



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
- Run Interactive Jobs
- 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

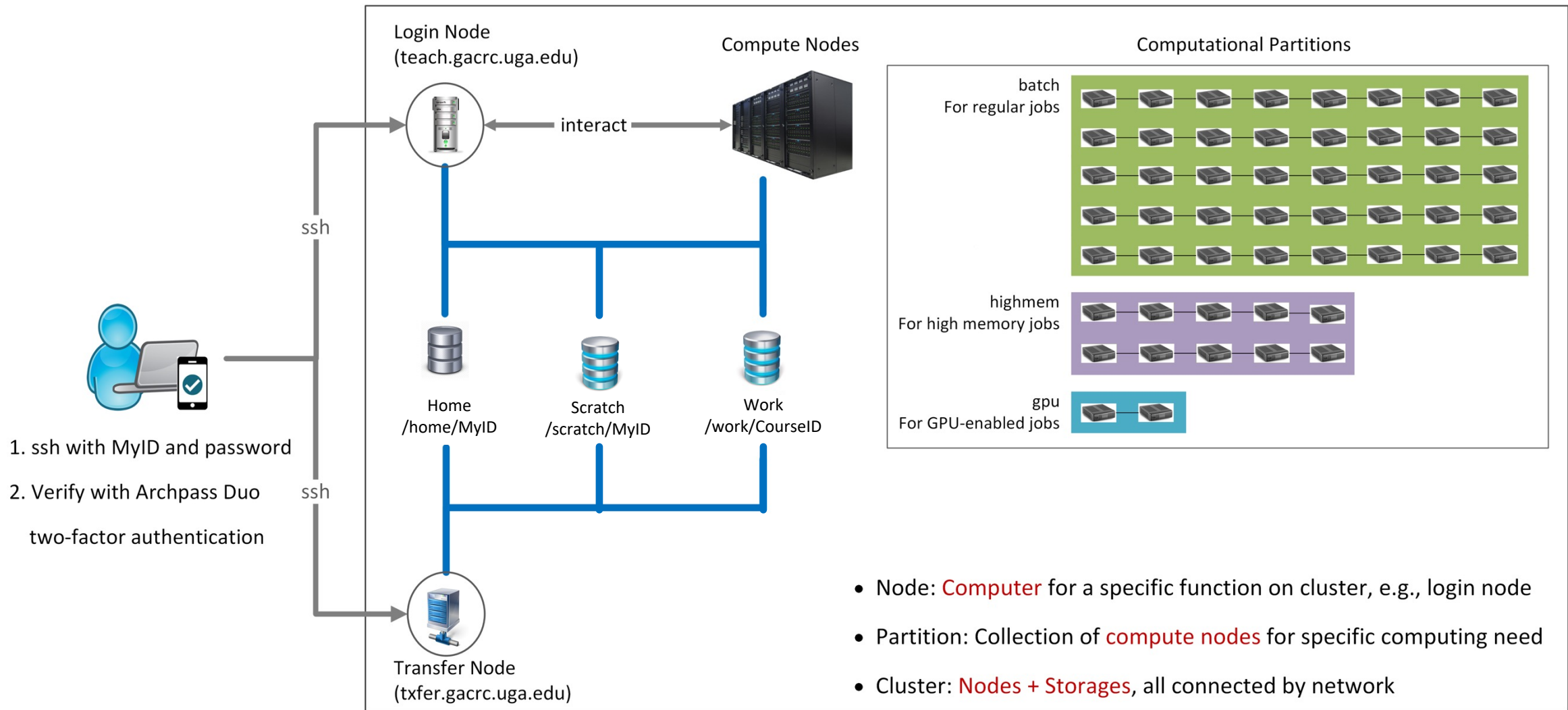
Wiki: <http://wiki.gacrc.uga.edu>

Support: https://wiki.gacrc.uga.edu/wiki/Getting_Help

Web Site: <http://gacrc.uga.edu>

Kaltura Channel: <https://kaltura.uga.edu/channel/GACRC/176125031>

Teaching Cluster



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 storing static data (e.g., scripts, programs, 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/3.10.4-GCCcore-11.3.0**
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
Transfer data on cluster to workDir : log on to Transfer node and then use `cp` or `mv`
6. Make a job submission script in workDir : `nano sub.sh`
7. Submit a job from workDir : `sbatch sub.sh`
8. Check job status : `sq --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/ 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:

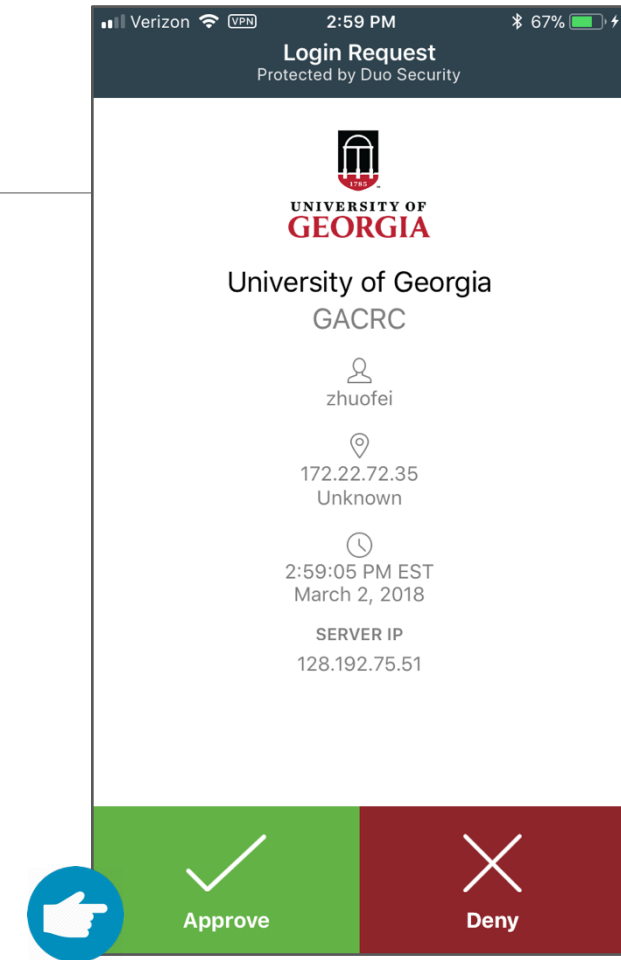
1. Duo Push to XXX-XXX-5758
2. Phone call to XXX-XXX-5758
3. Phone call to XXX-XXX-1925
- 4 5. SMS passcodes to XXX-XXX-5758 (next code starts with: 1)

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

Step1 (Cont.) - Windows using PuTTY

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

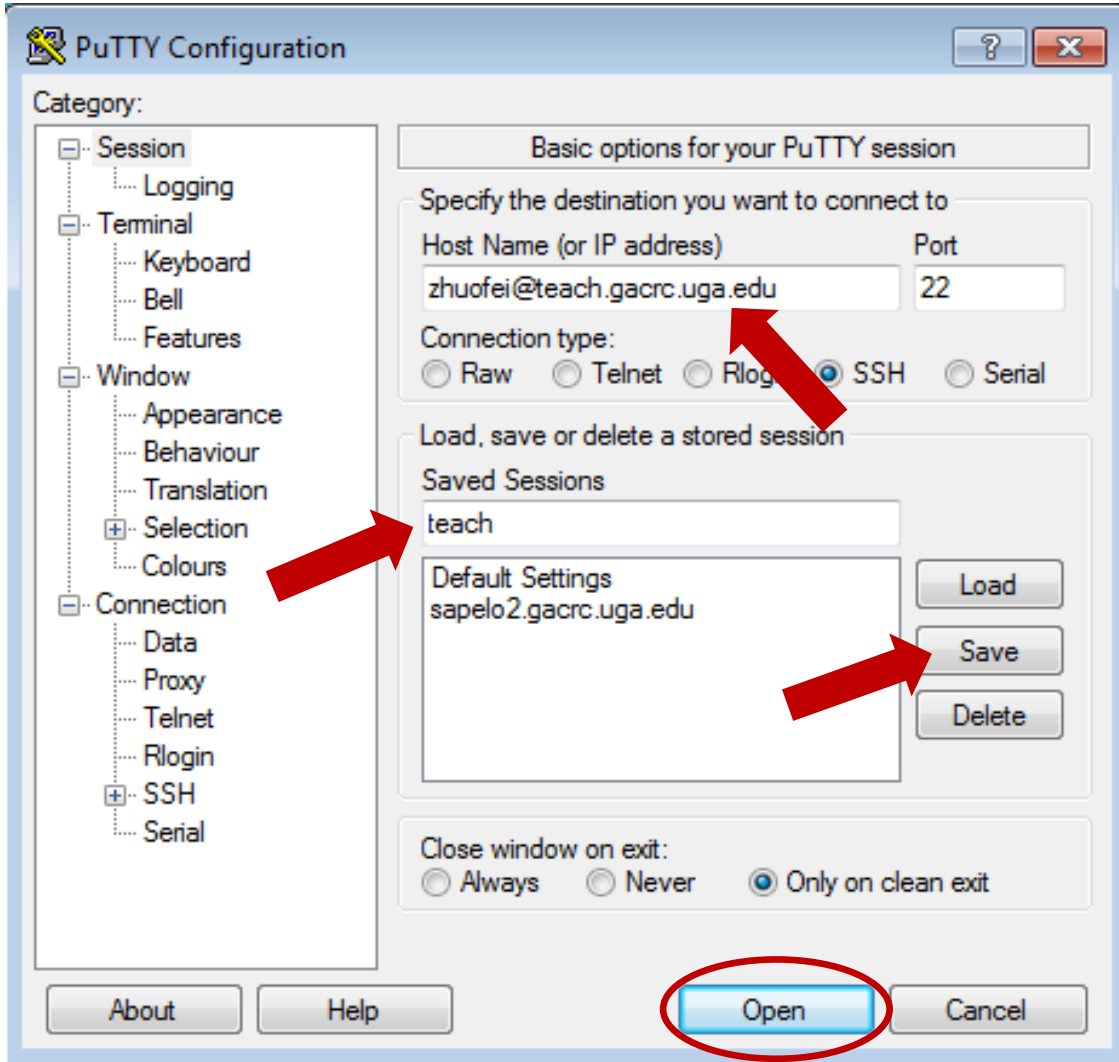
2. Detailed downloading and installation instructions:

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

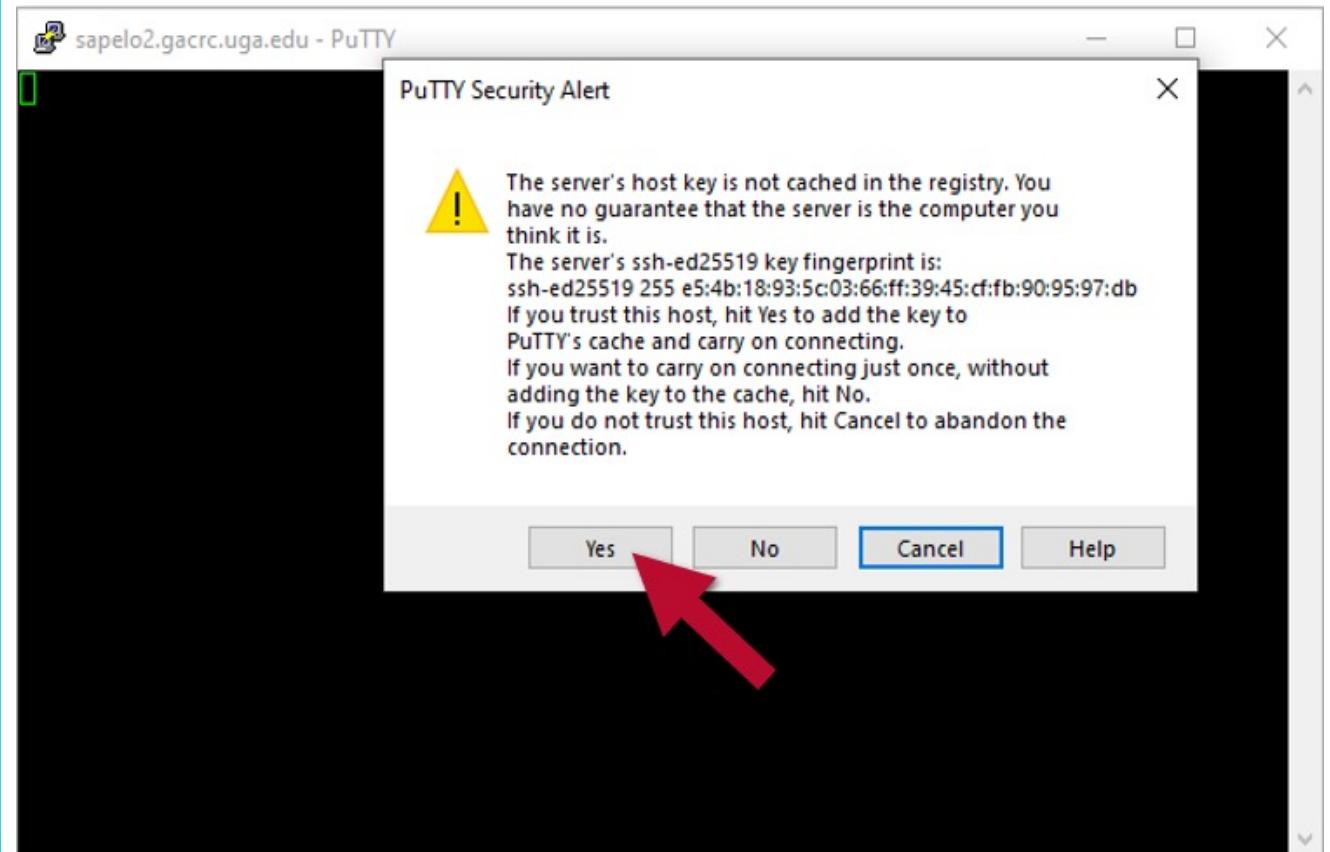
3. Detailed configuring and usage instructions:

https://wiki.gacrc.uga.edu/wiki/How_to_Install_and_Configure_PuTTY_-_Configuring_PuTTY

Step1 (Cont.) - Windows using PuTTY



The first time you connect to login node, PuTTY will give you this security alert window. Please click "Yes"



Step1 (Cont.) - Windows using PuTTY

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

```
zhuofei@teach-sub1:~  
Using username "zhuofei".  
Keyboard-interactive authentication prompts from server:  
Password: ← UGA MyID password  
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. Phone call to XXX-XXX-3535  
5. SMS passcodes to XXX-XXX-5758  
Passcode or option (1-5): 1 ← Select DUO option  
End of keyboard-interactive prompts from server  
Success. Logging you in..  
Last login: Thu Jan  7 10:20:01 2021 from 128.192.240.123  
zhuofei@teach-sub1 ~$ █ ← Logged on!
```

Step2 - 4: cd to /scratch dir, make and cd into workDir

```
zhuofei@teach-sub1 ~$ cd /scratch/zhuofei ← cd command to change directory
zhuofei@teach-sub1 zhuofei$ mkdir workDir ← mkdir command to create a subdirectory
zhuofei@teach-sub1 zhuofei$ cd workDir/ ← cd command to change directory
zhuofei@teach-sub1 workDir$ ls ← ls command to list contents of directory
zhuofei@teach-sub1 workDir$ ← 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
3. Alternative FileZilla https://wiki.gacrc.uga.edu/wiki/Transferring_Files#Using_FileZilla_2

Step 5 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP application window with the 'Login' dialog box open. The dialog box has a 'Session' section with the following fields:

- File protocol: SFTP
- Host name: txfer.gacrc.uga.edu
- Port number: 22
- User name: zhuofei
- Password: [masked]

At the bottom of the dialog box, there is a 'Login' button with a green arrow icon, which is circled in red. There are also 'Tools', 'Manage', 'Close', and 'Help' buttons. A checkbox at the bottom left is checked and labeled 'Show Login dialog on startup and when the last session is closed'.

Red arrows point to the 'Host name', 'User name', and 'Password' fields. A red circle highlights the 'Login' button.

Step 5 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP interface with a local file explorer on the left and a remote file explorer on the right. A modal dialog box titled "Server prompt - zhuofei@xfer.gacrc.uga.edu" is open in the center. The dialog contains the following text:

UGA DUO authentication is required for SSH/SCP access to GACRC systems.

UGA DUO is a two-factor authentication service which requires a password (one factor) and a code, phone, or device (second factor) to successfully authenticate.

If you are not enrolled in the UGA DUO service please visit the UGA DUO service self-service portal to enroll and configure or manage your DUO enabled devices.

https://eits.uga.edu/access_and_security/infosec/tools/duo/portal/

For additional help with UGA DUO authentication or to report an issue please visit:

https://eits.uga.edu/access_and_security/infosec/tools/archpass/

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. Phone call to XXX-XXX-3535
5. SMS passcodes to XXX-XXX-5758

Passcode or option (1-5):

At the bottom of the dialog are buttons for "OK", "Cancel", and "Help". A red arrow points to the input field with the text "Select DUO option".

Step 5 (Cont.) - Windows using WinSCP

