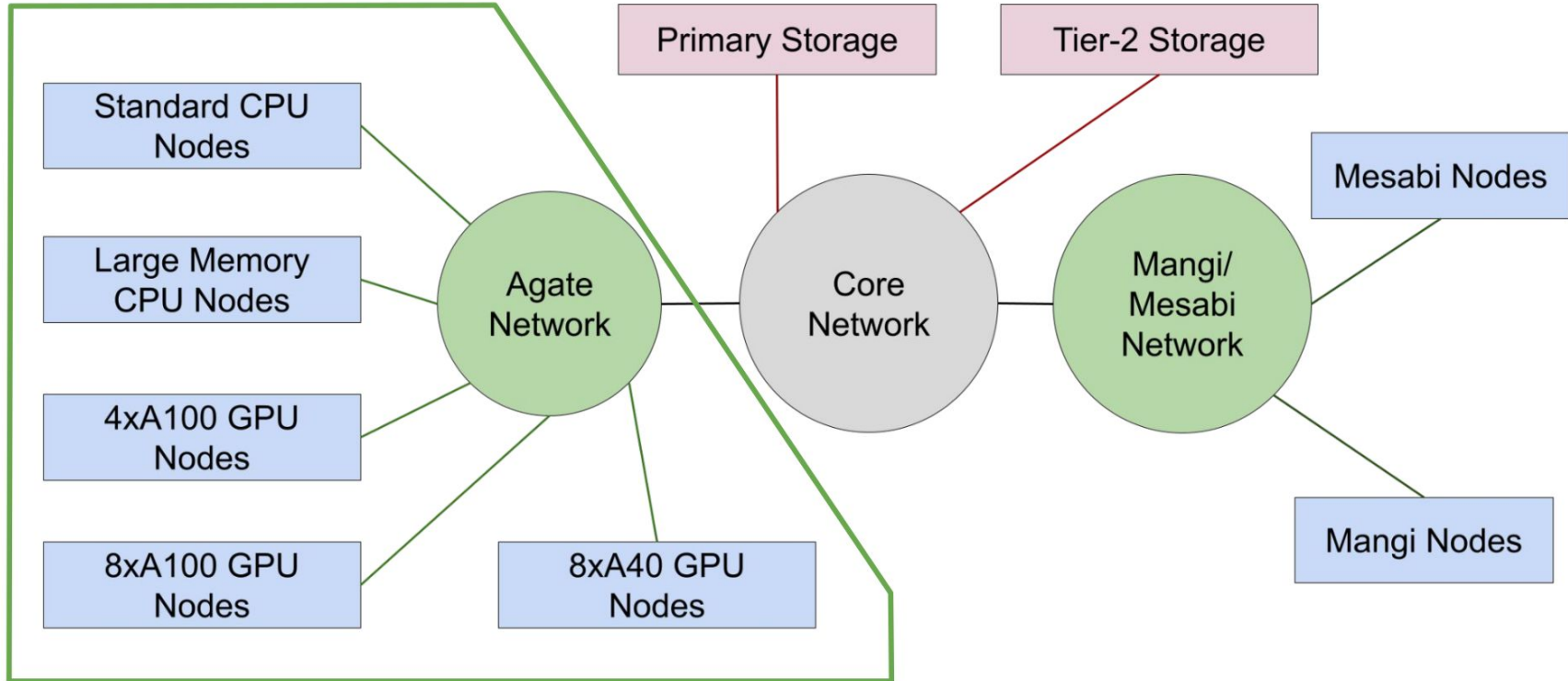
Mar, 2026

# Disclaimer

Many of the slides are taken from MSI's tutorial slides below, as well introductory slides made by **Dr. Ben Lynch, MSI Director**.

- Introduction to Minnesota Supercomputing Institute (MSI)  
<https://youtu.be/bNBfh2Q9l1E>
- Job submission and scheduling at MSI  
<https://youtu.be/r4m4WK4LfPY?si=BxtSrhzofEcYCTH6>
- Interactive computing at MSI  
[https://youtu.be/D6D77\\_gEmhw?si=PlMJigp-GYO\\_3bcF](https://youtu.be/D6D77_gEmhw?si=PlMJigp-GYO_3bcF)

# What's MSI?



# What's MSI?



## Mesabi

- Over 700 nodes
  - Memory configuration
    - 616 nodes have 64GB RAM
    - 24 nodes have 256GB RAM
    - 16 nodes have 1TB RAM
    - 40 k40 GPU nodes with 128GB RAM
- 17,784 cores provided by Intel Haswell Processors
- 480GB SSD available on 32 nodes



