

HiPerGator
The University of Florida Supercomputer for Research

Research Computing Orientation for UF Courses

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UF | Information Technology

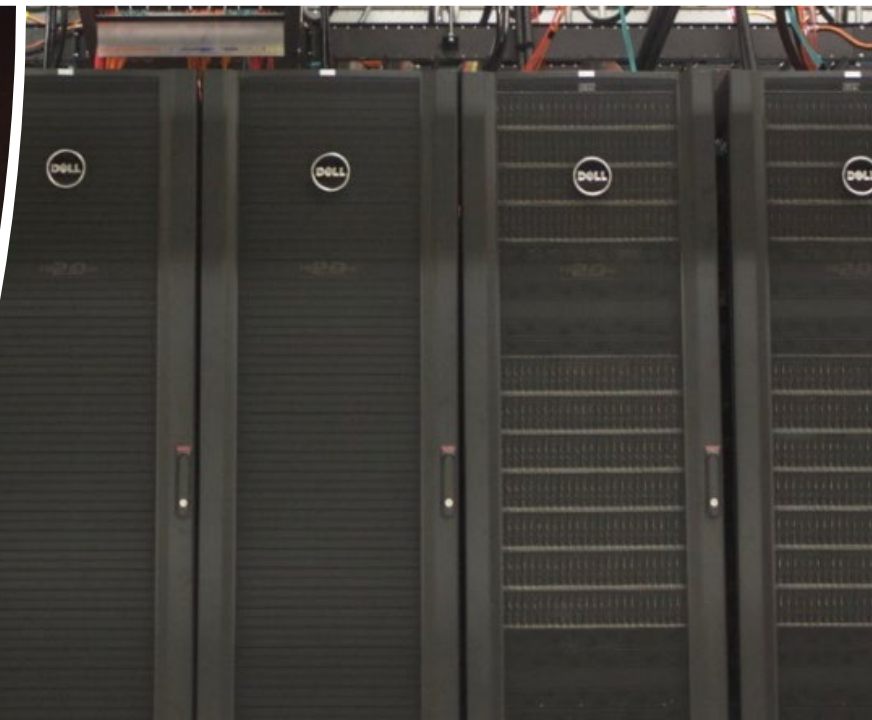
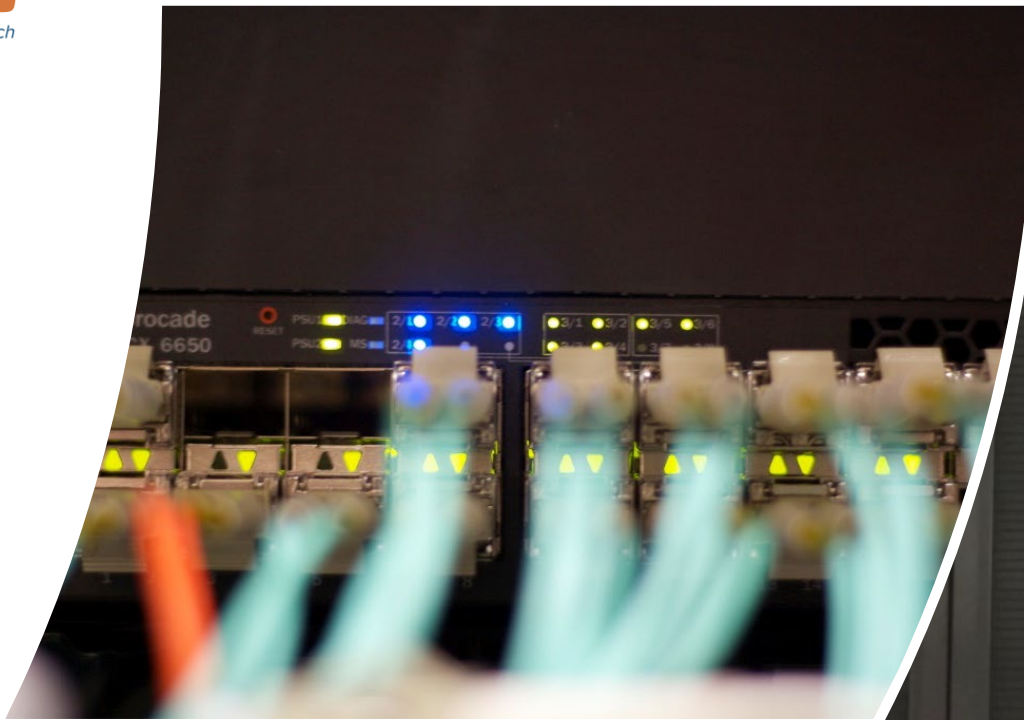




