Introduction to GACRC Teaching Cluster

Georgia Advanced Computing Resource Center (GACRC)
Enterprise Information Technology Services (EITS)
The University of Georgia
Outline

• GACRC
• Overview
• Working Environment  
  ➢ Three Folders  
  ➢ Three Computational Partitions  
  ➢ Software on Cluster
• Submit a Computational Batch Job
• GACRC Wiki and Support
GACRC

- A high-performance-computing (HPC) center at the UGA
- Provide to the UGA research and education community an advanced computing environment:
  - HPC computing and networking infrastructure located at the Boyd Data Center
  - Comprehensive collection of scientific, engineering and business applications
  - Consulting and training services

Wiki: http://wiki.gacrc.uga.edu
Support: https://wiki.gacrc.uga.edu/wiki/Getting_Help
Web Site: http://gacrc.uga.edu
Kaltura Channel: https://kaltura.uga.edu/channel/GACRC/176125031
Note: You need to connect to the UGA VPN at first when accessing from outside of the UGA main campus.
Working Environment

https://wiki.gacrc.uga.edu/wiki/Systems#Teaching_cluster

- Two nodes, your "username" is your MyID for both of them:
  1. For batch job workflow, the host to log into is teach.gacrc.uga.edu
  2. For file transfers, the host to log into is txfer.gacrc.uga.edu

- Three Directories:
  1. /home/MyID: directory for static data (e.g., scripts, software, etc...)
  2. /scratch/MyID: working space for running computational jobs
  3. /work/CourseID: directory for course data
     a. /work/CourseID/MyID: data storage space for individual user in a class (e.g., /work/binf8211/MyID)
     b. /work/CourseID/instructor_data: data shared with class by the instructors

- Three Partitions:
  1. batch: for running regular computational jobs
  2. highmem: for running high-memory jobs
  3. gpu: for running GPU jobs
Working Environment (cont.)

- **Software**

  1. Software names are long and have a Easybuild toolchain name associated to it
  2. Complete module name: Name/Version-toolchain, e.g., Python/3.8.2-GCCcore-8.3.0
  3. Software names are case-sensitive!

    - `module spider pattern`: Search modules using a name pattern (case-insensitive)
    - `module load/unload moduleName`: Load/remove a module
    - `module avail`: List all available modules on the cluster
    - `module list`: List modules currently loaded
    - `module purge`: Remove all modules from working environment
Submit a Batch Job

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster

1. Log on to Login node using MyID and password, and two-factor authentication with Archpass Duo: `ssh MyID@teach.gacrc.uga.edu`
2. Change directory to /scratch directory: `cd /scratch/MyID`
3. Create a working subdirectory for a job: `mkdir workDir`
4. Change directory to workDir: `cd workDir`
5. Transfer data from local computer to workDir: use `scp` or `WinSCP` to connect Transfer node
6. Transfer data on cluster to workDir: log on to Transfer node and then use `cp` or `mv`
7. Make a job submission script in workDir: `nano sub.sh`
8. Submit a job from workDir: `sbatch sub.sh`
9. Check job status: `squeue --me` or Cancel a job: `scancel JobID`
Step1: Log on to Login node

https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting_to_the_teaching_cluster

1. Teaching cluster access requires verification using two-factor authentication with Archpass Duo. If you are not enrolled in Archpass Duo, please refer to https://eits.uga.edu/access_and_security/infosec/tools/archpass_duo/ on how to enroll

2. If you are connecting from off-campus, please first connect to the UGA VPN and then connect to teach.gacrc.uga.edu. Information on how to use the VPN is available at https://eits.uga.edu/access_and_security/infosec/tools/vpn/
Step1: Log on to Login node - Mac/Linux using ssh

1. Open Terminal utility

2. Type command line: `ssh MyID@teach.gacrc.uga.edu`

3. You will be prompted for your UGA MyID password

4. You will verify your login using Archpass Duo authentication
ssh zhuofei@teach.gacrc.uga.edu  

1. use ssh to open connection

UGA DUO authentication is required for SSH/SCP access to GACRC systems. For additional help with UGA DUO authentication or to report an issue please visit: https://eits.uga.edu/access_and_security...

Password:  

2. Enter your MyID password  
When you enter password, no stars or dots will show as you are typing. Please type password carefully!