## Agate

- 412 nodes
- AMD processors with 64-128 CPU cores per node
- 344 CPU compute node
  - 244 have 512G mem
  - 100 have 2TB mem
- 58 GPU compute nodes
  - 50 A100 512G mem
  - 8 A100 1TB mem
- 10 GPU interactive nodes
  - 8 A40 GPUs 512G mem each

Basic access

# Prerequisite to connect

## Campus VPN

<https://it.umn.edu/services-technologies/virtual-private-network-vpn>

- MSI services are only available to on-campus network addresses
- Especially during the pandemic, many users are working off-campus
- VPN clients and instructions are available from OIT for most operating systems and mobile devices

## DUO Authentication

<https://it.umn.edu/services-technologies/self-help-guides/duo-set-use-duo-security>

- DUO 2-factor authentication is required for most MSI services
- DUO is also required to connect to the campus VPN

# Two way to access

- GUI interactive access
- Command-line access (please check their tutorial details)

## **Job submission and scheduling at MSI**

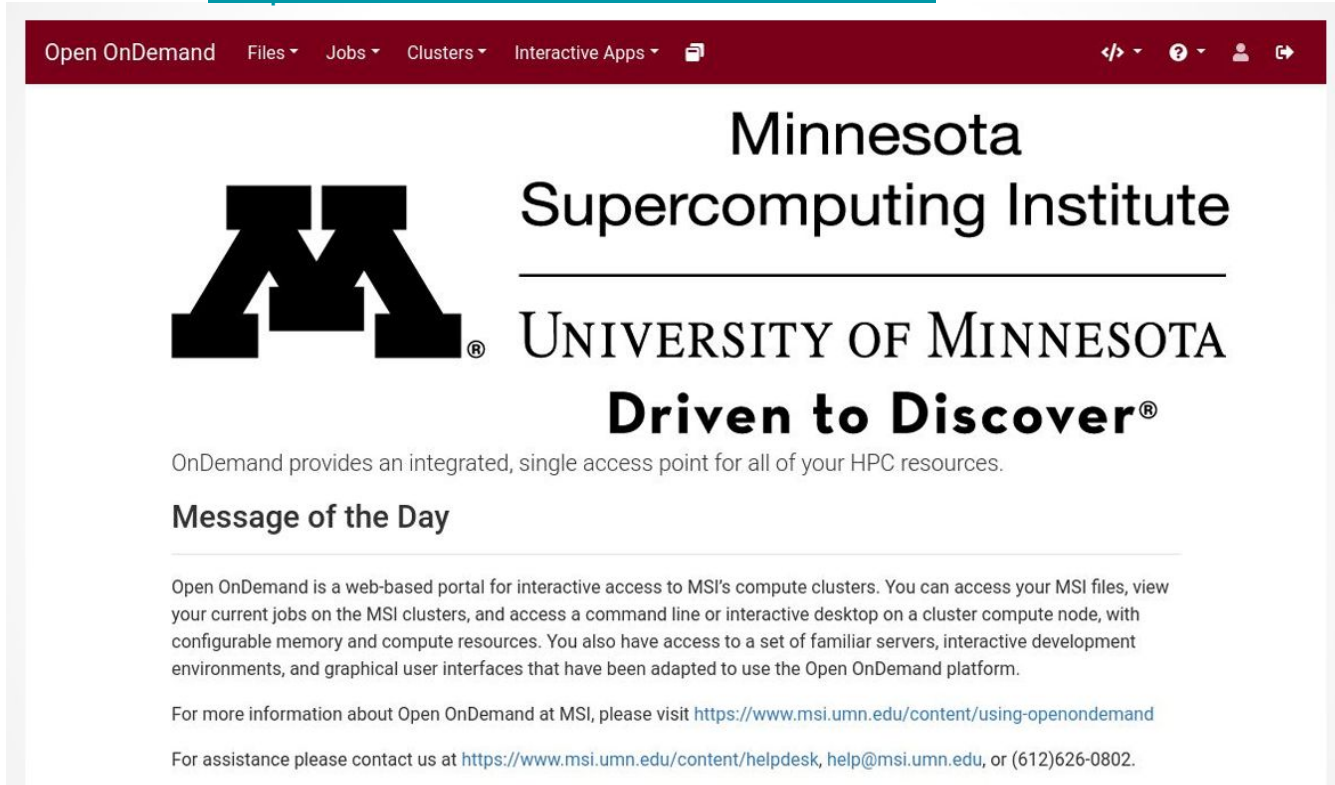
<https://youtu.be/r4m4WK4LFPY?si=BxtSrhzofEcYCTH6>