HiPerGator

The University of Florida Supercomputer for Research

Providing
computational
resources for a
top 10
university





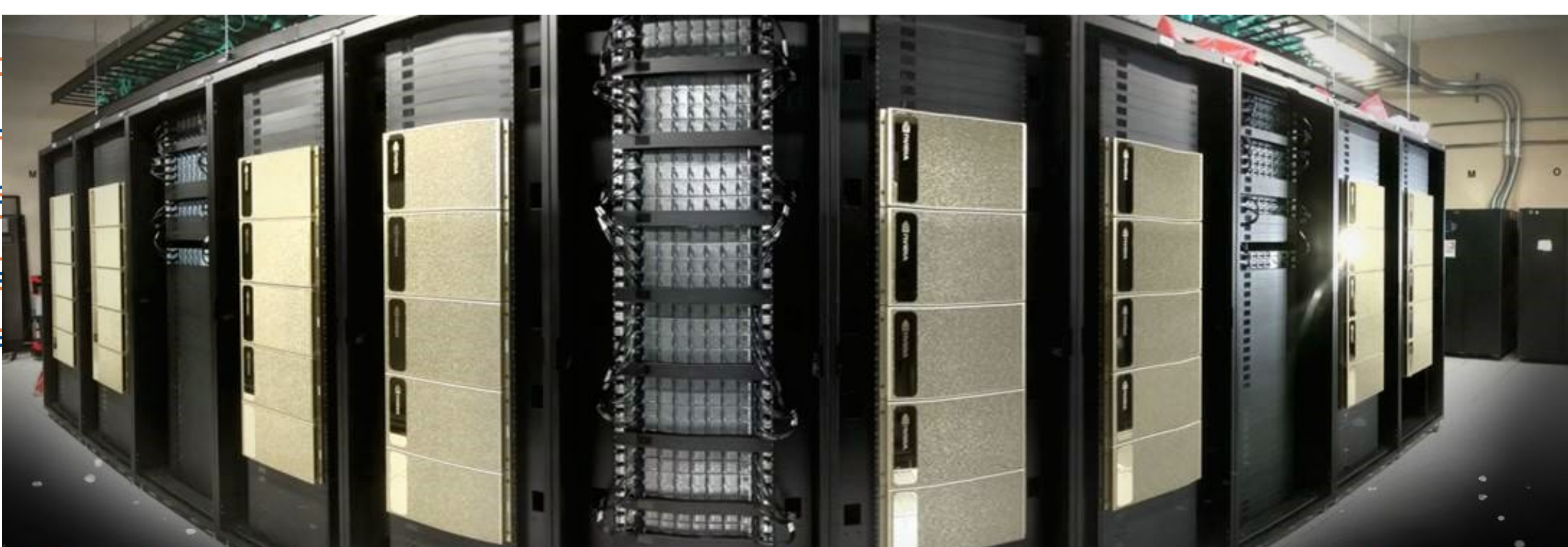
HiPerGator
The University of Florida Supercomputer for Research

#GATORGOOD



HiPerGator3

- ✓ Add less expensive, high-capacity storage (3PB /orange)
- ✓ Replace main filesystem (4PB /blue)
- ✓ Add 600+ GPUs
- ✓ Replace aging HPG1 cores with new AMD EPYC Rome cores (30,720 cores)
Milan cores (9,600, early 2021)



HiPerGator AI

UNIVERSITY OF FLORIDA



Course use of **HiPerGator**

The University of Florida Supercomputer for Research

- **Course is allocated 32 cores, 112GB RAM, 2TB Blue storage, GPUs as needed**
 - Design projects with this in mind
 - Time your work with this in mind
 - Use resources efficiently
- **Support requests should go through course TA**
 - If TA cannot solve the issue, the TA should open support requests
- **By using your account, you agree to the AUP**
 - <http://www.rc.ufl.edu/about/policies/>
 - No restricted data



HiPerGator Account Training

- myTraining: [HiPerGator Account Training](#)



- UF_ITT423_OLT
- Take within 2-weeks

- Content and links at: help.rc.ufl.edu/doc/New_user_training

- Page also has additional information for classes at the end

Getting Started [\[edit\]](#)

- Getting Started
- Mailing Lists
- New user training
- Training, Events and How-To Videos
- Non-Batch System Resources
- Interactive Development and Testing
- GUI Programs
- Blocked Accounts
- SSH Key Creation (Windows)
- Submit a Support Request
- Storage Types and Procedures
- Practical Storage Use
- Teaching Support





For users with an account

- If you already have a Research Computing account for research:
- **module load class/pre1234**
 - Ensures that jobs run under course allocation
 - Or use `--account=pre1234 --qos=pre1234`

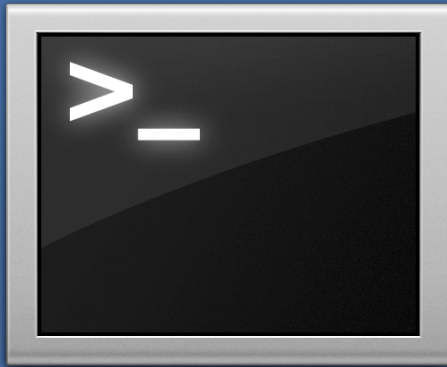


HiPerGator
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#GATORGOOD

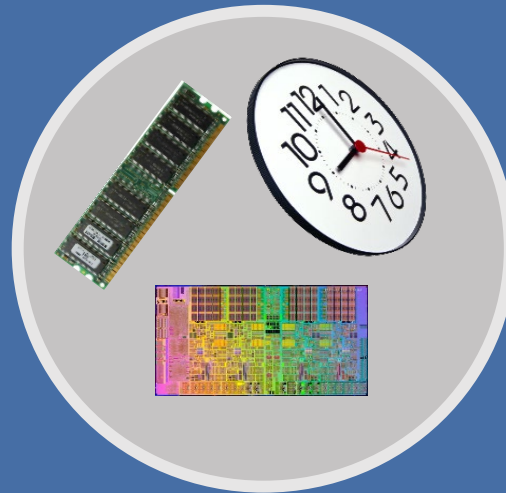
Cluster overview

User
interaction



Login node
(Head node)

SLURM
Scheduler



Tell SLURM what
you want to do

Compute
resources



Your job runs
on the cluster



Tools for working with HiPerGator

ssh client to connect to
`hpg.rc.ufl.edu`



e.g.: Terminal, MobaXterm



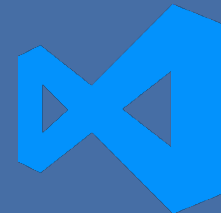
SFTP client to move files
to/from your computer



e.g.: Cyberduck, FileZilla

Text editor

Especially on Windows, be sure to convert DOS
line breaks to Unix, and *don't use Word*