Duo two-factor login for zhuofei

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-5758
2. Phone call to XXX-XXX-5758
3. Phone call to XXX-XXX-1925
4 5. SMS passcodes to XXX-XXX-5758 (next code starts with: 1)

Passcode or option (1-5): 1  

3. Select Duo option

Success. Logging you in...
Last login: Mon Aug  3 11:11:58 2020 from 172.18.114.119
zhuofei@teach-sub1 ~$

4. Logged on!

5. Verify login using Duo
Step 1 (Cont.) - Windows using PuTTY

1. Download and install PuTTY: https://www.putty.org/

2. Detailed downloading and installation instructions:

   https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY

3. Detailed configuring and usage instructions:

   https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY#Configuring_PuTTY
Step 1 (Cont.) - Windows using PuTTY

The first time you connect to login node, PuTTY will give you this security alert window. Please click "Yes"
Step 1 (Cont.) - Windows using PuTTY

Next you will enter your UGA MyID password and initiate DUO authentication procedure:

- **UGA MyID password**
- **Select DUO option**
- **Logged on!**
Step2 - 4: cd to /scratch dir, make and cd into workDir

```bash
zhuofei@teach-sub1 ~$ cd /scratch/MyID
zhuofei@teach-sub1 zhuofei$ mkdir workDir
zhuofei@teach-sub1 zhuofei$ cd workDir/
```

```bash
zhuofei@teach-sub1 workDir$ ls
```

```bash
zhuofei@teach-sub1 workDir$
```

- `cd` command to change directory
- `mkdir` command to create a subdirectory
- `ls` command to list contents of directory
- it is empty in workDir!
Step 5: Transfer data from local computer to workDir - Mac/Linux

https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_scp_2

1. Connect to Transfer node (txfer.gacrc.uga.edu) in Terminal from your local computer
2. Use **scp** command: scp (-r) [Source] [Target]
3. Enter your MyID password, then select Duo option to verify connection

*E.g. 1*: use scp on local computer, from Local ➔ workDir on cluster

```
scp ./file zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir
scp -r ./folder/ zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir
```

*E.g. 2*: use scp on local computer, from workDir on cluster ➔ Local

```
scp zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir/file .
scp -r zhuofei@txfer.gacrc.uga.edu:/home/zhuofei/workDir/folder/ .
```
Step 5 (Cont.) - Windows using WinSCP

https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_WinSCP_2

1. You need to connect to cluster’s Transfer node (txfer.gacrc.uga.edu)

2. Use WinSCP on local computer
   - WinSCP can be downloaded from https://winscp.net/eng/index.php
   - Default installation procedure is simple

Step 5 (Cont.) - Windows using WinSCP
Step 5 (Cont.) - Windows using WinSCP

Select DUO option
Step 5 (Cont.) - Windows using WinSCP

Change paths on your local computer and transfer node

Drag to transfer files or folders
Step 5 (Cont.): Transfer data on cluster to workDir

- Log on to Transfer node (txfer.gacrc.uga.edu)
  - Mac/Linux: ssh MyID@txfer.gacrc.uga.edu (page 9-10)
  - Windows: use PuTTY to log in MyID@txfer.gacrc.uga.edu (page 11-13)

- Directories you can access on transfer node:
  1. /home/MyID
  2. /scratch/MyID
  3. /work/CourseID/

- Transfer data between two folders on cluster using `cp` or `mv`, e.g.:
  ```
  mv /work/binf8211/MyID/datafile /scratch/MyID/workDir
  ```
Step 6: Make a job submission script in workDir using nano
https://wiki.gacrc.uga.edu/wiki/Sample_batch_job_submission_scripts_on_the_teaching_cluster

$ nano sub.sh

nano is a simple text editor on Linux. You are welcome to use other editors like vim or emacs.

Ctrl-x to save file and quit from nano
Step 6 (Cont.)

Copy

1. sample input data
2. job submission script
to your current working folder:
cp /usr/local/training/sample.fasta .
cp /usr/local/training/sub_blast.sh .