## **Interactive computing at MSI**

[https://youtu.be/D6D77\\_gEmhw?si=PlMJi9p-GYO\\_3bcF](https://youtu.be/D6D77_gEmhw?si=PlMJi9p-GYO_3bcF)

# GUI interactive access: OnDemand

<https://ondemand.msi.umn.edu/>



The screenshot shows the Open OnDemand web portal interface. At the top is a dark red navigation bar with the text "Open OnDemand" and several menu items: "Files", "Jobs", "Clusters", and "Interactive Apps". On the right side of the bar are icons for code editing, help, user profile, and a share icon. Below the navigation bar is the main content area, which features the Minnesota Supercomputing Institute logo (a stylized 'M' with three upward-pointing triangles) and the text "Minnesota Supercomputing Institute" in a large, bold, black font. Below this is a horizontal line, followed by "UNIVERSITY OF MINNESOTA" in a smaller, black, serif font, and "Driven to Discover®" in a bold, black, sans-serif font. Underneath the logo and text is a paragraph of introductory text: "OnDemand provides an integrated, single access point for all of your HPC resources." Below this is a section titled "Message of the Day" in a bold, black, sans-serif font. Underneath the title is a paragraph of text: "Open OnDemand is a web-based portal for interactive access to MSI's compute clusters. You can access your MSI files, view your current jobs on the MSI clusters, and access a command line or interactive desktop on a cluster compute node, with configurable memory and compute resources. You also have access to a set of familiar servers, interactive development environments, and graphical user interfaces that have been adapted to use the Open OnDemand platform." Below this paragraph is a line of text: "For more information about Open OnDemand at MSI, please visit <https://www.msi.umn.edu/content/using-openondemand>". At the bottom of the page is another line of text: "For assistance please contact us at <https://www.msi.umn.edu/content/helpdesk>, [help@msi.umn.edu](mailto:help@msi.umn.edu), or (612)626-0802."

# OnDemand walkthrough

Services accessed through menu bar

Open OnDemand Files Jobs Clusters Interactive Apps

Minnesota  
Supercomputing Institute

---

UNIVERSITY OF MINNESOTA  
**Driven to Discover**

OnDemand provides an integrated, single access point for all of your HPC resources.