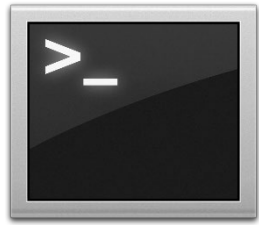


e.g.: VS Code





SSH Clients



Mac/Linux: Terminal



Windows:
MobaXterm or PuTTY

```
magitz — magitz@login1:~ — ssh magitz@hpg.rc.ufl.edu — 84x31
[flmnh-C02N85F3G:~ magitz$ ssh magitz@hpg.rc.ufl.edu
magitz@hpg.rc.ufl.edu's password:
Last login: Wed Aug  1 09:15:12 2018 from 10.138.175.245

Welcome to UF Research Computing
_____

The user agrees to comply with Research Computing's policies.

https://www.rc.ufl.edu/about/policies

Backup Policy
_____

Data on Research Computing storage systems is NOT backed up without investment
in backup services. Please visit the link below for more information.

https://www.rc.ufl.edu/about/policies/storage/protection/

UFIT Policy Notice
_____

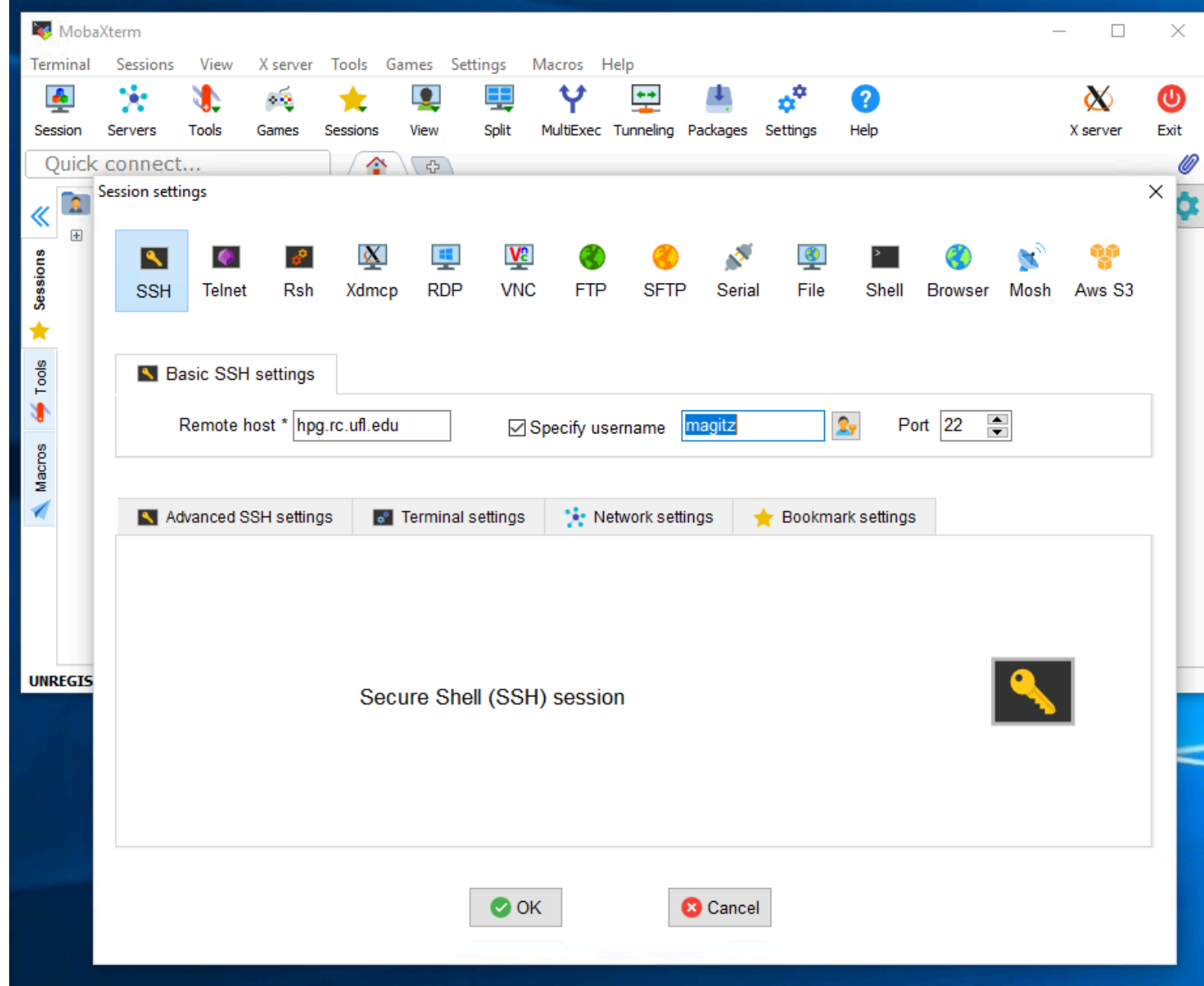
The user understands and acknowledges that the computer and the network are the
property of the University of Florida (UF). The user agrees to comply with the
UF Acceptable Use Policy and Guidelines. UF monitors computer and network
activities without user authorization. UF may provide information about computer
or network usage to UF officials, including law enforcement when warranted.
Therefore, the user should have limited expectations of privacy.

[magitz@login1 ~]$
```

`ssh user@hpg.rc.ufl.edu`

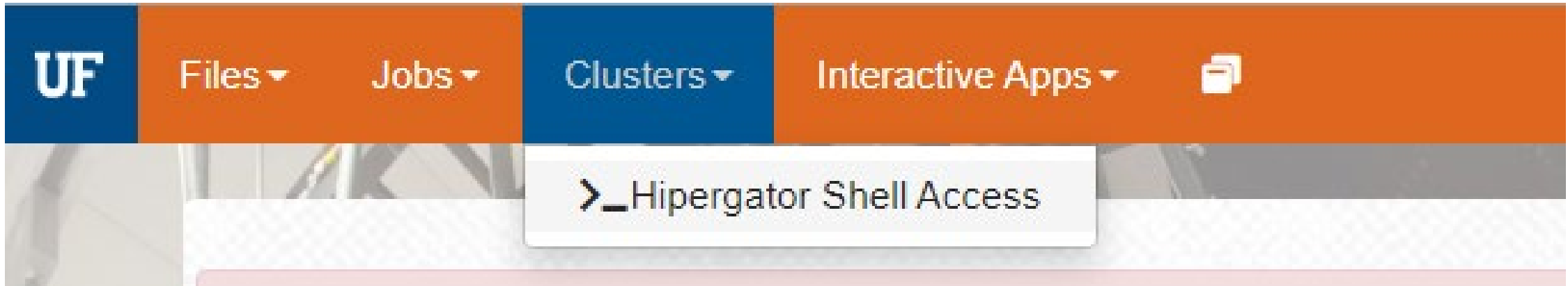


MobaXterm





ood.rc.ufl.edu



 Need to be on UF network (VPN if off campus)