#!/bin/bash
#SBATCH --job-name=testBLAST # Job name
#SBATCH --partition=batch # Partition (queue) name
#SBATCH --ntasks=1 # Single task job
#SBATCH --cpus-per-task=4 # Number of cores per task
#SBATCH --mem=20gb # Total memory for job
#SBATCH --time=2:00:00 # Time limit hrs:min:sec
#SBATCH --output=log.%j # Standard output and error log

#SBATCH --mail-user=MyID@uga.edu # Where to send mail
#SBATCH --mail-type=END,FAIL # Mail events (BEGIN, END, FAIL, ALL)

cd $SLURM_SUBMIT_DIR
module load BLAST+/2.9.0-gompi-2019b

time blastn -num_threads 4 -query sample.fasta -db /db/ncbiblast/nt/06042020/nt \
-out results.$(SLURM_JOB_ID) -outfmt 6 -max_target_seqs=2

More Information: https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster
Step 7: Submit a job from workDir using sbatch

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_submit_a_job_to_the_batch_queue

$ sbatch sub_blast.sh
Submitted batch job 139

**Tips:** sub_blast.sh is a job submission script for

1. specifying computing resources
2. loading software using `module load`
3. running any Linux commands you want to run
4. running the blast commands
### Step 8: Check job status using squeue

[https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster](https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster)

```bash
$ squeue --me
Wed Aug  8 13:40:02 2018

<table>
<thead>
<tr>
<th>JOBID</th>
<th>PARTITION</th>
<th>NAME</th>
<th>USER</th>
<th>STATE</th>
<th>TIME</th>
<th>TIME_LIMIT</th>
<th>NODES</th>
<th>NODELIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>162</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>PENDING</td>
<td>0:00</td>
<td>2:00:00</td>
<td>1</td>
<td>(None)</td>
</tr>
<tr>
<td>160</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>RUNNING</td>
<td>0:02</td>
<td>2:00:00</td>
<td>1</td>
<td>c2-11</td>
</tr>
<tr>
<td>161</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>RUNNING</td>
<td>0:02</td>
<td>2:00:00</td>
<td>1</td>
<td>c2-11</td>
</tr>
</tbody>
</table>

$ squeue --me -l

<table>
<thead>
<tr>
<th>JOBID</th>
<th>PARTITION</th>
<th>NAME</th>
<th>USER</th>
<th>ST</th>
<th>TIME</th>
<th>NODES</th>
<th>NODELIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>162</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>PD</td>
<td>0:15</td>
<td>1</td>
<td>(None)</td>
</tr>
<tr>
<td>160</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>R</td>
<td>0:17</td>
<td>1</td>
<td>c2-11</td>
</tr>
<tr>
<td>161</td>
<td>batch</td>
<td>testBLAS</td>
<td>zhuofei</td>
<td>R</td>
<td>0:17</td>
<td>1</td>
<td>c2-11</td>
</tr>
</tbody>
</table>
```

**Common STATE:** R for Running; PD for Pending; TO for TimedOut; S for Suspended; F for FAILED

**TIME:** the elapsed time used by the job, not remaining time, not CPU time.
Step 8 (Cont.): Check job details using sacct-gacrc -X

https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

```
$ sacct-gacrc -X

<table>
<thead>
<tr>
<th>JobID</th>
<th>JobName</th>
<th>User</th>
<th>Partition</th>
<th>NodeList</th>
<th>AllocNodes</th>
<th>NTask</th>
<th>NCPUS</th>
<th>ReqMem</th>
<th>MaxVMSize</th>
<th>State</th>
<th>CPUTime</th>
<th>Elapsed</th>
<th>Timelimit</th>
<th>ExitCode</th>
</tr>
</thead>
<tbody>
<tr>
<td>174</td>
<td>testBLAST</td>
<td>zhuofei</td>
<td>batch</td>
<td>tcn18</td>
<td>1</td>
<td>4</td>
<td>20Gn</td>
<td>RUNNING</td>
<td>00:04:56</td>
<td>00:01:14</td>
<td>02:00:00</td>
<td>0:0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Step 8 (Cont.): Cancel job using scancel

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_delete_a_running_or_pending_job

```
$ squeue --me -l
Wed Aug  8 14:03:47 2018
JOBID PARTITION   NAME     USER    STATE   TIME   TIME_LIMI  NODES NODELIST
169 batch   testBLAS  zhuofei  RUNNING  2:07    2:00:00       1 c1-38
168 batch   testBLAS  zhuofei  RUNNING  3:14    2:00:00       1 c1-39

$ scancel 169

[zhuofei@teach workDir]$ squeue -l
Wed Aug  8 14:03:47 2018
JOBID PARTITION   NAME     USER    STATE   TIME   TIME_LIMI  NODES NODELIST
169 batch   testBLAS  zhuofei  COMPLETI  2:25    2:00:00       1 c1-39
168 batch   testBLAS  zhuofei  RUNNING  3:32    2:00:00       1 c1-38