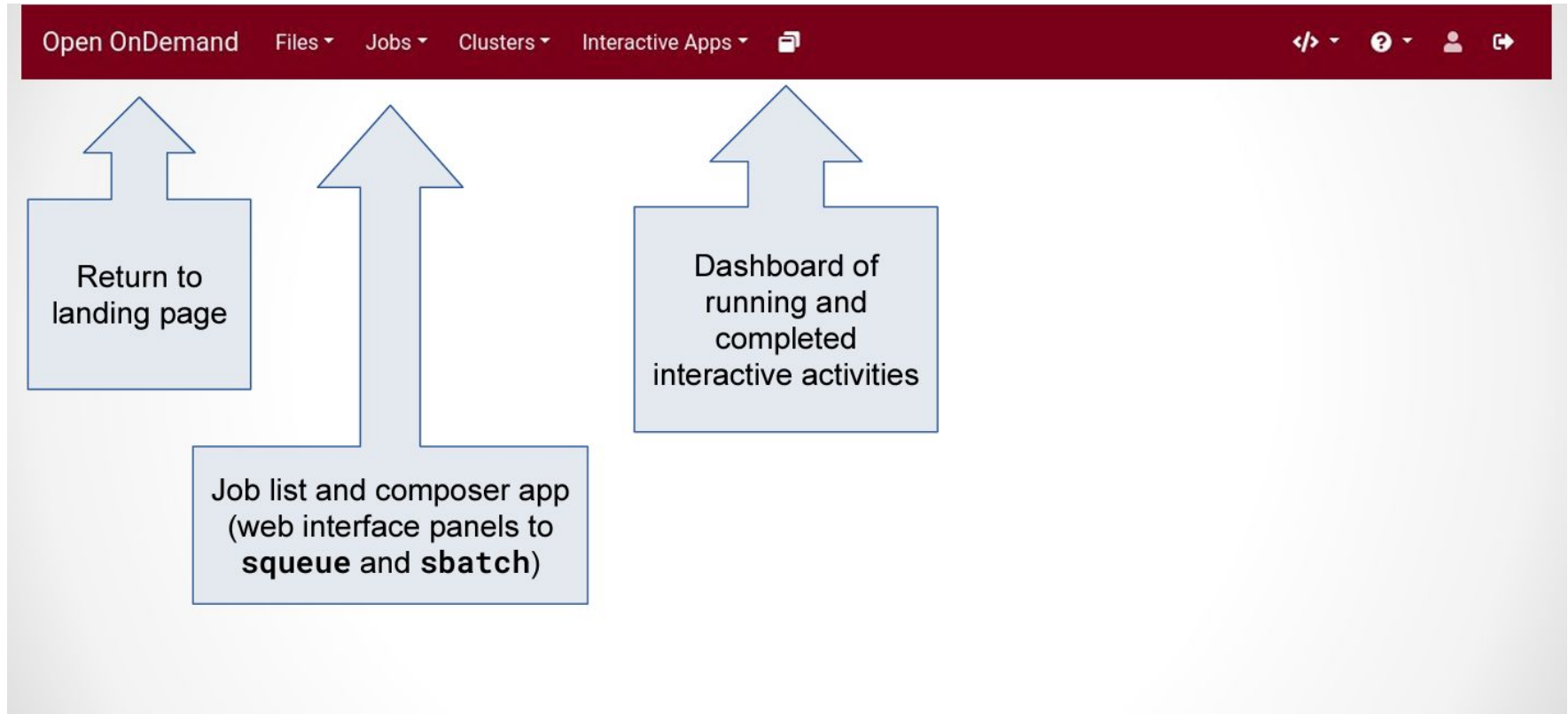
### Message of the Day

Open OnDemand is a web-based portal for interactive access to MSI's compute clusters. You can access your MSI files, view your current jobs on the MSI clusters, and access a command line or interactive desktop on a cluster compute node, with configurable memory and compute resources. You also have access to a set of familiar servers, interactive development environments, and graphical user interfaces that have been adapted to use the Open OnDemand platform.

For more information about Open OnDemand at MSI, please visit <https://www.msi.umn.edu/content/using-openondemand>

For assistance please contact us at <https://www.msi.umn.edu/content/helpdesk>, [help@msi.umn.edu](mailto:help@msi.umn.edu), or (612)626-0802.

# OnDemand walkthrough



# OnDemand walkthrough

The screenshot shows the OnDemand web interface. At the top, a dark red navigation bar contains the text "Open OnDemand" and several dropdown menus: "Files" (highlighted in yellow), "Jobs", "Clusters", "Interactive Apps", and "My Interactive Sessions". Below the "Files" menu, a white dropdown list shows "Home Directory" with a house icon and "/home/support" with a folder icon. A blue arrow points from a box labeled "File browser access" to the "/home/support" option. To the right, a light blue callout box contains the text "File browser:" followed by a bulleted list: "- browse/navigate/manage files", "- upload/download files up to few GB size", and "- access different starting dirs if you have multiple groups/projects". Below the navigation bar, a toolbar contains buttons for "Open in Terminal", "New File", "New Directory", "Upload", "Download", "Copy/Move", and "Delete". The main content area shows a breadcrumb path: "/ home / support / milligan /" with a "Change directory" button and a "Copy path" button. Below the path, there are checkboxes for "Show Owner/Mode" and "Show Dotfiles", and a "Filter:" input field. At the bottom, a table header is visible with columns for "Type", "Name", "Size", and "Modified at".

Open OnDemand Files Jobs Clusters Interactive Apps My Interactive Sessions

Home Directory  
/home/support

File browser access

File browser:

- browse/navigate/manage files
- upload/download files up to few GB size
- access different starting dirs if you have multiple groups/projects

>\_ Open in Terminal + New File New Directory Upload Download Copy/Move Delete

/ home / support / milligan / Change directory Copy path

Show Owner/Mode  Show Dotfiles Filter:

Showing 92 of 236 rows - 0 rows selected

Type	Name	Size	Modified at
------	------	------	-------------

# OnDemand walkthrough

The screenshot shows the OnDemand web interface. At the top, a dark red navigation bar contains the following items: "Open OnDemand", "Files", "Jobs", "Clusters" (highlighted in yellow), "Interactive Apps", and "My Interactive Sessions". A dropdown menu for "Clusters" is open, showing two options: ">\_Agate Shell Access" and ">\_Mesabi Shell Access". Below this menu, a light blue box with an upward-pointing arrow contains the text "Command line terminal access". To the right, another light blue box titled "Command line terminal:" contains a list of instructions: "SSH" in a web browser (almost), Launch terminal on cluster headnode, Roughly equivalent to e.g. `ssh <username>@agate.msi.umn.edu`, and Also launch in specific directory via file browser pane. A blue arrow points from this box to the "Open in Terminal" button in the file browser pane. The file browser pane at the bottom shows a path: `/ home / support / milligan /`. The "Open in Terminal" button is circled in red.

Open OnDemand Files Jobs Clusters Interactive Apps My Interactive Sessions

>\_Agate Shell Access  
>\_Mesabi Shell Access

Command line terminal access

Command line terminal:

- "SSH" in a web browser (almost)
- Launch terminal on cluster headnode
- Roughly equivalent to e.g. `ssh <username>@agate.msi.umn.edu`
- Also launch in specific directory via file browser pane

>\_ Open in Terminal New File New Directory Upload Download Copy/Move Delete

/ home / support / milligan / Change directory Copy path

# OnDemand walkthrough

The image shows a screenshot of the OnDemand web interface. At the top, there is a dark red navigation bar with the following items: "Open OnDemand", "Files", "Jobs", "Clusters", "Interactive Apps" (highlighted in yellow), and "My Interactive Sessions". Below the navigation bar, a dropdown menu is open for "Interactive Apps", listing several categories and their respective applications:

- Desktops
  - Desktop
  - Persistent Desktop
- GUIs
  - ANSYS Workbench
  - IGV
  - MATLAB
- IDEs
  - Abaqus
  - COMSOL Multiphysics
  - IDL
  - Mathematica
- Servers
  - Jupyter
  - RStudio Server

On the left side of the interface, there is a light blue text box with the following text:

Interactive Apps menu lists available application launchers

Each launcher leads to a session options page

Each session runs as an interactive job on a cluster resource

Launchers also available via the Interactive Sessions dashboard

Red arrows point from the text box to the "Interactive Apps" menu and its sub-items, and another red arrow points from the "Interactive Sessions dashboard" text to the "My Interactive Sessions" button in the navigation bar.

# OnDemand walkthrough

Session was successfully created. x

Home / My Interactive Sessions

### Interactive Apps

- Desktops
  - Desktop
  - Persistent Desktop
- GUIs
  - ANSYS Workbench
  - IGV
  - MATLAB
- IDEs
  - Abaqus
  - COMSOL Multiphysics
  - IDL
  - Mathematica
- Servers
  - Jupyter
  - RStudio Server

### Desktop (71087165) 1 node | 2 cores | Running

Host: [\\_acn23.agate.msl.umn.edu](#) Delete

Created at: 2023-02-16 12:31:57 CST

Time Remaining: 3 hours and 58 minutes

Session ID: a2a0db19-7a3a-45a0-9e90-eddca9bfd03b

Compression 0 (low) to 9 (high) | Image Quality 0 (low) to 9 (high)

Launch Desktop View Only (Share-able Link)

### RStudio Server (71064307) Completed

Created at: 2023-02-13 23:32:26 CST Delete

Session ID: 713d240a-60e3-488d-a2a4-3d5d80dcfd9a

For debugging purposes, this card will be retained for 5 more days

### RStudio Server (71061783) Completed

## My Interactive Sessions

List job status for interactive sessions: queued, running, finished

Launch into a running session (usually opens new browser tab)

Access full menu of interactive launchers

# Setting up your deep learning environment

# Put everything inside a virtual environment

## Conda



*Package, dependency and environment management for any language—Python, R, Ruby, Lua, Scala, Java, JavaScript, C/ C++, Fortran, and more.*

## Miniconda Highly recommended!

Miniconda is a free minimal installer for conda. It is a small bootstrap version of Anaconda that includes only conda, Python, the packages they both depend on, and a small number of other useful packages (like pip, zlib, and a few others). If you need more packages, use the `conda install` command to install from thousands of packages available by default in Anaconda's public repo, or from other channels, like conda-forge or bioconda.

Is Miniconda the right conda install for you? The [Anaconda](#) or [Miniconda](#) page lists some reasons why you might want one installation over the other.