The screenshot shows the WinSCP interface with two panes. The left pane shows the local Windows file system at `C:\Users\MosesHou\`, and the right pane shows the remote Linux file system at `/home/zhuofei/`. Red circles highlight the address bars of both panes, with arrows pointing to a text box. A green double-headed arrow is positioned between the panes, pointing to another text box.

Change paths on your local computer and transfer node

Drag to transfer files or folders

Name	Size	Type	Changed	Name	Size	Changed	Rights	Owner
..		Parent directory	7/10/2020 6:29:42 AM	..		12/22/2020 2:35:28 PM	rw-r--r--	root
Contacts		File folder	6/24/2020 5:30:50 AM	class_test		9/5/2019 9:26:34 AM	rw-r--r--	zhuofei
Desktop		File	1/6/2021 9:32:41 AM	CytoscapeConfigurati...		8/11/2020 10:47:52 AM	rw-r--r--	zhuofei
Documents		File folder	11/18/2020 1:04:09 PM	ens		10/13/2020 8:39:53 AM	rw-r--r--	zhuofei
Downloads		File folder	1/5/2021 6:40:34 AM	intel		10/9/2020 10:03:39 AM	rw-r--r--	zhuofei
Favorites		File folder	6/24/2020 5:30:50 AM	notification		8/17/2018 5:43:27 AM	rw-r--r--	zhuofei
Links		File folder		scripts		8/8/2018 2:14:03 PM	rw-r--r--	zhuofei
Music		File folder		term-account		1/4/2021 1:01:58 PM	rw-r--r--	zhuofei
Pictures		File folder		templates		8/9/2018 8:18:34 AM	rw-r--r--	zhuofei
Saved Games		File folder		workDir		10/29/2020 9:00:13 AM	rw-r--r--	zhuofei
Searches		File folder	6/24/2020 5:30:50 AM	workDir_template		7/30/2020 12:17:24 PM	rw-r--r--	zhuofei
Tracing		File folder	7/7/2015 10:45:05 AM	gcc-4.4.sif	128,788 KB	10/9/2020 10:25:27 AM	rw-r--r--	zhuofei
Videos		File folder	6/24/2020 5:30:50 AM	ling6570_config.sh	1 KB	11/19/2019 6:19:22 AM	rw-r--r--	zhuofei
				ml-search-gacrc	3 KB	1/4/2021 1:03:39 PM	rw-r--r--	zhuofei
						9/25/2019 7:12:13 AM	rw-r--r--	zhuofei

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

```
zhuofei@n124:/lustre1/zhuofei/workDir
File Edit View Search Terminal Help
GNU nano 2.0.9 File: sub.sh Modified
hello nano! I am Zhuofei!
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```

Step 6 (Cont.)

1. Copy sample job to workDir:

```
cp -r /usr/local/gacrc/training/Teach/* .
```

2. Job submission script:

```
sub.sh
```

3. Running Jobs:

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

```
#!/bin/bash
#SBATCH --job-name=testBowtie2      # Job name (testBowtie2)
#SBATCH --partition=batch           # Partition name (batch, highmem_p, or gpu_p)
#SBATCH --ntasks=1                  # 1 task (process) for below commands
#SBATCH --cpus-per-task=1           # CPU core count per task, by default 1
#SBATCH --mem=4G                    # Memory per node (4GB); by default using M as unit
#SBATCH --time=1:00:00              # Time limit hrs:mins:secs or days-hrs:mins:secs
#SBATCH --output=%x_%j.out          # Standard output log, e.g., testBowtie2_12345.out
#SBATCH --mail-user=username@uga.edu # Where to send mail
#SBATCH --mail-type=END,FAIL         # Mail events (BEGIN, END, FAIL, ALL)

ml Bowtie2/2.4.5-GCC-11.3.0          # Load software module and run bowtie2 below
bowtie2 -x index/lambda_virus -U myreads.fq
```

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.sh  
Submitted batch job 79
```

Tips: sub.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 bowtie2 commands



Step 8: Check job status using `sq --me`

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

```
$ sq --me
```

```
JOBID  NAME      PARTITION  USER  NODES  CPUS  MIN_MEMORY  PRIORITY  TIME  TIME_LIMIT  STATE  NODELIST(REASON)
79  testBowtie2  batch    zhuofei  1     1     4G          49        1:09  1:00:00    RUNNING  rb1-3
```




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