$ squeue --me -l
Wed Aug  8 14:04:08 2018
JOBID PARTITION   NAME     USER    STATE   TIME   TIME_LIMI  NODES NODELIST
168 batch   testBLAS  zhuofei  RUNNING  3:35    2:00:00       1 c1-38
```
Step 8 (Cont.): Check node info using sinfo
https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

```
$ sinfo
PARTITION   AVAIL  TIMELIMIT  NODES  STATE  NODELIST
batch*         up 7-00:00:00     1  down*  tcn17
batch*         up 7-00:00:00     24  idle  tcn[1-16,18-25]
interactive  up 7-00:00:00      5  idle  tcn[26-30]
gpu            up 7-00:00:00     1  idle  tcgn1
highmem        up 7-00:00:00     2  idle  tchmn[1-2]
```

idle = no cores in use; mix = some cores are still free; alloc = all cores are allocated
Obtain Job Details

https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster#How_to_check_resource_utilization_of_a_running_or_finished_job

Option 1: `squeue --me -l` for details of a running or pending jobs

Option 2: `sacct-gacrc -X` for details of computing resource usage of a running or finished job

Option 3: `seff` for details of computing resource usage of a finished job

Option 4: Email notification from finished jobs (completed, canceled, or crashed), if using:

```
#SBATCH --mail-user=username@uga.edu
#SBATCH --mail-type=ALL
```
Connecting: https://wiki.gacrc.uga.edu/wiki/Connecting#Connecting_to_the_teaching_cluster

Running Jobs: https://wiki.gacrc.uga.edu/wiki/Running_Jobs_on_the_teaching_cluster

Monitoring Jobs: https://wiki.gacrc.uga.edu/wiki/Monitoring_Jobs_on_the_teaching_cluster

Transfer File: https://wiki.gacrc.uga.edu/wiki/Transferring_Files#The_File_Transfer_node_for_the_teaching_cluster.28txfer.gacrc.uga.edu.29

Sample Job Scripts: https://wiki.gacrc.uga.edu/wiki/Sample_batch_job_submission_scripts_on_the_teaching_cluster

Linux Command: https://wiki.gacrc.uga.edu/wiki/Command_List
GACRC Support
https://wiki.gacrc.uga.edu/wiki/Getting_Help

- **Job Troubleshooting:**
  
  Please tell us details of your question or problem, including but not limited to:
  
  ✓ Your user name
  ✓ Your job ID
  ✓ Your working directory
  ✓ The partition name and command you used to submit the job

- **Software Installation:**

  ✓ Specific name and version of the software
  ✓ Download website
  ✓ Supporting package information if have

Please note to make sure the correctness of datasets being used by your jobs!
Georgia Advanced Computing Resource Center (GACRC) service catalog.

If you would like to reach out to GACRC and do not have a UGA MyID, please send an email to gacrc-help@uga.edu, and we will respond promptly.

Categories (3)

Services For Users
- General user support, request software installation or update, request training

Services for PIs
- For PIs only: Lab registration, user account creation/modification, class account requests, storage quota modifications

For GACRC Staff
- For GACRC's internal use only.

My Recent Requests
- Class provision on the teaching cluster - phys8601-dlindau
- Class provision on the teaching cluster - bomb8332-gjwoods
- Class provision on the teaching cluster - binf8211-szhao, lm43161
- MATLAB License Request
- Create cider lab group

Popular Services

View All Recent Requests
General Support

If you do not have a myID, please mail gacrc-help@uga.edu, and we will respond promptly.

The purpose of this form is to provide a method to report issues and to request help with GACRC systems.

Please use this form for all questions and support needs (e.g., to report issues, to troubleshoot jobs, to request resources or granting help, etc.). Please do not use this form for software installation requests or lab/user account management, which all have separate forms.

Please refer to the GACRC documentation for information on GACRC resources, how to connect and transfer files, how to run jobs, installed software list, training schedule, and a FAQ.

The link to this documentation is https://wiki.georgia.edu

https://uga.teamdynamic.com/TDCClient/Requests/ServiceCatalogSearch
Thank You!

Telephone Support
EITS Help Desk: 706-542-3106
Monday – Thursday: 7:30 a.m. – 7:30 p.m.
Friday: 7:30 a.m. – 6 p.m.
Saturday – Sunday: 1 p.m. – 7 p.m.

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