SFTP Client



MobaXterm

The screenshot shows the MobaXterm SFTP client interface. The top menu bar includes Terminal, Sessions, View, X server, Tools, Games, Settings, Macros, and Help. Below the menu is a toolbar with icons for Session, Servers, Tools, Games, Sessions, View, Split, MultiExec, Tunneling, Packages, Settings, Help, X server, and Exit. A search bar labeled "Quick connect..." is present. The main window displays a file explorer view for the remote directory `/home/magitz/Class_Files/JupyterNotebooks/`. The left sidebar shows a tree view of local drives and sessions. The main pane shows a table of files and folders with columns for Name, Size (KB), Last modified, Owner, Group, and Access.

Name	Size (KB)	Last modified	Owner	Group	Access
..					
..ipynb_checkpoints		2018-10-05 08:57	magitz	ufhpc	drwxr-xr-x
Dictionaries_Tuples.ipynb	13	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--
File_ID.ipynb	61	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--
Flow_control.ipynb	11	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--
Functions.ipynb	7	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--
Lists.ipynb	12	2019-03-21 10:56	magitz	ufhpc	-rw-rw-r--
python_lists.png	63	2018-10-05 08:57	magitz	ufhpc	-rwxrwxr-x
Strings.ipynb	11	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--
Variables_and_Types.ipynb	12	2018-10-05 08:57	magitz	ufhpc	-rw-rw-r--

Terminal output at the bottom of the window:

```
Directory content listed
Opening directory /home/magitz/Class_Files/JupyterNotebooks...
Open directory command received
Directory content listed
```

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <https://mobaxterm.mobatek.net>



Cyberduck, FileZilla



Storage on HiPerGator

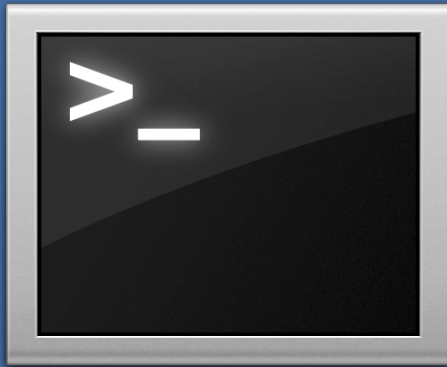


- **Home storage:** `/home/<user>`
 - 40GB limit
 - Scripts, code, compiled applications
 - **Do NOT use for job input/output**
 - **Week of snapshots at `~/.snapshot/`**
- **Blue storage:** `/blue/pre1234/<user>`
 - 2TB limit per class
 - **ALL input/output** from jobs should go here

- All storage systems are for research and coursework data only
- Nothing is backed up
- All course accounts are deleted at the end of the semester

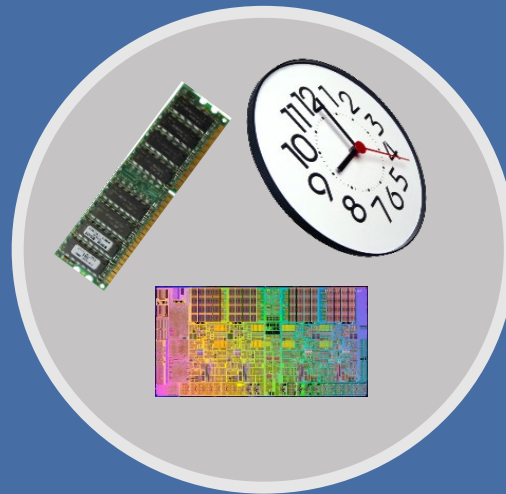
Cluster overview

User
interaction



Login node
(Head node)