```
$ sq --me
JOBID NAME PARTITION USER NODES CPUS MIN_MEMORY PRIORITY TIME TIME_LIMIT STATE NODELIST (REASON)
79 testBowtie2 batch zhuofei 1 1 4G 1 5:43 1:00:00 RUNNING rb1-3

$ scancel 79

$ sq --me
JOBID NAME PARTITION USER NODES CPUS MIN_MEMORY PRIORITY TIME TIME_LIMIT STATE NODELIST (REASON)
79 testBowtie2 batch zhuofei 1 1 4G 1 5:43 1:00:00 COMPLETING rb1-3

$ sq --me
JOBID NAME PARTITION USER NODES CPUS MIN_MEMORY PRIORITY TIME TIME_LIMIT STATE NODELIST (REASON)
```

Step8 (Cont.): Check job details using sacct-gacrc -X and seff

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

```
$ sacct-gacrc -X
```

JobID	JobName	User	Partition	NNode	NCPUS	ReqMem	CPUTime	Elapsed	Timelimit	State	ExitCode	NodeList
79.	testBowtie2	zhuofei	batch	1	1	4Gn	00:05:43	00:05:43	01:00:00	CANCELLED+	0:0	rb1-3

```
$ seff 79 # Check computing resources used by a COMPLETED job
Job ID: 79
Cluster: gacrc-teach
User/Group: zhuofei/gacrc-instruction
State: CANCELLED (exit code 0)
Cores: 1
CPU Utilized: 00:05:38
CPU Efficiency: 98.54% of 00:05:43 core-walltime
Job Wall-clock time: 00:05:43
Memory Utilized: 191.24 MB
Memory Efficiency: 4.67% of 4.00 GB
```

Step 8 (Cont.): Check node info using sinfo-gacrc

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

```
$sinfo-gacrc
```

PARTITION	NODELIST	STATE	CPUS	MEMORY(MB)	AVAIL_FEATURES	GRES
allnodes	c423	down*	32	190111	Intel,Skylake,EDR	gpu:P100:1(S:0),lscratch:890
allnodes	rb1-[2-12]	idle	32+	128561+	(null)	(null)
allnodes	rb1-1	down	64	1027693	(null)	(null)
batch	rb1-[3-10]	idle	32	128561	(null)	(null)
gpu	c4-23	down*	32	190111	Intel,Skylake,EDR	gpu:P100:1(S:0),lscratch:890
highmem	rb1-2	idle	64	1027693	(null)	(null)
highmem	rb1-1	down	64	1027693	(null)	(null)
interactive	rb1-[11-12]	idle	32	128561	(null)	(null)
fsr4601	rb1-[3-10]	idle	32	128561	(null)	(null)
fsr8602	rb1-[3-10]	idle	32	128561	(null)	(null)

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
```



Run Interactive Jobs

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

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

Description	Command
Start an interactive session	<code>interact</code>
Start an interactive session with X forwarding	<code>interact --x11</code>

<code>interact</code>	<code>srun --pty --cpus-per-task=1 --job-name=interact --ntasks=1 --nodes=1 --partition=inter_p --time=12:00:00 --mem=2GB /bin/bash -l</code>
<code>interact --x11</code>	<code>srun --pty --cpus-per-task=1 --job-name=interact --ntasks=1 --nodes=1 --partition=inter_p --time=12:00:00 --mem=2GB --x11 /bin/bash -l</code>



GACRC Wiki <http://wiki.gacrc.uga.edu>

Kaltura Channel <https://kaltura.uga.edu/channel/GACRC/176125031>

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!



[Service Catalog](#) / [Academics, Learning & Research](#) / [GACRC Service Catalog](#)

GACRC Service Catalog

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

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[Class provision on the teaching cluster - bcmb8330 - rjwoods](#)

[Class provision on the teaching cluster - binf8211 - szhao, lm43161](#)

[MATLAB License Request](#)

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Popular Services

Service - General Support - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Mail - zhuofei@uga.edu x Service - General Support x +

https://uga.teamdynamix.com/TDClient/Requests/ServiceDet?ID=25844

90% ...

UNIVERSITY OF GEORGIA

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Zhuofei Hou

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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 grant writing 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.gacrc.uga.edu>

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<https://uga.teamdynamix.com/TDClient/Requests/ServiceCatalogSearch>

Need Support? <http://help.gacrc.uga.edu>