Check out how to use conda to manage virtual environments, e.g.,

<https://conda.io/projects/conda/en/latest/user-guide/getting-started.html>

<https://docs.conda.io/projects/miniconda/en/latest/>

# Install PyTorch inside Conda

## INSTALL PYTORCH

Select your preferences and run the install command. Stable represents the most currently tested and supported version of PyTorch. This should be suitable for many users. Preview is available if you want the latest, not fully tested and supported, builds that are generated nightly. Please ensure that you have **met the prerequisites below (e.g., numpy)**, depending on your package manager. Anaconda is our recommended package manager since it installs all dependencies. You can also [install previous versions of PyTorch](#). Note that LibTorch is only available for C++.

PyTorch Build	Stable (2.1.0)		Preview (Nightly)	
Your OS	Linux	Mac	Windows	
Package	Conda	Pip	LibTorch	Source
Language	Python		C++ / Java	
Compute Platform	CUDA 11.8	CUDA 12.1	ROCm 5.6	CPU
Run this Command:	<pre>conda install pytorch torchvision torchaudio pytorch-cuda=11.8 -c pytorch -c nvidia</pre>			

Be careful of the CUDA version!

- \*\* **A100**: this gpu **ONLY WORKS** with cuda  $\geq$  11.3. (
- \*\* **V100**: this gpu **DOES NOT** work with cuda  $\geq$  11.3.

<https://pytorch.org/>



```
#SBATCH --partition=interactive-gpu      ## Job queue to submit your job
#SBATCH --gres=gpu:a40:1                ## Number and type of gpu to request
                                         ## Without this line,
                                         ## you are not requesting any gpu
```

```
cd /home/csci5527/your_x500/your_working_folder
                                         ## Direct your working directory

export PATH=/home/csci5527/$your_x500$/$your_conda$/
envs/$your_venv_name$/bin:$PATH          ## Load your conda env

python autoencoder_train.py              ## Execute your job
```

<https://www.msi.umn.edu/content/job-submission-and-scheduling-slurm> for more details

# Which partition?

Partition Name	Max cores per node	Maximum walltime	Max available node memory <sup>3</sup> (GB)	Memory per core (MB)	Local scratch per node (GB)	Max nodes per job	Max jobs per user
msismall	128	96:00:00	248-755	3900	850	1	4000 <sup>4</sup>
msilarge	128	24:00:00	248-755	3900	850	32	4000 <sup>4</sup>
msibigmem	128	24:00:00	1995	15950	850	1	4000 <sup>4</sup>
msigpu <sup>1</sup>	24-128	24:00:00	374-1002	3900-8000	850	4	4000 <sup>4</sup>
msilong	32	37-0	248-755	3900	850	*** <sup>5</sup>	*** <sup>5</sup>
interactive	128	24:00:00	499	3900	850	2	1
interactive-gpu <sup>1,6</sup>	64-128	24:00:00	499-755	5120	850	1	1
interactive-long	64-128	37-0	499	3900	850	1	1
preempt <sup>2</sup>	128	24:00:00	248-755	3900	850	1	4000 <sup>4</sup>
preempt-gpu <sup>1,2</sup>	64-128	24:00:00	499-755	3900-8000	850	1	4000 <sup>4</sup>

```
#SBATCH --partition=interactive-gpu
```

<https://www.msi.umn.edu/partitions>

# Frequently used commands

## Step 5: Submit your job

```
sbatch XXX.slurm # XXX.slurm is your job script name
```

## Step 6: Useful commands after submitting your job

(1) Checking the status of the MSI queue:

```
squeue -p interactive-gpu # Lists all job statuses on the  
                           # interactive-gpu partition (not only you)
```

Or simply checking your own queue status by:

```
squeue --me # chek your own jobs
```