SLURM
Scheduler



Tell SLURM what
you want to do

Compute
resources

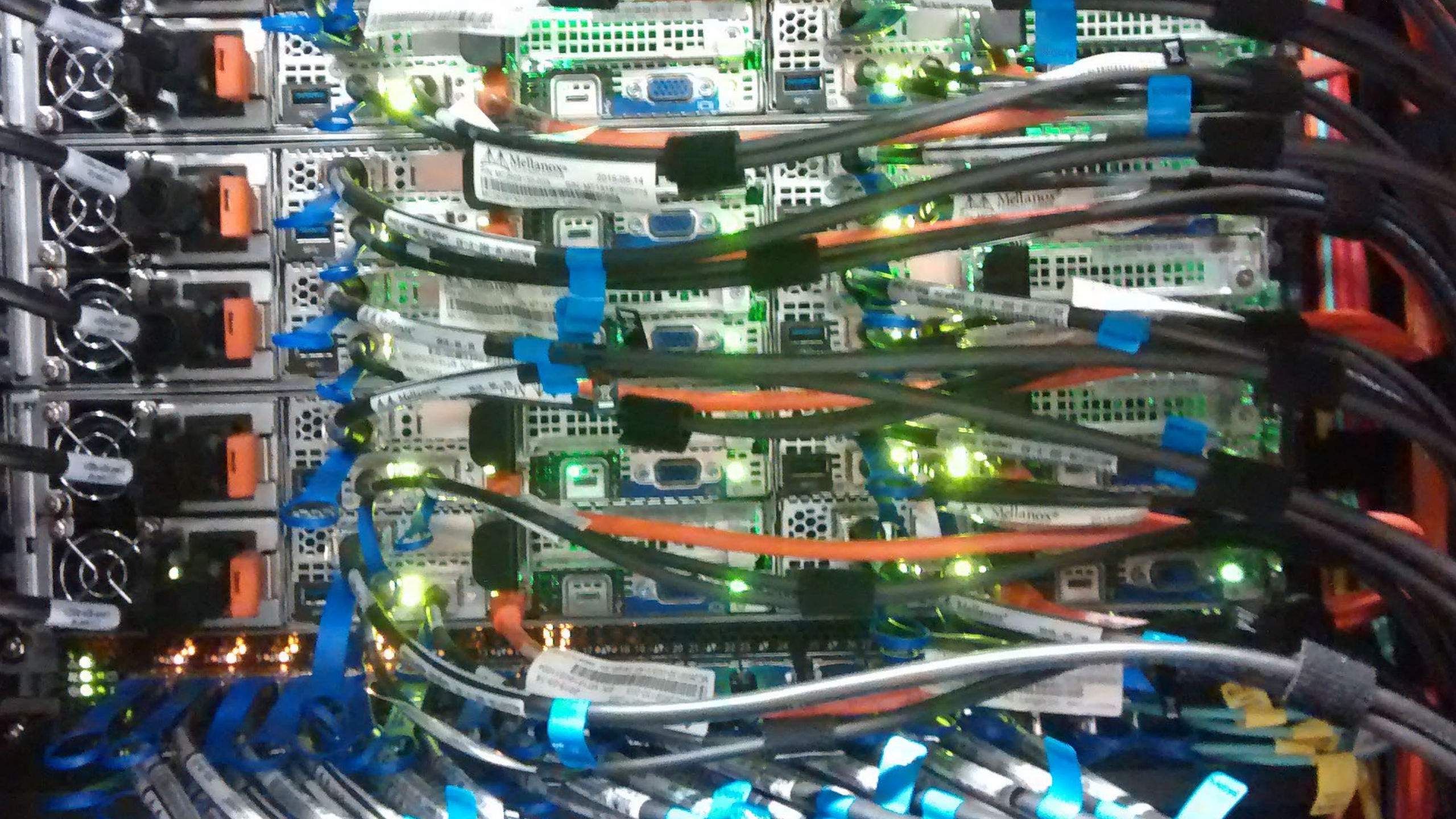


Your job runs
on the cluster



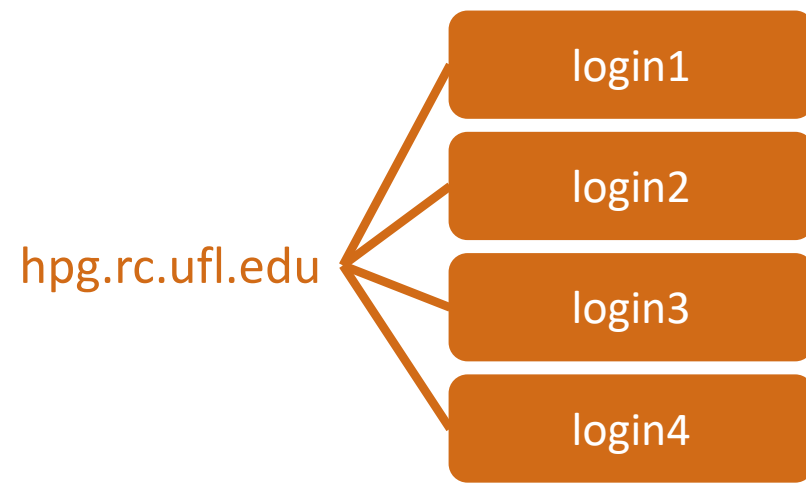
HiPerGator
The University of Florida Supercomputer for Research

#GATORGOOD





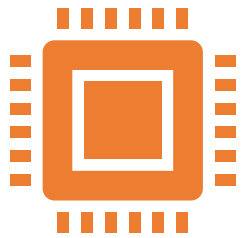
HiPerGator
The University of Florida Supercomputer for Research





Appropriate use of login nodes

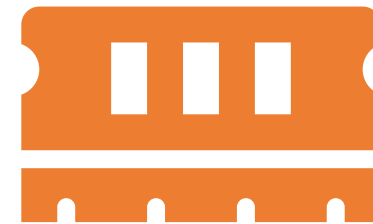
- Login nodes are for:
 - File and job management
 - Short-duration interactive testing and development
- Limit your use to **no more than:**



16 cores



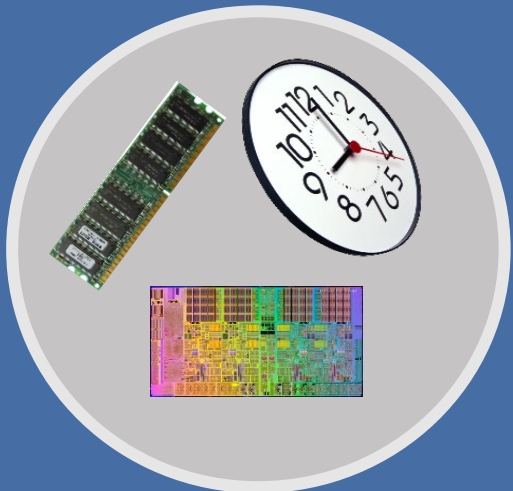
10 minutes



64 GB memory

Resources

SLURM Scheduler




Tell SLURM what you want to do

Development servers



GPU Servers



Galaxy

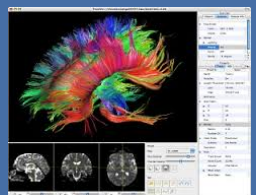


Galaxy

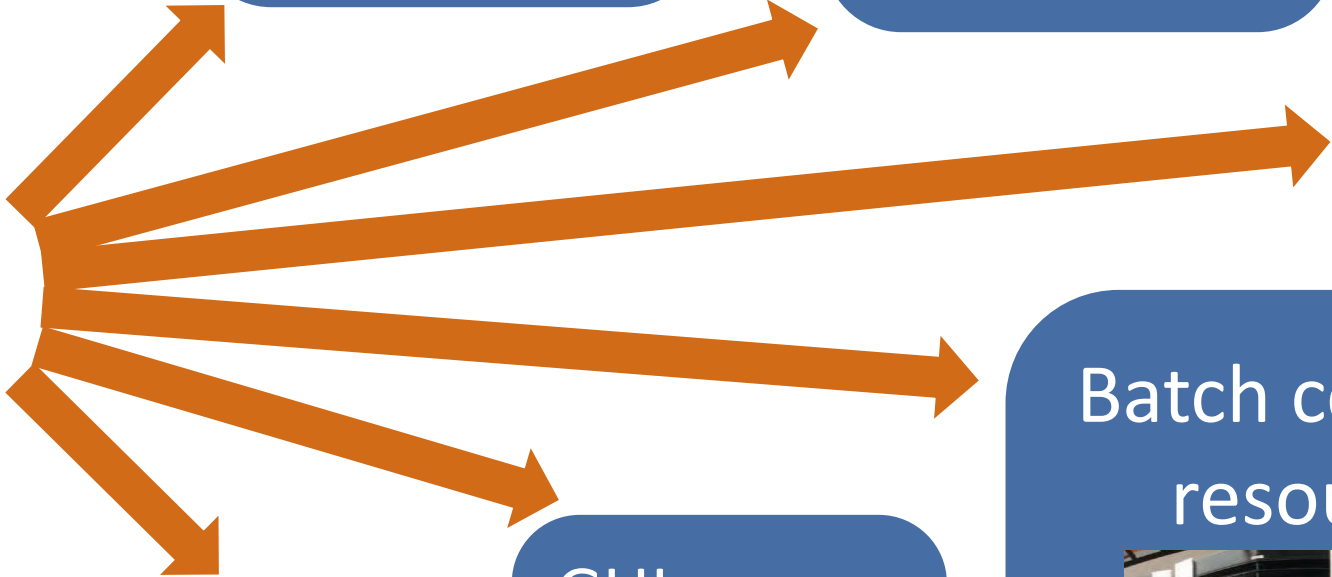
Jupyter servers



GUI servers



Batch compute resources

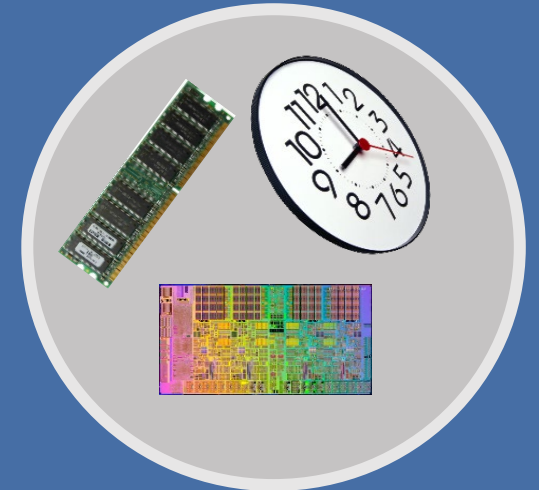




Scheduling a job

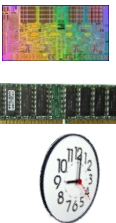
- What resources does your job need?
 - **How many CPUs** you want and how you want them grouped?
 - **How much RAM** your job will use?
 - **How long** your job will run?
 - **How many GPUs?**
- Also need the commands that will be run to do your work

SLURM Scheduler



Tell SLURM what you want to do

Basic SLURM job script



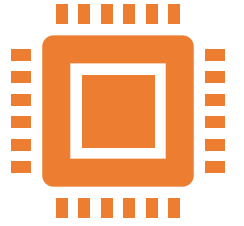
```
#!/bin/sh
#SBATCH --cpus-per-task=1      # Run on a single CPU
#SBATCH --mem=1gb              # Memory limit
#SBATCH --time=00:05:00       # Time: hr:min:sec

#SBATCH --job-name=job_test    # Job name
#SBATCH --mail-type=ALL        # Mail events
#SBATCH --mail-user=email_address # Where to send mail
#SBATCH --output=serial_%j.out # Output and error log

pwd; hostname; date           # Print some information
module load python            # Load needed modules
echo "Running plot script on a single CPU core"
python /data/training/SLURM/plot_template.py
date                           # Print ending time
```



SLURM CPU Requests

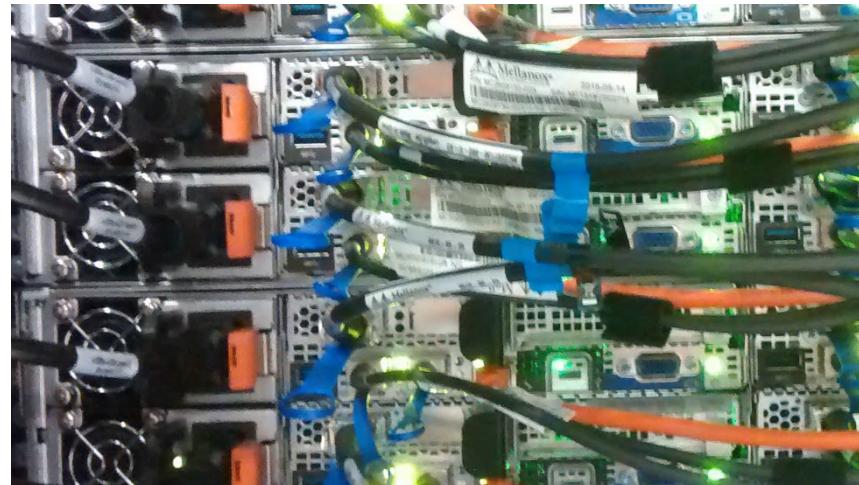
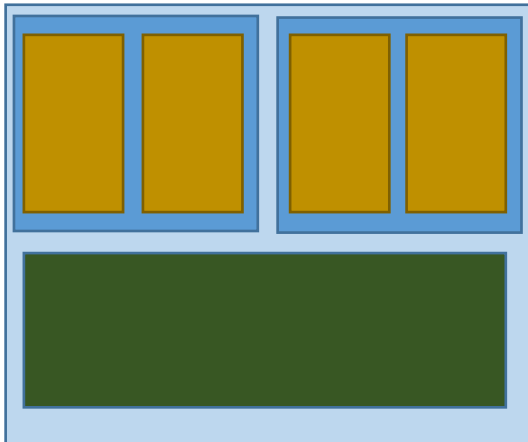