(2) Canceling a submitted job:

```
scancel jobIDnumber
```

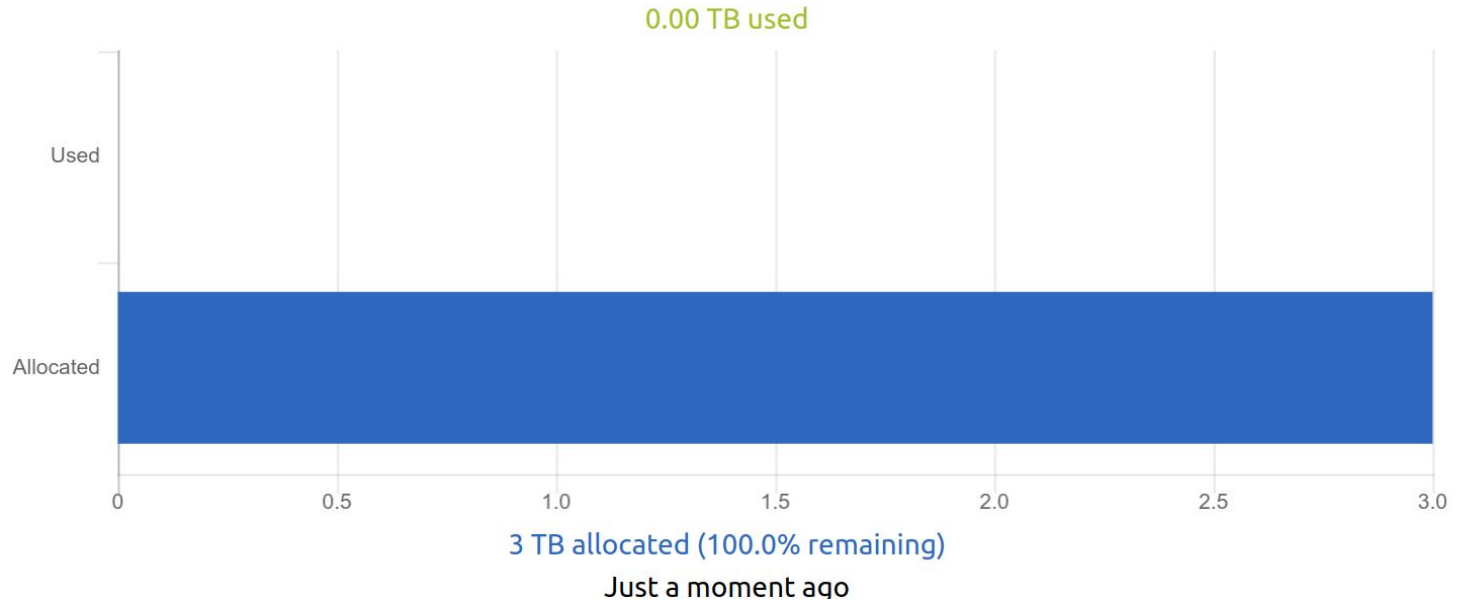
(3) Canceling all your submitted jobs:

```
scancel --user=your_x500
```

Save the class storage

# Storage/file counts shared for the whole class

## Storage



# Three levels of storage

## Primary Storage

- Primary storage is where you will do most of your work
  - GNU/Linux filesystem
- Watch your disk usage:

Impo

/hon  
Your

## Second Tier Storage

- Sometimes referred to as “Ceph”, the name of the software defined storage utility in use in this storage layer.
- Second tier storage is separate from primary storage, it is an “object store” - you must use special tools to access it.
- From the command line, you can use the “s3cmd” software package to interact with your storage:
  - See: <https://www.msi.umn.edu/support/faq/how-do-i-use-second-tier-storage-command-line>
- For a graphical interface, you can use Globus
  - See: <https://www.msi.umn.edu/support/faq/how-do-i-use-globus-transfer-data-msi-0>
- **Not** backed up, so if you delete a file, it will be gone for good
  - Quotas are much more relaxed on second tier storage
  - **Resilient system to store data**

## Primary Storage Scratch

- Quotas are large, so there should be leeway to make very large files here
  - Use it for intermediate/temporary files in analytical workflows
- Files are kept for 30 days, so be sure to copy important files to your group directory



space is also not backed up by snapshot  
**the tricks that exist to keep data in scratch for an 30 days. Consider data on scratch as having no**

.oba1/

**Required: use scratch storage to store your large datasets and immediate results**

# We'll distribute a concise set of notes

Canvas home →

- Discussion through **Piazza** (left tab)
- Shared project folder: [https://drive.google.com/drive/folders/1\\_oaf-joBspaYXyPoLyjccChDGehDWaQ3?usp=sharing](https://drive.google.com/drive/folders/1_oaf-joBspaYXyPoLyjccChDGehDWaQ3?usp=sharing) 
- MSI access notes: 
- Homework Solutions:
  - HW0: <https://canvas.umn.edu/courses/541406/files/folder/Homework%20Answer?preview=60440061>