- For threaded applications (single node):

#SBATCH --nodes=1 # Physical servers

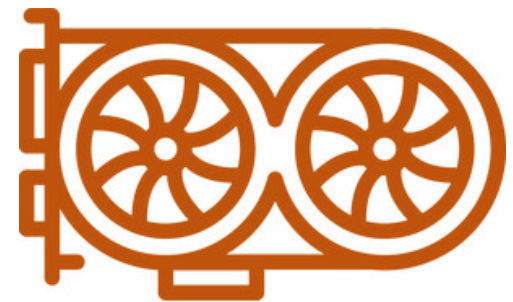
#SBATCH --ntasks=1 # MPI ranks or processes

#SBATCH --cpus-per-task=8





SLURM CPU Requests



© Can Stock Photo

```
#SBATCH --partition=gpu # required for GPUs
```

```
#SBATCH --gpus=1
```

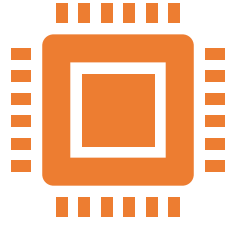
```
#SBATCH --gpus=quadro:1 #Specify type
```

```
#SBATCH --gpus=geforce:1
```

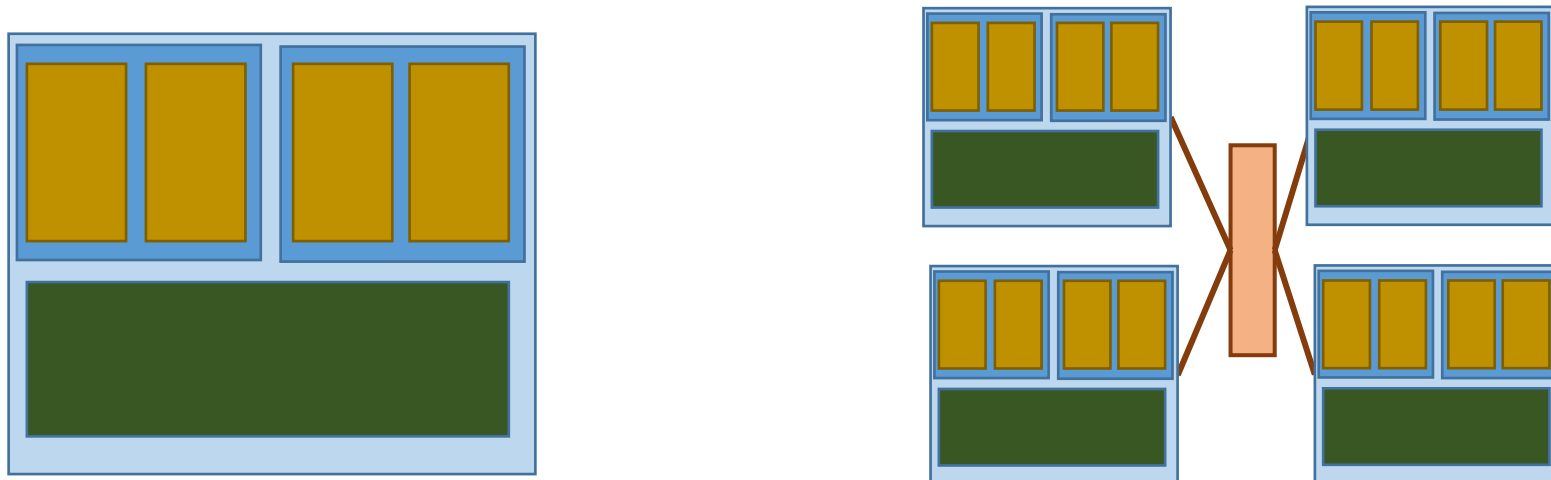
- See: https://help.rc.ufl.edu/doc/GPU_Access



SLURM CPU Requests

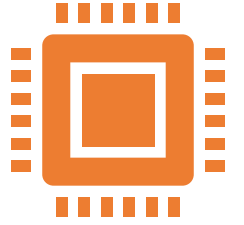


- Parallel applications
 - OpenMP, Threaded, Pthreads
 - All cores on one sever, shared memory
 - **MPI—Message Passing Interface**
 - Can use multiple servers
 - See: [help.rc.ufl.edu/doc/Sample SLURM Scripts](http://help.rc.ufl.edu/doc/Sample_SLURM_Scripts)





SLURM CPU Requests



- HiPerGator 2.0 Compute Servers
 - 32 cores
 - Two 16-core sockets
- HiPerGator 3.0 Compute Servers
 - 128 cores
 - Two 64-core sockets



SLURM Memory Requests



- `--mem=1gb` (total memory)
- `--mem-per-cpu=1gb` (memory per core)
 - Can use mb or gb
 - No decimal values: use 1500mb, not 1.5gb

HPG 2.0
120
GB RAM

HPG 3.0
1000
GB RAM



SLURM Time Request



- Time: **--time** or **-t**
 - 120 (minutes)
 - 2:00:00 (hh:mm:ss)
 - 7-0 (days-hours)
 - 7-00:00 (days-hh:mm)
 - 7-00:00:00 (days-hh:mm:ss)



Emails



Job ID: 94392

Cluster: hipergator

User/Group: magitz/ufhpc

State: COMPLETED (exit code 0)

Nodes: 1

Cores per node: 4

CPU Utilization: 00:00:44

CPU Efficiency: 52.38% of 00:01:24 core-walltime

Memory Utilization 1.52 MB

Memory Efficiency: 0.04% of 4.00 GB



Emails



Job ID: 5019

Cluster: hpg1

User/Group: magitz/ufhpc

State: CANCELLED (exit code 0)

Cores: 1

CPU Utilization: 00:00:00

CPU Efficiency: 0.00% of 00:00:00 core-walltime

Memory Utilization 1.26 MB

Memory Efficiency: 126.17% of 1.00 MB

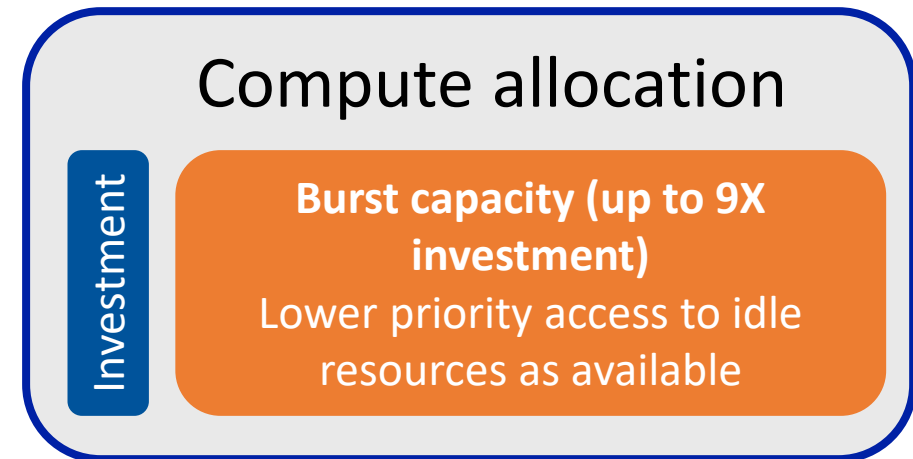
Job error file:

```
slurmstepd: Job 5019 exceeded memory limit (1292 > 1024), being killed
slurmstepd: Exceeded job memory limit
slurmstepd: *** JOB 5019 ON dev1 CANCELLED AT 2016-05-16T15:33:27 ***
```




Quality of Service (--qos)

- Each group has two QOS options
 - Investment QOS: **--qos=group**
 - Burst QOS:
 - The burst capacity, available when idle resources are available on the cluster
 - **--qos=group-b**
- Users can choose higher priority, or larger pool of resources





SLURM

- Note that multi-letter directives are double-dash:
 - `--mail-type` `sbatch: error: distribution type 'ail-type=ALL' is not recognized`
 - `--ntasks`
 - `--mem-per-cpu`
- Use either, ***but not both***, space or =
 - `--mail-user=magitz@ufl.edu` ✓
 - `--mail-user magitz@ufl.edu` ✓
 - not: `--mail-user= magitz@ufl.edu`



Submit your job

```
[magitz@login3 SLURM_examples]$ sbatch single_job.sh
```

```
Submitted batch job 30592170
```

```
[magitz@login3 SLURM_examples]$ queue -u gatorlink
```

JOBID	PARTITION	NAME	USER	ST	TIME	NODES	NODELIST (REASON)
30592170	hpg2-comp	serial_j	magitz	R	0:30	1	c24b-s15

```
[magitz@login3 SLURM_examples]$
```




Main page

Discussion

Read

Edit

View history



More

Search UFRC

Go

UFRC Help and Documentation

Welcome to the University of Florida Research Computing Help and Documentation site. The information here is focused on particular applications, services, and usage examples and complements more general policies and information found on our main web site. It is used for information that changes more frequently and might become quickly dated or incorrect on the web site. This site is edited by individual UFRC staff members. If you find inaccuracies, errors, or omissions on this site please let us know.

Getting Started [\[edit\]](#)

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- [Training, Events and How-To Videos](#)
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- [Practical Storage Use](#)
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Software and Reference Data [\[edit\]](#)

Use the tools from UFRC environment module for convenience.

- [Installed Applications](#)
- [Reference Data](#)
- [HiPerGator Tools](#)
- [Environment Modules System](#)
- [Software Development](#)
- [GPU Access](#)
- [Available Compilers](#)

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- ▶ [Infrastructure](#)
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Training

Navigation

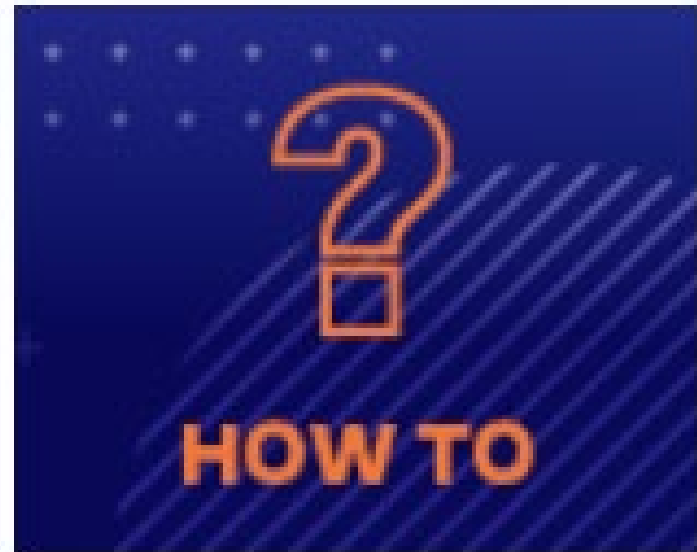
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Training



help.rc.ufl.edu/doc/Training